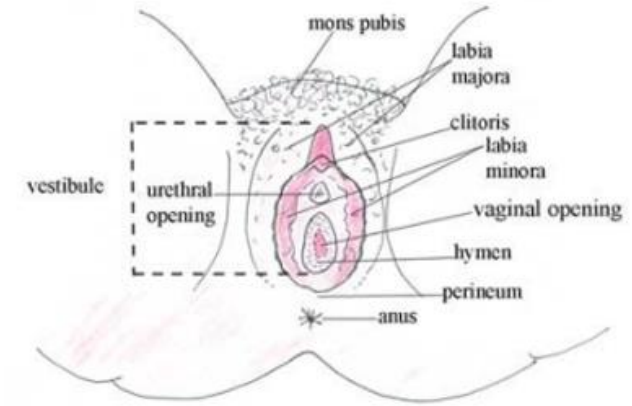
GYNECOLOGY STATE

1. Anatomy and topography of the external and internal female pelvic organs

a. **Introduction:** The female reproductive organs can be divided into the **upper genital tract** (ovaries, fallopian tubes, ovaries and cervix) located in the pelvis and **lower genital tract** (vagina and vulva) located in the perineum.

b. External female genitalia: refers to all external female genital organs. The components of the external female genitalia occupy a large part of the female perineum and collectively form what's known as the **vulva**.



i. **Perineum:** Region between the posterior labial commissure and the anus. It has a high risk of rupture during delivery.

ii. **Mons pubis**: Round eminence formed by subcutaneous fat located above the pubic symphysis. It becomes covered by hair during puberty.

iii. **Labia majora**: 2 longitudinal cutaneous folds that extend inferoposteriorly from the anterior to the posterior labial commissure.

iv. **Labia minora**: 2 small longitudinal cutaneous folds located between the labial majora. Anteriorly, they form the prepuce of the clitoris and frenulum of the clitoris.

v. **Clitoris**: Is an erectile structure containing 2 cavernous bodies and located beneath the anterior labial commissure. The glans clitoris is composed of erectile spongy tissue and is highly sensitive. The clitoral crus are covered by the ischiocavernous muscle.

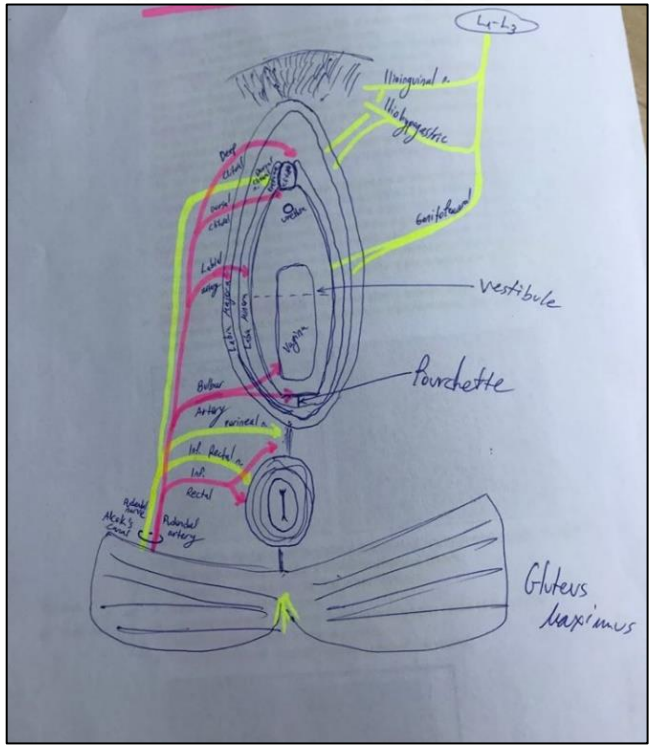
vi. **Vestibule**: is the cleft between the labia minora. Contains the orifices of the vagina, urethra and Bartholin's vestibular glands. The urethral orifice is situated 2.5cm below the clitoris, and is just above the vaginal orifice. In the virgin, the vaginal orifice is covered by the Hymen.

vii. **Hymen**: a thin mucus membrane situated at the vaginal orifice. It may vary in shapes, but is most commonly ringed.

viii. **Greater vestibular glands (Bartholin's)**: 2 mucous glands whose ducts open laterally to the posterior end of the vaginal orifice. Their secretions aid in vaginal lubrication during intercourse.

ix. **Lesser vestibular glands**: glands located in the anterior wall of the vagina which secrete fluid that helps in urethral lubrication.

x. **Blood supply**: Branches of the **internal pudendal artery** (branch of the **Int. iliac**).
- **Deep artery of the clitoris** (cavernous body of the clit), **dorsal artery of the clitoris** (dorsum of the clit), **labial artery** (labia), **bulbar artery** (bulbus of the vestibule) and **inferior rectal artery** (anus and perineum).
- **Venous drainage** is performed by the **vaginal plexus.**



xi. **Innervation**:
- **Lumbar plexus (L1-L3) → illioinguinal** and **illiohypogastric nerves** → labia majora and mons pubis
- **Lumbar plexus (L1-L3) → Genitofemoral nerve → labia majora**
- **Sacral plexus (S2-S4) → Inferior rectal nerve → anal sphincter**
- **Sacral plexus (S2-S4) → Perineal nerves → perineum**

- **Sacral plexus (S2-S4) → Dorsal nerve of the clitoris** → clitoris

c. **Internal female genitalia:** Refers to all internal female reproductive organs.

d. Vagina: A canal extending from the vestibule to the uterus. It is situated in a superoposterior direction and forms a 90º angle with the uterus. Anterior length is around 7 cm and posterior is around 9 cm.

i. The vaginal cervix forms a fold in relation to the uterine cervix (anterior, lateral and posterior fornices)

ii. It is situated **posteriorly** to the urethra and bladder and **anteriorly** to the rectum. Is it laterally surrounded by the levator ani.

iii. **Blood supply**: is via the **vaginal artery** (lower 2/3) and **uterine artery** (upper 1/3), which are both branches of **Internal iliac artery**. Venous drainage occurs via the **vaginal vein** and **uterovaginal plexus**.

iv. **Innervation**: via **sacral and lumbar splanchnic nerves**.

e. Uterus: A hollow thick-walled muscular organ situated between the bladder and rectum. It has a length of around 7.5 and a width of 5 cm.

i. **Parts of the uterus: Fundus** (roof, also contains the opening of the fallopian tubes), **body** (superior portion), **Isthmus** and **cervix**.

ii. **Parts of the cervix**: **Endocervix** (inner portion composed of the uterine orifice and cervical canal) and **Ectocervix** (projects into the vagina).

iii. **Stabilizing uterine ligaments**:

- **x1 Anterior** – formed by the Vesicouterine fold of peritoneum.
- **x1 Posterior** – formed by the Rectouterine fold of peritoneum ("Douglas Pouch").
- **x2 Lateral ('Broad')** – extend from the uterus to the pelvic wall.
- **x2 Uterosacral** - extend from the uterus to the sacrum. Fibrous tissue and muscle fibers **within the rectouterine fold**.
- **x2 Round** – flattened bands of 10-12cm, situated between the layers of the broad ligaments anteroinferiorly to the fallopian tubes. Pass via the inguinal canal.
- **x2 Cardinal (lig. transversalis coli)** – located on either side of the cervix, just below the broad ligament. It is the most important structure for uterine suspension.

iv. **Blood supply**: is via **uterine artery** (branch of the internal iliac) and **Ovarian artery** (branch of the abdominal aorta).

v. **Innervation**: via the **sacral splanchnic nerves** (PASY) and hypogastric plexus (SY).

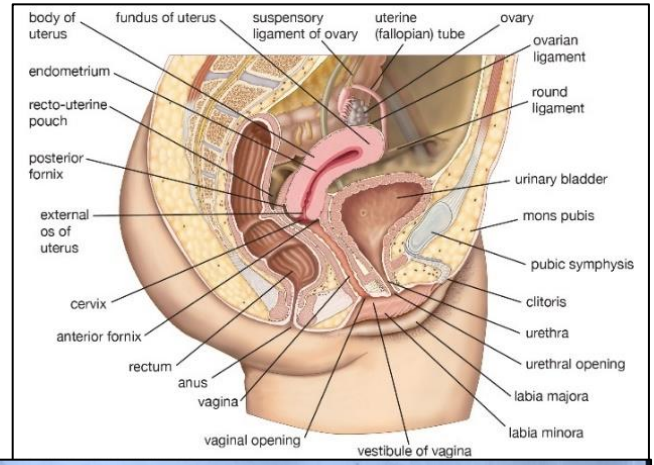
f. Fallopian tubes: 10cm tubes that connect the ovaries to the uterine cavity. Located at the superior margin of the broad ligament.

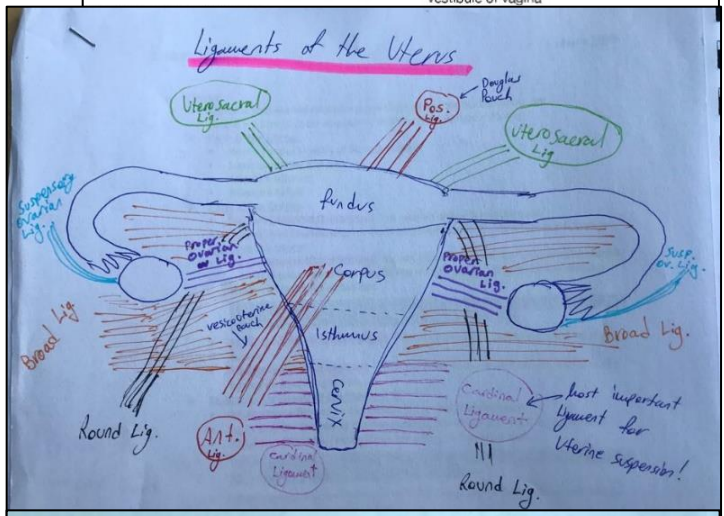
i. **Parts: Isthmus** (medial portion that includes the uterine ostium), **ampulla** (middle portion and is dilated) and **Infundibulum** (distal part that contains fimbriae and opens into the abdominal cavity).

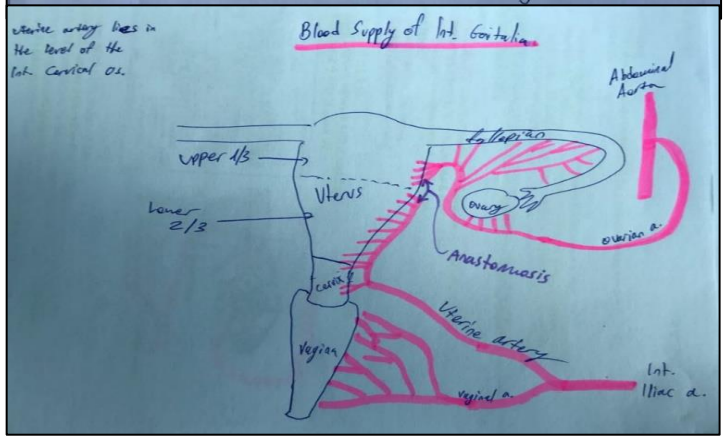
ii. **Blood supply**: **Uterine artery** and **Ovarian artery**.

iii. **Innervation**: **Sacral splanchnic nerve**.

g. **Ovaries: Round** organs located intraperitoneally in the ovarian fossa. The ovaries are attached posteriorly to the broad ligament





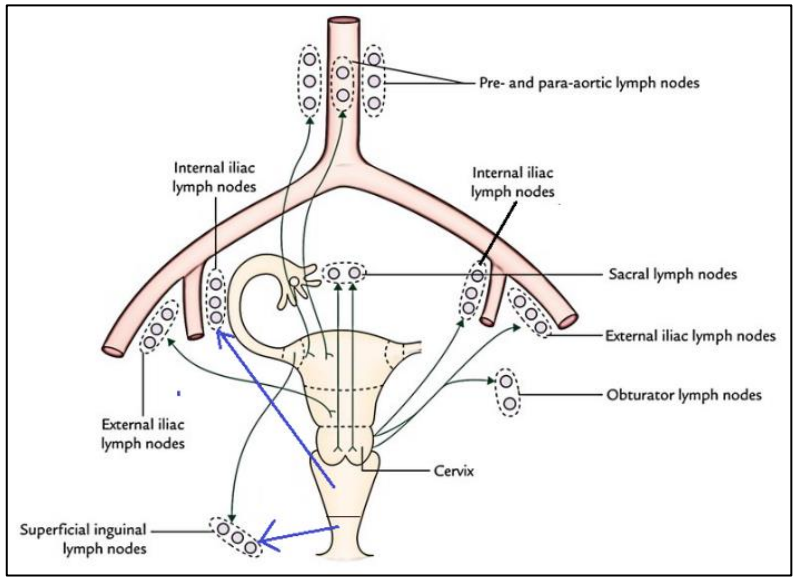


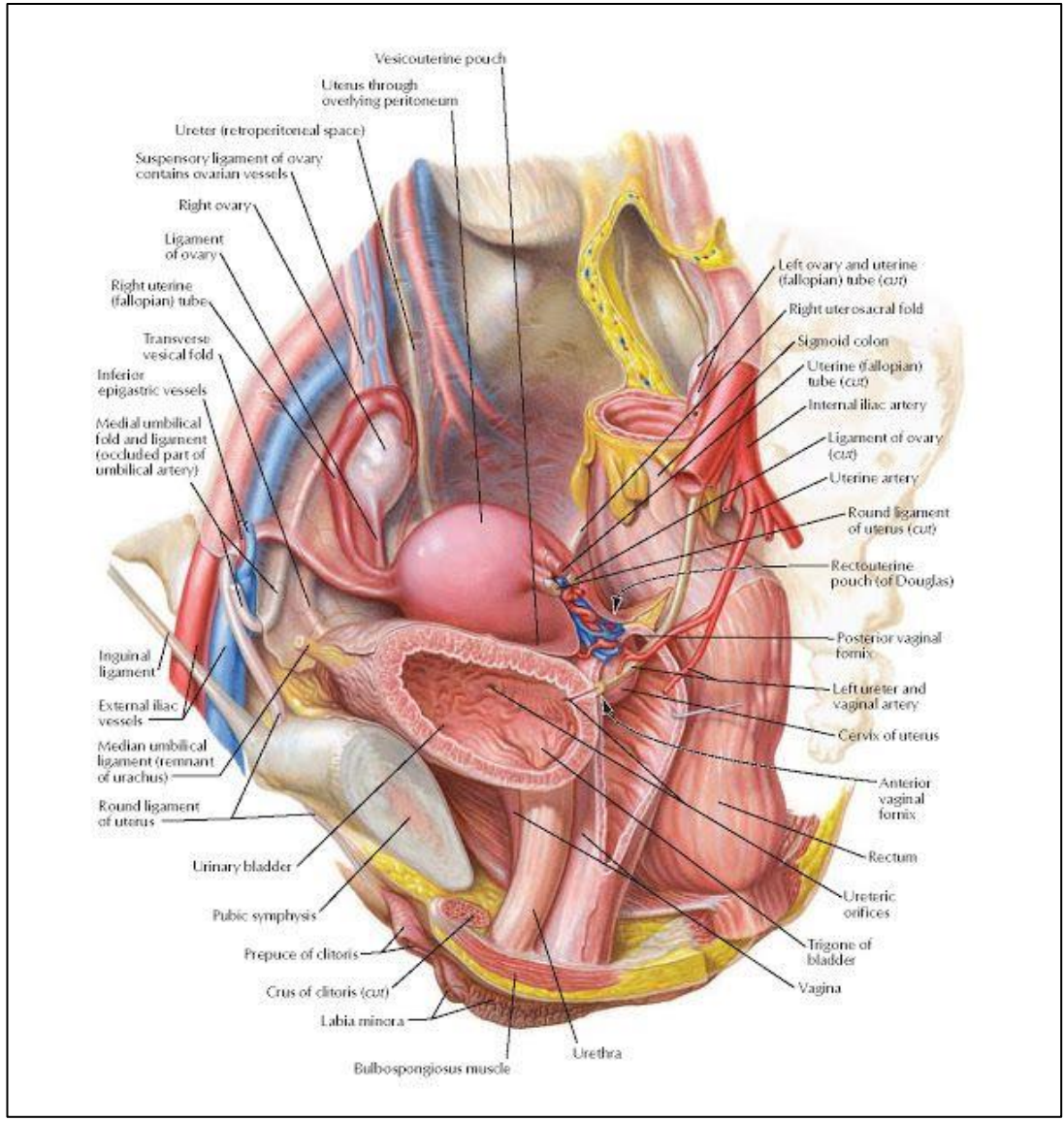
i. The ovaries lie inferoposteriorly to the fallopian tubes. Each ovary has a **tubal end** directed superolaterally and a **uterine end** directed inferomedially.
ii. **Ligaments**: **Suspensory ligament of the ovary** (connects the tubal end to the pelvis and contains the ovarian vessels) and **Proper ligament of the ovary** (connects the uterine end to the lateral angle of the ovary).
iii. **Blood supply**: **Ovarian artery** (branch of the Abdominal artery)
iv. **Innervation**: **Ovarian plexus** (rom renal plexus).

h. **Corona Mortis:** Is a variant anastomosis between the **obturator artery** (branch of the external iliac) and **inferior epigastric artery** (branch of internal iliac). During surgery, damage to this structure may induce massive bleeding.

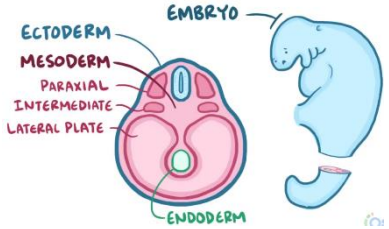
i. Lymphatic drainage of the female genitalia:
i. Vagina → Superficial inguinal and internal iliac LNs
ii. Uterus and cervix → external ileac and para-aortic LNs
iii. Ovary → Pre-aortic LNs

j. **Topography**:
i. **Vesicouterine pouch** → space between urinary bladder (anteriorly) and uterus (posteriorly)
ii. **Rectouterine pouch (of Douglas)** → space between the uterus (anteriorly) and rectum (posteriorly)
- Deepest space of the peritoneal cavity. Place where fluid usually accumulates.





2. Embryonal development of female pelvic organs and breast



1. Gonadal Development:

a. Undifferentiated Phase:

i. First 5w of development are identical for both sexes, the embryo is made of 3 germ layers: Ectoderm, Mesoderm and Endoderm

ii. Mesoderm broken into 3 more parts: Paraxial, Intermediate, Lateral Plate

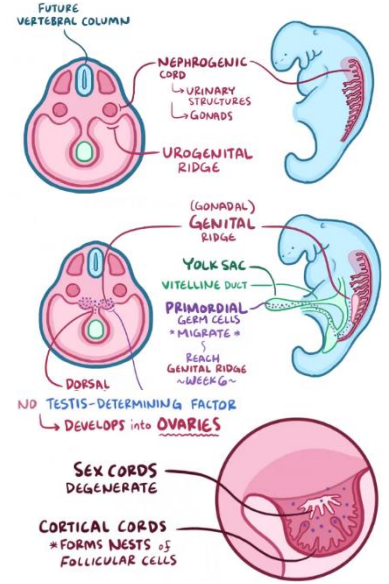
iii. Intermediate mesoderm condenses into 2 cylindrical **Urogenital Ridges**. Each ridge has a central cord called the **Nephrogenic Cord** – this gives rise to urinary structure and the gonads

iv. The section of the nephrogenic cord that gives rise to gonads is called the Gonadal/ Genital Ridge

v. A structure outside the embryo called the **Yolk Sac** is connected to the embryo via the **Vitelline Duct.** There are **Primordial germ cells (PGC)** (initially made from the endoderm) that move from the Yolk sac to the embryo via the vitelline duct. The PGC go from Yolk Sac → VD → Primitive digestive tract → Dorsal Mesentery.

vi. By 6w, PGC reach Genital Ridge and settle in the epithelium. This results in a signal causing undifferentiated gonads to start development

vii. Epithelial layer forms projections called **Primitive Sex Cords**



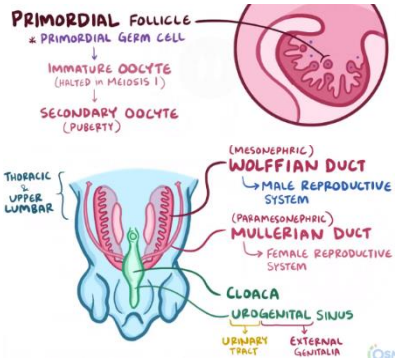
b. Differentiated Phase:

i. No Y chromosome → No **Testis-Determining Factor** → undifferentiated gonads differentiate into ovaries

ii. Sex cords degenerate while other epithelial projections are formed, called **Cortical Cords** – these form nests for follicular cells that surround PGC

iii. PGC + Ring of follicular cells = **Primordial Follicle** by 12w. While PGC is inside primordial follicle, it develops into an **Immature Oocyte** during Meiosis 1 and then into **Secondary Oocyte** during puberty.

2. Internal Genitalia:



a. Absence of **Testosterone** gives rise to the remaining of the female characteristics.

b. Genital Ducts are initially undifferentiated and are within the nephrogenic cords either side of the embryo.

i. **Mesonephric/ Wolffian Duct** – gives rise to male reproductive system

ii. **Paramesonephric/ Mullerian Duct** – gives rise to female reproductive system

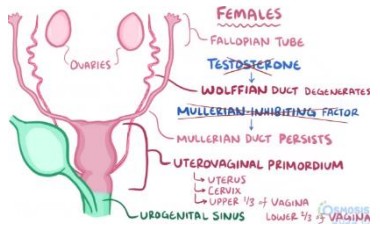
c. The ducts start at the thoracic and upper lumbar region and end in the **Urogenital Sinus** in the **Cloaca**

d. Ovaries don't make **testosterone** → Wolffian duct degenerates.

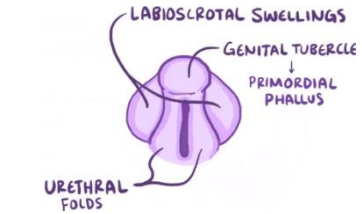
Ovaries don't make **Mullerian Inhibiting Factor** → Paramesonephric/ Mullerian Duct persists

i. Upper regions of the paramesonephric ducts: form the **Fallopian tubes**

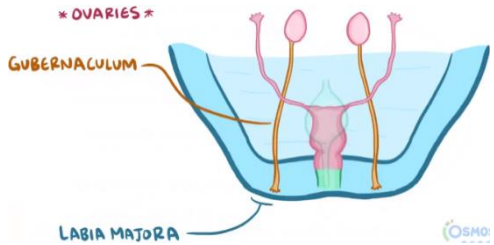
ii. Lower region of the paramesonephric duct: the ducts fuse → formation of the **Uterovaginal Primordium** → rise to **Uterus, Cervix** and **Upper 1/3 of Vagina.**



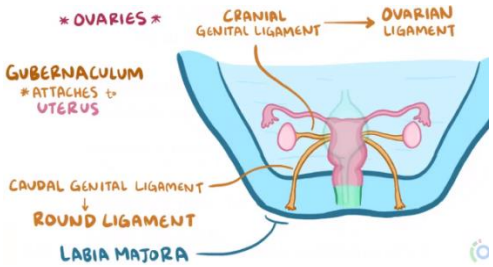
3. **External Genitalia:**
   a. **Undifferentiated Phase:**
      i. Opening of lower part of the urogenital sinus. On either side of the opening, there are 2 folds:
         a. **Urethral Folds**
         b. **Labioscrotal Swellings**
      ii. Above the opening there is the **Genital Tubercle** which acts as the **primordial phallus** for both sexes.
   b. **Differentiated Phase: by 12w**
      i. No Testosterone → urethral folds stay unfused and form **Labia Minora**
      ii. Labioscrotal swellings form **the Labia Majora** but fuse in the anterior position to form the **Mons Pubis**
      iii. Primordial Phallus shrinks and forms the **Clitoris**



4. **Descent of Gonads:**
   a. Initially, **Gubernaculum** attaches from the Ovaries to the Labia Majora
   b. When the uterus is formed, the middle of the gubernaculum attaches to it and separates into:
      i. **Cranial Genital Ligament → Ovarian ligament** (anchors ovaries on either side of the uterus)
      ii. **Caudal Genital Ligament/ Round ligament** (attaches uterus to the labia majora)



5. **Breast Development:**
   a. **Phase 1 – Development of mammary ridges/ crests (milk lines), Undifferentiated**
      i. Breast development begins by 4w.
      ii. 2 lines of thickened ectoderm develop on the ventral surface of embryo for both sexes, appear by 6-7w
      iii. These lines extend in curvilinear convex shape (curving towards the midline) from axilla to medial thigh
   b. **Phase 2 – Regression of the mammary ridges**
      i. Mammary ridges/ crest stops growing by 8w, length is regressed in a caudal to cranial direction
      ii. Ridges eventually disappear except at the level of 4th intercostal space
   c. **Phase 3 – Sprouting of Mammary Buds**
      i. During 5w, mammary ridge remnant proliferates creating **primary mammary bud**
      ii. **Primary mammary bud** grows downwards as solid diverticulum into underlying dermis during 7w
   d. **Phase 4 – Branching**
      i. 10w, branching or primary bud yielding **secondary buds**. These are fully formed by 12w
      ii. Secondary buds eventually develop into mammary lobules of the adult breast.



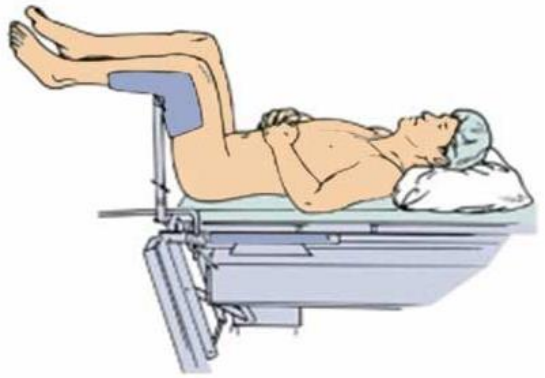
3. Assessment of the patient

1. **Introduction**: Routine gynaecologic evaluations are recommended every year for all women > 18 years who are sexually active.
2. **History:** A key difference in OB/GYN history is the focus on menstrual/menopausal history, sexual history, history of pregnancy and birth.
    - **a. Personal information:** name, date of birth, age, relationship status, occupation
    - **b. History of presenting illness:** description of the symptom (chief complaint), severity, duration and relationship to menstrual cycle, aggravating and relieving factors
        - **i. Pain: SOCRATES mnemonic** can be used to described (Site, Onset, Character, Radiation, Associations, Time course, Exacerbating or relieving factors, Severity)
        - **ii. Abnormal vaginal bleeding:** quantity, duration, relation to the menstrual cycle/menopause/sexual contact
        - **iii. Vaginal discharge**: color, consistency, amount and odor.
    - **c. Gynaecological history:**
        - **i. Menstruation history**:
            - **a.** Date of the last menstrual cycle (Assume all women are pregnant until proved otherwise)
            - **b.** Age at menarche/menopause
            - **c.** Menstrual pattern (duration, bleeding pattern, pain)
                - **i.** Length and regularity of the interval between cycles.
                - **ii.** Colour and volume of flow.
                - **iii.** Symptoms that occur with menses (cramping, loose stools).
            - **d.** Use of any contraception, current/future pregnancy plans
        - **ii. Past gynecological history**: history of any other gynaecological problems (e.g., endometriosis, fibroid, PCOS, infertility), previous surgical history, history of STI and/or PID, time and results of previous diagnostic/screening test.
    - **d. Sexual history:**
        - i. Assess current/past sexual partners (number, gender and timings)
        - ii. Assess current/past sex practices (genital/oral/anal)
        - iii. Assess current/past contraceptive methods use (type and frequency of use)
        - iv. History of STIs (previous diagnosis and treatment, previous STI testing results)
        - v. History of post-coital vaginal bleeding, History of sexual dysfunction (dyspareunia, low libido), History of sexual abuse
    - **e. Obstetrical history:**
        - i. **Past obstetrical history** (GTPAL system)
            - **a. G**ravida (number of conceived pregnancies)
            - **b. T**erm pregnancies (>37 weeks) → mode of delivery, birth weight and gender, maternal or perinatal complications, use of assisted reproductive techniques.
            - **c. P**reterm pregnancies (<37 weeks)
            - **d. A**bortions (elective or spontaneous before 20 weeks)
            - **e. L**iving children or live births
        - ii. **Current pregnancy history**:

    a. Gestational age and expected day of delivery
    b. Prenatal care, history of use of teratogenic drugs, history of maternal infections and immunizations
    c. Previous diagnostic tests, presence and frequency of fetal movements and contractions.
    d. Any complaints.

f. **Other history: Pharmacological history** (use of any drugs), **Family history** (esp. cancers of the reproductive system and endocrinological diseases), **Social history** (relationship status, socioeconomic status, occupation, drug and alcohol use), **Allergological history**.

3. **Examination:**
    a. **General examination:** Aims to seek the effects or causes of gynecological diseases. Assesses the general health and incidental diseases.
        i. General appearance, height, weight, BMI, temperature, pulse and BP and possibly signs of anemia, jaundice or lymphadenopathy.
    b. **Breast and axillary examination:** Before examination, ask the patient which part of their menstrual cycle they are currently in (because benign masses tend to swell before menstruation). Ask about any concerns and obtain the patients consent. Women age above 35 should be examined at least annually.
        i. Patient sits back and the breasts are inspected for symmetry and shape (→ asymmetry, swelling, breast masses), for any changes in the skin (redness, dipings, peau d'orange, excema, nipple retraction, discoloration) and for the presence of discharge.
        ii. Palpate all 4 quadrants of the breast with the patient lying supine and with the hand behind her hear. A circular movement or vertical palpation staring from the nipple may be used.
        iii. The axilla should then be palpated with the patients arm resting on the examiner's shoulder. LN should be examined for size, tenderness, mobility.
    c. **Abdomen:**
        i. **Inspection:** Assess the skin quality, distension, scars, stretch marks, striae and hernias.
        ii. **Palpation:**
            a. **Superficial palpation:** Asses for any guarding, tenderness, rigidity
                i. Guarding is **an involuntary response of the muscles**. Guarding is a sign that your body is trying to protect itself from pain
            b. **Deep palpation:** asses for any masses.
        iii. **Percussion:** Go around the abdomen. The bowel is resonant. Fluid filled and solid masses are dull. Look for shifting dullness (ascites).
        iv. **Auscultation:** usually done post-op to detect bowel sound.
    d. **Pelvic examination:** explain to the patient what is about to happen, why and how it will be done. After this, ask the patient to empty their bladder. A 3rd person (chaperone) must be offered. Allow the patient to remove their clothes in privacy. All equipment should be warmed.



        i. **Position:** Dorsal – laying on the back, lithotomy (for vaginal surgery)
        ii. **Inspection:**
            a. Check the vulva for any abnormalities (swelling, irritation, ulcers, warts)
            b. Check the skin for any scars, discoloration and hair distribution.
            c. Inspect the vaginal introitus for discharge and ask the patient to perform the valsalva maneuver to assess for organ prolapse.
            d. Palpate the labia majora for any masses or tenderness. Palpate for perineal lymph nodes.
        iii. **Bimanual vaginal examination:** Lubricate the index and middle finger of one hand and insert the 2 fingers into the vagina, and place the other hand over the pelvic region (i.e. lower belly) and feel the uterus and adnexa (joining parts).

a. For determining the size and location, tenderness or masses in the vagina, uterus or cervix

b. Uterine size and position → press below the cervix and on the abdominal midline.

c. Ovarian masses → press on the side of the cervix and from the costovertebral angle towards the pelvis. Normally nothing can be felt.

iv. **Rectovaginal examination:** Lubricate the index and middle finger of one hand and insert them into the vaginal canal and rectum. Use the other hand to push the uterus posteriorly by pressing on the anterior abdominal wall.

d. The procedure allows for palpation of the Rectovaginal septum.

v. **Speculum examination:** Separate the labia majora with the index and middle fingers and gently introduce the speculum into the vaginal canal with the blades facing down (45º angle). After partly advancing, rotate the speculum 45º (so that it is in a vertical position). Lock the screws of the speculum.

a. **Inspect the cervix for:**

i. Position and color

ii. Abnormal discharge

iii. Erosions and ulcerations, hemorrhages and masses.

b. **Signs of a Pathological Discharge:**

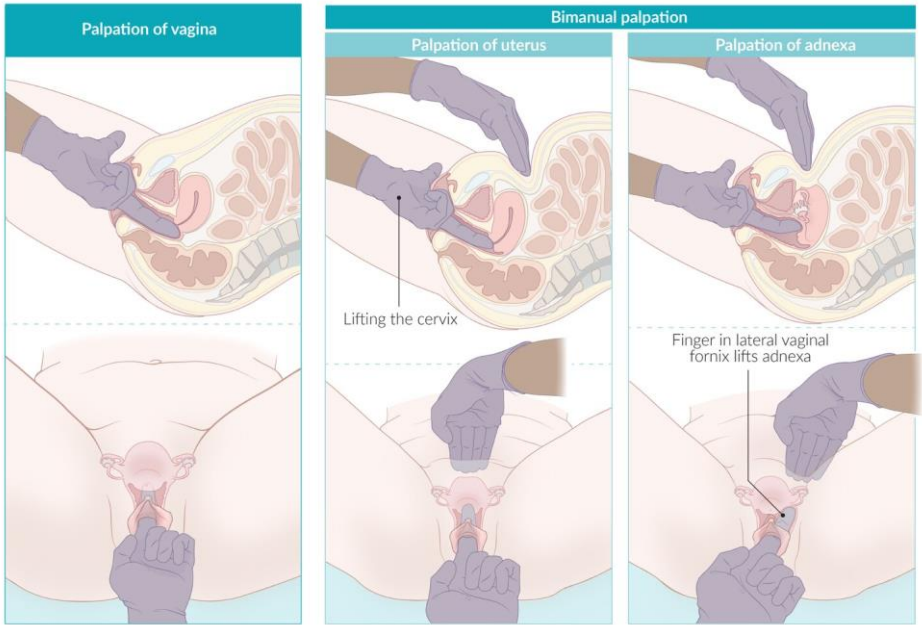
i. Malodorous (fishy).

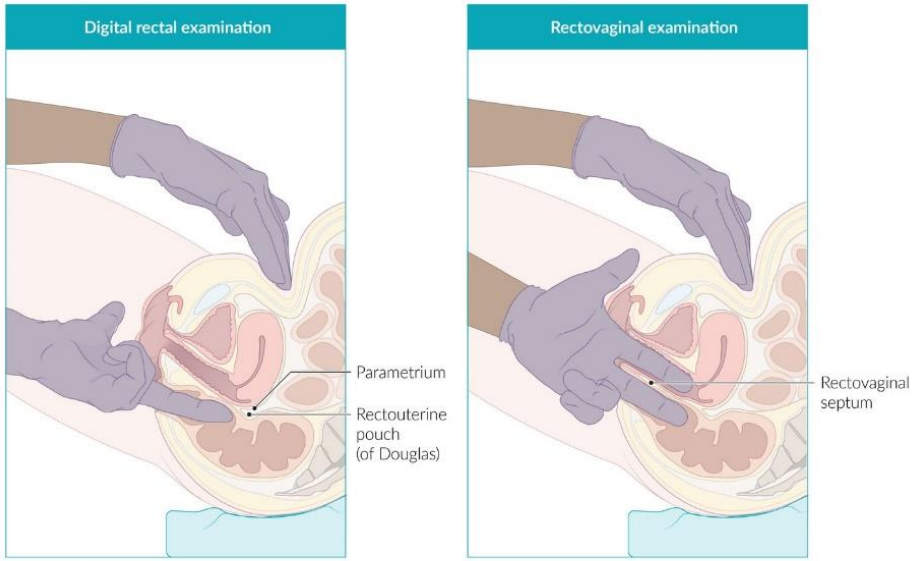
ii. Abnormal consistency (frothy, curd-like).

iii. Bloody, brown, yellow, green, or grey colour.

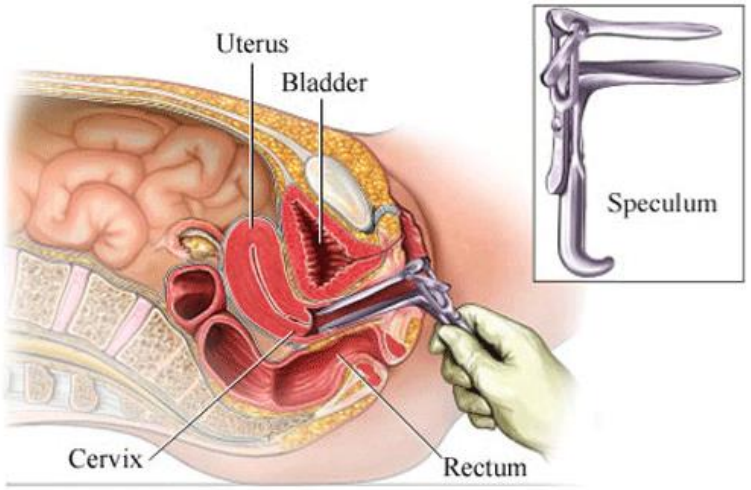
iv. Accompanying pruritic and/or erythematous vagina & cervical tenderness (PID).

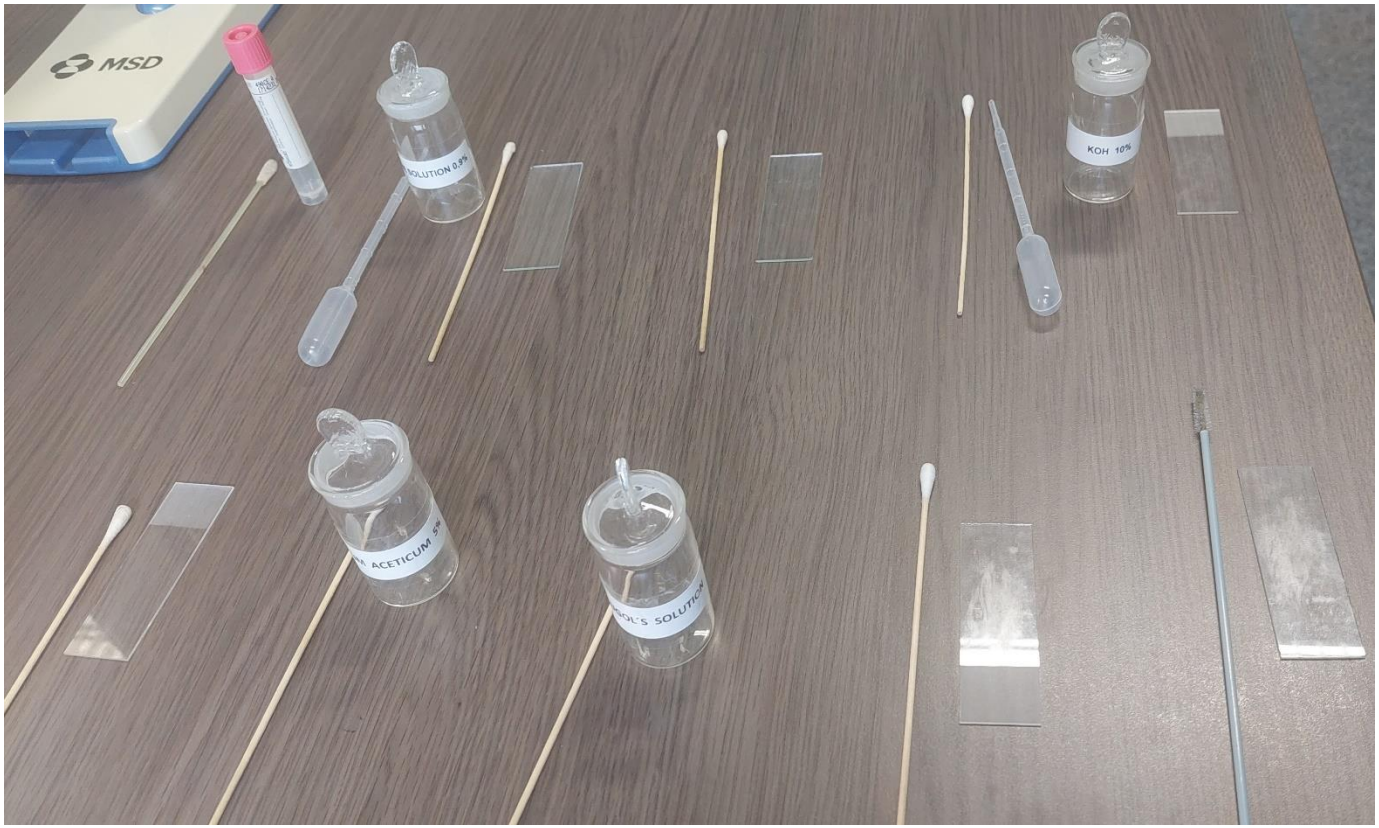
c. **Samples can be taken from the vagina for cytology and cultures** (see picture below on tests that can be performed during speculum examination).





i. **1st** → Swab of the Endocervix for culture examination (first test to be performed)
ii. **2nd** → Saline vaginal wet mount. Swab from the posterior vaginal fornix. (→ Trichomoniasis)
iii. **3rd** → Swab for Giemsa stain. Swab from the posterior vaginal fornix (→ Gonorrhea and Chlamydia)
iv. **4th** → Swab for vulvovaginal candidiasis. Swab from the posterior fornix (→ Candida Albicans)
v. **5th** → Amine test. Swab from the posterior vaginal fornix followed by addition of KOH and smelling (→ G. vaginalis)
vi. **6th** → Hormonal cytology. Swab from lateral upper 1/3 of the vagina.
vii. **7th** → Cleaning the mucus of the ectocervix using 5% acetic acid (→ colposcopy)
viii. **8th** → Shiffer's test using Lugol's iodine solution. Add Lugol's solution into the ectocervix. (Normal epithelia presents with a brownish colour, whereas CIN shows whitish colour).
ix. **9th** → Ectocervical smear.
x. **10th** → Pap smear. Brush from the Endocervix.



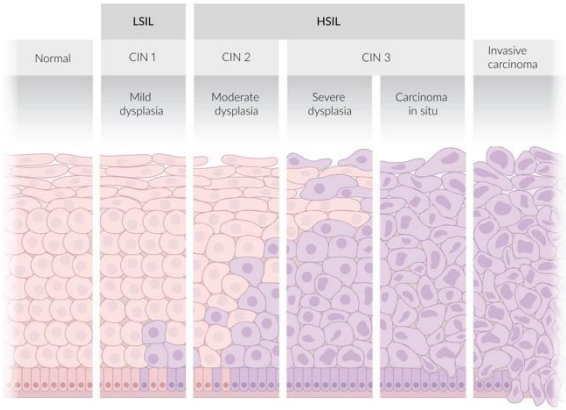


4. Colposcopy, cervical smear, oncological and hormonal cytology

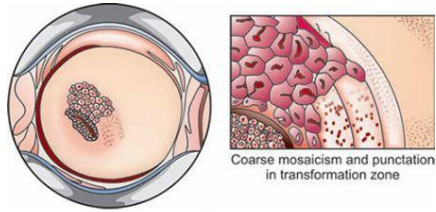
1. **Papanicolaou test** (pap smear/cervical cytology): a cytological screening test for cervical cancer in which a cell sample taken from the cervix is examined for cellular abnormalities that may be indicative of cervical cancer

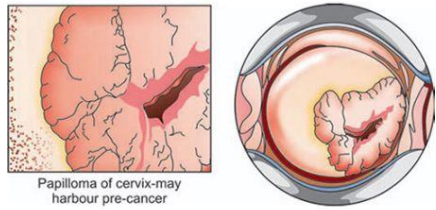
LSIL: low-grade squamous intraepithelial neoplasia

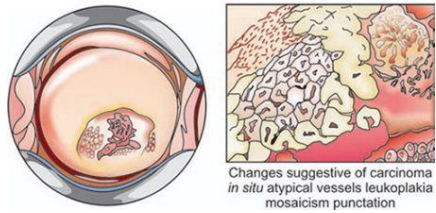
HSIL: high-grade squamous intraepithelial neoplasia



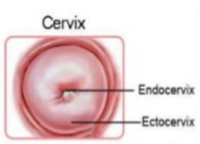
   a. **Indications:** screening for cervical intraepithelial neoplasia and invasive cervical cancer in individuals 21-65 years
   b. **Pap smear technique**:
      1. To obtain a specimen, use a sterile speculum to visualize the cervix.
      2. Cleanse the cervix using a cotton pledget
      3. Visualize the transformation zone
      4. The specimen is collected using a spatula or brush that is rotated by 360 degrees.
      5. The specimen is then prepared with Pap dye
   c. **Screening interval:** every 3 years if done alone, every 5 as co-testing
   d. **Findings:** Bethesda system
      i. **No epithelial cell abnormalities:** NILM (negative for intraepithelial lesion or malignancy)
      ii. **Epithelial cell abnormalities**
         1. **ASC-US:** atypical squamous cell of undetermined significance
         2. **ASC-H:** atypical squamous cell likely to contain HSIL
         3. **LSIL:** low grade squamous intraepithelial lesions. Correlates with cervical intra-epithelial neoplasia.
         4. **HSIL:** High grade squamous intraepithelial lesions. Correlates with CIN II/CIN III
         5. **SCC:** squamous cell carcinoma
         6. **AGC:** atypical glandular cells
         7. **AIS:** endocervical adenocarcinoma in situ
   e. **Advantages**: Identifies early cellular changes indicating a risk for developing cervical cancer.
   f. **Contraindications:** history of hysterectomy for nonmalignant disease, history of endometrial cancer
   g. **Management:**
      i. **NILM:** routine cytologic screening
      ii. **ASC-H, LSIL, HSIL:** ↑ incidence of severe histologic abnormalities → colposcopy evaluation and biopsy of abnormal sites
         1. **Postmenopausal women:** atrophic changes may result in LSIL, however risk of progression is low. Treat like ASC-US
      iii. **ASC-US**: low risk of invasive cancer
         1. Repeat cytological evaluation at 6 and 12 months
         2. "Reflex" testing for the presence of high-risk HPV serotypes
         3. If abnormal results for either → colposcopy
      iv. **AGC:** Colposcopic, endocervical and endometrial evaluation and sampling in addition to HPV testing
      v. **AIS, adenocarcinoma:** excisional procedures to assure adequate sampling should the above measures not be diagnostic

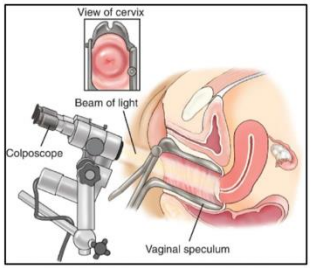


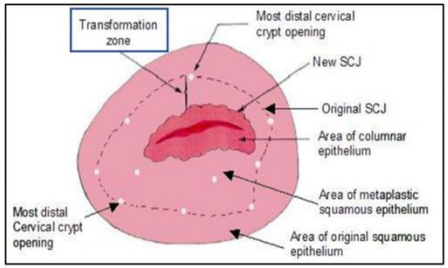




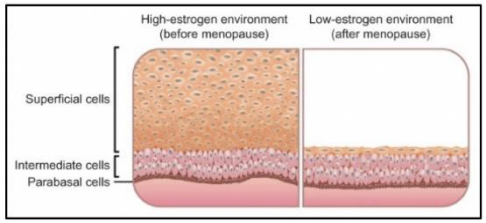
2. **Colposcopy:** Is a type of microscope used to acquire a magnified view of the ectocervix or vagina. Allows assessment of the ectocervix under magnification. Aplication of acetic acid or iodine facilitates the colposcopic detection of precancerous and cancerous lesions.
    a. **Indication**: for evaluation of LSIL in patient's age ≥25 and all patients with ASC-H and HSIL.
    b. **Abnormal patterns:**
        i. White lesions → condylomata accuminata
        ii. White membrane that cannot be scrapped off → cervical leukoplakia
        iii. Punctate lesions or mosaic pattern → CIN
        iv. Atypical vessels → cervical cancer
    c. **Schiller's or Lugols iodine:** enhance the definition of the outer limit of the TZ and enable detection of any abnormal areas of vaginal epithelium
        i. **Schiller test:** Normal cervical tissue shows brown color with iodine-glycogen reaction. Lack of color suggests abnormal tissue.





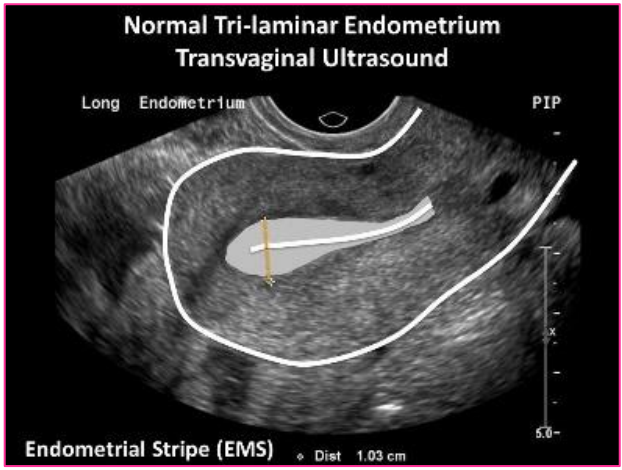


3. **Hormonal Cytology:** Hormones influences the morphology and staining characters of endometrial, endocervical and vaginal cells.
    a. **Indication:**
        i. Assessment of ovarian function, abnormal hormonal production and hormonal therapy
    b. **Fern test:** can determine the presence or absence of ovulation. Cervical mucus is spread and it is observed for a fern pattern.
        i. The fern front pattern indicates an estrogenic effect on mucus without the influence of progesterone; thus a non-front pattern indicates ovulation
    c. **Maturation index** (MI): method of evaluation of hormonal status based on vaginal smears
    d. **MI=** % parabasal cells: % of intermediate (navicular cells): % superficial cells
        i. **Interpretation:**
            1. **Follicular Phase** (Pre-Ovulation): 0/40/60 (ESTROGEN predominance).
                a. **Estrogen:** proliferation and maturation of vaginal squamous epithelial cells including superficial cells
            2. **Luteal Phase** (Post-Ovulation): 0/70/30 (PROGESTERONE predominance).
                a. **Progesterone:** ↑intermediate cells, ↓ superficial cells
            3. **Pregnancy** 0/90/10.
            4. **Menopause**: 0/80/20 to 50/50/0 to 100/0/0.
            5. **Contraceptives**: 0/60/40



5. Ultrasound in gynaecology

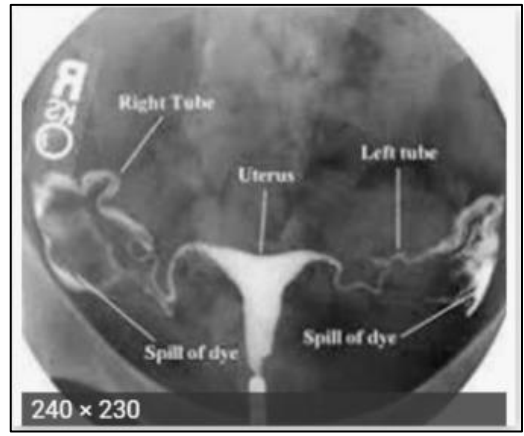
1. **Introduction**: US is the easiest method of assessing the uterus, ovaries and adnexal structures. It can detect:
    i. Intrauterine causes of infertility and metrorrhagia
    ii. Adnexal masses, source of unexplained pelvic pain
    iii. Early pregnancy, ectopic pregnancy, hydatiform moles
    iv. Congenital anomalies, Ovarian cysts and tumours, PID, tubo-ovarian abcesses, bladder abnormalities
    v. Assessment of fetal development and heartbeats during the first trimester
    vi. Measurement of cervical length in cases of cervical incompetence.



2. **Pelvic ultrasound:** ultrasound of pelvis that can be done abdominally, transvaginally or both.
    a. **Transabdominal US:** easiest method of assessing the uterus, ovaries, and adnexal structures.
        i. **Assessment:** urogenital tract, fetal development, pelvic organs
        ii. Full bladder is recommended as it helps raise pelvic structures from behind the symphysis and into view
    b. **Transvaginal US:** Allows more accurate imaging of the ovaries and uterus. Downward pressure with the other hand can bring the organs closer to the uterus.
        i. Can be used to guide ovarian cyst or oocyte aspiration.
        ii. Can be used for **screening of endometrial cancer** by measuring the thickness of the endometrium. Thickness above 5 mm requires additional follow-up.
3. **Sonohysterography:** A procedure in which saline is instilled into the uterine cavity via the cervical canal and abdominal ultrasonography is performed to evaluate the uterine cavity and morphology/patency of the fallopian tubes.
    a. **Intrauterine pathology:** It provides better visualization of polyps, Asherman's syndrome, or submucous leiomyoma
4. **Doppler ultrasound:** uses reflected sound waves to evaluate blood as it flow through a blood vessel. It helps to evaluate blood flow through the major arteries and veins.
    a. **"Bedside" or continuous wave Doppler:** uses pitch of the soundwaves to determine flow through blood vessel. The examiner listens to the sounds produced by the transducer to evaluate the blood flow through an area that may be blocked or narrowed. Can be done at the bedside or hospital and it's a fast estimate of the blood vessel damage or disease
    b. **Duplex Doppler:** uses standard US methods to produce a picture of a blood vessel and surrounding organs. A computer converts the doppler sounds into a graph that gives information about the speed and direction of blood flow
    c. **Color Doppler:** uses standard US methods. A computer converts doppler sounds into colors that are overlaid on the image of the blood vessel that represent the speed and direction of blood flow through the vessel
        i. can depict the vascularity of the pelvic organs and can be used for assessment of angiogenesis in tumor masses and establishment of blood flow features of malignant pelvic lesions
5. **Breast US**: May be used to assess breast lesions which were detected by palpation, mammography or MRI. It is used for women < 30 years of age. Additionally, it can be used to assess the axilla for LN involvement in breast cancer.

6. Imaging in gynaecology (X-ray, CT, MRI)

1. **X-ray:** Radiological imaging in gynecology has been largely replaced by ultrasound, but it still has a role in the diagnosis and assessment of malignancy and infertility.
    a. **Pelvic tumor:** dermoid cysts often have radiopaque material (teeth or bone) that distinguishes them from the ovarian tumors
    b. **Fibroids:** can be detected if they become calcified
    c. **Intrauterine contraception devices:** lost IUD's that have perforated the wall of the uterus can be seen on x-ray
    d. **Chest x-rays:** pleural effusions suggest stage IV ovarian carcinoma, ovarian hyperstimulation, ovarian fibromas. Choriocarcinoma appears as cannon-ball metastases in the lungs
2. **Mammography**: Refers to a localized X-ray to the breast. It is primarily used for the screening of breast cancer in women >30 years of age.
    a. Characteristics of malignant lesions → Stellate shaped high density mass with speculated margins, irregular and high density calcifications.
3. **Galactography:** X-ray method that involves injection of contrast into the milk ducts, followed by a mammography.
    a. Indicated in cases of suspicion of intraductal lesions.
4. **Hysterosalpingography:** injection of water-soluble contrast medium through the cervix into the uterine cavity. It is used to visualize the uterine cavity and fallopian tubes in the investigation of patients with infertility or recurrent miscarriage**.**
    a. **Polyps or submucous fibroids** produce rounded filling defects.
    b. **Intrauterine synechiae and congenital abnormalities** of the uterine cavity (septate or bicornuate uterus) can also be identified.
    c. **Tubal patency:** tubal obstruction can be identified and this is important in determining the feasibility of tubal surgery. If dye remains localized at the end of the tube, this suggests peritubal adhesions.



5. **Hysteroscopy**: Imaging method that involves introduction of a hysteroscope transcervically into to the uterus for visualization. Fluids are applied constantly to dilate the uterus.
    a. Commonly a part of the workup for AUB.
    b. Hysteroscopy can be combined with diagnostic/therapeutic interventions.
6. **CT:** scans of the pelvis are used mainly in the assessment of malignancy.
    a. Allows identification of retroperitoneal lymphadenopathy associated with malignancies
    b. Stage gynecological cancer
    c. Accurate tool for the detection of pelvic abcesses and to guide their drainage.
7. **MRI**: an alternative method of soft-tissue imaging which avoids the need for ionizing radiation.
    a. Stage and follow-up of pelvic cancers.
    b. Adjunct to US in the prenatal diagnosis of fetal anomalies
    c. Evaluates placental blood flow and accurate performance of pelvimetry
    d. Alternative to CT in pregnant women

7. Congenital Anomalies of Genital Organs

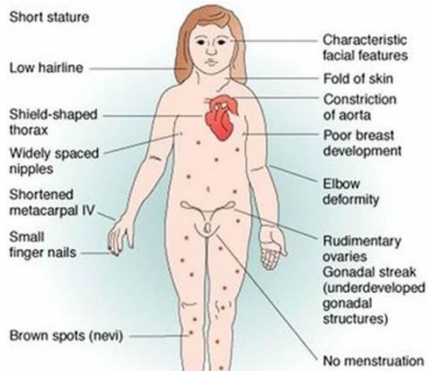
1. **Anomalies of Uterus:**
    a. **Anomaly of Mullerian Duct Fusion:** defective fusion but normally functioning gonads with normal development of secondary sexual characteristics.
        i. **Types:**
            a. **Mullerian agenesis:** both mullerian ducts fail to develop → absent or hypoplastic uterus, cervix and vaginal agenesis (ovaries still functional)
            b. **Unicornuate Uterus:** one of the mullerian ducts fail to develop.
            c. **Didelphic Uterus:** complete lack of mullerian duct fusion → double uterus, double cervix, double vagina
            d. **Bicornuate Uterus:** incomplete fusion of mullerian ducts
                i. **Uterus bicornis unicollis** – double uterus, single cervix, single vagina
                ii. **Uterus bicornis biocollis** – double uterus, double cervix, sometimes no vaginal septum
            e. **Septate Uterus: mullerian ducts fuse, but septa between 2 ducts persists.**
            f. **DES-related abnormality:**
                i. **Etiology:** in-utero exposure to diethylstilbesterol
                ii. **Manifestation:** Vagina → adenosis, adenocarcinoma, Cervix → cockscomb cervix, cervical collar, Uterus → T-shaped uterine cavity
        ii. **Manifestation:** asymptomatic before puberty, infertility, Menorrhagia, Mullerian agenesis (primary amenorrhea in a female with fully developed sexual characteristics)
        iii. **Complications:** increased risk of obstetric issues → cervical incompetence, ectopic pregnancy, preterm labour, urological complications: renal agenesis.
        iv. **Diagnosis:** Screening tests → transvaginal or abdominal US with hysterosalpingography, MRI to confirm
        v. **Treatment:** Metroplasty (reconstructive surgery to repair congenital anomalies), Septoplasty
    b. **Asherman Syndrome:**
        i. Endometrial adhesions or fibrosis
        ii. **Etiology:** Uterine dilation or curettage (most common), post-inflammatory (e.g., chlamydia)
        iii. **Manifestation:** uterine bleeding, secondary amenorrhea, infertility, recurrent pregnancy loss, periodic abdominal pain
        iv. **Diagnosis:** negative progesterone withdrawal test, Hysteroscopy (for confirmation)

2. **Anomalies of the vulva and vagina:**
    a. **Imperforate Hymen:** congenital defect, hymen has no opening
        i. **Pathophysiology:** central cells of Mullerian eminence in the urogenital sinus do not disintegrate → imperforate hymen → cryptomenorrhea at puberty (outflow tract obstruction causing backup of menstrual blood) → hematocolpos (vaginal retention of menstrual blood at puberty) and hematometra
        ii. **Manifestation:** Primary amenorrhea with periodic lower abdominal pain
            a. **At birth:** vaginal secretions accumulate → swelling in introitus → spontaneous resolution
        iii. **Diagnosis:** visible findings on physical examination, perineal examination → tense, bulging, bluish membrane in vulva
        iv. **Treatment:** excision/ hymenotomy

b. **Agenesis of Upper Vagina:**
    i. **Etiology:** Mullerian agenesis
    ii. **Pathophysiology:** agenesis/ hypoplasia of mullerian duct → atresia of upper 1/3 of vagina. Normal gonads and normal secondary sexual characteristics
    iii. **Manifestation:** primary amenorrhea, infertility, dyspareunia
    iv. **Associated anomalies:** absent/ malformed uterus and cervix
    v. **Diagnosis:** perineal examination → vaginal dimple and hymenal fringe
c. **Vaginal Atresia of lower 2/3 of Vagina:**
    i. **Etiology:** abnormal development of the urogenital sinus, caused by Fraser Syndrome (AR)
    ii. **Manifestation:** asymptomatic before puberty, primary amenorrhea, infertility, dyspareunia
    iii. **Diagnosis:** Perineal examination → vaginal dimple and hymenal fringe, Normal hormonal levels (LH, FSH, Prolactin, Estradiol, Testosterone), US to confirm
    iv. **Treatment:** vaginoplasty
d. **Transverse Vaginal Septum:**
    i. **Pathophysiology:** failure of recanalization of Mullerian duct → transverse septum in vaginal canal → cryptomenorrhea → hematocolpos
    ii. **Manifestation:** asymptomatic before puberty, primary amenorrhea, cryptomenorrhea, infertility
    iii. **Diagnosis:** transvaginal US (TVUS), MRI
    iv. **Treatment:** nonsurgical dilation over 6-12 months using graduated vaginal dilators (1^{st} line), Vaginoplasty (2^{nd} line)
e. **Labial Fusion:** partial or complete adhesion of the labia minora
    i. **Etiology:**
        a. **Infection:** Absence of estrogen → predisposition of mild infections due to reduced local defences in the vulva → local inflammation → adhesions
        b. **Other:** trauma (sexual abuse), congenital defect of urogenital sinus
    ii. **Manifestation:** visible findings on physical examination as mother brings child to physician since no vaginal opening can be seen, recurrent UTI and vaginitis (if external urethral opening is obstructed), perineal examination → missing features such as: the thin vertical midline fold in the perineum, the labia and the vaginal opening.
    iii. **Treatment:** topical estrogen, often resolves spontaneously after puberty since estrogen levels increase.

8. Somatosexual disorders, chromosomal abnormalities, intersexual development

1. **Definition:** Group of congenital conditions characterised by atypical development of **chromosomal, gonadal, and/or phenotypic sex.** These genetic mutations can change:
    a. **Number and function of sex chromosomes** (Turner's)
    b. **Structures of hormone receptors** (Androgen insensitivity syndrome)
    c. **Function of enzymes responsible for sex hormone synthesis** (congenital adrenal hyperplasia)
2. **Complications:** Mismatch between sexual genotype and phenotype resulting in difficulties related to gender identification, reduced fertility, organ malformations (cardiac abnormalities)
3. **Turner Syndrome, 45 XO**
    a. **Etiology:** chromosomal nondisjunction during meiosis or mitosis
    b. **Pathophysiology:** chromosomal nondisjunction → X chromosome mosaicism → impaired ovarian development → malfunctioning streak gonads → estrogen and progesterone deficiency
    c. **Manifestation:** female phenotype, primary ovarian insufficiency (often comes with delayed puberty, infertility and primary amenorrhea), short stature, shield chest (broad chest with wide spaced nipples), webbed neck, cardiovascular abnormalities (bicuspid aortic valve, coarctation of aorta, aorta dissection, HTN)
    d. **Diagnosis:** hypergonadotropic hypogonadism (low estrogen, androgen but high FSH and LH), karyotyping
    e. **Treatment:** estrogen and progesterone substitution, GH therapy, surgical removal of streak gonads



4. **Klinefelter Syndrome, 47 XXY**
    a. **Etiology:** nondisjunction of sex chromosomes during meiosis a/w advanced maternal age
    b. **Pathophysiology:** testicular dysgenesis:
        i. Seminiferous tubules dysgenesis → loss of Sertoli cells → ↓ inhibin B → ↑ FSH
        ii. Leydig cell dysfunction → ↓ testosterone → ↑ LH
        Increased FSH and LH → increased conversion of testosterone into estrogen
    c. **Manifestation: Eunuchoid growth pattern** (tall, slim with long extremities), gynecomastia, reduced facial and body hair, testicular atrophy, reduced fertility and libido), **developmental delay** (neurocognitive dysfunction, language impairment, poor social skills)
    d. **Complications:** breast cancer, testicular cancer
    e. **Diagnosis:** Karyotyping
        i. **Hormone levels:** ↑FSH and LH, ↓ T with ↑ aromatase and estrogen
        ii. **Testicular Biopsy:** Seminiferous tubules fibrosis, Leydig cells hyperplasia
    f. **Treatment:** life-long testosterone substitution
5. **Androgen Insensitivity Syndrome, 46 XY**
    a. **Etiology:** XR mutation of androgen receptor genes
    b. **Pathophysiology:** defective androgen receptor → end organ insensitivity to androgens
    c. **Manifestation:**
        i. Complete Androgen insensitivity: absent male genitals, female external genitalia and physique due to increased aromatization of androgens to estrogens → testicle feminisation and breast development, blind-ended vaginal pouch, no pubic hair

ii. Partial androgen insensitivity various phenotypical configurations possible

d. **Diagnosis:**
   i. Clinical findings
   ii. **Before puberty:** high testosterone
   iii. **After puberty:** high LH and Estrogen, normal testosterone
   iv. Genetic testing
e. **Treatment:** Hormone treatment (estrogen replacement/ high dose androgen therapy with male gendered identity patients), Gonadectomy (for intraabdominal/ intra-labial testicles), Psychological support

6. **Aromatase Deficiency, 46 XX or 46 XY**
   a. **Etiology:** AR in CYP19A1 gene that codes for enzyme aromatase
   b. **Pathophysiology:** defective/ absent aromatase → ↓ conversion of T to E → ↓ serum E and ↑ serum T
   c. **Manifestation:** tall stature, osteoporosis, hyperglycemia, eight gain, fatty liver
      i. **46, XX**
         a. **At birth:** ambiguous external genitals, normal internal genital organs
         b. **Puberty:** impaired maturation of SSC, primary amenorrhea, virilization (= appearance of male SSC)
      ii. **46, XY:** abnormal sperm production, small/ undescended testicles, low libido
   d. **Diagnosis:** hormone level testing (↑ T, ↑ androstenedione, ↓ E), before birth (maternal virilization)
   e. **Treatment:** Estrogen and progesterone replacement therapy, Ca and Vit D supplement, surgical correction of ambiguous genitals
7. **Ovo-testicular Disorder of Sexual Development, 46 XX > 46 XY**
   a. **True Hermaphroditism:** presence of both male and female reproductive tissue and/or organs
   b. **Pseudo-hermaphroditism:** mismatch between gonads and secondary sexual characteristics
      i. **Male pseudo-hermaphroditism:** male gonads with female secondary sexual characteristics (SSC)
      ii. **Female pseudo-hermaphroditism:** female gonads with male SSC
   c. **Etiology:** SRY gene translocation from Y to X chromosome
   d. **Manifestation:** ambiguous genitals, infertility
      i. **46 XX**
         a. **At birth:** labial fusion, urogenital sinus, polycystic ovaries
         b. **At puberty:** primary amenorrhea
      ii. **46 XY**
         a. **At birth:** hypospadias, cryptorchidism
         b. **At puberty:** gynecomastia, recurrent groin pain/ scrotal pain, testicular enlargement
   e. **Diagnosis:** chromosomal and genetic testing, biopsy of gonads (shows both testicular and ovarian tissue)
   f. **Treatment:** surgical removal of genital structures according to gender identity

9. Puberty and Disorders of pubertal development

Puberty refers to the phase of development between childhood and adulthood in which complete functional maturation of the reproductive glands and external genitalia occurs. It is a stage of development when **sexual maturation** and **growth** are completed and the person becomes **fertile** (ovulation in ♀, spermatogenesis in ♂). Other processes that characterize this transitional phase are the **development of the secondary sexual characteristics**, **growth spurts** and **psychosocial maturation**.
Although there is considerable variation, puberty begins on average at **11 at girls** and **13 at boys.**

a. **Physiology:** Unknown initial trigger → ↑ activators and/or ↓ inhibitors of GnRH secretion → pulsatile GnRH secretion → pulsatile secretion of LH and FSH → stimulate gonads to produce sex hormones → production of sex hormones (estrogen and testosterone) → 2° sexual characteristics

b. Factors influencing puberty:

i. General health conditions (nutritional state, body weight)
ii. Genetics
iii. Social environment (eg. family stress).

c. **Sequence of puberty:**

Boy: 13 - 16 y/o, ~ 5 years	**Girl: 11 - 14 y/o, ~ 4 years**
Adrenarche: adrenal gland starts androgen production (axillary and pubic hair, body odor and acne develops).	
Gonadarche: testicular enlargement to **> 4ml** volume (**1st sign of puberty**)	**Thelarche:** breast bud development (**1st sign of puberty)**
Pubarche: adrenal androgen stimulates development of pubic hair.	
Growth spurt: ~ 18 months after testicular enlargement (~ 10 cm/year)	**Growth spurt:** shortly after thelarche (~ 9 cm/year)
Spermarche: spermatogenesis starts	**Menarche:** menstruation starts. The menstrual cycle may be irregular in adolescents during the first few months/years after menarche due to irregular hormone secretion.

d. Physical and psychosocial changes during puberty:

- Development of the breast, gonads and pubic hair according to the Tanner stages.
- **Growth spurt:** Linear growth during adolescence is around 5 cm/year. Varies between sexes, generally occurring between 13-15 years (in girls may develop two years earlier. Growth spurt starts earlier in girls, but boys are taller due to longer puberty and faster growth spurt. Assessed using growth velocity chart.
- **2° sex characteristics**
  1. **Male:** Adam's apple, voice deepening, ↑ muscle mass, widening of shoulder and chest
  2. **Female:** widening of hip, softening of skin and hair, fat distribution to thighs, buttocks and hips
- **Dermatological changes**: Acne vulgaris, hyperhidrosis, hair problems (seborrheic dermatitis), ↑ sebum secretion and excessive sweating with skin and hair changes.
- **Psychosocial changes**:
  1. **Cognitive development**: Growing intellectual interests, limited capacity to think about the future (in the begging but later this changes), enhanced moral reasoning.

2. **Psychosocial development**: Preoccupation with self-esteem and body image, mood swings, desire for independence, exploration of identity, experimentation with hobbies, interests and risks (eg. cigarrete smoking, sexual activities)
3. **Sexuality and relationships**: Increased interest in sexuality and sexual orientation, growing peer identification, self-exploration of sexual interests.

Precocious puberty refers to the precocious development of secondary sexual characteristics **before 8 for girls and before 9 for boys** (specifically breast bud and testicular enlargement).

a. Classification:

i. **Based on the type and hormones released**:

- **Central precocious puberty** (GnRH dependent precocious puberty)
- **Peripheral precocious puberty** (GnRH independent precocious puberty)
  1. **Isosexual PP** (early pubertal development appropriate for sex)
  2. **Heterosexual PP** (develops sexual characteristic of the opposite sex) (Boys → McCune-Albright syndrome and Leydig cell tumours, Girls → CAH).
- **Benign pubertal variants** (precocious thelarche, idiopathic premature pubarche, premature adrenarche, precocious menarche).
- **Obesity-related precocious sexual development**.

b. Central precocious puberty refers to a precocious puberty caused by premature activation of HPG axis and elevated levels of GnRH.

i. Etiology: Idiopathic (most common cause), CNS lesions (intracranial lesions such as hamartoma, glioma, craniopharyngioma, trauma, infections including meningitis and encephalitis), radiation.

ii. Pathophysiology: Etiology → premature activation of the HP axis → abnormally early release of GnRH → early development of the secondary sexual characteristics

iii. Clinical features:

- **Premature sexual development** that typically follows the normal pattern of puberty.
- **Increased growth velocity during puberty** → children are taller than their pears, but are of shorter stature during adulthood.

c. Peripheral precocious puberty refers to a precocious puberty without elevated levels of GnRH. It occurs due to ↑ peripheral synthesis of or exogenous exposure to sex hormones.

i. **Etiology**:

- ↑ **Androgen production**: CAH (enzyme deficiencies → shunting of cholesterol to androgen production), virilizing ovarian tumours (eg. Sertoli-Leydig cell tumour, Leydig cell tumour) and adrenocortical tumours (↑DHEA) and exogenous androgens
- ↑ **Estrogen production**: Autonomous ovarian cyst, McCune- Albright syndrome, HCG-secreting tumour (eg. dysgerminomas) and exogenous estrogen.
- ↑ **B-HCG production**: Dysgerminoma, embryonal cell carcinoma, choriocarcinoma
- **Primary hypothyroidism, exogenous steroid use**

ii. **Clinical features**: Patients exhibit premature sexual development. May not follow the normal developmental pattern.

d. Obesity-related precocious sexual development: Obesity is associated with early development of puberty, mainly due to obesity related insulin resistance. This resistance leads to ↑ insulin and leptin levels (→ ↑ GnRH release).

e. Variants of normal puberty: the name is self-explanatory. No treatment needed

i. Premature thelarche: Isolated breast development in girls under 8 years of age. There is no biochemical evidence of adrenarche (normal serum androgens, normal bone age).

ii. **Premature pubarche:** Premature onset of pubarche (isolated development of pubic hair). Seen in **children < 8y**. No other signs of puberty are present. No biochemical evidence of adrenarche and normal bone age.

f. Diagnostics:

i. **History:** Assess when the first sign was noticed, timing of puberty in family member, drug history, medical history

ii. **PE:** vitals, anthropometrics, Tanner staging, cafe-au-lait spots, dysmorphic features

iii. **If signs of precocious puberty are present → X-ray of the left wrist and hand** (compare bone age to chronological age → difference of >1 year indicates precocious puberty).

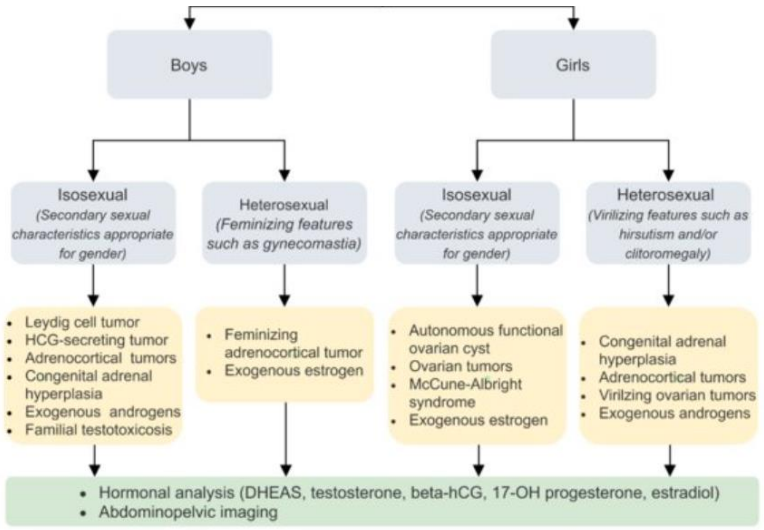
- Accelerated bone age seen in precocious puberty but not in variants of normal puberty

iv. **Endocrine test:** Once advanced bone age is reported, perform **endocrine tests** including LH, FSH, estrogen and testosterone, DHEA, 17-hydroxyprogesterone (CAH), TSH and T4.

- If ↑ **LH levels → GnRH dependent precocious puberty**
- If **normal LH or ↓ LH levels → GnRH stimulation test** (administration of GnRH to evaluate the reactivity of HPG axis):
  1. GnRH dependent PP → ↑ LH and FSH elevate
  2. GnRH independent PP → No ↑ LH and FSH

v. **Cranial MRI:** Indicated in the case of GnRH dependent precocious puberty (↑LH) to rule out intracranial pathology.

vi. **US: Pelvic ultrasound** (ovarian, uterus, testicles) and **adrenal ultrasound** are indicated in cases of GnRH independent precocious puberty



g. Treatment:

i. **Central precocious puberty:**

- **GnRH agonist** (chronic use suppresses HPG axis – goserelin and leuprolide) and **management of any underlying cause** (surgery to remove any tumor)

ii. **Peripheral precocious puberty:**

- **Surgery for any tumor**, **corticosteroids for CAH**, **Tamoxifen** for McCune-Albright

Delayed puberty refers to the absent or incomplete development of secondary sexual characteristics (primarily development of breast bud and testicular enlargement) by the age of **13 in girls** and **14 in boys** (this ages correspond to absence of breast development and no testicular enlargement).

a. Constitutional delay of puberty: A variation of normal growth. Most common cause of delayed puberty.

i. The puberty is delayed (**late bloomers**) but the final height will be normal. Family history is often positive for delayed puberty. **Bone age is delayed**, but **growth velocity is constant**.

b. Hypergonadotropic hypogonodism (1º hypogonodism): Insufficient sex hormone production due to gonad failure (problems with the gonads).

i. **Hormone level:** ↓ estrogen/testosterone but ↑ FSH and LH (→ due to lack of negative feedback)

ii. **Etiology:**

- **Congenital:** Turner syndrome (45, XO, early ovarian fibrosis), Klinefelter syndrome (47, XXY, seminiferous tubule dysgenesis), anorchia (congenital absence of testis)

- **Acquired:** post-chemo or RT, trauma or surgery, autoimmune, infection (gonorrhoea, TB, mump), undescended testis

c. **Hypogonadotropic hypogonodism (2° hypogonodism):** Insufficient GnRH production and or gonadotropin release by the pituitary. ↓ GnRH → ↓ FSH & LH → ↓ estrogen & testosterone
   i. **Hormone level:** ↓ estrogen/testosterone, ↓ FSH and LH
   ii. **Etiology:**
      - **Excessive exercise, malnutrition, eating disorders:** Poor nutritional status causes ↓ GnRH secretion
      - **Chronic disease:** congenital heart disease, CF, IBD, celiac disease, CKD, hypothyroidism (↓ T3/T4 → ↑ TRH → ↑ prolactin → ↓ GnRH)
      - **Hypothalamic disorder**:
         1. **Congenital:** isolated GnRH deficiency, Kallman syndrome (delayed puberty + anosmia), Prader-Willi syndrome
         2. **Acquired:** infection, tumor (prolactinoma, craniopharyngioma, astrocytomas), trauma, infiltrative disease (hemochromatosis, granulomatous disease), surgery and radiation
      - **Pituitary disorder:**
         1. **Congenital:** empty sella syndrome, genetic mutation
         2. **Acquired:** tumor, infection, irradiation, trauma

d. **Clinical features:** Those of the underlying condition and absence of secondary sexual characteristics (testes < 3 ml, absent breast buds)

e. **Diagnosis:**
   i. **History:** Assess family history of delayed puberty, medical history and lifestyle.
   ii. **PE:** Assess Tanner staging, anthropometrics, growth chart and growth velocity, dysmorphic features
   iii. **Bone age:** X-ray of the wrist and hand. Allows evaluation bone age and if growth is impaired.
   iv. **Endocrine test:** Measure serum LH, FSH, estrogen and testosterone.
      - ↓ Testosterone/estrogen + ↑ LH and FSH → Hypergonadotropic Hypogonodism (suspect gonadal disease)
      - ↓ Testosterone/estrogen + ↓ LH and FSH → Hypogonadotropic Hypogonodism (suspected disease of the HPG axis)
   v. **GnRH stimulation test:** differentiate 1° and 2° hypogonadism. Involves giving the patient GnRH and then measuring LH and FSH level.
      - ↑ **LH and FSH** → normal HPG axis → problem with gonads → 1º hypogonodism
      - ↓ **LH and FSH** → abnormal HPG axis → 2° hypogonadism
   vi. **Additional tests:** Based on the suspected etiology:
      - Serum prolactin levels → prolactinoma, IGF-1 levels → GH deficiency, T3/T4 and TSH → hypothyroidism
      - Karyotype → Turner's syndrome and Klinefelter syndrome
      - Anti- Tissue transglutaminase, anti-endomysial and anti-gliadin Ab → Celiac's, Cl sweat test → CF,
      - Abd. US → ovarian streaks in turner's, testicular masses, Head MRI → tumour, trauma or infiltrative disease of the hypothalamus and pituitary

f. **Treatment:**
   i. **Constitutional growth delay** → expectant management is sufficient.
   ii. **Treat the identified disorder:** thyroid replacement, surgery for brain tumor, treat celiac and IBD, dopamine agonist for prolactinoma
   iii. **Boys:** testosterone
   iv. **Girls:** estradiol + progesterone (to induce menstruation).

10. <u>The role of the hypothalamo-pituitary axis in the regulation of menstrual cycle</u>
11. <u>Endometrial Cycle (Refer to question nº6)</u>

1. **Menstrual cycle:** Menstrual cycle refers to the cyclic changes that the ovaries and endometrium undergo every month. It is a tightly regulated process that makes conception and pregnancy possible. The menstrual cycle is composed of the: (1) **Ovarian cycle**, which controls the production and release of oocytes and the release of estrogen and progesterone and (2) **Uterine or Endometrial cycle**, which controls the preparation and maintenance of the lining of the uterus to receive the embryo.
   a) **Basic characteristics:**
      i. A normal menstrual cycle lasts **24-38 days** (**28 days on average**), with the first day of the menstrual bleeding counted as day 1 of the cycle.
      ii. Menses lasts an average of **3-7 days**, with an average blood loss of **40-60 ml**.
      iii. It involves simultaneous changes in the ovaries (**ovarian cycle**) and the uterus (**uterine cycle**). The cycles are related to each other: (1) Ovarian changes are regulated by hormones released from the anterior pituitary and (2) Uterine changes are regulated by hormones released from the ovary.
      iv. The menstrual cycle changes with age.
         - First few years after menarche, the cycle is irregular
         - Menstrual cycles are the longest at 25-30 years of age, with younger and older individuals having shorter cycles.
   b) **Hormonal feedback loops:** the menstrual cycle is a tightly regulated process, in which the coordinated release of hormones from the hypothalamus, pituitary and gonads produces a single mature oocyte.
      i. **Follicular phase**:
         1. Hypothalamus releases **GnRH** in pulses → stimulates release of **FSH** and **LH** from the anterior pituitary
         2. **LH** stimulates the **theca cells** → production of **progesterone** and **androstenedione**.
         3. **FSH** stimulates follicular development, stimulates the granulosa cells and recruits a group maturing follicles → production of **estradiol** and **inhibin B** → **negative feedback** to the pituitary → inhibits FSH release
         4. The day before the LH surge, one follicle becomes dominant and estradiol levels peak → **positive feedback** to the pituitary → LH levels surge
      ii. **Ovulation**: **LH surge** induces ovulation → mature occyte is released from the Graffian follicle
      iii. **Luteal phase**:
         1. The Graffian follicle undergoes **LH-induced transformation** into the corpus luteum → produces **progesterone** → inhibits LH release
         2. **Falling LH levels** → degeneration of the corpus luteum → decreased progesterone and estradiol → the endometrium cannot be maintained → menstration occur.
   c) **Ovarian and uterine cycle:**

Ovarian cycle	
Follicular phase	**Luteal phase**
- Lasts 1-14 days (end of menses to LH surge) - ↑ GnRH → ↑LH and FSH → FSH and LH stimulates a few 1º follicles to develop 1. FSH stimulates development of several follicles → granulosa cells produce estradiol	- Lasts 14-15 days (from ovulation to the start of menses) - Following ovulation, the granulosa cells produce LH receptors → LH-induced transformation of the Graffian follicle into the corpus luteum → production of progesterone - Progesterone negatively inhibits the secretion of GnRH, LH and FSH → ↓ LH causes degeneration of the corpus luteum → ↓ progesterone → menses **1.** LH maintains the corpus luteum.

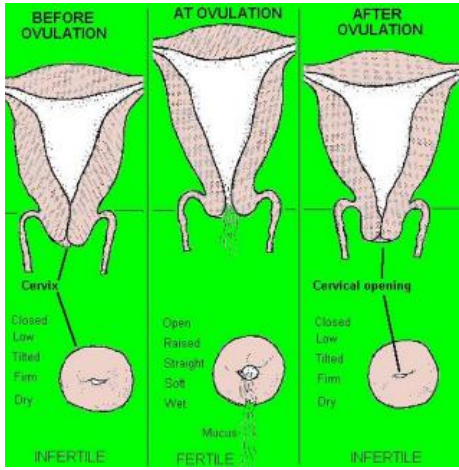
2. LH stimulates the theca interna to produce androstenedione and progesterone → androstenedione is converted into estradiol by granulosa cells 3. Estrogen → negative feedback on FSH → follicles with less FSH receptors degenerate and the one with most receptors develops into the Graffian follicle. 4. Graffian follicle continues to produce estradiol → ↑↑↑ estrogen now has a positive feedback on the pituitary → release of FSH and LH → LH surge → ovulation	**2.** If fertilization and implantation occur, the syncitiotrophoblast will produce HCG which maintains the corpus luteum until the placenta can produce enough progesterone and estrogen. - ↓ of progesterone → ↓ negative feedback on the pituitary → ↑ secretion of GnRH → ↑ LH and FSH → start of another cycle

Uterine cycle

Menses	**Proliferative phase**	**Secretory phase**
- Lasts 3-7 days (day 1 to 7) - Absence of pregnancy → no formation of syncitiotrophoblast → no HCG production → resolution of the corpus luteum → ↓ progesterone. - ↓ Progesterone → vasospasms and constriction of spiral arteries → ischemic → degeneration and sloughing off of the function endometrial layer.	- Lasts 10 days - Growing follicles during the follicular phase produce estrogens → proliferation of the endometrium - Endometrial proliferation is characterized by: **i)** Proliferation of endometrial epithelial cells **ii)** Endometrial glands become straight and tubular **iii)** Stromal cells start to enlarge and accumulate glycogen **iv)** Spiral arteries start to regenerate. - The cervical mucus becomes watery (aids sperm movement).	- Lasts 10-14 days - Progesterone produced by the corpus luteum promotes endometrial differentiation → prepares the functional layer for implantation (edematous stromal cells and maximally developed spiral arteries) - The cervical mucus becomes thick (preventing the passage of sperm) - ↑ Body temperature

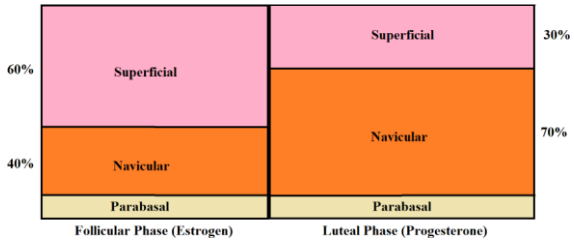
12. The effects of menstrual cycle on ovaries, cervix, vagina and breast

1. **Introduction:** The menstrual cycle refers to the monthly hormonal cycle a female's body goes through to prepare for gestation and pregnancy. During this cycle, hormones are released in specific patterns and these hormones affect the structure and function of multiple organs, including the ovaries, cervix, vagina and breast.
2. **Ovaries:** The ovarian structure and function will vary according to the phase of the menstrual cycle.
    a. **Follicular phase:**
        - In the follicular phase, FSH stimulates the maturation of several primary follicles into secondary follicles, the cells of which start to produce estrogens.
        - Estrogens → inhibit FSH synthesis → low levels of FSH then select the dominant follicle (the one with the larger number of FSH receptors) → development of the tertiary follicle (Graffian follicle)
    b. **Ovulation:** In response to the LH surge, the Graffian follicle then moves to the surface of the ovary, where it ruptures and the secondary oocyte is released (ovulation)
    c. **Luteal phase:**
        - Following ovulation, the granulosa cells produce LH receptors → LH-induced transformation of the Graffian follicle into Corpus luteum.
        - If no fertilization and implantation occur, the corpus luteum degenerates into a corpus albicans (mass of fibrotic tissue).
3. **Cervix:** The cervical structure also changes according to the phase of the menstrual cycle.
    a. Cervical Mucus:
        i. **Infertile Mucus:** thick acidic mucus which blocks the cervix → preventing spermatozoa from entering the uterus. This is present all the time, except during ovulation.
        ii. **Fertile Mucus:** Watery mucus that contains more water and is less acidic. This helps guide the spermatozoa through the cervix. Present for several days around ovulation.
        iii. **Mucus during pregnancy:** During pregnancy there is a thick antimicrobial mucosal plug which blocks the cervix and preventing infection. Plug comes out as cervix dilates before labour
    b. Cervical Position:
        i. **Before and after ovulation:** the cervix remains dry, firm and is positioned low and closed.
        ii. **During ovulation:** the cervix becomes wet, softer, it rises and opens. This is due to the high levels of estrogen mid cycle.



4. **Vagina:** The vaginal structure changes according to the phase of the menstrual cycle.
    a. Follicular – Estrogen mediated:
        i. The vaginal epithelium thickens to its fullest.
        ii. The surface layer is composed of large angular squamous with pyknotic nuclei.

iii. **On Smear:**
   a. Superficial cells > navicular cells
   b. Superficial cells predominate in smears taken mid cycle due to high levels of E



b. **Luteal – Progesterone mediated:**
   i. Proliferation of middle layer only
   ii. **On smear:**
      a. Navicular cells > superficial cells
      b. Navicular cells in this stage are large, boat-shaped, glycogen-filled basophilic cells

c. **Maturation Index (MI):**
   i. Method of evaluation of hormonal status by using vaginal smears and looking at the ratio of navicular cells (%) and superficial cells (%)
   ii. **MI = % Parabasal cells : % Navicular (intermediate) cells : % Superficial Cells**
   [MI = P: I: S (My PISs)]
   iii. MI is measured in 5 fields at 10x magnification
   iv. **Interpretation:**
      a. Follicular Phase (Pre-Ovulation) → 0/40/60 (**ESTROGEN** predominance).
      b. Luteal Phase (Post-Ovulation) → 0/70/30 (**PROGESTERONE** predominance).
      c. Pregnancy → 0/90/10 (very high progesterone).
      d. Menopause → 0/80/20 to 50/50/0 to 100/0/0.
      e. Contraceptives → 0/60/40.
      f. 0/0/100 in postmenopausal women → sign of an estrogen producing tumor

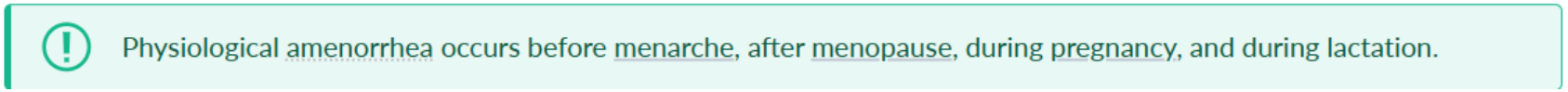
5. **Breast:**
   a. **Effects of Hormones:**
      i. **Estrogen** induces proliferation of ductal cells (Follicular phase).
      ii. **Progesterone** induces differentiation of terminal ductal cells into milk-producing acini (Luteal phase).
   b. **Changes during the Life:**
      i. **Normally:** acini are collapsed and filled with desquamated epithelium.
      ii. **Pregnancy:** proliferation of all epithelial cells. The breast becomes enlarged andsensitive, and the areola becomes widened and more pigmented.
      iii. **Menopause:** the glands atrophy and are replaced with CT and fat.

13. Menstrual Cycle disorders

1. **Menstrual cycle disorders** refers to any change in the frequency, intensity and onset of menstruation as well as symptoms such as pronounced abdominal discomfort, GI complaints and/or psychiatric symptoms. The most important menstrual cycle disorders include **Dysmenorrhea** (menstrual pain), **Amenorrhea** (menstrual cessation), **Abnormal uterine bleeding** (AUB) and **Premenstrual syndrome** (PMS).
2. **Dysmenorrhea: question 14**
3. **Amenorrhea:** Amenorrhea refers to the lack of onset or cessation of menstruation. Normal menstruation starts around the age of 12.
    a. **Types of amenorrhea:**
        - **1° amenorrhoea:** lack of menstruation by age 15 in the presence of 2° sexual characteristics or 13 in their absence of secondary sexual characteristics.
        - **2° amenorrhoea:** absence of menstruation for more than 3 months in women with previously regular cycles, or 6 months for women with previously irregular cycles.

	Primary amenorrhea	**Secondary amenorrhea**
Definition	- Lack of menstruation by the age of 15 in the presence of 2º sexual characteristics - Lack of menstruation by the age of 13 in the absence of 2º sexual characteristics.	- Lack of menstruation for more than 3 months in women with previously regular cycles. - Lack of menstruation for more than 6 months in women with previously irregular cycles.
Etiology	- **Constitutional growth delay** (↓ GnRH, ↓LH and FSH) - **Hypogonadotropic hypogonodism** (Kallman syndrome, Prader-Willi, stress, eating disorders, CNS tumours → ↓ GnRH, ↓ LH and FSH) - **Hypergonadotropic hypogonodism** (GnRH is released but ovaries do not respond. Gonadal dysgenesis, Turner's syndrome (most common cause) → ↑ GnRH, ↑ FSH and LH, ↓ estrogens and progesterone) - **Congenital anomalies** (Mullerian agenesis (2nd most common cause), imperforated hymen, vaginal atresia → normal hormone levels) - **Receptor and enzyme abnormalities** (Androgen insensitivity syndrome, 5a- reductase deficiency, CAH)	- **Pregnancy** (most common cause) - **Ovarian disorders** (premature ovarian failure, PCOS) - **Medications** (antipsychotics, chemotherapy, oral contraceptives) - **Hypothyroidism** (↓T3/T4 → ↑TRH → ↑ prolactin → ↓ GnRH) and **Hyperthyroidism** - **Hyperprolactinemia** (pituitary tumours, dopamine antagonist drugs, CRF, Stress, pregnancy, lactation) - **Sheehan syndrome** (post-partum necrosis of the pituitary gland), **Cushing's syndrome**, **Adrenal insufficiency**, **Asherman syndrome** (condition of adhesions and/or fibrosis of the endometrium), - **Hypo- and Hypergonadotropic hypogonodism** - **Functional hypothalamic amenorrhea** (dysfunction in the pulsatile secretion of GnRH due to excessive exercise, reduced caloric intake in eating disorders)
Clinical features	Depends on the underlying cause	Depend on the underlying cause
Diagnostics	- Physical examination for 2º sexual characteristics, pelvic US (assess presence of uterus and exclude congenital anomalies) - Pregnancy test - Assess FSH and LH levels ▪ ↑ FSH → primary ovarian insufficiency (Hypergonadotropic)	- Physical examination and obtain pregnancy test - If negative, order FSH, TSH and prolactin: ▪ ↑ FSH → Hypergonadotropic hypogonodism ▪ ↑ TSH → hypothyroidism ▪ ↑ Prolactin → check medication (dop. Antagonists) or order MRI

	▪ N or ↓ FSH → growth delay or hypogonadotropic - Check other hormone levels, including prolactin and TSH (if galactorrhea) and testosterone and DHEA-S (if hyperandrogenism)	- Progestin intake challenge (10 days of progestin intake) ▪ Induced withdrawal bleeding → anovulation ▪ No withdrawal bleeding → uterine abnormalities or estrogen deficiency - If virilisation is present, check testosterone, DHEA-S and 17-hydroxyprogesterone.
Treatment	Management of the underlying cause. Surgery for anomalies and HRT for hypogonodism.	Management of the underlying cause. - Surgical resection for tumours or dopamine agonists for hyperprolactinemia - Lifestyle changes or pulsatile GnRH therapy for FHA - OCPs for ovarian failure



4. **Abnormal uterine bleeding: question 15**
5. **Premenstrual syndrome: question 14**

14. Dysmenorrhea, Premenstrual Syndrome

1. **Dysmenorrhea**
   a. **Definition**: recurrent lower abdominal pain that develops shortly before or during menstruation (although pain is highly subjective, if a woman describes it as unusually very painful → dysmenorrhea).
   b. **Types of dysmenorrhea**
      i. **1° dysmenorrhoea:** the pain has no obvious organic cause. Has a very high prevalence of up to 90% and manifests mostly during adolescence.
         a. **Risk Factors:** early menarche, nulliparity (never having completed a pregnancy beyond 20 weeks), smoking, obesity, family history.
         b. **Pathogenesis:** Caused by ↑ prostaglandin formation in the luteal and menstrual phases
            i. ↑↑ Prostaglandins lead to → uterine vasospasm and ischemia, nervous sensitization and sustained uterine contractions → pain
         c. **Clinical features**: Spasmodic, crampy pain in the lower abdomen and/or pelvic midline. Normal pelvic examination.
            i. May be accompanied by headache, diarrhea, and fatigue.
      ii. **2° dysmenorrhoea:** the pain is due to an underlying condition. May begin later in life than primary dysmenorrhea.
         a. **Etiology:** Uterine etiologies (PID, IUD, Adenomyosis, leiomyomas, cervical polyps) and extra-uterine causes (Endometriosis, adhesions, IBDs)
         b. **Clinical features:** 2nd amenorrhea should be suspected in >25 years, abnormal pelvic examination, no previous history, infertility, irregular cycles, AUB, dyspareunia, post-coital bleeding
   c. **Diagnosis: Primary dysmenorrhea** is a diagnosis of exclusion based on rulling out causes of 2º dysmenorrhea. **Secondary dysmenorrhea** is diagnosed based on the underlying cause.
      i. **History:** time and severity of pain, history of PID or STD, history of genital tract surgery, dyspareunia
      ii. **Physical Examination:**
         a. abdominal exam (pelvic masses)
         b. pelvic exam (cervical excitation, adnexal tenderness, masses)
      iii. **Lab test:** CBC (to exclude infection), urinalysis (to exclude UTI), b-HCG (to exclude ectopic pregnancy) and gonococcal/chlamydial swab (rule out STDs, PID)
      iv. **Pelvic US** – e.g., for uterine fibroids, uterine adenomyosis or endometriosis
   d. **Treatment:**
      i. NSAIDs (1st line analgesia for dysmenorrhea)– e.g. mefenamic acid
         a. 2nd line – paracetamol
      ii. Topical application of heat
      iii. Hormonal contraceptives (Combined OCPs, IUD with levonorgestrel).
      iv. Treat any underlying causes

Differential diagnosis of dysmenorrhea

Diagnosis	Clinical features
Primary dysmenorrhea	• Crampy lower abdomen &/ back pain during menses • Normal examination
Endometriosis	• Pain peaks before menses • Dyspareunia • Infertility
Fibroids	• Heavy menses with clots • Constipation, urinary frequency, pelvic pain/heaviness • Enlarged uterus on examination
Adenomyosis	• Dysmenorrhea, pelvic pain • Menorrhagia • Bulky, globular & tender uterus
Pelvic congestion	• Dull & ill-defined pelvic ache that worsens with standing • Dyspareunia

2. **Premenstrual syndrome:** Distressing psychological or physical symptoms that occurs during luteal phase of the menstrual cycle and resolves with onset of period. The symptoms can start approximately 5 days before the period begins and they end within approx. 4 days after the onset of the period.
   a. Affects around 12% of women.
   b. **Manifestation:**

i. **Psychological symptom:** depression, hopelessness, anxiety, tension, affect lability, mood swings, aggressiveness, ↓ interest, fatigue
ii. **Physical symptom:**
    a. Pain → dyspareunia, breast tenderness, headache, back pain
    b. GI changes → nausea, diarrhea
    c. Bloating and weight gain
iii. **Diagnosis:** Diagnosis is based on history and self-assessment
iv. **Treatment**: Lifestyle changes (regular exercise, healthy diet, avoiding triggers), drugs (NSAIDs, OCPs, SSRIs – for severe cases) and dietary supplements (Ca, Vit. E and D).

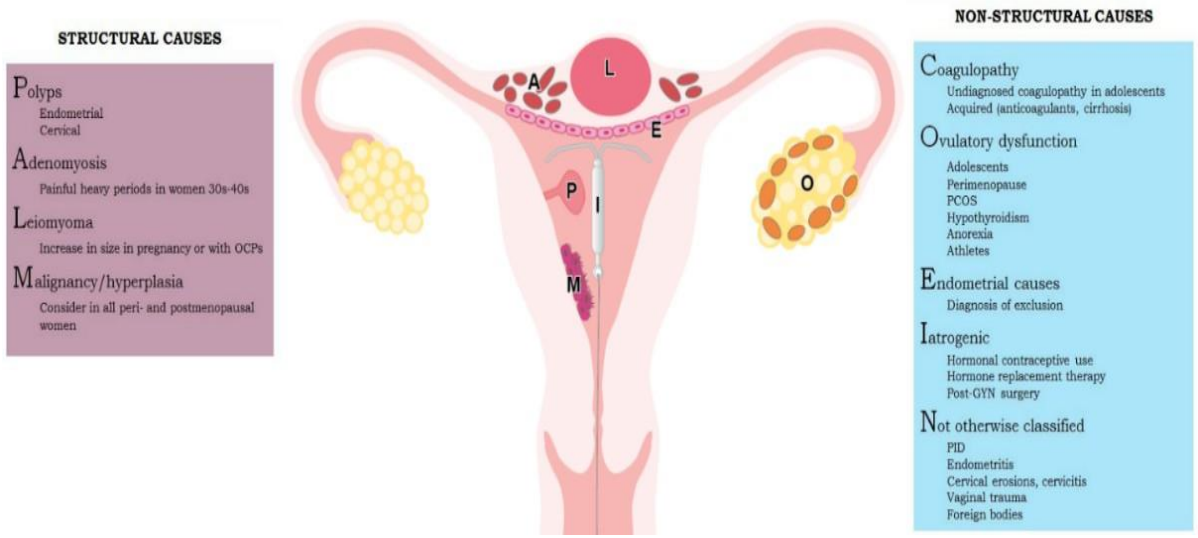
15. Dysfunctional Bleeding aka Dysfunctional Uterine Bleeding (DUB)

1. **Definition: Abnormal or dysfunctional uterine bleeding** (AUB/DUB) is defined as menstrual bleeding that is abnormal and/or irregular in frequency, duration and /or intensity. Average menstrual cycle is 25-30 days long.
2. **Etiology:** The International federation of gynaecologists and obstetrics (FIGO) developed a classification system for the etiologies of AUB called **PALM-COEIN system**.
   - **i.** **P**olyps (endometrial or cervical)
   - **ii.** **A**denomyosis
   - **iii.** **L**eiomyomas (↑ in size in pregnancy and with OCPs)
   - iv. **M**alignancies and hyperplasia (consider in all peri- or post-menopausal women)

   Structural causes

   - **v.** **C**oagulopathies
   - vi. **O**vulatory dysfunction (Adolescents, peri-menopause, PCOS, hypothyroidism, anorexia, athletes)
   - vii. **E**ndometrial etiologies
   - **viii.** **I**atrogenic (Hormonal contraceptives, HRT, post-surgery)
   - ix. **N**ot otherwise specified (PID, endometritis, cervical erosions, cervicitis, vaginal trauma, FB)

   Non-structural causes



3. **Classification:**

	Normal parameters	**Abnormality:**	**Description:**	**Common Causes:**
Changes in frequency	24-38 days	**Amenorrhea**	Absent of menstruation	**1º Amenorrhea** → Gonadal dysgenesis, Turner's syndrome, Mullerian Agenesis

				2º Amenorrhea → pregnancy, FHA, PCOS, hypothyroidism, Sheehan and Cushing' syndrome, hyperprolactinemia
		Oligomenorrhea	Very infrequent bleeding Cycles every > 38 days	Pregnancy (inc. ectopic), PCOS, insufficient caloric intake, hyperthyroidism
		Polymenorrhea	Very frequent bleeding Cycles every cycle < 24 days	Menarche, perimenopause, psychological stress.
Changes in volume	Determined by the patient 40-60 ml	**Hypomenorrhea**	Light menstruation Bleeding < 25 ml (often just 'spotting')	Endometrial atrophy, eating disorders, chronic endometritis, OCPs
		Hypermenorrhea or menorrhagia	Heavy menstrual bleeding that interferes with quality of life	Endometrial cancer/hyperplasia, endometriosis, hypothyroidism, coagulopathies
Intermenstrual bleeding	None	**Metrorrhagia**	Pathological bleeding other menses	Endometrial cancer/hyperplasia, cervical cancer Polyps Cervicitis OCPs Breakthrough bleeding (midcycle bleeding due to hormone imbalance usually after starting new OCP therapy) Endometriosis, myomas, polyps, carcinomas Contact bleeding (during examination) During pregnancy may indicate spontaneous abortion.
		Menometrorrhagia	Bleeding > 80ml inbetween periods. Excessive uterine bleeding occurring outside of the normal period.	
Duration	< 8 days of menses	Prolonged → >8 days		Endometriosis, Endometrial hyperplasia and cancer
Regular	Variation between the shortest and longest cycle is 7-9 days	**Irregular** → variation > 8 days		PCOS and perimenopause

4. **Diagnosis:**
    a. **Gynaecological History:**
        i. Age of menarche, last menstrual period, cycle length and regularity, pregnancies, family history, recent complaints
        ii. Characteristics of abnormal bleeding (frequency, regularity, duration and volume)
        iii. Last Menstrual Period (LMP)
    b. **Physical Examination:**
        i. If bleeding is acute → ensure hemodynamic stability
        ii. Pelvic examination (Bimanual Examination)
        iii. Speculum, Colposcopy and Vaginal Smearing.

    a. Colposcopy: examination of cervix, vagina and vulva for signs of disease
    b. Swabs for microbiologic testing (rule out cervicitis due to gonorrhea/chlamydia)

c. **Pap smear:** rule out carcinoma
d. **Blood and Urine Tests:**
    i. CBC (assess anemia)
    ii. Coagulation panel (assess coagulopathy).
    iii. β-hCG (first we must rule out ectopic pregnancy!)
e. **Pelvic Ultrasonography:**
    i. Rules out structural anomalies (e.g., polycystic ovaries) and can measure endometrial thickness.
    ii. Assess PALM causes (Polyps, Adenomyosis, Leiomyomas, Malignancy).
f. **Endometrial Biopsy:** by Novak suction curette.
    i. Postmenopausal patients with any uterine bleeding and/or endometrial thickness > 5mm
    ii. All patients > 45 years with frequent, heavy and/or prolonged bleeding
    iii. Patients < 45 years of age with frequent, heavy and/or prolonged bleeding who are at high risk of endometrial carcinoma (RF → obesity, PCOS, T2DM, tamoxifen therapy, excessive estrogen exposure)
g. **Hysterosalpingography:**
    i. X-ray after introduction of contrast into the cervix for assessing structural lesions.
h. **Hysteroscopy:**
    i. This is the GOLD STANDARD, as it provides direct visualization (endoscopy).

Pathology	**Clinical Hallmarks:**	**Treatment:**
Primary Dysmenorrhea	Spasmodic, crampy pain in the lower abdomen and/or pelvic midline	NSAIDS (mefenamic acid, paracetamol), topical heat, hormonal contraceptives (OCPs, IUD with progestogen)
Endometriosis	Chronic pelvic pain that worsens before the onset of menses. Dysmenorrhea, Dyspareunia, Infertility Rectovaginal tenderness and palpable adnexal masses (**chocolate cysts**) on palpation. • **Dx** → PE, TVUS and laparoscopy or laparotomy	**Pharmacologic:** Combination OCP (first-line), GnRH analogs, androgen analogs (Danazol), NSAIDs, progestins. **Surgical:** excision, cauterization and ablation of lesions. **Definitive = TAH-BSO.**
Adenomyosis (disease characterized by endometrial tissue within the uterine wall)	Dysmenorrhea Chronic pelvic pain with Menorrhagia. Uniformly-enlarged uterus. • **Dx** → MRI or TVUS, histopathology	**Pharmacologic** NSAIDs (first-line), OCPs, progestins. **Surgical** Histeroscopy followed by endometrial ablation/resection. **Definitive** Hysterectomy**.**
Endometritis (inflammation of the endometrial lining)	Lower abdominal/pelvic pain AUB Fever (if peritonitis or pelvic abscesses develop) Infertility • **Dx** → PE, testing for typical pathogens, biopsy	**Mild to moderate cases (outpatient trt):** IM ceftriaxone + PO doxycycline (14 days). **Severe cases (inpatient trt):** **First-line:** IV clindamycin + IV gentamicin
Endometrial Cancer	AUB • **Dx** → PE (often normal), TVUS, staging exams (CXR, CT, MRI), endometrial biopsy	**Women who wish to maintain fertility and early stage disease** Progestins **Post-menopausal or women who do not wish to preserve fertility** TAH-BSO **Adjunctive or palliative** Radiotherapy, chemotherapy
Uterine leiomyoma	Often asymptomatic AUB, Back pain, dyspareunia, infertility Irregularly-enlarged uterus. Urinary tract or bowel symptoms. • **Dx** → TVUS, MRI	Treat only if symptomatic! **Pharmacologic** GnRH agonists, progestins, NSAIDs, Androgenic agonists (Danazol → ↓ FSH and LH). **Surgical** Myomectomy or hysterectomy
Endometrial Polyp	Asymptomatic. AUB, Infertility, difficulty conceiving • **Dx** → TVUS, hysteroscopy, endometrial biopsy	**Asymptomatic** → observation & follow-up **Symptomatic** → surgical removal.

5. **Management of blood loss:**
    a. **Non-surgical management:**
        i. **Hemodynamicaly unstable patients:** Fluid resuscitation, blood transfusion and intrauterine tamponade (intrauterine ballon or gauze packing).
        ii. **Pharmacological:** OCPs, progestins (PO, IV or as levonorgestrel-releasing IUD)
    b. **Surgical management:** Severe bleeding/hemodynamic instability, patient unresponsive to hormonal treatment or contraindication, condition requiring repair
        i. **Uterine dilation and curettage with concomitant hysteroscopy**
        ii. **Endometrial ablation** (does not preserve fertility)
        iii. **Transcatether uterine artery embolization**
        iv. **Hysterectomy**
6. **Ddx and Treatment:**

16. Polycystic Ovary Syndrome

PCOS (aka 'Stein-Leventhal Syndrome') is a disorder characterized by hyperandrogenism (abnormally increased production of male sex hormones in woman), and oligoovulation / anovulation with the presence of polycystic ovaries. It affects 6–10% of women in their reproductive years.

1. **Etiology:**
    a. **Hyperinsulinemia:**
        i. Obesity/DM2/lack of physical activity (→↑ insulin resistance → hyperinsulinemia).
        ii. ↑activation of desmolase → ↑synthesis of androgens.
    b. **AD-inheritance:**
        i. Abnormally hairy father
        ii. Oligomenorrhea in mother
        iii. Female siblings with hirsutism and oligomenorrhea.
2. **Pathophysiology:**
    a. **Peripheral insulin resistance → hyperinsulinemia →:**
        i. ↑Formation of adipose-tissue → obesity & dyslipidemia.
        ii. ↓Hepatic generation of sex hormone–binding globulin (↓SHBG) → androgenicity.
        iii. **Hyperinsulinemia → ↑↑LH production:**

    a. Occurs because theca cells in ovary express insulin receptors → excess insulin causes growth of theca cells → theca cells contain LH receptors, so more theca cells mean ↑ LH receptors → hypothalamus ↑ rate of GnRH pulses → ↑ LH binds to theca cells
    b. ↑ LH leads to theca cells to make large amounts of androstenedione
        i. More androstenedione is produced than can be converted by the granulosa cells into estrogen
            1. Excess androstenedione → converted by aromatase in fat tissue to estrone (part of the estrogen family)
            2. ↑ Estrogen → negative feedback on the pituitary gland → ↓ FSH
            3. ↑ androstenedione → hirsutism, male pattern baldness, acne
    c. Due to the LH levels being high, there is no LH surge → therefore ovulation is not triggered → this leads to dominant follicle remaining in the ovary → which forms a cysts or degenerates
        i. Lack of ovulation → amenorrhea or oligomenorrhoea → infertility

3. **Manifestation:** OHIO (Oligomenorrhea, Hirsutism, Infertility, Obesity)
    a. **Menstrual irregularities** – can manifest as: Primary amenorrhea, secondary amenorrhea or **oligomenorrhea**
    b. **Infertility**
        i. ↑ **Androstenedione**
            a. Hirsutism (hair on the upper lip, chin, around nipples, along the Linea alba of the lower abdomen).
            b. Androgenic alopecia (male-pattern baldness).
            c. Acne vulgaris.
    c. Obesity (and possibly other components of metabolic syndrome).
    d. Acanthosis nigricans.
    e. Psychiatric conditions – depression and anxiety
    f. Premature adrenarche (development of pubic hair, body odour, skin oiliness, and acne).
4. **Diagnosis:**
    a. **Screening lab tests:**
        i. **17-hydroxyprogesterone (17-HPO):** level of less than 1000 ng/dL measured 60 minutes after cosyntropin stimulation rules out late-onset CAH.
        ii. **24-hour urine sample for free cortisol:** levels of urinary free cortisol that are x4 the upper limit of normal are diagnostic for Cushing syndrome.
        iii. **Serum insulin-like growth factor 1 (IGF-1):** normal level rules out acromegaly.
        iv. **Fasting serum prolactin:** level < 25mg/dL rule out hyperprolactinemia.
        v. **Serum TFTs:** normal TFTs (TSH & fT3) rule out hypothyroidism.
        vi. **CT/MRI:** to rule out a tumour (only if suspected).
    b. **Hormone Assays:**
        i. **FSH + LH + LH/FSH ratio**
            a. In PCOS, ratio of LH: FSH is usually greater than 3 – i.e. ↑↑↑ LH : ↑ FSH
        ii. Androgens (Testosterone, DHEA, Androstenedione) + levels of SHBG (sex hormone binding globulin).
    c. **Glycemia & Lipidemia Assessment:**
        i. Random & Fasting Glycemia
        ii. oGTT (2-hour postload glycemia < 7mM indicates normal glucose tolerance).
        iii. Total cholesterol (N = < 200 mg/dL) & LDL (N = < 160 mg/dL).

   d. **Imaging = TVUS on day 2-3 of the menstrual cycle:**
      i. At least 12 subcapsular follicular cysts of diameter 2-9mm AND/OR increased ovarian volume by up to $10ml^3$.
5. **Treatment:**
   a. **Weight loss:** exercise and healthy diet (to decrease insulin resistance)
   b. **Oral antidiabetics:** metformin (in increase insulin sensitivity)
   c. **Combined oral contraceptive** therapy → regularize menses, ↓LH & ↑SHBG.
   d. **Treatment for Anovulation** (examined by progesterone test):
      i. **1st-line** = Clomiphene-Citrate
      ii. **2nd-line** = exogenous GnRH analog, laparoscopic ovarian drilling, IVF.

17. Climacterium, Menopause

Climacterium is the bodily and mental changes linked to the reproductive and endocrine function in men and women during the latter part of middle age.

   i. **Perimenopause**: time period between first instance of climacteric symptoms caused by fluctuating hormone levels to one year after menopause (avg time: 4yrs)
   ii. **Premenopause**: time period from first climacteric irregular menstrual cycle to last menstrual period. (45-55 yrs. old)

Menopause: the time at which a woman permanently stops ovulating, thus develops amenorrhea. It usually occurs between 49-52 years of age and is diagnosed after 12 months of secondary amenorrhea. Menopause is preceded by the Climacterium (Premenopausal and Perimenopausal periods)

   iii. **Postmenopause**: time period beginning 12 months after last menstrual period

1. **Pathophysiology:** ↓ in no. of ovarian follicles with age → ↓ ovarian function → less theca and granulosa cells → ↓ estrogen and progesterone levels → loss of negative feedback to the gonadotropic hormones → burst of ↑ GnRH → ↑ levels of FSH and LH in blood (hypergonadotropic hypogonadism) → ↑ frequency of anovulatory cycles (i.e., menstrual cycles w/o release of egg) → ovarian function eventually stops permanent
2. **Manifestation:** (Menopausal HAVOCS → **H**ot flashes/**Heat** intolerance, **A**trophy of **V**agina, **O**steoporosis, **C**oronary artery disease, **S**leep impairment)
   b. **Changes in menstruation**
      i. Irregular menses (which gradually decrease in frequency). Eventually complete amenorrhea occurs
   c. **↑SY tone** → autonomic symptoms – e.g., ↑sweating, hot flashes and heat intolerance, vertigo, headache
   d. **Mental symptoms:** Impaired sleep, Depressed mood/ mood swings, anxiety/irritability, loss of libido

e. **Weight gain and bloating.**
f. **Atrophic features** (these symptoms are caused by ↓Estrogen):
    i. **Breast tenderness and ↓breast size**.
    ii. **Vulvovaginal atrophy:** atrophy of the vulva, cervix, vagina leading to:
        a. Vaginal dryness and pruritus
        b. Dyspareunia
    iii. **Urinary atrophy:** Atrophy of the urinary tract → can lead to:
        a. Urinary incontinence
        b. Dysuria, urinary frequency & urgency
        c. ↑ urinary tract infections

3. **Diagnosis:**
    g. **Lab tests to help confirm peri/Postmenopause:**
        i. ↓Estrogen & ↓progesterone.
        ii. FSH levels can fluctuate widely in perimenopause
        iii. Testosterone & prolactin levels are within normal ranges.
    h. **Screening for complications of menopause:**
        i. DEXA scan - all postmenopausal women > 65yo should be screened using DEXA to measure bone mineral density for osteoporosis. Levels of Ca & Vit. D in the blood is measured too
4. **Treatment:** Indicated when symptoms severely effect quality of life or when there is premature menopause in order to avoid increased risk of osteoporosis or post oophorectomy.
    i. **Non-Pharmacological:** Lifestyle modifications, Lose weight, Supplementation of Ca-Vit.D, Lubricants for vulvovaginal dryness, Relaxation techniques.
    j. **Pharmacological:**
        i. **Vaginal estrogen-containing creams:** for atrophic vaginitis.
        ii. **Hormone replacement therapy (HRT):** replaces the estrogen that the ovaries stops making after menopause
            a. **Estrogen therapy:** only for women after hysterectomy
            b. **Estrogen + progestin therapy:** for women with a uterus.
                i. **Risks of Hormonal Therapy:**
                    1. Unopposed estrogen (i.e. w/o progestogen) → endometrial hyperplasia → ↑risk of endometrial cancer.
                    2. Estrogen + progestin therapy → ↑risk of breast cancer.
                    3. Hypercoagulability, Cholelithiasis, Stress urinary incontinence
        iii. **Non-Hormonal Treatments:**
            a. SERMs = Selective estrogen receptor modulators (Raloxifene/Tamoxifene) can be used for atrophic vaginitis & in patients after hysterectomy.
            b. Clonidine/Paroxetine → for SY symptoms (esp. hot flushes).

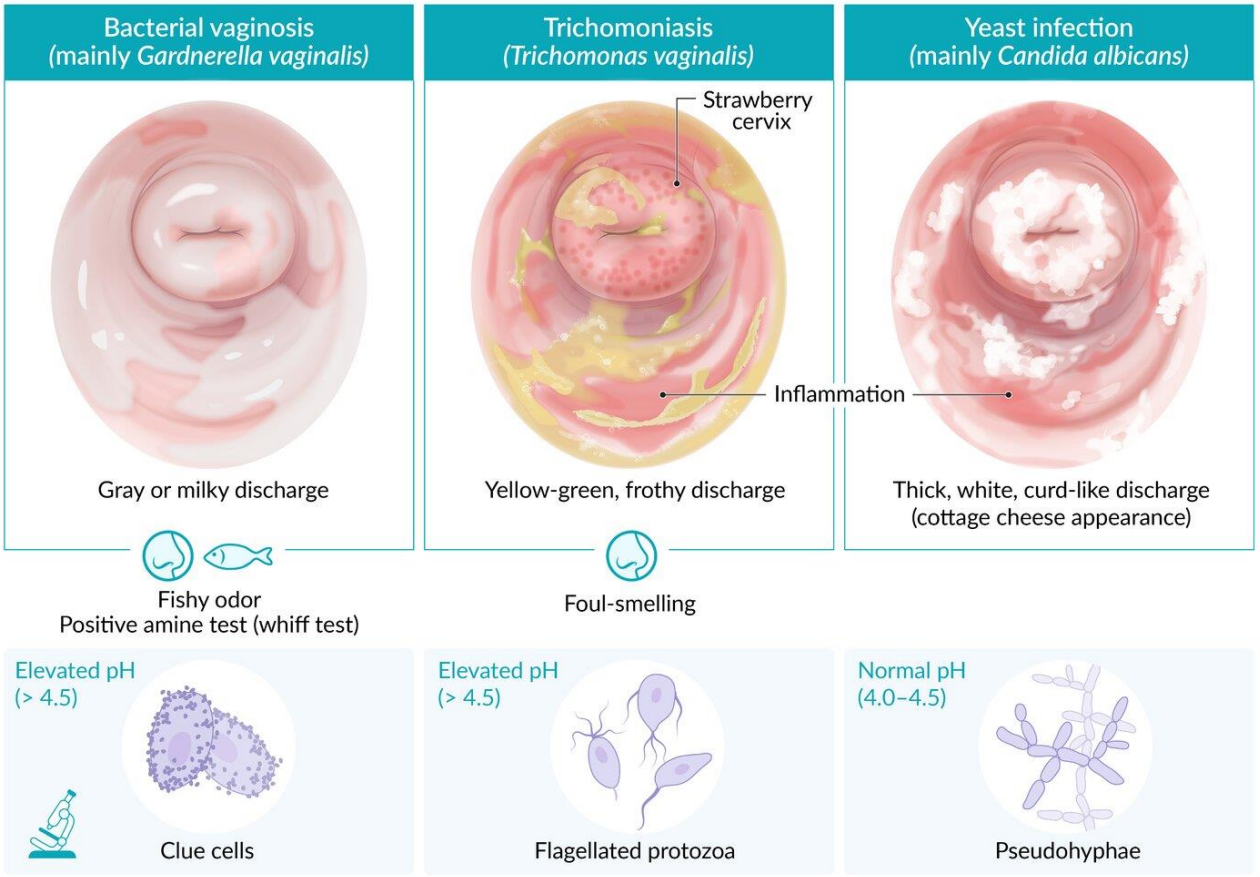
18. **Gynaecological inflammatory disorders**
19. **Inflammatory diseases of the vulva, vagina and cervix**

1. **Vulvovaginitis:** refers to a large variety of conditions that result in inflammation of the vulva and vagina. The causes may be infectious (bacterial vaginosis in most cases) or non-infectious.
    a. Physiologically → the normal vaginal flora (mainly lactobacilli) → keeps the pH levels low → prevents overgrowth of organisms
    b. Disruption of that flora (eg. due to sexual intercourse) → predispose to infection and inflammation.

2. **Infectious vulvovaginitis**: refers to an inflammatory disease of the vulva and vagina caused by pathogens
    a. **Etiology**: Bacterial vaginosis (Gardnerella), T. vaginalis, vaginal yeast infection and aerobic vaginitis.
    b. **Gonorrhea** and **C. Trachomatis** can also cause vaginal discharge

	Bacterial vaginosis (Gardnerella)	**Trichomoniasis**	**Candida vaginitis**	**Aerobic vaginitis** (inflammatory vaginitis of non-infectious origin with microbiome disturbance and secondary bacterial infection)
Epidemiology	Most common vaginal infection (22-50% of cases)	4-35% of cases	2nd most common cause (17-39%)	8% of chronic vaginitis

Pathogen	Gardnerella vaginalis (pleomorphic, gram negative rod)	Trichomonas vaginalis (protozoan with flagella)	C. Albicans	E. coli, S. agalactiae, S. aureus
Risk factors	Sexual intercourse, IUD, vaginal douching, pregnancy	Sexual transmission	Pregnancy, immunodeficiency, ATB treatment	↓ concentration of lactobacillus
Clinical features	▪ Commonly asymptomatic ▪ Increased vaginal discharge, that is grey or milky with a fishy odor ▪ Pruritus and pain are uncommon	▪ Foul-smelling, frothy, yellow-green, purulent discharge ▪ Vulvovaginal pruritus, burning sensation, dyspareunia ▪ Strawberry cervix (erythematous with petechiae)	▪ White, crumbly and sticky vaginal discharge resembling cottage cheese ▪ Erythematous vulva and vagina ▪ Vaginal burning sensation, strong pruritus, dysuria and dyspareunia	▪ Copious, yellow, purulent, odourless vaginal discharge ▪ Vaginal inflammation and redness ▪ Dyspareunia, burning sensation
Diagnosis	Diagnosis is made if at least 3 **Amsel criteria** are met: ▪ Presence of clue cells on vaginal wet mount (cells with stippled appearance and fuzzy borders) ▪ Vaginal pH > 4,5 ▪ Positive amine test (administration of KOH into the discharge → amine odor) ▪ Thin, homogenous grey-white or yellow discharge that adheres the vagina	Diagnosis is based on vaginal wet mount. ▪ Saline vaginal wet mount → motile trophozoites with multiple flagella ▪ pH > 4,5	Diagnosis is based on vaginal wet mount: ▪ Vaginal wet mount with KOH → pseudohyphae ▪ Normal pH (4 – 4,5)	▪ Negative amine test ▪ pH > 4,5 ▪ Leucocytes on microscopy
Treatment	▪ Oral or intravaginal metronidazole ▪ Intravaginal clindamycin	▪ Oral metronidazole or tinidazole (not for pregnant women) ▪ Concurrent treatment of sexual partners.	▪ Topical azole (miconazole or clotrimazole) ▪ Single oral fluconazole (CI in pregnant women)	Adapt treatment based on severity of infection, atrophy and inflammation: ▪ ATBs (kanamycin or fluoro) ▪ Local steroids ▪ Local estrogen
Complications	Adverse pregnancy outcomes such as preterm delivery, spontaneous abortion	Adverse pregnancy outcomes		Adverse pregnancy outcomes



3. **Genitourinary syndrome of menopause (or atrophic vaginitis):** Most common cause of non-infectious vulvovaginitis, mostly affecting older post-menopausal women. It is a symptom complex caused by the effects of hypoestrogenism on the vaginal epithelium.
    a. **Etiology**: hypoestrogenism (after menopause, after BSO, chemotherapy, hypothalamic amenorrhea)
    b. **Pathophysiology**: Hypoestrogenism → atrophy of the epithelium in the vagina and vulva
    c. **Clinical features**: ↓ labial fat pad, vaginal soreness and dryness, dyspareunia, burning sensation after sex
    d. **Diagnosis**: mainly clinical
    e. **Treatment**: Vaginal moisturizers and lubricants, vaginal estrogen therapy
4. **Allergic vulvovaginitis**: May affect women of any age, but is especially common in pre-pubescent girls.
    a. **Etiology**: Allergies to laundry or cleaning detergents, textile fibers, sanitary napkins
    b. **Clinical features**: pruritus, redness, burning sensation
    c. **Diagnosis**: Allergy diagnostics (pin prick test, intradermal injection tests)

d. **Treatment**: Avoid irritants, corticosteroid creams if needed.

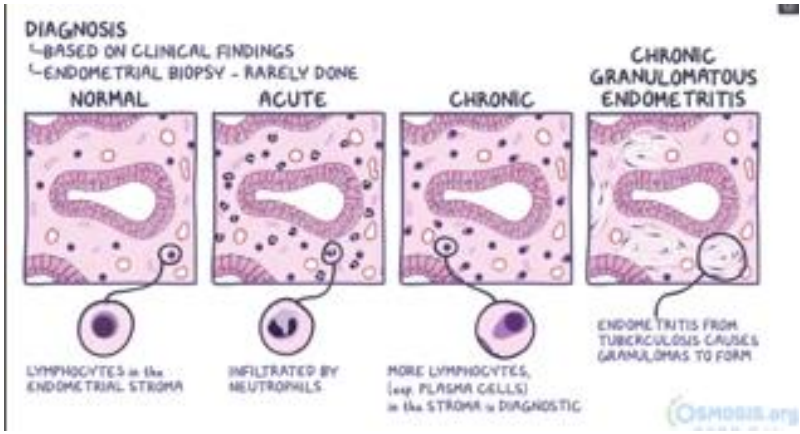
5. **Cervicitis:** inflammation of the uterine cervix (in contrast to PID, which is defined to an inflammation that spreads beyond the cervix).
   a. **Etiology**:
      i. **Infectious (most common)**: Chlamydia, Gonorrhea, HSV-2 , T. vaginalis
      ii. **Non-infectious**: local trauma (tampons), chemical irritation (latex exposure), radiation, malignancy
   b. **Risk factors:** young age, multiple sex partners, unprotected intercourse
   c. **Clinical features:**
      i. Often asymptomatic. Usually there is **no fever** (in contrast to PID)
      ii. Vaginal discharge (purulent, blood-tinged, malodorous)
      iii. Dyspareunia, postcoital or intermenstrual bleeding, lower abdominal pain
      iv. Symptoms of underlying condition (genital lesions)
   d. **Physical examination:** abdominal palpation (tenderness/discomfort), bimanual exam (motion tenderness of the cervix), pelvic exam (erythematous, edematous, friable cervix that's bleeds easily)
   e. **Diagnostics:** mainly clinical based on mucopurulent discharge and a friable cervix
      i. **Asses vaginal secretions:** appearance, pH , leukocyte count, and visible pathogens (e.g., protozoa in T. vaginalis infections)
      ii. **Swab samples**: for bacterial culture
      iii. **NAATs for N. gonorrhea and C. trachomatis.**
   f. **Treatment:** oral ATB (gonorrhea, chlamydia, T vaginalis), oral antiviral (HSV), topical therapy (genital wart removal)
   g. **Complication:** May progress to PID

20. <u>Inflammatory diseases of the uterus</u>

Endometritis refers to an inflammation of the endometrium. Like vulvovaginitis, it may have both infectious and non-infectious causes.

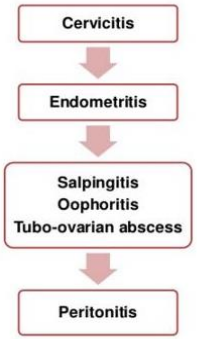
1. **Risk factors:** C-section delivery, prolonged rupture of membranes, long labour with multiple vaginal examinations
2. **Etiology:** It may or may not be associated with childbirth.
   a. **Organisms:** Ureaplasma urealyticum, Gardnerella vaginalis, Group b streptococcus, Chlamydia (late-onset postpartum endometritis)
   b. **Obstetric endometritis:** Acute (postpartum infection), Chronic (retained products of conception after delivery/elective abortion)
   c. **Non-obstetric endometritis:** Acute (STIs, PID and invasive gynecologic procedures), Chronic (chlamydia, TB, bacterial vaginosis, IUD)
3. **Clinical features:**
   a. Fever occurring within 36hrs of delivery.

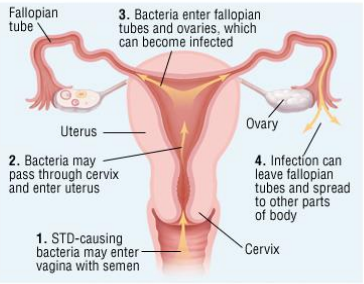
   b. Lower abdominal pain
   c. Foul-smelling discharge from the uterus in obstetric population
   d. Abnormal vaginal bleeding/discharge, dyspareunia, dysuria
4. **Diagnosis:** Based on clinical diagnosis. Rarely, endometrial biopsy is performed.
   a. **Physical examination** for vital signs (r/o sepsis),
   b. **CBC**, **urinalysis/urine culture** (r/o UTI), **TVUS** (only if pt doesn't respond to ATBs in 48hrs)
   c. **Tests for chlamydia and gonorrhea**.
   d. **Endometrial biopsy:** Usually clinical finding enough to make diagnosis.
5. **Treatment:**
   a. **Outpatient**: IM Ceftriaxone + oral doxycycline
   b. **Severe cases (in-patient)**: Gentamicin + Clindamycin
   c. **Tuberculosis**: RIPE (Rifampin, Isoniazid, Pyrazinamide, Ethambutol)
   d. **Recently underwent gyni procedure**: Consider Metronidazole
   e. **Remove retained placental/fetal tissue** (Dilation and curettage)
   f. **Prophylaxis Cefazolin before C-section**
6. **Complications:** endomyometritis (spread to myometrium), peritonitis, pelvic abscess, salpingitis, oophoritis, Asherman's syndrome (intrauterine adhesions)
   a. **Asherman's syndrome:**
      i. Severe inflammation of the endometrium makes the basal layer unable to regenerate the functional layer → basal layer undergoes fibrosis → deposition of collagen → formation of fibrous bands (adhesions/synechiae) → uterine walls stick to each other → failure to respond to hormonal stimulation → absence of menstrual bleeding
      ii. Severe cases → obliterate the uterus completely causing infertility or recurrent pregnancy loss



21. Pelvic Inflammatory Diseases

PID is caused by a bacterial infection that spreads beyond the cervix to infect the upper female reproductive tract, including the uterus, fallopian tubes, ovaries and surrounding organs.



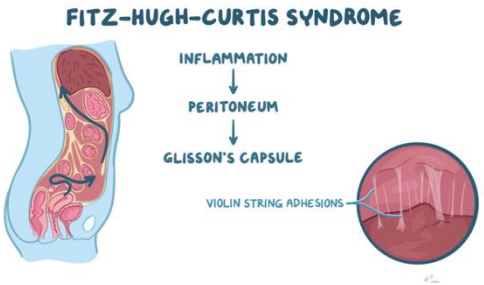


1. **Epidemiology:** 4.5% of women experience PID. It is one of the most common causes of infertility.
2. **Etiology**:
    a. C. trachomatis and N. Gonorrhoea (most common), E.coli, Ureaplasma, Mycoplasma
3. **Risk Factors:** Multiple sexual partners, unprotected sex, history of STI, IUD, Bacterial vaginosis, retrograde menstruatoion
    a. Risk is lower during pregnancy – cervical mucus plug (develops at 12 weeks) prevents bacteria from ascending
4. **Pathophysiology**: Infection of the lower genital tract (vagina and cervix) → ascends to infect the upper genital tract (endometrium, fallopian tubes, ovaries) → spreads to involve the peritoneum).
5. **Site of infection:**
    a. Endometrium → endometritis
    b. Uterine adnexa → adnexitis
    c. Fallopian tubes → Salpingitis
        i. PID is most problematic when it affects the Fallopian tubes
        ii. Inflammation of the fallopian tubes → activation of immune processes → scar tissue formation → epithelium sticks to one another → closed pockets/dead end pouches → complications
        iii. Complications → Tubo-ovarian abcesses, Hydrosalpinx, difficulty in conceiving, ↑ risk of ectopic pregnancy, Fitz-Hugh-Curtis syndrome.
    d. Ovaries → oophoritis
    e. Surrounding pelvic structures and peritoneum → parametritis and peritonitis
6. **Staging based on CDC guidelines**

Stage I	Acute endometritis and/or salpingitis
Stage II	stage I + peritonitis
Stage III	stage I + stage II + tubal occlusion, pylosalpinx or tubo-ovarian abscess (TOA)
Stage IV	Ruptured TOA

7. **Clinical features:** Symptoms may vary considerably. Some women may be asymptomatic.
    a. Lower abdominal pain that may progress to acute abdomen.
    b. Nausea, vomiting
    c. Fever
    d. Dysuria, urinary frequency
    e. Menorrhagia, metrorrhagia
    f. Dyspareunia and abnormal vaginal discharge (yellow/green)

g. **Perihepatitis (Fitz-Hugh-Curtis Syndrome) -** RUQ pain, tenderness



8. **Diagnosis:** Diagnosis is primarily based on clinical findings. Further diagnostics help to confirm the diagnosis.
   a. **Important diagnostic criteria**:
      i. Patient history → most often is a sexually active young women.
      ii. Lower abdominal pain
      iii. Vaginal examination
         - Cervical motion tenderness (severe cervical pain during pelvic examination)
         - Uterine and/or adnexal tenderness
         - Purulent, bloody cervical and/or vaginal discharge
   b. **Blood tests**: ↑ESR and leukocytosis
   c. **Pregnancy test**: Important to exclude ectopic pregnancy
   d. **Cervical and urethral swab**:
      i. Gonococcal and Chlamydial DNA (PCR) and cultures
   e. **Imaging**:
      i. **US**: may display free fluid, abcesses, pyo/hydrosalpinx
      ii. **Exploratory laparotomy**: Only in ambiguous cases
9. **Differential diagnosis of lower abdominal pain in a women of reproductive age**:
   a. Ectopic pregnancy, PID, Appendicitis, Kidney stones, Ovarian cyst rupture, Ovarian torsion, Pelvic cellulitis.

> PID may manifest with symptoms of appendicitis due to periappendicitis or perihepatitis. Symptoms may also mimic ectopic pregnancy.

> PID should be suspected in young, sexually active women who present with lower abdominal pain and adnexal/cervical motion tenderness.

10. **Treatment:**
    a. **Outpatient**
       i. Single IM dose of Ceftriaxone + oral doxycycline
       ii. Signs of vaginitis and/or gynecological instrumentation → add oral metronidazole
    b. **Inpatient (parenteral):**
       i. Indicated for severe illness with nausea, vomiting and/or high fever and when tubo-ovarian abcesses or pregnant
       ii. Cefoxitin or cefotetan plus doxycycline
       iii. Clindamycin plus gentamycin
       iv. In the case of tuboovarian abcesses → add metronidazole or clindamycin
    c. **Analgesics for pain** – acetaminophen

d. Surgery – remove adhesions, treat complications such as tubo-ovarian abscess, hydrosalpinx

11. Complications

Short term	Long term
1. Pelvic peritonitis 2. Fitz-Hugh-Curtis syndrome (perihepatitis) – inflammation of liver capsule, characterized by violin-string like adhesions extending from the peritoneum to the liver. 3. Tubo-ovarian abscess: confined pus collection of the uterine adnexa.	1. Infertility – caused by adnexitis, adhesions of fallopian tubes and ovaries and tubal scarring → result in impaired ciliary function and tubal occlusion 2. Ectopic pregnancy 3. Chronic pelvic pain 4. Hydrosalpinx/pyosalpinx – accumulation of fluid /pus in the fallopian tubes due to chronic inflammation and consequent stenosis

22. Sexually Transmitted Diseases (STD), genital tuberculosis, HIV

STDs are a group of infections that are mainly transmitted via sexual contact (exchange of fluid, sexual intercourse)

1. **Etiology:** STD is usually classified based on etiological agent (bacterial, viral, parasitic)
    a. **Bacterial:** Neisseria Gonorrhoea, Treponema Pallidum (syphilis), Chlamydia trachomatis, Hemophilllis ducreyi, Gardnerella vaginalis, Genital tuberculosis,
    b. **Viral:** HIV, HSV, HPV
    c. **Protozoa:** Trichomonas Vaginalis
    d. **Ectoparasites:** Pubic lice, Scabies
2. **Neisseria Gonorrhoea:**
    a. **Source:** human (Asymptomatic infected women are the main carrier). It is a **strict pathogenic bacteria.** A person can have gonorrhoea multiple times because **we do not develop immunity against the antigenic variable pili.** Transmission: physical contact (intercourse or delivery)
    b. **Pathogenesis:** Attach to mucosal epithelial cell of urethra and vagina using pili → endocytosed by cell → kills the epithelial cell → urethritis and cervicitis.
    c. **Virulence factor:**
        i. **Pili**: attachment to non-ciliated epithelial cells, high antigenic variability makes it hard to develop immunity
        ii. **IgA protease:** cleaves IgA
    d. **Manifestation:**
        i. **Men:** dysuria and white purulent discharge
            1. **Complication:** ascending gonorrhoea may cause prostatitis, epididymitis, balanitis
        ii. **Women:** white purulent vaginal discharge (urethritis of woman is often asymptomatic
            2. **Complication**:
                i. Infection can spread to the uterus, fallopian tube, ovaries → causing pelvic inflammatory disease (PID) → scarring of fallopian tube → sterility, ectopic pregnancy.
                ii. Infection can spread to the peritoneum from fallopian tube → Peritonitis.
                iii. Infection of the liver capsule → Fitz-Hugh Curtis Syndrome (peritonitis and violin string adhesion of the liver)
        iii. **Septic arthritis:** N. gonorrhoea can invade mucosa and enter bloodstream → accumulate in synovial fluid → septic arthritis (fevers, arthralgias). Most common cause of arthritis in sexually active young adults.
        iv. **Neonatal conjunctivitis (ophthalmia neonatorum)**: Inoculation of bacteria in the eyes of newborn delivered by an infected mother → Rapid onset **purulent conjunctivitis** → risk of blindness
    e. **Diagnosis:**
        a. **Gram Stain:** G- diplococci within the WBC
        b. **Sugar fermentation:** N. Gonorrhoeae ferments glucose, not maltose (differential with N. meningitidis, which ferments maltose nto glucose)
        c. **Culture:** selective to grow on Thayer-Martin agar
    f. **Treatment**:
        i. Ceftriaxone + doxycycline or erythromycin to cover both gonorrhoea and chlamydia
        ii. Erythromycin eye drop for prophylaxis for new born
3. **Syphilis (Treponema Pallidum)**

a. **Source**: humans. Transmission: body fluid or congenital transmission (T. pallidum is very labile and can't survive on fomites)
b. **Syphilis (rule of 6: 6 weeks incubation, 6 weeks for ulcer to heal, 2ndary syphilis 6 weeks after ulcer and last 6 weeks, 6 years to develop tertiary syphilis)**
    i. **Primary syphilis**: bacteria multiply at site of inoculation → painless chancre/ulcer (highly infectious) and lymphadenopathy → heals spontaneously within 6 weeks
    ii. **Secondary stage**: 6 weeks after ulcer heals → the disseminated bacteria → Maculopapular rash on the palm and sole (infection of endothelial cells), condyloma lata (wart like lesion) in moist area (genital), meningeal signs. Symptoms will resolve within 6 weeks, and the person enters latent stage
    iii. **Latent stage**: The person becomes asymptomatic but serologically positive as T. pallidum resides in tissue and organs.
        3. May experience relapses of secondary stage several times
    iv. **Tertiary stage**: chronic inflammation (years) against T. pallidum → damage to soft tissue and bones → gumma (necrotizing granuloma)
        4. **Cardiovascular**: aneurysm of ascending aorta because of infection of the vasa vasorum damages the aorta (aortitis)
        5. **Neurosyphilis**:
            i. **Tabes dorsalis**: loss of proprioception and vibration senses due to damage to the posterior column
            ii. **General paresis**: general weakness, loss of sensation, and maybe even paralysis due to damage to the **cerebral cortical destruction**
        6. **Congenital syphilis**: infection via vertical transmission (TORCHES). Can lead to stillbirth, or congenital deformities: saddle nose, saber shin (anterior bowing of tibia), Hutchinson teeth (all teeth looks like canin), Mulberry molar, Deafness (CN8 infection), snuffles (nasal discharge)
c. **Diagnosis:**
    i. **Dark Field microscopy** of fluid sample from the lesions
    ii. **Non-specific tests:** screening tests (cheap and fast) using cardiolipin as antigen. It can give false positive in pregnancy, viral infection, drugs, rheumatic fever, and lupus or leprosy
        7. **VDRL**: Measure Ig against cardiolipin.
    iii. **Specific tests:**
        8. **FTA-AB** (specific treponemal test): test using T. pallidum as antigen and detect anti-T. Pallidum antibodies
        9. **TPHA:** T. pallidum hemagglutination test
d. **Treatment, Prevention, and Control**
    i. **1 dose of 2.4 million IM Penicillin G** is the DOC for primary, secondary or early latent syphilis
    ii. **3 doses of 2.4 million IM Penicillin G** weekly is the DOC for late latent or tertiary syphilis
    iii. **Doxycycline** is used if the patient is allergic to penicillin and cannot undergo desensitization
e. **Complication of treatment**
    i. **Jarisch-Herxheimer reaction**: complication of syphilis treatment by penicillin. The lysed bacteria release endotoxin → fever, chills, myalgias
    ii. **Allergic reaction**: some people are allergic to penicillin.

4. **Chlamydia Trachomatis:** Chlamydia is the most common STD
a. **Chlamydia (non-gonococcal urethritis, Serotype D - K):** Painful urination with watery discharge. Infection may spread and cause PID, peritonitis, Fitz-Curtis-Hugh syndrome
b. **Lymphogranuloma venereum (Serotype L1- L3):** painless ulcers on genitals → dissemination of bacteria causes painful inguinal lymphadenopathy
c. **Diagnosis**
    i. **NAAT: gold standard**
d. **Treatment:**

i. **Serotype D-K**
    1. Doxycycline (100mg oral for 7 days) or azithromycin (1g oral single dose)
    2. If gonococcal suspected, combine with azithromycin with ceftriaxone
    3. Partner therapy recommended
    4. Asymptomatic pts must be treated
ii. **Serotype L1-L3**
    5. Doxycycline or erythromycin

5. **Genital Tuberculosis**
    a. **Route of infection: hematogenous**
    b. **Common sites of involvement**
        i. **Male:** epididymis, testis, prostate, vas deferens, seminal vesicles and ejaculator duct
        ii. **Female:** ovaries, fallopian tubes, endometrium
    c. **Clinical features:**
        i. **Male:** scrotal mass (may be painful or painless), watery discharge, infertility (as a result of fibrosis of ejaculatory duct), ↑urinary frequency, nocturia, recurrent prostatitis/epididymitis that is unresponsive to ATBs
        ii. **Female:** constitutional symptoms (fever, weight loss, night sweats, chills etc), menstrual irregularities, abdo pain, infertility, adnexal mass on pelvic examination
    d. **Diagnostics:**
        i. **Male**:
            1. **Urinalysis:** hematuria, sterile pyuria
            2. **Microbiology**: acid-fast staining
            3. **Scrotal ultrasound:** calcification, hydrocele, diffuse/nodular enlargement of epididymis
            4. **Transrectal ultrasound:** calcification in prostate/seminal vesicles
        ii. **Female**:
            5. **Menstrual fluid or endometrial curettage sample:** acid fast stain, PCR
            6. **Ultrasound:** Tubo-ovarian abscess
            7. **Hysterosalpingography:** occluded fallopian tubes, hydrosalpinx, calcification
            8. **Hysteroscopy:** adhesions and obliterated uterine cavity
    e. **Treatment**:
        i. RIPE: 2 months of rifampin PLUS isoniazid, pyrazinamide, and ethambutol (intensive phase)
        ii. 4 months of rifampin and isoniazid (continuation phase)
        iii. Pyridoxine to prevent B6 deficiency from isoniazid (adjuvant therapy)

6. **HIV**
    a. **HIV**: A retrovirus that infects cells with CD4 on their membrane (T cells, mφ, dendritic cells). HIV-1 is much more common than HIV-2 (western africa). HIV is a single strand positive sense RNA virus with reverse transcriptase
    b. **Source**: Infected person. Transmission: sexual contact, blood transfer, maternal transfer (transplacental, delivery, breast milk)

i. **High risk population:** homosexual man, IVDU, haemophiliac, non-haemophilic but receiving blood transfusion, newborn

c. **Pathogenesis**: Inoculation of the virus → binds to CD4 and coreceptor (CCR5, CXCR4) on the cell surface using gp120 protein → use gp41 protein for fusion and entry into cell → Reverse transcriptase transcribe HIV's single strand RNA into double stranded DNA → integrase integrate viral DNA into cell DNA →everytime immune cell is activated, new virus are also being made and released to infect more cells.

d. **Stages of HIV infection:**
   i. **Acute phase**: HIV infects DC with CD4 and CCR5 → carries to lymph node → HIV infect other WBC in lymph node → spike in HIV in blood → flu-like symptoms due to immune system fighting against HIV → HIV in blood ↓ but still detectable (by 12th week) → enters chronic phase.
   ii. **Chronic phase (2 - 10 years):** HIV infects more and more CD4 at a slow rate. The person remains asymptomatic, but the T cell count slowly declines and viral count slowly increases. T cell count is usually above 500 cells/ul, so they can still fight some infections.
   iii. **AIDS:** Diagnosed when the person's T cell count is < 200/ul.

e. **CD4 T cell count**: Normal range is b/w 500 - 1500/ul as T cell count slowly declines, some infections become more prominent and severe
   i. **200 - 500**: lymphadenopathy (swollen lymph node), hairy leukoplakia (EBV infection), oral thrush (C. albicans) b.
   ii. **< 200**: Most people died due to severe immunosuppression
      1. People usually experience persistent fever, weight loss, fatigue, diarrhea (CMV, MAC)
      2. **AIDS defining diseases**: presence of these diseases is closely associated with AIDS
         i. Pneumocystis pneumonia (P. jirovecii), recurrent bacterial pneumonia, esophageal candidiasis (C. albicans), Kaposi sarcoma (HHV-8), primary lymphoma (EBV)

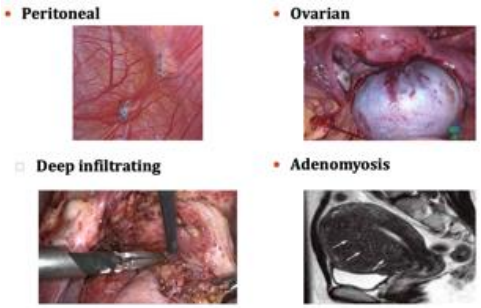
f. **Diagnosis**:
   i. **Antibody test:** detect IgG against HIV
   ii. **Antibody-Antigen test**: detect both IgG against HIV and HIV antigen (p24 capsid protein)
      3. **Screening test** for HIV because it has high sensitivity and specificity. If it is positive, then second check with confirmatory antibody or RNA test
   iii. **RNA/DNA test**: detect viral RNA and DNA (aka viral load test). Use this test to make prognosis and monitor the effect of the therapy

g. **Treatment:** HAART therapy - 3 drugs to prevent resistance (2 NRTIs and one integrase inhibitor)
   i. **Nucleoside reverse transcriptase inhibitors (NRTI):** Zidovudine, Lamivudine
      4. **MOA**: Competitively inhibit reverse transcriptase and terminate the DNA chain
   ii. **Non-nucleoside reverse transcriptase inhibitors**: Delavirdine, Efavirenz, Nevirapine
      5. **MOA**: Bind to reverse transcriptase at site different from NRTIs → inhibit reverse transcriptase
   iii. **Protease inhibitor**: Atazanavir, Darunavir, Fosamprenavir, Indinavir, Lopinavir, Ritonavir, Saquinavir
      6. **MOA**: inhibit HIV protease → inhibit cleavage of viral polyprotein into many enzymes → inhibit viral maturation
   iv. **Integrase inhibitor**: Dolutegravir, Elvitegravir, Raltegravir
      7. **MOA**: binds to HIV integrase → Inhibits HIV genome integration into host cell chromosome
   xiv. **CCR5 inhibitor (Maraviroc):** Binds CCR5 on the surface of T cells/monocytes, inhibiting coreceptor binding → HIV can't bind to T cell

23. Endometriosis

Endometriosis is a common, benign and chronic disease of women of reproductive age that is characterized by occurrence of endometrial tissue outside the uterus.

1. **Epidemiology:** Most develops in women aged 20-40 and affects between 2-10% of women.
2. **Etiology:** not fully understood but retrograde menstruation appears to play an important role.
    a. **Multifactorial:** involves immune, endocrine, cellular and genetic factors
    b. **Current theories:**
        i. **Metastatic theory:** lymphatic/hematogenous spread of endometrial cells and retrograde menstruation
        ii. **Metaplastic theory:** Coelemic metaplasia into endometrial cells
3. **Risk Factors: nulliparity**, prolonged estrogen exposure (**early menarche**/late menopause, short menstrual cycle, unopposed estrogen therapy), family history, menstrual flow obstruction, ↓BMI, ↑dietary trans-fat, age
4. **Pathophysiology:**
    a. Regardless of the location of the endometrial tissue → it reacts to the menstrual cycle → proliferates under the influence of estrogen
    b. Endometriotic implants results in:
        i. ↑ production of inflammatory and pain markers
        ii. Anatomical changes (e.g. pelvic adhesions) → infertility
        iii. Nerve dysfunction
5. **Types:**
    a. **Pelvic/peritoneal:** peritoneum, pelvic organs (fallopian tubes, bladder, cervix) and rectouterine pouch
    b. **Ovarian:** ovarian cyst (chocolate cyst; contain blood)
    c. **Deeply infiltrating endometriosis:** >5mm into retroperitoneal space (lungs, diaphragm)



6. **Clinical features**: depends on the location of the endometrial tissue growth:
    a. ¼ are asymptomatic
    b. **Gynaecological**: dysmenorrhea, chronic pelvic pain (that worsens before menses), dyspareunia, menorrhagia, **infertility** (due to formation of adhesions and alteration of pelvic anatomy)
    c. **Uterus**: Uterosacral tenderness and/or nodularity
    d. **Ovaries**: Lateral pelvic pain, back pain
    e. **Urinary tract**: dysuria, cyclic hematuria, suprapubic tenderness and/or pain, recurrent UTIs, incontinence
    f. **Intestines**: Dyschezia (painfull or difficult defecation), diarrhea, constipation and rectal bleeding.
7. **Diagnostics**:
    a. **History and PE**: presence of Rectovaginal tenderness, adnexal masses and lateral displacement of the uterus
    b. **TVUS:** cystic mass with homogenous internal echogenicity, nodules in the rectovaginal septum.
    c. **MRI –** cyst with blood appears as high signal intensity on T2
    d. **Laparoscopy (confirmatory test):** irregularly shaped, red-blue lesions, white opacification, nodules/cysts, fibrous adhesions (severe disease)
8. **Treatment:** No definitive treatment and management options depend on desire to preserve fertility. High recurrence.
    a. **Asymptomatic endometriosis** → expectant management.
    b. **Symptomatic endometriosis:**

i. **Pharmacological**:
   - **NSAIDs** (pain management) and **continuous hormonal contraceptives**
   - **NSAID alone** → if pregnancy is desired
   - **GnRH agonists** (buserelin, goserelin, leuprolide) with **estrogen-progestin OCPs** (to avoid hypoestrogenic effects)

ii. **Surgical**:
   - **Laparoscopic excision and ablation of endometrial implants** → to confirm the diagnosis and exclude malignancy, to treat patients that do not response to drugs and to treat complications
   - **Hysterectomy with/without BSO** → leads to infertility.

9. **Complications**:
   i. Anaemia,
   ii. ↑ Risk for ectopic pregnancy (Uterotubal adhesions → obstruction of oocyte pathway → risk of ectopic pregnancy)
   iii. ↑ Risk ovarian cancer
   iv. Diarrhea, constipation, intestinal obstruction, intussuception, infertility (due to adhesion formation)

Adenomyosis is a benign disease characterized by the occurrence of endometrial tissue within the myometrium due to hyperplasia of the endometrial basal layer.

1. **Epidemiology**: peak incidence at the age of 35-50
2. **Etiology**: the exact etiology is unknown, but it is associated with endometriosis and uterine leiomyomas.
3. **Clinical features**: Often asymptomatic. May present with dysmenorrhea, AUB, chronic pelvic pain and an uniformly enlarged uterus that is soft but tender on palpation.
4. **Diagnosis**: Clinical and supported by TVUS or MRI showing asymmetric myometrial wall thickening. Histology confirms the diagnosis.
5. **Treatment**:
   i. Conservative → Combined OCPs or progestin only contraception, NSAIDs (for pain relief), GnRH agonists (buserelin, goserelin, leuprolide)
   ii. Surgical → excision of single lesions or hysterectomy

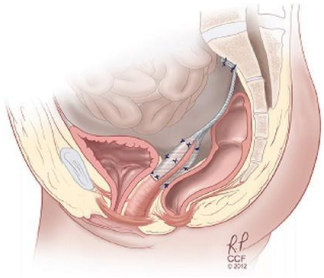
24. Pelvic Pain Syndrome

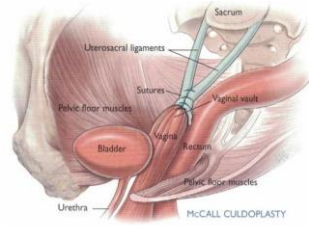
1. **Acute Pelvic pain:**
    a. Acute pelvic pain in a woman of reproductive age with a +ve pregnancy test is an ectopic pregnancy until proven otherwise
    b. **Gynaecological causes:**
        i. Early pregnancy complications: ectopic pregnancy, miscarriage, ovarian hyperstimulation syndrome
        ii. PID
        iii. Ovarian cyst: torsion/hemmorhage/rupture
        iv. Mittelschmerz
        v. Pregnancy complications: fibroid degeneration, ovarian cyst accident, ligament stretch
        vi. Primary dysmenorrhea
        vii. Acute exacerbation of chronic pelvic pain
    c. **Non-gynaecological causes**: GI (IBS/IBD/appendicitis/diverticulitis) or urological (stones, UTI)
2. **Chronic Pelvic Pain**
    a. **Definition:** intermittent or constant pelvic pain in the lower abdomen for at least 6 months, not occurring exclusively with menstruation or intercourse and is not associated with pregnancy.
        i. CPP is a symptom not diagnosis
    b. **Causes**:
        i. Endometriosis: presence of endometrial-like tissue outside the uterine cavity
        ii. Adenomyosis: ectopic endometrial tissue in the myometrium (dysmenorrhea, menorrhagia, CPP, uniformly enlarged uterus)
        iii. Post hysterectomy syndrome – ovarian trapping with dense adhesions at pelvic side walls causing pain
        iv. Pelvic venous congestion: cyclical dragging pain, worst pre-menstrual & after prolonged periods of standing, dyspareunia
        v. Non- gynaecological: IBS/IBD, fibromyalgia, neuropathic pain
3. **Diagnosis**:
    a. **History**: SOCRATES, sexual history and future fertility wishes, abuse, LMP, GI/urinary symptoms
    b. **Physical examination**: pelvic discharge, masses, adnexal tenderness
    c. **Labs**: B-hCG (r/o pregnancy), CBC w/ diff, CRP
    d. **Imaging**: US (abdominal/TVUS), X-Ray, CT or MRI if appropriate
    e. **Laparoscopy:** avoid as invasive
4. **Treatment**:
    a. **Analgesia**:
        i. May prevent emergency admissions
        ii. Opiates if severe acute exacerbation
    b. **Neuropathic** treatment (amitriptyline, gabapentin and pregabalin)
    c. **Hormonal treatment**
    d. **Surgery** – hysterectomy can be helpful but not always effective

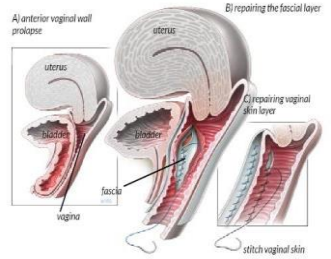
25. Displacement of pelvic organs

Displacement of pelvic organs refers to the herniation into or descent of pelvic organs to or beyond the vaginal walls. Its commonly seen in women of advanced age

1. **Classification:**
    a. **Partial/subtotal:** pelvic organs are partially outside the vaginal wall opening
    b. **Total: pelvic** organs are everted and located outside the vaginal wall opening
2. **Risk factors:** multiparity, prior pelvic surgery, connective tissue disorders, ↑intrabdominal pressure (obesity, constipation), DM (diabetic neuropathy)
3. **Etiology:** insufficiency of the pelvic floor muscles and the ligamentous supportive structure of uterus and vagina
4. **Clinical features:**
    a. Vaginal fullness, lower back pain, pelvic pain, rectal fullness, constipation, incomplete rectal emptying, weak anal sphincter, weak pelvic muscles
    b. Lower back pain (worsen with prolonged standing or walking)
5. **Staging**
    a. **Stage 0:** no prolapse
    b. **Stage 1:** the most distal portion of the prolapse is **>1cm above** the level of the hymen
    c. **Stage 2:** the most distal portion of the prolapse **is 1cm or less proximal/distal** to hymenal plane
    d. **Stage 3:** the most distal portion of prolapse is **>1cm from hymen** but no more than **2cm less than vaginal length**.
    e. **Stage 4:** Vagina is **completely everted or uterine procidentia** (prolapse) has occurred
6. **Differential Dx:** elongation of cervix, urethral diverticulum, pelvic floor dysfunction
7. **Treatment:**
    a. **Lifestyle modification**: smoking cessation, weight loss
    b. **Conservative:** Kegels exercises, vaginal pessary (a silicone or latex device inserted into vagina; provides support for pelvic organs)
    c. **Surgery**: indicated if conservative TX fails
        i. **Colpocleisis**: involves sewing the walls of the vagina together to provide support for pelvic organs
        ii. **Reconstructive surgery** (abdominal or vaginal approach): restore original position of descended pelvic organs
            1. Sacrocolpopexy: fixation of the vaginal apex or uterus to the sacrum using a mesh (1st pic)
            2. Suspension techniques: prolapsed organ is fixated (suspended) using native tissues (2nd pic)
            3. Colporrhaphy: reinforcement of the anterior or posterior vaginal wall (3rd pic)
            4. Sacrohysteropexy
8. **Complications**: urinary stress incontinence, fecal incontinence, ascending infections (cystitis, pyelonephritis, cervical infections, endometritis, PID)







26. Urogynaecology

Urogynaecology is a surgical sub-specialty of urology and gynaecology.

1. **Main disorders include**:
   - **a.** Urinary incontinence
   - **b.** Pelvic organ prolapse – q25, UTIs, Vesicovaginal fistula
2. **Urinary incontinence**
   - **a.** Inability to maintain micturition control → involuntary urine leakage
   - **b. Types:**
     - **i. Stress UI:** involuntary leakage with ↑ intra-abdominal pressure (e.g. exertion, sneezing or coughing). It is more often seen in women.
       1. **Pathogenesis:** pelvic floor/sphincter insufficiency → when intra-abdominal pressure ↑ → bladder is pushed downward → stress UI
       2. **Etiology:** urethral surgery, childbirth, aging, menopause (↓ estrogen → ↓ sphincter tone), pelvic surgery/injury, anterior spinal a. syndrome
       3. **Diagnosis:** History, Stress test, Video urodynamics (see the bladder descent during voiding)
       4. **Blaivas classification**: 4 subtypes of stress UI based on video urodynamic study
          - **i. Type 0:** report of UI, but without clinical signs
          - **ii. Type I:** leakage on stress with bladder base descent < 2cm below the inferior margin of the symphysis pubis.
          - **iii. Type II:** leakage on stress with bladder base descent >2cm below the inferior margin of the symphysis pubis iv.
          - **iv. Type III:** bladder neck and proximal urethra are open at rest
       5. **Treatment:**
          - **v. Conservative & Pharmacologic:**
            1. **Kegel exercise:** Tighten the pelvic floor muscles for 3 - 5 seconds → relax the muscles for 3 - 5 seconds (Repeat 10 times, 3 sets a day)
            2. **Lifestyle modification:** ↓ smoking, avoid constipation, weight loss, ↓ fluid intake
            3. **Containment devices** (pads, urethral plug)
            4. **Duloxetine (SNRI):** stimulate pudendal n. → ↑ urethral sphincter muscle activity
          - **vi. Surgery:**
            5. **Urethral bulking agent:** injecting bulking materials into the proximal urethra to improve urethral resistance
            6. **Burch colposuspension:** lift the bladder up by stitching the paracervical fascia to iliopectineal ligament. Treat SUI due to pelvic weakness
            7. **Suburethral slings:** hold up the urethra with a piece of tape/sling made of synthetic or biological material
     - **ii. Urge UI:** involuntary leakage immediately preceded by urgency (sudden, strong desire to void)
       1. **Pathogenesis:** detrusor muscle react to the slightest irritation → contracts uncontrollably (overactive bladder) → UI **b.**
       2. **Etiology:** suprapontine lesion (stroke, cancer, dementia), acute cystitis, bladder stones **c.**
       3. **Treatment:**
          - **i. Conservative & Pharmacologic:**
            1. **Bladder training:** scheduled voiding and voluntarily suppressing the urgency b/w the set time.
            2. **Anticholinergics (oxybutynin, solifenacin, tolterodine):** inhibit M3 receptor → ↓ detrusor contraction
            3. **β3-agonist (mirabegron):** binds to β3 receptor → relax the detrusor muscle

ii. **Surgical**
    4. **Botox injection:** paralyze detrusor muscle, repeated injection needed every 3 - 9 months,
    5. **Augmentation cystoplasty:** making the bladder bigger by attaching it to a detubularized section of the intestine.
    6. **Neuromodulation:** modulate neural transmission to suppress bladder reflex (e.g. sacral nerve stimulation)

iii. **Overflow UI: l**eakage of urine when the bladder is abnormally distended with large residual volumes
1. **Pathogenesis:** Atonic bladder → bladder gets overfilled with urine → excess urine leak out of the bladder → overflow UI
2. **Etiology:**
    i. Spinal shock (transient loss of all function below the level of lesion)
    ii. Peripheral neuropathy (e.g. DM - impaired transmission of filling signal)
    iii. Sacral cord injury (damage to micturition reflex)
3. **Diagnosis:**
    i. **History**
    ii. **Urodynamic study:** PVR, Pressure-flow study, EMG
    iii. **Imaging:** CT/MRI to assess spinal cord/peripheral nerve injury
4. **Treatment: no curative treatment, focuses on removing the urine and preventing complications**
    i. **Lifestyle modification**: ↓ caffein, alcohol & fluid intake, wearing absorbents to manage overflow incontinence, scheduled voiding ii.
    ii. **Catheterization**: intermittent-self catheterization or indwelling catheter or suprapubic catheter
    iii. **Direct parasympathomimetic (bethanechol):** binds to M3 receptor in the bladder → stimulates detrusor contraction
    iv. **Indirect parasympathomimetics (neostigmine, pyridostigmine):** ↑ ACh that binds to M3 receptor in bladder → ↑ detrusor contraction
    v. **α-blocker (tamsulosin, doxazosin, prazosin):** relax the SMC in the urethra → ↓ resistance to urine outflow. Especially in man with BPH (BPH ↑risk of atonic bladder)
    vi. **Sphincterotomy**: surgical division of the sphincter muscle to weaken it → urine flows out more easily, can lead to incontinence
    vii. **Urinary diversion (ileal conduit):** creates an alternative pathway for the urine to leave the bladder

iv. **Mixed urinary incontinence:** involuntary leakage of urine associated with urgency and also with exertion, effort, sneezing, or coughing.
1. **Manifestation:** symptoms of both stress and urge UI (hence mixed)
2. **Treatment:** treat the more troublesome symptoms first
    i. **Conservative:** pelvic floor muscle training, bladder training, avoid bladder irritants, weight loss
    ii. **Pharmacologic:** anticholinergics or mirabegron for urge UI, duloxetine for stress UI
    iii. **Surgery:** for stress UI

c. **Diagnosis:**
i. **History:** Identify the type of UI based on patient's complaint (e.g. stress UI = incontinence when cough). Identify the risk factors for UI (surgery, radiotherapy, neurological disease, OBGYN history)
ii. **Physical examination:** palpate the bladder, neurological exam (gait, anal reflex, perineal sensation, lower limb function)
    1. **Stress test:** ask the patient to cough or strain, then observe for urine leakage
iii. **Urinalysis ± culture:** rule out infection as a cause of urge incontinence
iv. **PVR volume measurement:** PVR volume is also useful (< 50ml = normal, > 200ml = abnormal, 50-200ml = need other test)
v. **Pressure-Flow study rate:** ↓ flow rate suggests BOO or ↓ bladder contractility.

27. Ethical problems in obstetrics and gynaecology

1. Medical ethics is founded on a set of core principles that are based on respect to patients as individuals.
    a. **Autonomy**: provide sufficient information for the patient to be able to make their own decisions regarding their care (i.e. informed consent)
    b. **Beneficence**: Advocate for the patient and act in their best interest
    c. **Nonmaleficence**: Avoid causing injury or suffering to the patient
    d. **Justice**: treat patients fairly and equitably
2. **Examination of gynaecological patient**
    a. Show highest level of professionalism and maintain good conduct to increase patients comfort
    b. Patient should be informed about what will be done, how and why it will be done
    c. Examination should take place in a closed comfortable place with privacy.
    d. Ask if the patient requires a chaperone – support the patient with reassurance and emotional support during a procedure they may find embarrassing orr uncomfortable
    e. Minors should be accompanied by an adult (preferably parent)
3. **Operations that may affect future childbirth**
    a. Each surgery has some chance of iatrogenic sterility and future obstetric complications that must be discussed with the patient.
    b. Some surgeries will result in sterility: hysterectomy, bilateral oophorectomy
    c. The decision to undergo surgery should depend on: patient decision (autonomy), current medical status of patient, reproductive status etc.
4. **Request of contraception or termination of pregnancy (TOP) by a minor**
    a. Such patient should be asked if they want their parents involved – it may relieve them
    b. However, if the minor does not desire to involve parents, we are obliged to keep her confidentiality. We can provide care as long as she is capable of decision making.
    c. Not giving care to these patients may harm them: unprotected sex, STDs, undesired pregnancy.
5. **Religious view contradicts with needed care**
    a. Many religious people will refuse treatment due to their belief, e.g. termination of pregnancy (TOP) , c-section and blood transfusions
    b. Should not treat them, but the patient must be fully informed of the consequences of their decisions.
6. **Induced abortion**
    a. **For:**
        i. Women have right over their body (e.g., woman may decide not to have a child after being raped)
        ii. May avoid future suffering of baby and parents (severe genetic malformation)
        iii. Preservation of maternal life during pregnancy complications
    b. Against:
        i. Fetal right to live and have a valuable future
        ii. Fetal personhood (soul) and pain (fetus is a patient)
        iii. Religious beliefs
7. **Sperm/egg donation**
    a. Raises question regarding biological vs legal parents

28. Fertilisation, implantation

Fertilisation refers to the union of a human oocyte and sperm, usually occurring in the ampulla of the fallopian tube**. Implantation** refers to the stage of pregnancy at which the embryo adheres to the wall of the uterus

1. Events from ovulation until implantation:

Time	Events	Possible disorders
Day 0	• **Capacitation:** final maturation of the sperm in the female genital tract due to the influence of estrogen • **Fertilization: 2 phases** - **Acrosomal reaction:** dissolution of the spermatic cell membrane and the zona pellucida of the ovum - **Impregnation and cortical reaction:** penetration of sperm into the ovum. Afterwards, the zona pellucida goes through changes that prevent other sperm from penetrating • **Conjugation:** fusion of the sperm and ovum to form the zygote	• **Genopathies:** - Injury to the gene loci - Nondisjunction (trisomy/monosomy)
Days 1-5	• **Zygote travels down the fallopian tube towards the uterus** - **Day 2:** 2-cell stage - **Day 3:** 4-cell stage - **Day 4:** 8-cell stage → 16-cell stage (morula) - **Day 5:** blastocyst (200-300 cells = inner cell mass + trophoblast)	• **Blastopathies:** - Congenital anomalies (very complex) - High risk of abortion - Multiple pregnancy • Occurrence up to 14 days after conception
Days 6-7	• **Zonal hatching:** rupture of the zona pellucida → hatching of the blastocyst • **Implantation of blastocyst:** - The trophoblast penetrates the endometrium - May result in brief implantation bleeding	
Days 8-12	• **Formation of fetoplacental unit:** the trophoblast divides into: - **Syncytiotrophoblast** → develops into the placenta and starts to produce hCG - **Cytotrophoblast** → chorionic cavity - The maternal circulation becomes connected with the placental circulation • **Early gastrulation:** development of bilaminar embryonic disc (2 layers) - Epiblast (→ amniotic cavity) and hypoblast (yolk sac and lining)	
Week 3	• **Late gastrulation:** formation of the trilaminar disc - Ectoderm + mesoderm + endoderm - The neural plate begins to form from the neuroectoderm	• **Embryopathies:** - Anomalies of individual organs - Particularly susceptible to teratogens and infections

29. Male infertility

Infertility is defined as the inability to achieve pregnancy after 12 months of unprotected sex in women <35 years of age and 6 moths in women >35 years of age.

- **a. Primary infertility:** infertility in persons who have never achieved pregnancy
- **b. Secondary infertility**: infertility in persons who have previously achieved at least one pregnancy

1. **Etiology:**
   - **a. Congenital**: Klinefelter's syndrome (extra X chromosome), Kallmann syndrome (GnRH secreting neurons fail to develop during fetal development →structural abnormalities→cryptorchidism)
   - **b. Sperm disorders** (**impaired motility**, oligospermia, **azoospermia**) are the most common cause of male infertility
     - **i.** Microdeletions of the azoospermic factor (AZF) regions of the Y chromosome are associated with low sperm counts and motility.
   - **c. Testicular causes** (scrotal injuries, testicular torsion, **infections**, varicocele, orchitis)
   - **d. Medications**: anabolic steroids, spironolactone
   - **e. Endocrine**: thyroid disorders, cushings syndrome, hypergonadotropic hypogonadism (cryptorchidism), primary hypogonadism, hypogonadotropic hypogonadism (hypopituitarism)
2. **Diagnosis**:
   - **a. History**: child growth and dev, sexual dev during puberty, exposure to smoking alcohol, radiation, steroids, chemo etc
   - **b. Primary features of hypogonadism**: loss of body hair, ↓testicular size, gynecomastia
   - **c. Semen analysis**: volume (2-5mil), pH (7.2-7.8), number(>15Million/ml), motility, shape
   - **d. Bloods**: testosterone, LH, FSH, prolactin, LFTs, TFTs, estrogen, anti-sperm antibodies
   - **e. Karyotype test** (chromosomal abnormalities)
   - **f. Imaging**: scrotal US (varicocele/hydrocele/torsion) , TRUS (suspected blockage) , testicular biopsy (recommended in men w/ azoospermia on semen analysis)
3. **Treatment**:
   - **a. Lifestyle modification**: alcohol, nicotine, recreational drug use
   - **b. Pharmacological**: clomiphene citrate, tamoxifen (Disinhibition of the hypothalamic-pituitary-adrenal axis → ↑ LH and FSH secretion → ↑ testosterone production), testosterone (stimulate spermatogenesis), bromocriptine (for hyperprolactinemia), low dose corticosteroids (supress anti-sperm antibodies)
   - **c. Sperm retrieval for assisted reproduction (IVF, intrauterine insemination, sperm injection)**: MESA, TESA, TESE
   - **d. Surgical treatment** (for testicular anomalies)
     - **i. Orchiopexy**: surgery to move and fixate an undescended testicle into the scrotum
     - **ii. Detorsion of testes**
     - **iii. Varicocelectomy**
     - **iv. Vasovasostomy**: resection of an obstructed segment of the vas deferens + anastomosis of segments of vas deferens above and below the obstruction
     - **v. Vasoepididymostomy**: resection of vas deferens + anastomosis of the vas deferens to the epididymis in order to bypass epididymal obstruction

30. Female infertility

Definition: Infertility is defined as the inability to achieve pregnancy after 12 months of unprotected sex in women <35 years of age and 6 moths in women >35 years of age.

- **a. Primary infertility:** infertility in persons who have never achieved pregnancy
- **b. Secondary infertility**: infertility in persons who have previously achieved at least one pregnancy
- **c. Recurrent pregnancy loss**: the inability of a woman to carry to live birth even if conception is possible (e.g. due to APS, uterine myomas)

1. **Etiology:**
   - **a. Ovarian related causes (m/c)**
     - **i. Menstrual cycle abnormalities (e.g. functional hypothalamic amenorrhea)**: caused by ↓hypothalamic GnRH secretion in the absence of an underlying pathological disease. Occurs during states of decreased energy availability (excessive exercise, stress, and reduced caloric intake)
     - **ii. Hyperprolactinemia:** ↑prolactin → galactorrhoea in women, gynecomastia in men + sym of hypogonadotropic hypogonadism (due to ↓ FSH and LH secretion)
     - **iii. Pituitary adenoma**
     - **iv. Diminished ovarian reserve:** a normal consequence of age, can also be caused by underlying disorder (e.g. endometriosis)
     - **v. Hypogonadotropic hypogonadism**
     - **vi. PCOS**
   - **b. Pelvic causes:** PID, **endometriosis**, fallopian tube adhesion (following surgery or infection)
   - **c. Uterine causes:** anatomical anomalies, uterine leiomyoma, pelvic adhesions (after PID esp. recurrent chlamydial infections), Asherman syndrome (scarring fibrosis adhesions of endometrium caused by curettage, ↓sensitivity of endometrium to progestogens)
   - **d. Cervical causes:** Trauma, anti-sperm antibodies in cervical mucus
   - **e. Others:** Thyroid dysfunction, DM, hypertension, Obesity, Cushing's, alcohol, nicotine
2. **Diagnosis**:
   - **a. Assessing ovulation:**
     - **i.** menstrual history
     - **ii.** body temperature (normally ↑ during 2nd half of menstrual cycle),
     - **iii.** hormone tests
       1. Midluteal serum progesterone levels: progesterone should increase shortly after ovulation → failure of progesterone levels to rise indicates anovulation
       2. Androgen levels: elevated levels induce negative feedback to the hypothalamus → inhibition GnRH secretion → decreased estrogen levels and suppression of ovulation
       3. FSH & LH: elevated in ovarian insufficiency
       4. TSH levels: elevated in hypothyroidism
          - **i.** Low T3/T4 levels in hypothyroidism → ↑ TRH levels → stimulation of prolactin release → inhibition of GnRH release → decreased estrogen levels and suppression of ovulation)
     - **iv.** Endometrial biopsy: a flat endometrium indicates a defect in the luteal phase (↓activity of estrogen)
   - **b. Assessment of fallopian tubes and uterus**

    i. Hysterosalpingography: indicated if tubal occlusion suspected
c. **Examine cervix**: Colposcopy (structural abnormalities/changes and discharge), Pap smear (microbio), testing cervical mucus for anti-sperm abs.

3. **Treatment**:
    a. **Treat underlying causes** (levothyroxine for hypothyroidism, bromocriptine for hyperprolactinemia, metformin for PCOS)
    b. **Ovulation induction:**
        i. Clomiphene citrate: Inhibits hypothalamic estrogen receptors and the negative feedback of estrogen to the hypothalamus that normally leads to decreased secretion of gonadotropins
        ii. GnRH (pulsatile) : stimulates the release of FSH and LH → follicle maturation
        iii. Gonadotropins (recombinant hCG/LH): stimulate final oocyte maturation → ovulation
        iv. GnRH antagonist: given in late follicular phase to prevent premature ovulation
    c. **Assisted reproduction**: IVF or intracytoplasmic sperm injection
    d. **Intrauterine insemination**: washed and concentrated sperm are introduced directly into uterine cavity
    e. **Surgery**: removal of tubal, cervical or uterine adhesions, myomas and scar tissue

31. Assisted reproduction

1. **In Vitro Fertilisation (IVF):** most common
    a. **Phase 1:** oocyte & sperm collection
        i. **Ovarian stimulation:**
            1. Growth of ovarian follicles is stimulated by application of gonadotropin
                a. Recombinant FSH at day 1-4 after menses, for 8-12 days
                b. Administration human menopausal gonadotropin (hMG)
                c. This is combined with ovulation inhibition (GnRH agonist/antagonist), as collection of ovulated oocytes from the fallopian tube is harder
            2. Response is then evaluated by TVUS → normal response = 11-30 antral follicles
        ii. **Sperm collection:**
            1. Semen sample obtained after a 3–5-day period of sexual abstinence, and immediately prior to oocyte retrieval
            2. The semen sample is centrifuged in order to remove the fluid, debris & WBCs
            3. The yielded sample is then incubated for 60 min in atmosphere of 5% CO2, which yields a supernatant containing motile sperm
        iii. **Oocyte retrieval:**
            1. Transvaginal aspiration of follicles is performed 36hrs after hMG stimulation, of follicles that have reached at least 18mm in diameter
            2. 36-72h after retrieval, progesterone supplementation is started (to support decidual growth of the endometrium)
            3. 2 weeks from retrieval a pregnancy test is done
        iv. **Oocyte classification & selection:**
            1. The follicular fluid is scanned under microscopy and oocytes are graded according to the appearance of corona-cumulus complex.
    b. **Phase 2: oocyte insemination**
        i. The sperm supernatant is evaluated for morphology & motility, and a sample of 200,000 sperms are selected
        ii. The sperm sample is mixed with mineral oil and is added to the selected oocyte
    c. **Phase 3: embryo culture**
        i. The inseminated oocytes are incubated in an atmosphere of 5% CO2 & humidity of 98%
        ii. Hallmark of successful fertilisation = presence of 2 pronuclei, extrusion of a 2^{nd} polar body
            1. Should be present 18h after insemination
        iii. The fertilised oocyte is then transferred into a growth media and placed under an incubator
    d. **Phase 4: embryo transfer**
        i. One or two embryos are transferred as morula or blastocyst (ideally ET is done 72h after oocyte insemination)
        ii. If the pregnancy test result is positive, progesterone supplementation continues until the 12^{th} gestational week (until the placenta produces its own progesterone)
2. **Success of IVF:** depends on many factors
    a. **Duration of subfertility** (↓ success with ↑ duration)
    b. **Age** (pregnancy rates are highest between 25-35yo)
    c. **Elevated basal FSH** may indicate a poor response to ovarian stimulation
    d. **Previous pregnancy** → higher chance of successful IVF outcome

e. **Previous failed IVF** → ↓ chance of success
f. **Presence of intramural fibroid** → ↓ chance of success
g. **Smoking and ↑ BMI** → ↓ chance of success

3. **IVF-assisting techniques:**
   a. **Intracytoplasmic sperm injection:**
      i. Instead of mixing the spermatozoa with the retrieved oocytes, a single spermatozoon is introduced into the oocyte under a microscope using an injection pipette
      ii. Used for men with severely abnormal semen parameters, may also be tried when failed fertilisation occurs in IVF
      iii. Higher fertilisation rates are obtained if the selected sperm exhibit some motility, but otherwise no strict selection criteria
      iv. Greatly ↑ the success of IVF with sever male-factor subfertility
      v. Men with severe oligozoospermia should have karyotype and CF screen before ICSI
   b. **Assisted zona hatching:**
      i. Some IVF embryos show thicker zona pellucida, which interferes with implantation
      ii. AZH is performed several hours prior to ET to weaken the zona pellucida
      iii. It is recommended to female patients > 38yo, after multiple failed ARTs, and in all cryopreserved embryos
      iv. Methods:
         1. Mechanical = creating a weak spot in the zone via use of laser
         2. Chemical = digestion of the zona by acidic solution (Tyrode)
   c. **Embryo cryopreservation:**
      i. Some IVFs result in multiple embryos – if undesired then they can be stored in liquid nitrogen for 3-5y
      ii. Uses:
         1. Donation to other couples
         2. Donation for research
         3. Re-use for the same woman later in life
      iii. Frozen embryos are unfrozen 24-96h after ovulation, and need to be incubated 24h prior to transfer
   d. **Surrogacy:** mainly indicated in:
      i. Congenital absence of the uterus (MRKH syndrome)
      ii. After hysterectomy
      iii. Medical conditions incompatible with pregnancy
      iv. Homosexual male couples

4. **Intrauterine insemination:**
   a. Couples that may benefit:
      i. Mild male factor subfertility
      ii. Unexplained subfertility
      iii. Coital difficulties
      iv. Homosexual female couples
   b. **Principle:**

i. Sperm is prepared and placed directly into the uterus to aid conception
ii. Sperm concentration suitable for IUI = motile count of > 10M/ml
iii. NICE recommends up to 6 cycles of IUI (success usually occurs by the 4th cycle)
iv. If >3 follicles develop, the treatment cycle should be cancelled as there is a high rate of multiple pregnancies (>25%)

5. **IVF-related procedures:**
   a. **Gamete intrafallopian transfer:**
      i. Begins with follicular stimulation & oocyte retrieval (same as IVF)
      ii. However, in GIFT, the oocyte, along with 150,000 sperms, are loaded into a special catheter and injected into the fallopian tube
   b. **Zygote intrafallopian transfer:**
      i. First, IVF is done to yield a zygote
      ii. Then, the 2-pronuclei embryo is injected into the fallopian tube
6. **Gamete donation:**

Sperm donation	Oocyte donation
Indications: • Male sterility • Oligospermia with failed surgical sperm recovery • ↑ risk of transmitting genetic disorders (e.g., Huntington's) • ↑ risk of transmitting infections (HIV) • Women with no male partner	**Indications:** • Female sterility • Older women (> 45y) • Women with repeated IVF failure • ↑ risk of transmitting genetic disorders (e.g., Huntington's)
Used for: • ICSI, IUI, GIFT	**Used for:** • IVF, GIFT

7. **Ovarian hyperstimulation syndrome (OHSS):** complication of ovulation induction (superovulation)
   a. **Incidence:** up to 10%, and in 1/200 cases it is severe
   b. **Pathophysiology:** ↑ gonadotropins (esp. hCG) → ↑ VEGF → capillary leakage
   c. **Characterised by:**
      i. Ovarian enlargement
      ii. Fluid accumulation in peritoneal & pleural spaces
      iii. Haemoconcentration (→ hypercoagulability)
   d. **Risk factors:**
      i. PCOS
      ii. Younger women with low BMI
      iii. Previous OHSS
   e. **Types:**
      i. Early onset = within 3-7 days after supplementation of hCG

ii. Late onset = within 12-17 days after supplementation of hCG

f. **Prevention:**
   i. Management is focused on prediction and active prevention
      1. Involves low-dose gonadotropins, cycle cancellation, “coasting” during stimulation, or elective embryo cryopreservation for replacement in a further frozen-thawed cycle
      2. In vitro maturation may be used in women with polycystic ovaries, with high antral follicle counts collecting immature eggs to avoid ovarian stimulation and risk of OHSS

g. **Treatment:** supportive care
   i. Daily evaluation of hydration status (weight, FBC, U&E, LFTs, albumin)
   ii. Strict fluid balance with careful maintenance of intravascular volume
   iii. Assessment of respiratory function (pleural effusions)
   iv. Dealing with ascites and effusion (US & centesis)
   v. Thromboprophylaxis: compression stockings and/or LMWH
   vi. Analgaesia and antiemetic

32. Family planning, sexual and reproductive health

1. **Family planning** is the abbility of individuals and couples to control their number of children and the spacing between births. It may involve measures of family planning services and reproductive medicine, including contraception, infertility counselling, STIs counselling and infertility treatment.
    a. **Goals:**
        i. Improve pregnancy planning and spacing
        ii. Prevent unintended pregnancies
        iii. STI prevention
        iv. Educate the population about conception and how to achieve or avoid it
    b. **Family planning services include:**
        i. **Infertility counselling**:
            1. For those who have not conceived after one year of unprotected vaginal intercourse
            2. For those who are infertile, sterile, or unable to physically conceive (i.e., same-sex couples, individuals with reproductive organ disorders)
            3. Offers counselling on optimizing fertility, offers appropriate treatment plan, provide counselling on assisted reproduction technology.
        ii. **Reproductive life plan** and **preconception counselling**
            1. **Reproductive life plan** refers to a set of goals regarding the wish and timing to have children based on personal values, priorities and resources.
            2. **Preconception counselling** is a form of medical counselling provided to couples who are planning to conceive. Aims at identifying and addressing risk factors.
                - **Key components**: **Risk assessment** (immunizations, medication use, genetic carrier screening, environmental risk), **Healthy lifestyle promotion** (counselling on proper nutrition, regular exercise, smoking and alcohol cessation), **Medication and psychological intervention and counselling** and **Physical assessment**.
        iii. **Pregnancy testing and counselling**
        iv. **STI counselling** (prevention of STIs)
        v. **Preventive health counselling** (e.g., breast cancer screening, cervical cancer screening)
2. **Methods used in family planning:**
    a. **Calendar-based method:** recording the length of previous menstrual cycles to determine the fertile days
        i. Achieve pregnancy by unprotected intercourse during fertile days, avoid pregnancy by avoiding unprotected intercourse during fertile days
        ii. This method assumes that:
            1. The ovum can be fertilised only 24h after ovulation
            2. Sperm can fertilise only 48h after sex
            3. Ovulation usually occurs 14-16 days after the last menstrual period
        iii. This divides the menstrual cycle into:
            1. Days 1-7 = considered infertile
            2. Days 8-19 = considered fertile, unsafe for unprotected intercourse
            3. Day 20 until end of cycle = considered infertile
    b. **Cervical method:** based on examination of the cervical mucus
        i. **Infertile mucus:** after a menstrual cycle ends, the cervix is blocked by a thick acidic mucus that prevents spermatozoa from entering the uterus

1. Mainly produced during low concentrations of oestrogen

ii. **Fertile (ferning) mucus:** for several days around ovulation, the mucus produced contains more water and is less acidic – it helps guide the spermatozoa through the cervix
    1. Produced under the influence of high levels of oestrogen

c. Symptothermal method: based on morning body temperature – this method is only suitable for regular and predictable cycles

i. Lower temperature during **follicular phase**, raised temperature during **luteal phase** (due to progesterone)
ii. Peak in temperature is reached 1-2 days after ovulation
iii. For desired pregnancy, intercourse should take place up to 3 days from temperature rise

3. Sexual and reproductive health: branch of medicine involved in education and prevention of sexual related conditions.

a. Prevention of sex-related morbidities (especially STIs):

i. Condoms
ii. Regular screenings for chlamydia, gonorrhoea, HIV
iii. Avoid multiple sex partners
iv. Hygiene maintenance
v. Detection of gender-based violence (mainly affects women)

b. Prevention of unplanned pregnancy:

i. Education about contraception and different methods (from adolescence)
ii. Instruction about methods of detecting fertility periods
iii. Education about the "morning after" pill (ensuring people don't depend on it)
iv. Maintaining confidentiality of abortion-desiring patients

c. Assisting a couple to have a desired pregnancy:

i. Instruction about methods of detecting fertility periods
ii. In case of infertility → full workup to detect cause
iii. Assisted reproduction technologies (ARTs)

d. Maternal and neonatal health maintenance:

i. Proper education of the mother about how to take care of the baby
ii. Cessation of maternal smoking and alcohol abuse

33. Contraception

Contraception refers to a group of methods and devices that are used to **prevent pregnancy.** In general, contraception can be divided into **hormonal contraception** and **non-hormonal contraception** (barrier methods).

Hormonal contraceptives involve the use of estrogen and progestin analogs to prevent pregnancy. The contraceptive effect is mediated by negative feedback at the hypothalamus, ultimately leading to ↓ LH and FSH secretion.

- **a. Oral contraceptive pills**: Most common form of hormonal contraception. We distinguish between combined OCPs and progestin-only OCPs.
  - i. **Combined OCPs**: Pills containing a combination of **estrogen (ethinylestradiol) plus progesterone analogue**. It is used as a combined pill, because estrogen-only pills are associated with increased risk of breast cancer. Different combined OCPs are classified based on the type of progesterone they contain.
    - **2nd generation** → Norethisterone, levonorgestrel
    - **3rd generation** → desogestrel, destodene, norgestimate (metabolized to levonorgestrel)
  - **ii. Progestin-only OCPs:** Pills that contain only progesterone analogue. It has similar efficacy as combined OCPs but it must be taken every day.
    - May contain norethindone.
    - Indicated when combined OCPs are contraindicated (during lactation, SCD, SLE and autoimmune diseases)
- **b. Contraceptive patch**: Contraceptive transdermal patch that provides low doses of estrogen and progestin. Are considered to have the same efficacy as COCP. Only require application once a week.
- **c. Vaginal ring**: Flexible vaginal ring containing ethinyl estradiol and etonogestrel. The ring is inserted in the vagina and left for 3 weeks and is then discarded. After a hormone week free, a new ring is inserted.
- **d. Injectable progestin**: IM or subcutaneous injection of long acting progestin-only contraceptive.
- **e. MOA:** Mechanism depends on the hormones used.
  - i. **Estrogen** → supresses released of GnRH, LH and FSH via negative feedback.
    - (a) ↓ LH → inhibits ovulation
    - (b) ↓ FSH → inhibits folliculogenesis
  - ii. **Progestins**:
    - (a) ↓ GnRH and LH secretion → supresses ovulation
    - (b) Inhibits endometrial proliferation → prevent implantation of the embryo
    - (c) Changes cervical mucus (↑viscosity) and impairs fallopian tube peristalsis → inhibits sperm ascension and egg implantation
- **f. Adverse effects**:
  - i. **Estrogen** → VTE, CV events, hypertension, headaches, development of hepatic adenoma
  - ii. **Progestin** → Breakthrough bleeding
- **g. Indications:**
  - i. **Contraception**.
  - ii. **Non-contraceptive indications**: Symptomatic treatment of AUB, PCOS, Hyperandrogenism, Endometriosis, Adenomyosis, Dysmenorrhea, Premenstrual syndrome.
- **h. Contraindications:**
  - i. CVD disease → Thromboembolism, coagulopathy, CHD, Stroke, hypertension

ii. Hepatic tumours, estrogen dependent tumours
iii. Acute pancreatitis, SLE, Vasculitis
iv. Smoking >15 cigarettes a day in individuals >35 years of age (very high risk of CVD disease)

Intrauterine device (IUD) are small, T-shaped birth control devices inserted into a woman's uterus to prevent pregnancy. It is inserted through a quick clinical procedure. Individuals must be tested for STIs and pregnancy beforehand.

a. Copper IUD: T-shaped device wrapped in copper wire that is inserted into the uterus. Approved for 10 years of continuous use.
   i. **MOA**: Induces altered tubal motility and a sterile inflammatory reaction in the endometrium (prevents implantation)
   ii. **Indications**: Emergency contraception, long acting contraception, in patients with CI for estrogen containing pills.
   iii. **CI**: Uterine abnormalities, cervical infections, pregnancy
   iv. **Complications**: Menorrhagia, dysmenorrhea, uterine perforation, PID

b. Progestin IUD: Progestin-releasing (levonorgestrel-releasing) contraceptive device that is placed into the uterus.
   i. Very effective method, which provides long-term, reversible contraception and causes less menstrual bleeding than copper IUD.
   ii. **AE**: AUB, dysmenorrhea, pelvic pain
   iii. **CI**: Active PID, pregnancy, uterine abnormalities, cancer, STIs

Non-hormonal contraception are birth control options for individuals who do not tolerate hormonal contraception or who wish to avoid hormonal contraception.

a. Behaviour methods: Are associated with high failure rate due to poor reliability.
   i. **Coitus interruptus**: Withdrawal of the penis shortly from the vagina shortly before ejaculation.
   ii. **Fertility-awareness based methods**: Involves only performing unprotected sex during infertile periods. It is based on the Calendar-based method, Cervical mucus method or Symptothermal method.

b. Barrier methods:
   i. Condom: worn before intercourse to trap the ejected sperm, also prevents STIs. Latex allergy may develop.
   ii. Diaphragm/sponge with spermicide, spermicide foam/jelly: diaphragm/sponge/jelly placed inside vagina prior to sexual intercourse to prevent passage of semen into cervix.
   iii. Cervical cap: device that holds spermicide placed over the base of the cervix 8hrs before sexual intercourse to prevent passage of semen into the cervical canal.

i. Sterilization: Surgical methods to induce reversible infertility.
   i. **Female sterilization**: Surgical interruption of the fallopian tubes (Tubal ligation w/without partial salpingectomy, clipping or banding of the fallopian tubes).
   ii. **Male sterilization (Vasectomy)**: Division and removal of a section of the vas deferens.

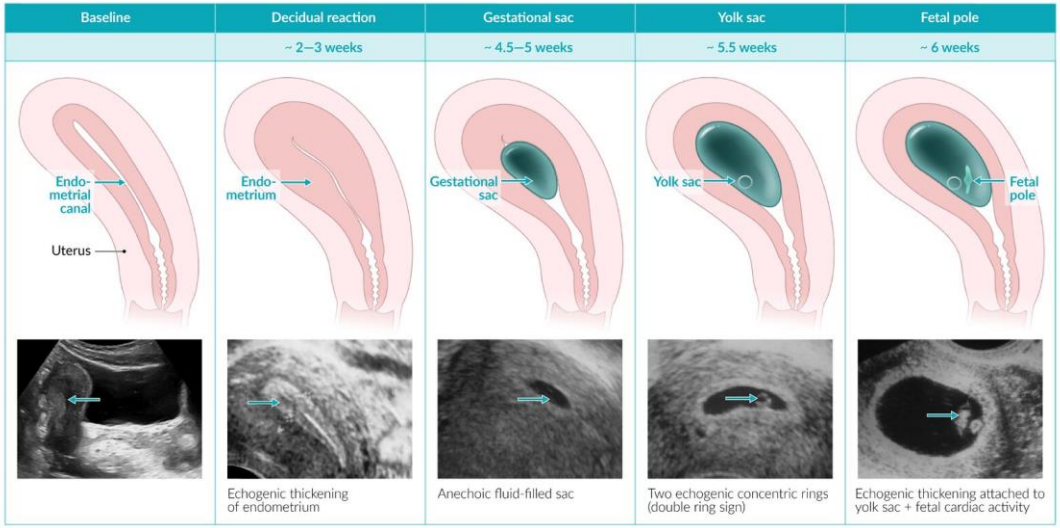
Emergency contraception: EC is indicated for individuals who have had unprotected intercourse or contraception failure and who do not wish to conceive.

i. IUDs: Either copper or progestin IUD.
ii. Oral emergency contraception: most effective when taken within 3 days of unprotected intercourse.
   - **Antiprogestins (ulipristil acetate):** Most effective and taken as a single dose.
   - **Progestins (levonorgestrel):** OTC medication.

34. <u>Termination of I. trimester pregnancy</u>
35. <u>Termination of II. trimester pregnancy (genetic reasons, ethical and forensic issues)</u>

Termination of pregnancy or **Induced abortion** refers to the use of interventions (medical or surgical) to end pregnancy. The WHO estimates that 30% of all pregnancies end in an induced abortion. Legislation varies widely among countries, even being illegal in some.

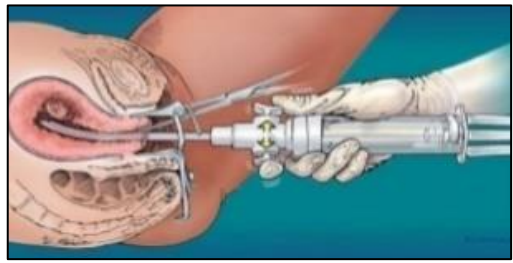
1. **Regulation of termination of pregnancy:**
   - **a.** Pregnancy **until 12 weeks** may be medically terminated due to medical reasons or based on personal maternal choice.
   - **b.** Pregnancy **until 24 weeks** may be medically terminated if:
     - **i.** Continuance of pregnancy would involve greater risk than if the pregnancy than if the pregnancy would be terminated.
     - **ii.** Mother's life is in danger
     - **iii.** There is confirmed severe foetal abnormality
     - **iv.** Foetus is incapable of life
   - **c.** Pregnancy may be medically **after 24 weeks** if there is grave risk to the life of the women, evidence of severe fetal abnormality or risk of grave physical or mental injury to the women.
2. **Reasons for termination:**
   - **a.** Miscarriage
   - **b.** Foetal genetic/congenital defects
   - **c.** Hydatidiform mole
   - **d.** Anticipated harm to the mother.
   - **e.** Maternal cancer during pregnancy
   - **f.** Personal reasons (personal choice, minor, inability to raise child) and forensic reasons (rape, domestic violence)
3. **Examination/tests before elective termination of pregnancy:** Before abortion, the provider must confirm pregnancy, assess the gestational age and make a decision together with patient on the method used**.** Some providers screen and treat for STIs prior
   - **a. Confirm pregnancy:** Urine pregnancy test (B-HCG) or US.
   - **b. Perform a gestational age assessment:** based on US.
   - **c. Blood tests:** Haematocrit, blood group, Rh(D) status (Rh negative women should receive anti-D immunoglobulin within 72 hours of abortion)
   - **d. Assessment of STIs**



4. **Methods of termination of pregnancy:** The methods of TOP depends on the gestational age and women's choice.
5. **Methods of medical termination in the 1st trimester:** Effective until the end of 10th week. **Feticide + Mifepristone + Misoprostol**
   - **a. Feticide:** terminate foetal life by injecting KCl into umbilical cord to stop the heartbeat
   - **b. Mifepristone:** anti-progesterone – causes gestational sac to detach from uterus, ↑ uterine contractility, and opening and ripening of cervix
   - **c. Misoprostol:** PGE1 analogue – induce uterine contraction

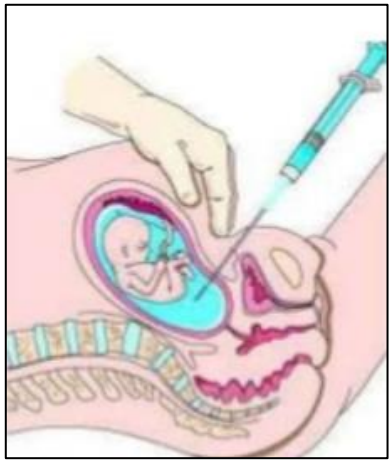
d. **Method:** Oral 200 mg mifepristone and 24-48 hours later, oral 400 mg of misoprostol. The women then stays in the clinic for 4 hours, during which expulsion occurs.

6. **Methods of surgical termination in the 1st trimester:**



   a. **Vacuum aspiration:** can be done up to the 12th week of gestation as outpatient procedure under local anaesthetic. Quicker (15 mins), more effective (98%), and safer than Dilation and Curettage.
      i. **Manual (MVA) =** via a suction cannula attached to a syringe
      ii. **Electrical (EVA) =** via a suction pump which works by negative pressure
   b. **Dilation and curettage (D&C):** can be done up to week 13.
      i. **Procedure**: Involves administration of diazepam → dilation of the cervix (by inserting a series of thicker and thicker rods) and inserting a suction cannula into the middle of the uterine cavity and suctioning. Then curettage is introduced to evacuate any remaining fetal tissue.
      ii. **Complications:**
         1. **Early**: excessive haemorrhage, cervical injury, uterine rupture, endometritis, perforation of bowel/bladder, failure (1%)
         2. **Late**: PID, infertility, cervical incompetence, uterine adhesions

7. **Methods of medical termination in the 2nd trimester** (also referred as **labour induction abortion**):
   a. **Mifepristone + misoprostol:** Same regimen as termination in the first trimester. 97% success rate in 2nd trimester, mean time until abortion is 6.5hrs
   b. **PGE1 analogues:** misoprostol 800 ug PO alone
   c. **PGE2 analogue:** dinoprostone 20mg vaginally. Mean time until abortion is 17hrs
   d. **Oxytocin infusion:** 300U in 500 ml of normal saline. Infusion rate of 50 micU/min.
8. **Surgical methods:**
   e. **Between weeks 13-15: Dilation and evacuation**
      i. Done under general anaesthesia.
      ii. Involves dilating the cervix and removing fetus by forceps, then flushing uterine cavity for final tissue removal.
      iii. Complications:
         - **Early**: excessive hemorrhage, cervical injury, uterine rupture, endometritis, bowel/bladder perforation, failure
         - **Late**: PID, infertility, cervical incompetence, uterine adhesions.



   f. **Between weeks 16-20: instillation abortion**
      i. **Intra-amniotic – hypertonic solution (NaCl 20%):**
         1. Amniocentesis puncture
         2. 90-95% success, mean time until abortion is 32hrs
      ii. **Intra-amniotic – 30% urea solution:**
         1. Amniocentesis puncture
         2. Given together with oxytocin or PGF2a
         3. 90-95% success, mean time until abortion is 13hrs
      iii. **Extra-amniotic – 0.1% ethacridine lactate**
         1. Transcervically given via intrauterine catheterisation, 10cm above the internal os
         2. 90-95% success rate

g. Between weeks 20-27: hysterotomy

i. Featus is removed via a cut in the uterus, as in in an operation similar to a Caesarean section (requires smaller incision than a C-section)

First trimester (up to 12th week)	Second trimester (up to 12-24th week)
Medical	
• Mifepristone + Misoprostol (until 10 weeks)	• Mifepristone + misoprostol • Misoprostol • Dinoprostone • Oxytocin infusion
Surgical	
• Vacuum aspiration = up to week 12 (MVA/EVA) • Dilation and curettage = up to week 13	• Dilation & evacuation = weeks 13-15 • Intrauterine hypertonic solution = weeks 16-20 - Intra-amniotic installation (urea/saline) - Extra-amniotic installation (ethacridine) • Hysterotomy = weeks 20-27

9. Complications of abortion:

a. Hemorrhage
b. Infection (reduced by proper screening and prophylactic ATBs)
c. DIC
d. Cervical laceration and Uterine perforation
e. Retained products of abortion and abortion failure
f. Higher risk of premature birth of subsequent pregnancies.

10. Ethical and forensic issues of abortion:

a. Abortion act of 1967 (UK): Statutory grounds for termination of pregnancy.

a. A: continuing the pregnancy would involve **greater risk to the life of the pregnant woman** than if the pregnancy was terminated
b. B: termination is **necessary to prevent grave permanent injury** to the physical and/or mental health of the pregnant woman
c. C: pregnancy has not exceeded 24 weeks and continuing the pregnancy would involve greater risk than termination, of injury to physical/mental health **of the pregnant woman**
d. D: pregnancy has not exceeded 24 weeks and continuing the pregnancy would involve greater risk than termination, of injury to physical/mental health **of any existing children of the pregnant woman**
e. E: there is a substantial risk that if the child were born it would suffer from such physical/mental abnormalities as to be **seriously handicapped**

b. According to the GMC:

a. Doctors must ensure their personal beliefs do not prejudice their patient care
b. Doctors have the right to refuse participation in TOPs on grounds of conscientious objection. If so, they must always refer to another doctor who will help
c. Patients under 16 should be encouraged to involve their parents, but if they are considered Fraser-competent, they can give their own consent

1. Fraser-competent: where a child is mature enough to make decisions about things that affect them

c. **Ethical POV:**
    a. **Justification of abortion:**
        2. Women have freedom and right over their body (e.g., a woman may decide not to have a child after being raped) (Autonomy)
        3. Safety (where abortions are illegal, some take place by dangerous actions that may harm the mother)
        4. Avoiding future suffering of a child and their parents (severe genetic malformations, low socioeconomic status, etc.)
        5. Preservation of maternal life due to pregnancy complications
    b. **Against abortion:**
        6. Foetal personhood (soul) and pain
        7. Foetal right to live and have a valuable future
        8. Abortion despite uncertainty of foetal rights may be considered as negligence
        9. Religious beliefs

36. Abortion

Termination of pregnancy or **Induced abortion** refers to the use of interventions (medical or surgical) to end pregnancy. The WHO estimates that 30% of all pregnancies end in an induced abortion. Legislation varies widely among countries, even being illegal in some.

1. **Regulation of termination of pregnancy:**
   a. Pregnancy **until 12 weeks** may be medically terminated due to medical reasons or based on personal maternal choice.
   b. Pregnancy **until 24 weeks** may be medically terminated if:
      i. Continuance of pregnancy would involve greater risk than if the pregnancy than if the pregnancy would be terminated.
      ii. Mother's life is in danger
      iii. There is confirmed severe foetal abnormality
      iv. Foetus is incapable of life
   c. Pregnancy may be medically **after 24 weeks** if there is grave risk to the life of the women, evidence of severe fetal abnormality or risk of grave physical or mental injury to the women.
2. **Reasons for termination:**
   a. Miscarriage
   b. Foetal genetic/congenital defects
   c. Hydatidiform mole
   d. Anticipated harm to the mother.
   e. Maternal cancer during pregnancy
   f. Personal reasons (personal choice, minor, inability to raise child) and forensic reasons (rape, domestic violence)
3. **Methods:**
   a. **Medical:** medical abortion is much more common than surgical abortion due to the simplicity of administration.
      i. **Combination of mifepristone + misoprostol** is the most effective medical abortion in < 10 weeks of gestation
      ii. **Misoprostol:** PGE1 analog, it stimulates uterine contraction
      iii. **Dinoprostone:** PGE2 analog 20 mg intra-vaginally.
      iv. **Oxytocin infusion:** 300U in 500 ml of saline.
         - **Advantage**: easy administration, can do it anywhere (can do it at home)
         - **Disadvantage:** abdominal pain, prolonged bleeding
   b. **Surgical:**
      i. **1st trimester**: suction termination or dilation and curettage.
      ii. **2nd trimester**: dilatation and evacuation and installation abortion (intra-amniotic administration of 20% NaCL or 30% urea or extra-amniotic administration of ethacridine lactate).
         - **Cervical preparation**: softening and dilatation of the cervix. It should be performed prior to surgical abortion to reduce the difficulty.
4. **Consideration before aborting:**
   a. **Counselling/support**: the mother should receive both verbal and written information regarding abortion. Arrange meeting with psychiatrist may be necessary for woman with psychiatric history.
   b. **Blood test**: Hb level, blood cross matching (in the case of hemorrhage and transfusion is necessary), Rh testing is necessary

c. **Ultrasound:** is used to confirm pregnancy and to assess the gestational age.
d. **Prophylactic antimicrobials:** metronidazole at time of abortion + doxycycline or azithromycin after abortion

5. **Consideration after abortion:**
   a. Anti-D immunoglobulin should be given to all Rh – women undergoing medical or surgical abortion (250IU ≤ 20wks; 500IU >20wks).
   b. Provide written information, which should include:
      i. Symptoms that may be experienced following abortion
      ii. Symptoms requiring further medical attention
      iii. Contact numbers
   c. Follow-up within 2 weeks after abortion
   d. Refer for further counselling if required
   e. Discuss and prescribe/provide ongoing contraception
6. **Complication of abortion:**
   a. **Surgical abortion:** infection, uterine perforation or rupture, cervical trauma, bleeding
   b. **Medical abortion:** bleeding, retained products of conception, nausea and vomiting, diarrhoea
   c. **Psychological consequences**
      i. **Short term:** anxiety and depressed mood
      ii. **Long term**: regret and concern about future fertility has been shown to be common

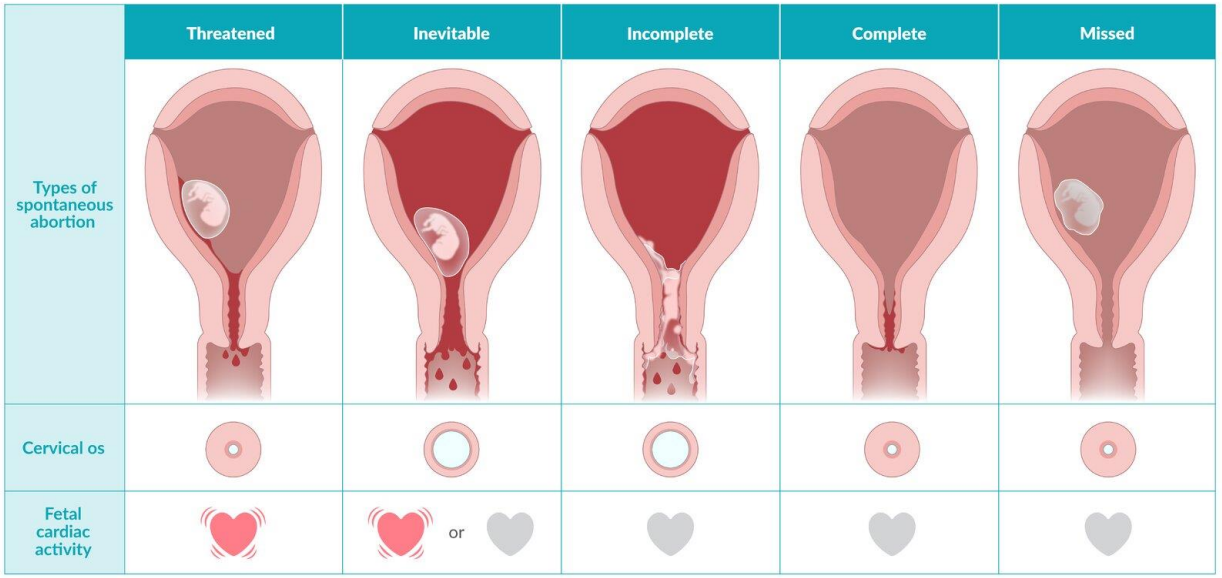
37. Recurrent (habitual) abortion

Pregnancy loss can occur even in previously healthy pregnancies. If it occurs before 20 weeks (10% of pregnancies), it is called **miscarriage** or **spontaneous abortion**. If it occurs after 20 weeks of gestation, it is called **stillbirth**. The majority of spontaneous abortions are due to fetal aneuploidy, but in many cases the causes of spontaneous abortion are unknown.

1. **Definitions:**
    a. **Miscarriage or spontaneous abortion**: Loss of pregnancy before 20 weeks of gestation. 15% of clinically recognized pregnancies miscarriage and the risk increases with maternal age.
    b. **Recurrent miscarriage or abortion**: When 3 or more miscarriages occur in succession. Affects 1% of couples and warrants further investigation.
2. **Etiology** (Non-recurring chromosomal abnormalities account for 50% of spontaneous miscarriages. However, recurrent miscarriages are associated with rarer causes).
    a. **Maternal**:
        i. **Abnormalities of reproductive organs**: Septate uterus, Uterine leiomyomas, Uterine adhesions (Asherman's syndrome), Cervical incompetence
        ii. **Systemic diseases:** diabetes mellitus, hyperthyroidism, hypothyroidism, genetic disorders, infections, hypercoagulability
    b. **Fetoplacental:** Chromosomal abnormalities (50% of spontaneous abortions), Congenital anomalies, Anembryonic pregnancy (The formation of a gestational sac without an embryo or fetal pole)
    c. **Miscellaneous:** trauma, iatrogenic (amniocentesis or chorionic villus sampling), environmental (exposure to toxins or maternal smoking), unknown
3. **Etiology of recurrent miscarriage**:
    a. **Anti-phospholipid syndrome**: Autoimmune disease associated with hypercoagulable state. Associated with recurrent miscarriage due to uteroplacental thrombosis. Treatment with low-dose aspirin plus heparin (pregnant women).
    b. **Parenteral chromosomal defects**: Prenatal diagnosis with chorionic villus sampling or amniocentesis should be offered. Assisted reproduction is used in this patients (use of donor cells or pre-implantation genetic diagnosis of IVF embryos).
    c. **Anatomical abnormalities**: Uterine abnormalities are diagnosed with TVUS (if abnormal → MRI or HSG).
    d. **Hormonal factors**: Thyroid dysfunction, particularly in the presence of autoantibodies, is associated with recurrent miscarriage.
4. **Clinical features of miscarriage:** Depend on the type of miscarriage.
    a. Vaginal bleeding, pain, changes in uterine size and cervical os.

Type	Vaginal bleeding	Fetal activity	Products of conception (POC)	Cervical os	Prognosis
Threatened abortion: There is bleeding but the fetus is still alive. The uterus has the appropriate size and the cervical os is closed.	Yes	Yes	Intrauterine	Closed	Reversible
Inevitable abortion: Bleeding is usually heavier. Although the fetus may still be alive, the cervical os is open and miscarriage is about to happen.	Yes	May be present	Visible/palpable POC	Dilated	Irreversible
Incomplete abortion: vaginal bleeding and uterine cramping leading to cervical dilation, with some, but not all, POC having been passed.	Yes	No	POC within the cervical canal or uterus	Dilated	Irreversible

Complete abortion: vaginal bleeding and uterine cramping have led to all POC being passed. This is confirmed by a sonogram showing no intrauterine contents or debris	Yes	No	POC completely outside of the uterus	Closed	Irreversible
Missed abortion: sonogram finding of a nonviable pregnancy without vaginal bleeding, uterine cramping, or cervical dilation.	No	No	No expulsion of the POC	Closed	Irreversible



5. **Diagnostics:**
    a. **Pelvic examination**: Should be performed in all cases of vaginal bleeding and visualization of the cervix is necessary to confirm that the source of bleeding is uterine.
    b. **Absence of fetal cardiac activity** should raise suspicion of spontaneous abortion
    c. **Transvaginal ultrasound** is the best imaging test once there is absence of fetal cardiac activity or confirmed uterine bleeding. Findings consistent with a spontaneous abortion include:
        i. Absence of fetal cardiac motion
    d. **A downtrending β-hCG** is consistent with a failed pregnancy
6. **Treatment:**
    a. **Prevention:** Minimize risk with treatment of maternal disease and adequate prenatal care.
    b. **Threatened abortion:**

i. **Expectant management:** serial clinical monitoring (i.e., intermittent screening for symptoms of disease).
ii. Avoid strenuous physical activity
iii. Weekly pelvic ultrasound
iv. Rule out treatable causes of vaginal bleeding
v. Rh(D)-negative women should receive Rh(D)-immune globulin

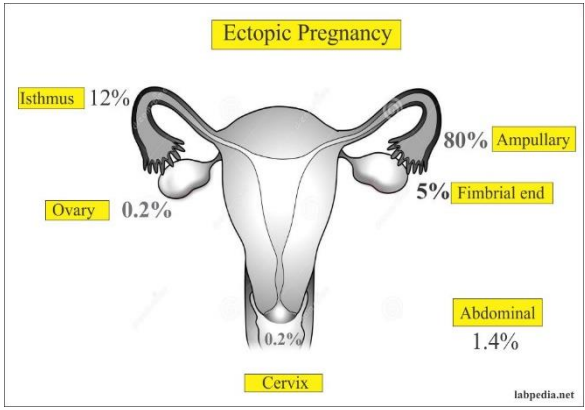
c. **Inevitable, incomplete or missed abortions:** depends on patient preference
   i. **Expectant management:** Surgical evacuation is usually recommended if evacuation does not occur after 4 weeks
   ii. **Medical evacuation: Misoprostol** (induce cervical ripening and expulsion of the products of conception). When available, pretreatment with **mifepristone** 24 hours prior is recommended.
   iii. **Surgical evacuation** (dilation and curettage): Preferred method in septic abortion or if there is heavy bleeding
      1. **Complications**: uterine perforation, hemorrhage, endometritis, and/or intrauterine adhesions
   iv. **Complete abortion**: no treatment required

d. **Complications**:
   i. **Septic abortion:** Complication of a inevitable, incomplete or missed abortion, in which retained products of conception become infected.
      1. **Clinical features:** Fever, abdominal and/or pelvic pain, purulent vaginal discharge and/or bleeding, uterine tenderness, septic shock
      2. **Management** (as any patient with sepsis): broad spectrum ATB, surgical evacuation of uterine cavity
   ii. **DIC:** Retained products of conception result in release of thromboplastin into systemic circulation (→ activation of extrinsic pathway).
   iii. **Endometritis:** An acute or chronic inflammation of the endometrium.

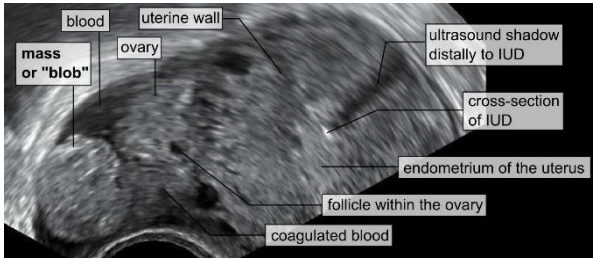
38. Ectopic pregnancy

Ectopic pregnancy occurs when a fertilized egg implants outside the uterus, most commonly in the ampulla of the fallopian tubes.

1. **Classification**:
   a. **Uncomplicated ectopic pregnancy**: An ectopic pregnancy without any complications. May resolve spontaneously.
   b. **Complicated ectopic pregnancy**: Associated with complications such as severe bleeding (hemoperitoneum, vaginal bleeding), rupture (tubal rupture) or hemodynamic compromise. Gynecological emergency that requires surgical treatment.
2. **Location**: fallopian tube (98%) > ovarian > abdominal > cervical
3. **Risk factors**:
   a. **Anatomic alterations of the fallopian tubes (main cause):**
      i. History of PID (e.g., salpingitis) (PID may lead to the formation of stenosis, blind ending pouches or adhesions in the fallopian tube that may trap the embryo)
      ii. Previous ectopic pregnancy
      iii. Surgeries involving the fallopian tubes
      iv. Endometriosis
      v. Ruptured appendix
      vi. Kartagener syndrome
   b. **Nonanatomic risk factors:**
      i. Smoking
      ii. Advanced maternal age
      iii. Pelvic inflammatory disease
      iv. Intrauterine device
      v. In vitro fertilization



4. **Clinical features:** Patients present with symptoms typically 4-6 weeks after their last menstrual cycle.
   a. **General symptoms**: Lower abdominal pain and guarding (similar to appendicitis), vaginal bleeding, signs of pregnancy (amenorrhea, nausea, breast tenderness, frequent urination)
      i. PE: displays tenderness in the area, cervical motion tenderness, closed cervix, enlarged uterus.
   b. **Tubal rupture**: Acute course with sudden severe lower abdominal pain (acute abdomen), signs of hemorrhagic shock (tachycardia, hypotension, syncope).
5. **Diagnosis:** Consider ectopic pregnancy in any women of childbearing age presenting with lower abdominal pain and signs of pregnancy.
   a. **Serial serum b-hCG:** Elevated b-HCG. Levels doubling every 2 days.
   b. **Imaging:**
      i. **TVUS**: Best initial test to determine the location of pregnancy. Supportive findings include an empty uterine cavity with a thickened endometrium, free fluid in the rectouterine pouch, extra-ovarian adnexal mass, tubal ring sign (echogenic ring that surrounds an unruptured ectopic pregnancy).
      ii. **Transabdominal US**: Can be used to exclude ddx. Less sensitive.
   c. **Laparoscopy:** gold standard, but should only be used for unstable patients suspected of having ectopic pregnancy.



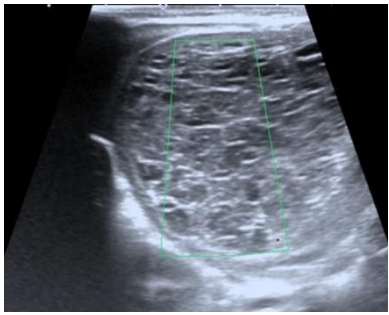
6. **DDx**:

a. Acute abdomen
b. PID, Appendicitis, kidney stones, ovarian cyst rupture, ovarian torsion

7. **Management:** first determine if the patient is hemodynamically stable or not
    a. **Stable:**
        i. **Expectant management**: In an early diagnosed women with hemodynamic stability and declining HCG, expectant management with serial HCG measurements may be performed.
        ii. **Medical therapy (Methotrexate):** single dose of 50 mg/m2 given IM → measure hCG at 4 and 7 days → if ↓ hCG is < 15%, given 2nd dose of methotrexate
            1. **MOA:** Methotrexate inhibit folate pathway → inhibit DNA synthesis → terminate pregnancy
        iii. **Non-urgent surgical method (Laparoscopy)**: Indicated for unsuccessful medical therapy, CI for MTX, patient preference
            1. Either **salpingostomy** (removal of the ectopic pregnancy without removing the affected fallopian tube) or **salpingectomy**.
    b. **Unstable:**
        i. **Acute stabilization**: Start IV fluid resuscitation, deliver blood transfusions ASAP. If hypotension persists consider vasopressors.
        ii. **Surgery:** laparotomy with salpingectomy once the patient is stable

39. Emergencies in gynaecology

1. **Ectopic pregnancy:** refers to the implantation of a fertilized egg outside the uterus, most commonly in the ampulla of the fallopian tube.
    a. **Tubal rupture**: The most important emergency associated with ectopic pregnancy is rupture of the fallopian tubes due to excessive growth of the ectopic pregnancy.
        i. **Clinical features**: Acute onset of severe lower abdominal pain (acute abdomen), signs of hemorrhagic shock (tachycardia, tachypnea, hypotension)
        ii. **Diagnosis**: ↑ b-HCG, TVUS (empty uterine cavity, free fluid in the rectouterine pouch, extra-adnexal mass), laparoscopy
        iii. **Management**: Start immediate IV fluid resuscitation plus blood transfusions. Once the patient is stabilized, laparotomy salpingostomy or salpingectomy is performed.
2. **Acute pelvic inflammatory disease:** is caused by a bacterial infection that has spread beyond the cervix to infect the upper female genitalia.
    a. Pelvic peritonitis: Presents with fever, severe diffuse abdominal pain, peritoneal signs (guarding, diffuse tenderness), N/V. It can lead to sepsis and septic shock.
        i. Treatment: Broad spectrum ATBs, supportive care (IV fluids, electrolyte management, Analgesics, antipyretics and VTE prophylaxis) and, possibly, emergency laparotomy.
    b. Tubo-ovarian abscess: A confined collection of pus in the uterine adnexa. May spread to adjacent organs (e.g., bladder, bowel).
        i. Clinical: fever and chills, acute pain and vaginal discharge, septic shock with hypotension and tachycardia.
        ii. Diagnosis:
            1. Cervical culture: chlamydia and gonorrhea
            2. Blood culture: test for Bacteroides fragile, ↑ WBC and ESR
            3. CT scan: bilateral complex pelvic masses
        iii. Management:
            1. Inpatient IV clindamycin, gentamicin plus metronidazole.
            2. Exploratory laparotomy
            3. Percutaneous drainage through a colpotomy incision
    c. Ectopic pregnancy: there is a sixfold increase in the risk of an ectopic pregnancy after pelvic infection.
    d. Chronic pelvic pain and **dyspareunia**
    e. Hydrosalpinx/pyosalpinx: accumulation of fluid/pus in the fallopian tubes due to chronic inflammation and consequent stenosis.
3. **Ovarian torsion:** Partial or complete twisting of the ovary and the fallopian tube around their supporting ligaments. It most commonly occurs in women of childbearing age.
    a. Risk factors: Ovarian enlargement (associated with cysts, ovarian tumours, ovarian hyperstimulation syndrome, pregnancy), laxity of pelvic ligaments, strenuous physical activity, history of PID, pelvic surgeries.
    b. Pathophysiology: twisting of the ovary and tubes → compression of ovarian vein and lymphatics → ↓ venous and lymphatic outflow → edema of the ovaries and fallopian tubes → compression of the ovarian artery → ovarian ischemia and necrosis → hemorrhage
    c. Clinical features:
        i. Sudden-onset unilateral lower abdominal and/or pelvic pain
        ii. Nausea and vomiting



iii. Adnexal mass may be palpable
iv. In partial ovarian torsion, abdominal pain may be intermittent or resolve spontaneously.

d. **Diagnosis:** Urine or blood B-HCG (to exclude pregnancy or ruptured ectopic pregnancy), WBC and CRP may be elevated, Pelvic US with doppler (TVUS or TAUS should be performed in all patients. Findings → enlarged, edematous ovary with decreased blood flow)

e. **Management:** if suspected, **emergency exploratory laparotomy** should be performed with adnexal detortion (pre-menopausal women) or salpingo-oophorectomy (postmenopausal women).

4. **Abnormal vaginal bleeding:** Vaginal bleeding that is not attributable to expected menstrual bleeding and can be a clinical feature of a number genitourinary conditions. There are various etiologies and the workup can is based on patient's age, pregnancy status and presence of accompanying pain.

a. **Painfull vaginal bleeding**:

Cause:	Clinical features:	Diagnostics:
Ectopic pregnancy	Lower abdominal pain, vaginal bleeding, signs of pregnancy (amenorrhea, N/V, breast tenderness)	Positive pregnancy test, TVUS, laparoscopy (unstable patients)
Spontaneous abortion	Cramping abdominal pain, vaginal bleeding, fever, purulent vaginal discharge	TVUS (absence of fetal heart sounds), ↓ b-HCG
Adenomyosis	Lower abdominal pain, menorrhagia, dysmenorrhea, infertility, uniformly enlarged uterus.	TVUS, MRI (asymmetric myometrial walls)
Leiomyomas	Back or pelvic pain, menorrhagia, dysmenorrhea, infertility, irregularly enlarged uterus	TVUS
Ovarian cyst rupture	Sudden onset of unilateral abd. pain,	US (pelvic free fluid)
PID	Lower abdominal pain, fever, menorrhagia, metrorrhagia, dyspareunia, purulent discharge.	US, cervical and urethral swabs
Cervicitis	Lower abdominal pain, metrorrhagia, vaginal discharge	Cervical swab
Endometriosis	CPP that worsens before menses, dysmenorrhea	US, laparoscopy
Trauma	Pelvic pain, bruising, hematoma	

b. **Painless vaginal bleeding**:

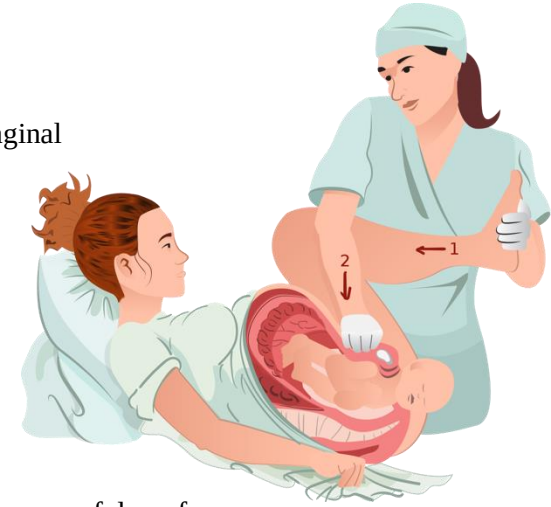
Cause:	Clinical features:	Diagnostics:
PCOS	Amenorrhea, oligomenorrhea, menorrhagia, hirsutism, obesity, acne vulgaris, infertility	US
Endometrial hyperplasia	Metrorrhagia, constant bleeding	TVUS, histology
Endometrial polyps	Irregular menstrual bleeding, spotting	TVUS, hysteroscopy
Cervical cancer	Menometrorrhagia, abnormal vaginal discharge	Pap smear, HPV DNA, colposcopy, biopsy
Endometrial cancer	Metrorrhagia, menometrorrhagia, AUB	TVUS, endometrial biopsy
Adverse effects (anticoagulants, OCP, IUDs)	Easy bruising, bleeding diasthesis	
Anembryonic pregnancy	Asymptomatic, AVB, loss of pregnancy symptoms, falling b-HCG levels	TVUS (no visible embryo)

5. **Coital laceration and sexual assault:**
    a. **Management:**
        i. **Stabilization.** The first step is to determine the patient's vital signs and do whatever is needed to stabilize them. An informed consent needs to be obtained.
        ii. **History-taking.** Record the events that happened in the patient's own words. Also obtain a reproductive, obstetric, sexual, and contraceptive history.
        iii. **Examination.** A thorough general and pelvic examination should be performed with photographic or drawing documentation of any injuries or trauma.
        iv. **Specimens**. A rape kit should be used to obtain biologic specimens (e.g., vaginal, oral, or anal specimens) for DNA or other evidence for use in potential legal proceedings. These must be appropriately labeled and documented, including signatures of receiving authorities.
            1. **Labs**: VDRL, HIV screen, pregnancy test, urine drug screen, and blood alcohol level.
        v. **Prophylaxis:** ATB for gonorrhea (ceftriaxone), chlamydia (azithromycin), and trichomoniasis (metronidazole). Antiviral HIV prophylaxis only within 24hrs after exposure. Active and passive immunization for hepatitis B is appropriate.
        vi. **Pregnancy prevention**: Administer two tablets of high progestin OCPs immediately, repeating two tablets in 12 h. A newly released formulation of levonorgestrel tablets (Plan B) is available specifically for postcoital pregnancy prevention.
6. **Complicated ovarian cyst**
    a. **Ruptured ovarian cyst:** ovarian cyst ruptures result in the sudden onset of lower abdominal pain. Can result in significant hemorrhage.
        i. **Risk factors:** Rupture is caused by an increase in intracystic pressure (associated with vigorous physical activity, vaginal intercourse, large cysts, reproductive age). Most common type of ruptured cyst is corpus luteum cyst.
        ii. **Clinical features:**
            1. May be asymptomatic
            2. Sudden-onset unilateral lower abdominal pain
            3. Possible nausea and vomiting
            4. Minimal vaginal bleeding (spotting) may occur in some cases.
            5. In case of significant hemorrhage: **hypovolemic shock**
        iii. **Diagnostics:**
            1. **Labs:** urine or serum β-hCG (exclude pregnancy), CBC (anemia)
            2. **Transabdominal/transvaginal pelvic ultrasound:** Free fluid, most commonly in the pouch of Douglas (rectouterine pouch)
        iv. **Treatment:**
            1. **Hemodynamically unstable patients:** emergency exploratory laparoscopy/laparotomy to obtain hemostasis
            2. **Hemodynamically stable patients:** conservative management with analgesics and observation
            3. **Blood transfusion** if needed

7. **Obstetric emergencies**
    a. **Fetal bradycardia:** Any time the fetal heart rate is below 100 to 110 bpm for longer than 2 minutes, it is called a prolonged deceleration. Longer than 10 minutes is termed bradycardia.
        i. **Complications:** placental abruption, cord prolapse, uterine tetanic contraction, uterine rupture, pulmonary embolus (PE), amniotic fluid embolus (AFE), and seizure. They have also been associated with poor fetal outcome.

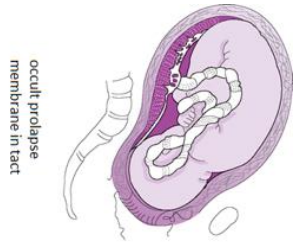
ii. **Treatment**: place in right lateral decubitus position, oxygen face mask,
    1. **Hypotension**: IV hydration and ephedrine
    2. **Tetanic uterine contraction**: nitroglycerin

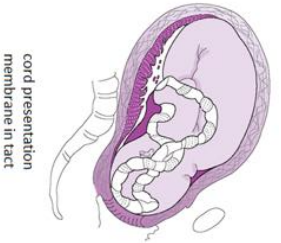
b. **Shoulder dystocia:** the anterior shoulder of the fetus becomes impacted behind the maternal pubic symphysis during vaginal delivery
    i. **Risk factors:** history of shoulder dystocia, fetal macrosomia, maternal DM
    ii. **Clinical features:** arrested active phase of labor, Turtle sign (the fetal head is partially delivered but retracts against the perineum)
    iii. **Treatment:**
        1. **McRoberts maneuver:** supine position with the buttocks on the edge of the table, then abduct, externally rotate, and hyperflex the maternal hips to the symphysis pubis to move anteriorly and release the impacted fetal shoulder.
        2. **Fracture of fetal clavicle**
        3. **Zavanelli maneuver:** Administer a tocolytic agent, The fetal head is pushed back into the pelvis. Once successful, perform a cesarean delivery.



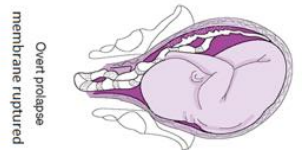
c. **Uterine rupture:** Uterine rupture is caused by uterine distention and typically occurs during labor.
    i. **Risk factors**: fetal malpresentation, multiple gestations, oxytocin overdose, prior uterine surgery, maternal age, short interdelivery interval, postterm pregnancy, macrosomia, history of spontaneous abortion, and induction of labor.
    ii. **Clinical features**: Fetal distress, Severe abdominal pain, Sudden pause in contractions, Light to moderate vaginal bleeding, Hemodynamic instability, Loss of fetal station, Palpable fetal parts through the rupture
    iii. **Treatment:** immediate laparotomy with emergency c-delivery.

d. **Cord prolapse:** occurs when the umbilical cord exits the cervical opening before the fetal presenting part.
    i. **Types:**
        1. **Occult:** the cord has not come through the cervix but is being compressed between the fetal head and the uterine wall)
        2. **Partial:** the cord is between the head and the dilated cervical os but has not protruded into the vagina
        3. **Complete:** the cord has protruded into the vagina).
    ii. **Risk factors:** Rupture of membranes with the presenting fetal part not applied firmly to the cervix, malpresentation.
    iii. **Management:** Do not hold the cord or try to push it back into the uterus. Place the patient in knee-chest position, elevate the presenting part, avoid palpating the cord, and perform immediate cesarean delivery.





e. **Postpartum hemorrhage:** is vaginal delivery blood loss ≥500 mL or cesarean section blood loss ≥1,000 mL
    i. **Etiology:** uterine atony, retained placental fragments, cervical or vaginal lacerations, coagulopathies, and uterine inversion.
    ii. **Clinical features:** vaginal bleeding, rapid heartbeat, low blood pressure, and signs of shock.
    iii. **Diagnosis:**
        1. **Lab:** hematocrit, Hb to estimate blood loss
        2. **Physical examination:** laceration, hematoma
        3. **Speculum:** uterine inversion, retained placental tissue,
        4. **Ultrasound:** diagnose uterine atony, or abnormal placental attachment



iv. **Treatment:**

1. **General:** to control blood loss and ensure perfusion of vital organ
    a. Monitor vital sings and urine output, oxygenation, fluid therapy, blood transfusion
2. **Surgical procedures:** in cases of uncontrolled bleeding→ Ligation of uterine or internal iliac arteries, or uterine artery embolization or hysterectomy.

40. Pre- and postoperative care in gynaecology

1. **Goals:**
    a. **Preoperative**: Optimize patient's health for surgery and anesthesia. Provide clear peri-operative explanation for informed consent and reduced anxiety
    b. **Postoperative:** Reduce postop complications, early management, early discharge.
2. **Preoperative care:**
    a. **General: Educating the patient:** Explain management options to the patient, using diagrams and avoiding medical jargon, be prepared to answer questions and allow the patient to bring a relative**.**
    b. **Explaining the risks of the operation:** Explain that risk and frequency varies with procedure complexity and consider patient's co-morbidities (smoking, BMI, diabetes, hypertension)
    c. **Gaining Consent for the surgery:**
        i. Obtain at appropriate time
        ii. Health professional with knowledge obtains consent, surgeon countersigns
        iii. Ensure patient understands: condition, risks, surgery, recovery, tissue removal
        iv. Consent for additional events and document objections
        v. Written consent for vaginal exams under anesthesia by medical students
    d. **History and examination:** A thorough examination is crucial, including auscultation of the heart and lungs to determine fitness for anaesthesia
    e. **Investigations:**
        i. Avoid ordering routine investigations
        ii. Order investigations based on findings from history and examination
        iii. FBC, U&E, group and save, CXR (for suspected heart/lung disease), ECG (for cardiovascular disease), LFT & CXR (for oncology patients), glucose test (for abnormal glucose tolerance), pregnancy test (for women of child-bearing age), C-spine X-rays (for patients with rheumatoid arthritis)
    f. **Risk assessment:** factors (patients age, co-morbidity, nature of operation, characteristic of disease, anesthetic technique). ASA classification widely used, only consider patients physical condition for approximate risk quantification.
    g. **Evaluate patient's medications:** check for changes or new medications needed based on history, examination, and investigation results.
        i. **Oral Anticoagulants:** discontinue before surgery to decrease intra- and postoperative bleeding
            1. **Minor surgery:** oral anticoagulants should be adjusted to an INR of 2.0
            2. **Major surgery**: discontinue oral anticoagulants at least 3 days before
            3. **NSAIDs:** stopped 1-2 days preoperatively, clopidogrel (must be discontinued 7 days preoperatively)
        ii. **Oral contraceptive pills:** combined oral contraceptive pill should be stopped 4-6 weeks before major surgery to reduce the risk of thromboembolism, alternative contraception should be used (progesterone-only pill is safe)
    h. **Social issues:** stop smoking, avoid smoking, and take parenteral vitamins if necessary (liver disease)
3. **Preoperative preparations:**
    a. **Thromboembolism prophylaxis:**
        i. 10-40% risk of DVT and 0.1-1% risk of PE in gynecological ops
        ii. Low-risk patients don't need prophylaxis beyond early mobilization
        iii. Length, complexity, age and risk factors evaluated for other patients

iv. **Prophylactic measures**: subcutaneous heparin, calf compression, TED stockings, oral warfarin, leg elevation, early mobilization
v. **LMWH replaces UFH for prophylaxis**, with equal/better antithrombotic activity, reduced bleeding, improved pharmacokinetics, no coagulation monitoring

b. **Antibiotic prophylaxis:**
   i. Antibiotics reduce infection risk in gynecological surgery by 50%.
   ii. Choose antibiotics effective against likely wound contaminators, and avoid further doses to prevent adverse effects and antibiotic resistance.
      1. **Urogenital surgery:** use 2nd gen cephalosporin or aminoglycoside as single IV dose at induction.
      2. **Hysterectomy:** use 1st/2nd gen cephalosporin + metronidazole or co-amoxiclav.
      3. **Other gynecological procedures**: transvaginal uterine instrumentation may lead to upper genital tract infections, vaginal swabs taken before insertion.

4. **Postoperative care:**
   a. Monitoring begins in the recovery room with regular observation.
   b. **Pain control:** morphine, syringe pump, and epidural (arranged prospectively, by the surgeon and anesthetist)
      i. Change to oral form of analgesia with a step-down approach once acute pain subsides (codeine, paracetamol, NSAIDs).
   c. **Maintain fluid balance**: by monitoring urine output, systolic blood pressure, and electrolytes.
   d. **Avoid fluid overload** in the elderly and monitor glucose and potassium in diabetic patients.
   e. **Manage N&V**: anti-emetics.
   f. **Urinary catheter** must be inserted before surgery and removed when patient is mobile and eating/drinking.
   g. Only use drains if needed due to widespread peritoneal disease and ascites.
5. **Post-operative complications:**
   a. **Bleeding:**
      i. Maintain intra-operative hemostasis
      ii. Replace fluid loss using colloids for hypotension, crystalloids for extra-cellular fluid loss
      iii. Start blood transfusion for significant blood loss
   b. **Sepsis:** Sepsis <48 hours usually improves on its own
      i. Take history, examine chest, abdomen, wound, legs, urine, take swabs and send for FBC, CRP, U&E, LFT, blood cultures
      ii. Staphylococcus aureus wound infection: flucloxacillin or erythromycin
      iii. **Pyrexia uncertain:** broad-spectrum ATB
   c. **DVT:** Prophylaxis measures and early mobilization are important
      i. **Treatment**: anticoagulation and subcutaneous LMWH to prevent PE and resolve DVT
   d. **Cardiovascular:** ↑ risk of MI after general anesthesia→ monitor patients with chest pain
   e. **Pulmonary complications:**
      i. **PE**: sudden onset of chest pain and tachypnoea
      ii. Take arterial blood gases and order a CXR, ventilation-perfusion scan, or CT pulmonary angiogram
      iii. Stop low molecular weight heparin if PE is suspected
   f. **Bowel:**

i. Reducing surgery duration helps bowel recovery
ii. Avoid opiates for constipation prevention
iii. Bowel obstruction presents as abdominal distension, nausea, vomiting, and tinkling bowel sounds

g. Urinary complications:

i. **Urinary retention:** insert catheter, await bladder function restoration
ii. **Fistulae:** may be vesico-vaginal or uretero-vaginal, surgical repair necessary for large ones
iii. **Ureteric injury:** occurs after devascularization, ligation, or kinking, may require ureteric stent or re-implantation

41. Premalignant diseases of cervix, endometrium and vulva

1. **Vulvar Intraepithelial Neoplasia** (VIN): common vulvar lesion with malignant potential. It is a precancerous lesion characterized by dysplasia of squamous cells. The most common location is **labia minora** and despite treatment it may progress to vulvar carcinoma (<10%).
    a. **Risk factor:** smoking, immunosuppression, poor hygiene, HPV infection (usual type → HPV-16)
    b. **Classification:**
        i. **Usual type**: Commonly multifocal and associated with HPV infection.
        ii. **Differentiated type**: Commonly unifocal and associated with Lichen sclerosis and other dermatoses.
    c. **Clinical features**: Pruritus and pain. Lesions may be red, white, pigmented, warty, patches, nodules or papules.
    d. **Diagnosis**: inspection of the vulva and perineum. Multiple biopsy may be needed to assess the extent of the disease and depth of invasion.
        i. If there is VIN, the vagina and cervix must also be evaluated for squamous dysplasia.
    e. **Treatment:**
        i. **Mild dysplasia**: regular follow up every 6 months because regression may occur
        ii. **Moderate/Severe dysplasia**: laser ablation (for younger woman) or wide local excision (for old woman).

2. **Vaginal Intraepithelial Neoplasia** (VAIN): Precancerous lesion characterized by dysplasia of the squamous cells of the vagina. Seen in women aged 50-60s. Most women with VAIN have CIN.
    a. **Risk factor:** HPV infection, radiation, immunosuppressive therapy
    b. **Clinical features:** Usually asymptomatic. May present with postcoital spotting and vaginal discharge.
    c. **Diagnosis**:
        i. **Colposcopy**: Lesions appear as raised, flat or ulcerated.
            - After addition of **5% acetic acid** → white lesions with sharp borders. Biopsy should be taken of any suspicious lesion
            - **Schiff's test**: Lugol's solution is added. The lesions are stained light yellow whereas normal mucosa has mahogany color.
    d. **Treatment:**
        ii. **Surgical treatment** (mainstay): Local excision and/or CO2 laser ablation, partial/total vaginectomy
        iii. **Non-surgical treatment**: Topical 5FU, radiotherapy

3. **Cervical Intraepithelial Neoplasia** (CIN): It is a pre-cancerous lesion characterized by dysplasia of the squamous cells. May progress to invasive carcinoma if left untreated. CIN grading system is a histologic grading system, whereas the Bethesda system is a cytological one. They are related. Peak incidence occurs in 25-29 years of age.
    a. **Risk factors**: Persistent high risk HPV infections (esp. HPV 16, 18, 31, 33), multiple sexual partners, early onset of sexual intercourse, smoking, immunocompromise
        - Prevention is made via **vaccination** against individual strains.
    b. **Screening protocol:** CIN causes no symptoms and is not visible in the cervix**.** Screening protocol for cervical cancer starts at the age of 21.
        i. From 21-30 → Pap smear every 3 years every 5 years.
        ii. Above 30 → Pap smear every 3 years, HPV DNA every 5 years, both tests every 5 years.
    c. **Classification**: CIN is subdivided into CIN I - III based on the histologic evaluation:

i. **CIN I (Bethesda class → LSIL)**: mild dysplasia, atypical cells involving ~1/3 of the basal epithelium.
   - Observation since it may regress spontaneously. HPV measurement of the sample is also done. If high grade strains are seen → colposcopy. If high grade strains are not seen → the women is returned to normal screening.

ii. **CIN II (Bethesda class → LSIF if HPV-16 negative, HSIL if HPV-16 positive):** Moderate dysplasia, atypical cells involving 1/3-2/3 of the basal epithelium.

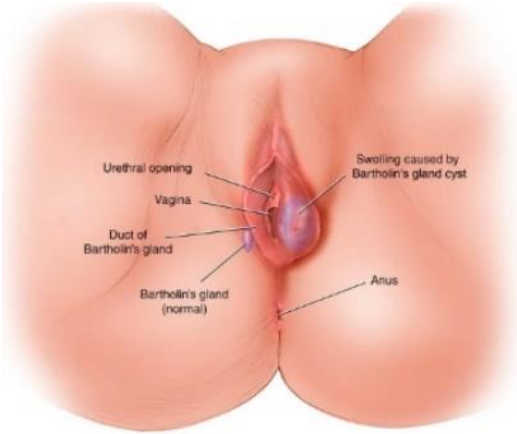
iii. **CIN III (Bethesda call → HSIL):** Severe dysplasia, atypical cells involving >2/3 of the basal epithelium. Basal membrane has not been invaded.
   - CIN II and CIN III have the same management → colposcopy → excision of the transformation zone using cutting diathermy (**loop excision of transformation zone → LETZ**) or ablation (**loop electrosurgery**).
   - If left untreated, 1/3 of women with CIN II/III will develop cervical cancer in the next 10 years.

4. **Endometrial Hyperplasia:** is a benign thickening of the uterine lining caused by proliferation of endometrial glands due to excessive estrogen but insufficient progestin stimulation. It is can progress to **endometrioid endometrial adenocarcinoma**.
   a. **Risk factor:** anything that ↑ estrogen levels:
      i. Follicle persistence in anovulatory cycles (perimenopause, PCOS),
      ii. Estrogen producing tumours (granulosa or theca cell tumours)
      iii. Nulliparity, early menarche and late menopause,
      iv. Obesity, Tamoxifen (SERM that acts as antagonist of estrogen receptors in the breast and an agonist in the endometrium → hyperplasia)
   b. **Pathogenesis:** excessive estrogen stimulation unopposed by progesterone → proliferation of endometrial glands → risk of progression into endometrioid endometrial adenocarcinoma.
   c. **Classification:**
      i. **Endometrial hyperplasia without atypia:** Very low risk of carcinoma.
      ii. **Endometrial hyperplasia with atypia:** Atypical cells with extensive mitosis are present. Very high risk of endometrial carcinoma.
   d. **Manifestation:** abnormal uterine bleeding (menorrhagia, metrorrhagia, postmenopausal bleeding)
   e. **Diagnosis:**
      i. **TVUS**: assess the endometrial thickness. If >1.5 cm in premenopausal women or >5 mm in post-menopausal women → biopsy
      ii. **Endometrial biopsy**: Using a Novak's currete. Hysteroscopy-guided or blind endometrial biopsy.
   f. **Treatment**: Depends on the presence of atypia and if menopause has occurred.

	Pre-menopausal	**Post-menopausal**
Endometrial hyperplasia without atypia	▪ Progestin therapy (cyclic progestin administration from the 12-25th day of the menstrual cycle) ▪ OCPs (women with PCOS)	▪ Progestin therapy
	All patients receiving progestin therapy → US follow-up every 3-6 months	
Endometrial hyperplasia with atypia	▪ Women wishing to conceive → progestin therapy with close survailance ▪ Women not wishing to conceive → TAH-BSO	▪ TAH-BSO

42. <u>Benign tumours of vulva and vagina</u>
43. <u>Benign tumours of cervix and uterus</u>

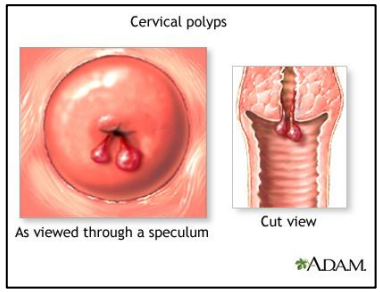
1. **Vulva:**
    a. **Urethral caruncle:** Benign small fleshy outgrowth of the posterior lip of the external urethral opening. Most common lesion of the female urethra, developing mostly on post-menopausal women (hypoestrogenic state).
        i. **Clinical features**: lump in the urethra, light bleeding, dysuria
        ii. **Treatment**: Topical estrogen or surgical excision.
    b. **Condyloma accuminata**: Cauliflower shaped warts or flat lesions caused by genital HPV infection (serotype 6/11). Can occurs in the vulva, vagina or cervix.
        i. **Clinical features**: Cauliflower shaped warts or flat lesions that are pruritic.
        ii. **Treatment**: Topical podophyllin, 5-FU, Imiquimod, surgical removal (simple excision, CO2 laser, cryotherapy).
        iii. **Prevention**: Via vaccination. Either **Gardasil** (Quadrivalent vaccine for vaginal serotypes 6,11,16 and 18) or **Cervarix** (Bivalent vaccine for cervical serotypes 16, 18)
    c. **Vulvar cysts:**
        i. **Mucous cyst (mucocele):** retention cyst, treated with simple excision
        ii. **Bartholin cyst:** Blockage of the ducts causes cyst formation. No treatment is needed unless an abscesses form. Then, simple incision and drainage plus ATB is enough.
        iii. **Epidermoid cyst:** lined by squamous epithelium. Drainage may be necessary.
    d. **Vulvar benign tumours**:
        i. **Fibroma, fibromyoma, dermatofibroma**: removal of lesion is necessary to exclude leiomyosarcoma or sarcoma
        ii. **Lipoma**: removal only if painfull or cosmetically unacceptable.



2. **Vagina:**
    a. **Epidermal cysts**: are cysts that usually result from occlusion of a pilosebaceous duct or a blocked hair follicle. They are lined with squamous epithelium and contain tissue that would normally be exfoliated.
        i. Symptoms: normally asymptomatic, unless it becomes superinfected and develop into abscesses
        ii. Treatment: incision, drainage or complete excision when the cysts cause symptoms.
    b. **Gartner duct cysts:** Gartner duct is a vestigial remnant of the mesonephric duct. Gartner duct cysts arise from these vestigial remnants. They are generally located on the anterolateral aspect of the vagina and are usually small. Occasionally, they may be large and bulge from the introitus.
        i. Symptoms: most asymptomatic, adolescence with dyspareunia or difficulty inserting a tampon
        ii. Treatment: No treatment if small/asymptomatic, surgical excision may be required if they are large and obstruct the outlet.
    c. **Condyloma accuminata.**
    d. **Leiomyoma:** these lesions are benign smooth muscle neoplasms, usually solitary (very rare). Usually located on the anterior vaginal walls. They present as intra-vaginally brownish nodules.
        i. Symptoms: mainly asymptomatic but if large enough (vaginal discharge/bleeding, dyspareunia, urinary retention)

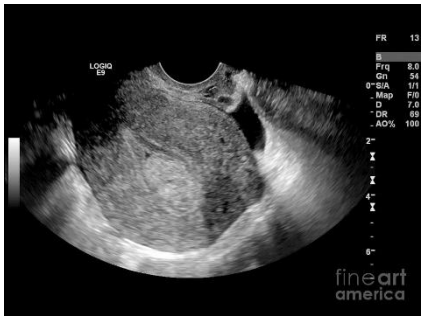
ii. **Treatment:** local excision.

3. **Cervix:**
   a. **Endocervical polyps**: Most common benign tumor of the cervix. It refers to hyperplastic cervical epithelium polypoid lesion. Usually occurs between 30-60 years.
      i. **Clinical features**: Presents as a polypoid structure protruding from the cervical os. Usually asymptomatic but may present with vaginal bleeding.
      ii. **Treatment**: Surgical resection of the polyp followed by cauterization of the polyp's pedicle (to prevent recurrence).



   b. **Squamous papilloma:** is a benign solid tumor, usually the result of inflammation and trauma.
      i. It resembles condyloma accuminata but without koilocytes microscopically.
      ii. Treated by excision.
   c. **Leiomyoma:** is a benign tumor of SMC. Similar to the one found in the uterine cavity. Treatment is only needed for symptomatic patients.

4. **Uterus:**
   a. **Endometrial hyperplasia**: Benign precancerous tumour of the uterus. It is a benign thickening of the endometrial lining caused by proliferation of endometrial glands due to excessive estrogen but insufficient progesterone stimulation.
      i. Risk of progression into endometrial adenocarcinoma (type 1).
   b. **Endometrial polyps**: Endometrial polyps are localized overgrowths of endometrial tissue, which mainly affect post-menopausal women.
      i. They are localized within the uterine wall extending into the uterine cavity. Can be pedunculated or sessile, single or multiple. Expresses estrogen and progesterone receptors (estrogen stimulates growth).
      ii. **Risk factors**: Hypertension, obesity, Tamoxifen or HRT, history of cervical polyps.
      iii. **Clinical features**: Usually asymptomatic. May present with irregular menstrual bleeding, menorrhagia, post-menopausal bleeding and infertility.
      iv. **Diagnosis**: TVUS, Hysteroscopy, endometrial biopsy (rule out hyperplasia and carcinoma).
      v. **Treatment**: Only when symptomatic. Surgical removal by hysteroscopy.

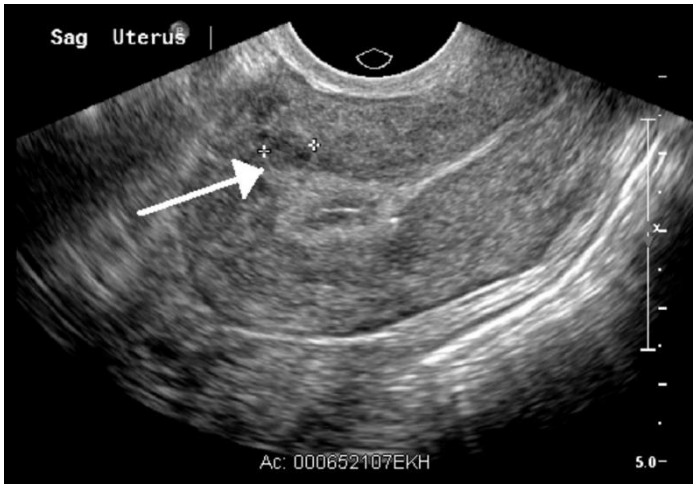


   c. **Leiomyoma (fibroid)**: Uterine leiomyomas are benign, hormone sensitive smooth muscle tumours of the uterus. It is the most common tumour of the female genital tract.
      i. **Etiology**: Predisposing factors include nulliparity and early menarche, obesity and family history.
         - Fibroids are mostly found in **women of reproductive age** (because their growth is influenced by hormones). During menopause → ↓ hormone levels → leiomyomas shrink.
      ii. **Classification based on location**:
         - **Submucosal**: directly below the endometrium.
         - **Intramural**: growing within the myometrium wall.
         - **Subserosal**: located in the outer uterine wall, beneath the peritoneum.
         - **Cervical**.
      iii. **Clinical features**: Most women have small asymptomatic fibroids.

- **AUB**: menorrhagia, metrorrhagia, dysmenorrhea
- **Features of mass effect**: Enlarged, firm and irregular uterus, back or pelvic pain/discomfort, urinary tract or bowel symptoms (frequency, retention, incontinence)
- **Reproductive abnormalities**: infertility, dyspareunia

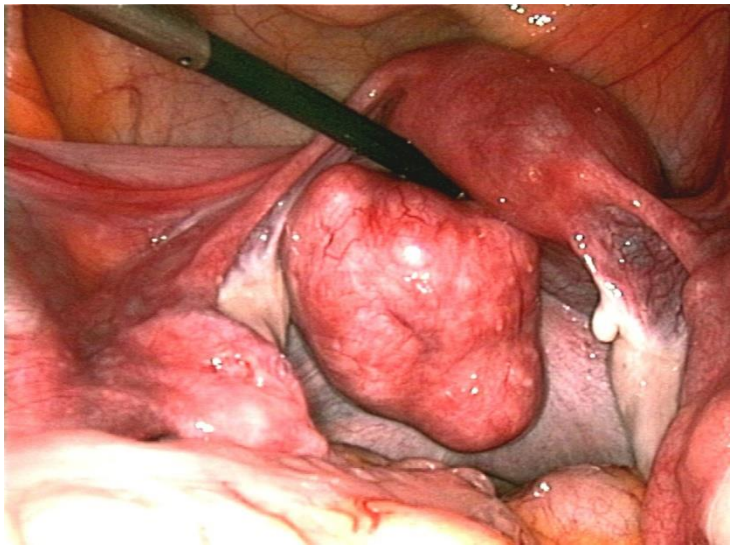
iv. **Diagnosis**:

- **Imaging**: **Pelvic US** (most appropriate initial test. Supportive finding → well-circumscribed hypoechoic solid mass, calcifications and/or cystic areas), **Sonohysterography** (to further evaluate endometrial abnormalities detected on US), **MRI**.
- **Lab**: CBC (anemia), urinary pregnancy test, coagulation panel (for ddx of AUB).



v. **Treatment**:

- **Asymptomatic patients**: Expectant management with monitoring for symptoms changes.
- **Symptomatic patients**:
  a. **Fertility is desired**:
     1) **Pharmacotherapy**: OCPs (either combined OCPs or progestin-only pill), levonorgestrel IUD, GnRH agonists (Buserelin, Goserelin, Leuprolide) or GnRH antagonists.
     2) **Myomectomy** (hysteroscopy or laparoscopy guided)
  b. **Fertility is not desired**:
     1) **Uterine preservation is desired**: Uterine artery embolization, Radiofrequency ablation
     2) **Uterine preservation is not required**: Hysterectomy



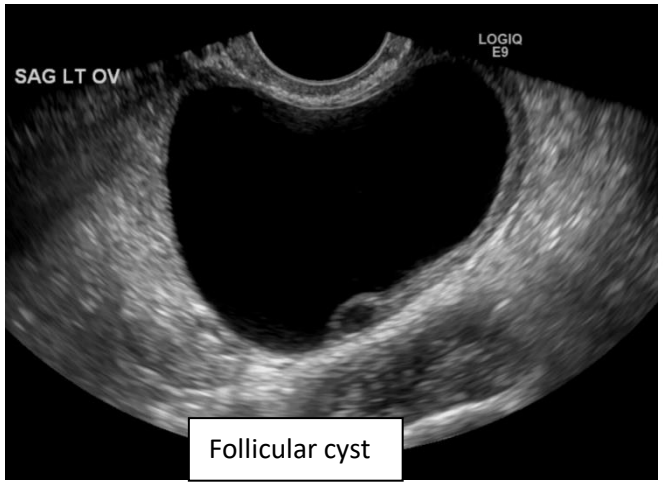
44. Ovarian cysts

Ovarian cysts are fluid-filled sacs within the ovary. Cysts are the most common cause of ovarian enlargement.

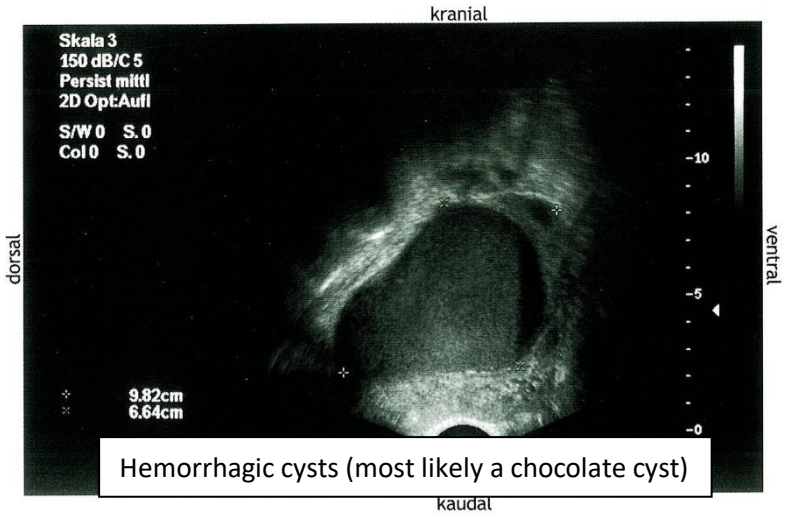
1. **Functional ovarian cyst**: result from a disruption in the development of follicles or the corpus luteum and often resolve on their own.
    - **i. Follicular cyst**: Most common ovarian mass in young woman. Thin, fluid filled cyst lined internally by granulosa cell and externally by theca interna. It develops when a Graafian follicle does not rupture and does not releases the egg but continues to grow. Follicular cysts measure > 3 cm.
        - Associated with hyperestrogenism and endometrial hyperplasia.
    - **ii. Corpus luteum cyst:** Are formed by the enlargement and build-up of fluid in the corpus luteum after failed regression. Produces progesterone, which may delay menses.
        - Associated with progestin-only OCPs, ovulation inducing medication. Common during pregnancy.
    - **iii. Theca lutein cyst**: Often multiple cysts that develop bilaterally. The cyst results from exaggerated stimulation of theca cells by circulating gonadotropins such as b-HCG.
        - Associated with pregnancy, gestational trophoblastic disease.
2. **Non-functional ovarian cysts**: A group of cysts that does not arrive as a result of a physiological process.
    - **a. Chocolate cyst:** cyst-like structures that contain blood, fluid, and menstrual debris and are associated with endometriosis.
    - **b. Dermoid:** A mature cystic teratoma (benign tumour). Most common ovarian tumor in females.
        - **i. Clinical:** mostly asymptomatic but, if large enough, may cause ↑ Abdominal girth, Pressure symptoms (e.g., ↑ urinary frequency), Lower abdominal pain
        - **ii. Ultrasound:** Heterogeneous mass, hyperechoic nodule, echogenic shadowing, absent internal vascularity and/or fluid-fluid levels
    - **c. Ovarian cystadenomas:** Most common benign ovarian tumor of epithelial origin. Can be serous or mucinous. Is frequently bilateral.
        - **i. Clinical:** Typically asymptomatic, symptoms of abdominal displacement may be present (e.g., pain, ,↑urinary frequency)
        - **ii. Ultrasound:** Unilocular cystic mass, absent flow on Doppler
    - **d. Malignant cysts (from ovarian cancer)**: higher risk in post-menopausal women.
3. **Clinical features:**
    - **i.** Usually asymptomatic (incidental finding)
    - **ii.** Can cause lower abdominal pain and lead to complications
    - **iii.** Adnexal mass that is sometimes palpable
    - **iv.** Possibly signs of the underlying cause:
        - Menorrhagia → endometriosis,
        - Hirsutism, acne, obesity and infertility → polycystic ovary syndrome
    - **v.** Ovarian cancer must be ruled out in premenarchal and postmenopausal patients with a palpable ovarian mass.
4. **Diagnostics**: Based on pelvic ultrasound.

Simple cyst	Corpus Luteum cyst	Theca Lutein cyst
▪ Smooth lining on all sides, anechoic, no internal flow on Doppler ▪ Single (follicular cyst, corpus luteum cyst),	▪ Uniocular cyst with thick walls ▪ ↑ Peripheral vascularity (ring-of-fire sign) ▪ Small central lucency	▪ Bilateral multilocular cysts with thin walls ▪ Fluid-filled ▪ Solid components may be present.

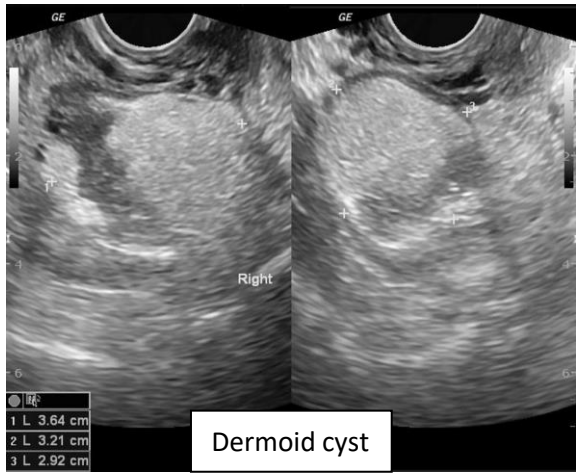
▪ Multiple (PCOS, multilocular theca lutein cysts),	▪ Intracystic echogenic debris may be present.	



Follicular cyst



Hemorrhagic cysts (most likely a chocolate cyst)



Dermoid cyst

5. **Treatment:**
    - **i. All patients:**
        - **Pain management**: NSAIDs, opioids (severe)
        - **Treatment of underlying condition** (PCOS, endometriosis)
    - **ii. Functional cysts:** watchful waiting with repeat ultrasound
    - **iii. Complications, large cysts, persistent painful cysts:** consider surgery (>5cm cysts require cyst removal by laparoscopy)
6. **Complications**: Ovarian torsion, ruptured ovarian cyst and hemorrhage

45. Malignant tumours of vulva and vagina

Vulva cancer is a maligancy of the outer female genetalia that predominantly develops in post-menopausal women (after 60).

a. Etiology: Most important risk factors include HPV infection (especially serotypes 16, 18, 31, 33), vulvar dystrophy, VIN or CIN, smoking, vulvar dermatoses (such as lichen scleroses), immunosuppression.

b. **Classification:** SCC (80% of cases), Basal cell carcinoma, Melanoma
   i. **Paget's disease of the vulva**: Adenocarcinoma or carcinoma in situ with low risk of underlying invasive disease. Presents as an eczematous lesion with raised, well demarcated borders, erythematous patches, crusting and ulcerations.

c. **Clinical features:** May initially be asymptomatic.
   ii. Local pruritus, possibly with pain
   iii. Reddish blackish and/or whitish patches of discoloration or ulceration
   iv. Lumps or growths of various shapes
   v. Dyspareunia
   vi. Lymphadenopathy in the groin area.

d. Diagnosis: Diagnosis is based on pelvic examination and biopsy of all suspicious lesions. Sentinel LN biopsy may be performed.

e. Treatment:
   i. **1st line**: **local excision** and **surgical resection with/without groin lymphadenectomy** (**radical vulvectomy**).
   ii. **Radiotherapy** or **palliative chemotherapy** when the disease has metastasized.

Vaginal Cancer is closely related to vulvar cancer in terms of etiology and histology. Most are metastatic cancers from the cervix or endometrium. Primary vaginal carcinomas are rare (1-2% of malignant gynaecological tumours). Most often occur in women over 50. The upper third of the posterior wall is the most common site.

a. **Etiology:** HPV infection (especially serotypes 16, 18, 31, 33), VAIN or CIN, smoking, cervical cancer

b. **Subtypes**:
   i. **SCC**: Most common type that grows as an exophytic mass. VAIN is the precursor lesion. Mostly develops secondary to cervical SCC.
   ii. **Clear cell adenocarcinoma**: Cancer derived from the glandular cells lining the vagina. Associated with in utero exposure to diethylstillbestrol (daughters of females exposed are commonly affected).
   iii. **Sarcoma botryoides**: Rare, highly malignant embryonal rhabdomyosarcoma that arises most commonly in the GU system. Resembles a bunch of grapes.

c. **Clinical features**: Painless vaginal bleeding, leukoplakia, vaginal ulceration with contact bleeding, malodorous discharge. Mass or ulcer may be evident.

d. **Diagnosis**: Pelvic examination, colposcopy (if abnormal cytology results are obtained in the absence of a clear lesion in examination), biopsy.

e. **Therapy**: Intra-vaginal radiotherapy and surgical treatment.

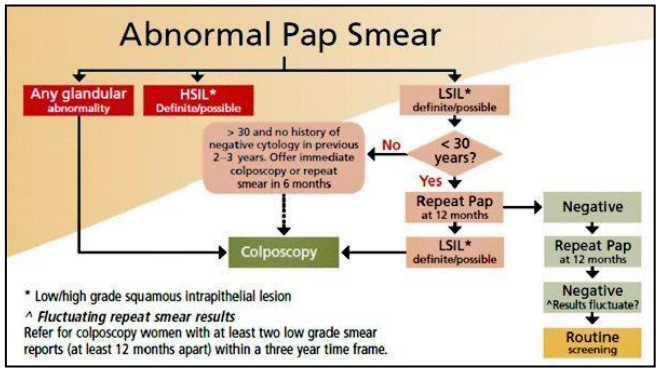
45. Malignant tumours of the cervix

Cervical cancer is the 3rd most common type of gynecological cancer after endometrial (1st) and ovarian cancer (2nd).

a. **Epidemiology**: The mortality and incidence of cervical cancer have significantly declined since the introduction of Pap smears and vaccination. Peak incidence between 35-45 years. CIN, a precursor lesion to cervical cancer, typically occurs in young adults (25-35 years).
b. **Etiology:** Infection with high risk HPV is the main cause of cervical cancer (HPV 16, 18, 31, 33).
c. **Risk Factors:**
    i. **Factors ↑ risk of acquiring HPV:** Many sexual partners, Unprotected Sex, early onset of sexual activity, history of STI
    ii. **Immunosuppression** (HIV → x5 higher risk)
    iii. **Exposure to smoking and DES**.
d. **Classification:**
    i. **According to cytology (Bethesda system): No epithelial abnormalities** (NILM) and **epithelial cell abnormalities** (ASC-US, ASC-H, LSIL, HSIL, SCC, AGC).
    ii. **According to cervical biopsy findings (CIN grading):** CIN I, II and III.
    iii. **Invasive cancer:** Cervical carcinoma is classified by invasion beyond the basement membrane. Most common arises in the transformation zone of the cervix.
        - **Classification**: SCC (80% of cases), Adenocarcinoma (20% of cases)

e. **Clinical features:** Patients are usually asymptomatic in the earlier stages of the disease and develop symptoms later in the course.
    i. **Early symptoms:**
        - **Abnormal vaginal bleeding** (irregular menstrual bleeding, menorrhagia usually after sex)
        - **Abnormal vaginal discharge** (blood-stained or purulent malodorous discharge)
        - **Dyspareunia** and **pelvic pain**.
    ii. **Late symptoms:** Hydronephrosis, lymphedema, fistula
    iii. **On physical examination:** Cervix can have erosion, ulcer, mass (usually exophytic) on speculum examination.
f. **Screening Guideline:**
    i. **Age 25-29 years** → Pap smear every 3 years.
    ii. **30-65 years** → Pap every 3 years, HPV testing every 5 years, HPV testing plus Pap smear every 5 years
    iii. **Age > 65 years** → No screening is recommended if adequate prior screening hasbeen negative. Otherwise, same screening as from age 30.
g. **Diagnosis (if abnormal Pap Smear or HPV testing):**

i. **Colposcopy:** a procedure where a colposcope is used to examine the cervix and vagina. The procedure allows magnified visualisation of the epithelium to guide biopsy sampling for histologic diagnosis.
   - **Findings:** Leukoplakia or acetowhite epithelium, findings of invasive cancer (gross exophytic neoplasm, ulceration, necrosis, erosions)
   - **Cervical biopsy:** is done as part of colposcopy.
   - **Conization:** excision of a cone of cervical tissue that contains parts of both the ectocervix and endocervix:
     1. Premenopausal → Transition Zone located on ectocervix → shallow cone.
     2. Postmenopausal → Transition Zone located on endocervix→ deep cone.
   - **Punch biopsy.**



h. Staging of invasive cervical cancer:
   i. **Lab tests:** CBC, liver function, renal function
   ii. **Evaluation of invasion:** Pelvic examination, cervical biopsy (either punch biopsy or conization), endoscopic procedures (cystoscopy, hysteroscopy or rectoscopy)
   iii. **Evaluation of metastasis:** CXR, Thoracic, abdominal and pelvic CT, MRI, PET-CT scans.

i. Grading (FIGO): Divided into 4 stages:
   i. **Stage 0 (Tis):** Carcinoma in situ (CIN III)
   ii. **Stage 1**: carcinoma confined to cervix/uterus
   iii. **Stage 2:** carcinoma beyond invades beyond the cervix, but not to pelvic wall or lower ⅓ of vagina
   iv. **Stage 3:** tumour extend into pelvic wall or vagina or causes hydronephrosis
   v. **Stage 4:** tumour extend beyond true pelvis

j. Treatment: depends on the stage
   i. **Stage 0:** Local excision via **conization** or **Loop electrosurgery excision procedure** (LEEP)(procedures in which a cone of cervical tissue is excised), **simple extrafascial hysterectomy**
   ii. **Stage 1A1:**
      - **Best: Total Abdominal Hysterectomy**
      - **Fertility-sparing: therapeutic conization** with close follow-up.
   iii. **Stage 1A-2, IB or 2A:**
      - **1A2/1B1: Radical hysterectomy with lymphadenectomy** or **conization**
      - **1B2/2A: Radio-chemotherapy** and **radical hysterectomy with lymphadenectomy**.
      - **Fertility-sparing: Radical trachelectomy** (removal of the cervix, upper vagina and parametrium)
   iv. **Stage 2B, 3 or 4A: Concomitant chemoradiotherapy** (Pt- based chemo) or **Radiotherapy** (EBR or Brachytherapy) alone.
      - Adjuvant radical hysterectomy with bilateral pelvic lymphadenectomy
   v. **Stage IVB: Palliative concurrent chemoradiotherapy**, **palliative chemotherapy with targeted**
      - Adjuvant radical hysterectomy with bilateral pelvic lymphadenectomy or pelvic exanteration

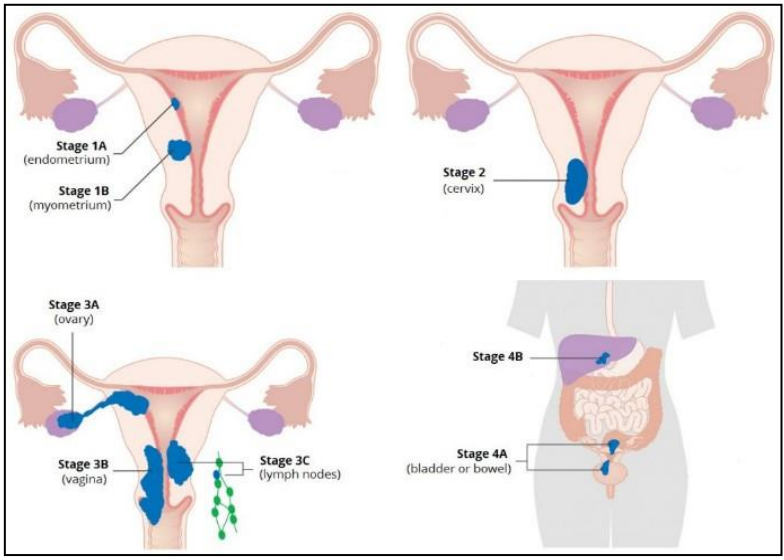
46. Malignant tumours of uterus

Endometrial adenocarcinoma is the most common gynaecological cancer with a peak incidence between 55 and 64 years of age. 75% of diagnosed patients are postmenopausal women (esp. ≥ 65yo). It is the 4th most common cancer in women. In general, the majority of endometrial cancers are diagnosed early and have a good prognosis.

1. **Types:** Endometrial cancer is divided into two types based on histological characteristics.
   a. **Type 1 endometrial cancer (endometrioid adenocarcinoma):** Most common form (80%). Associated with **prolonged estrogen stimulation** (eg tumour cells have E receptors). Commonly arises from endometrial hyperplasia (EIN). Mostly confined to uterus, has a good prognosis and occurs closer to menopause.
      i. **Risk factors:** Nulliparity, early menarche and late menopause, PCOS, obesity, hypertension, estrogen replacement therapy
      ii. **Molecular pathogenesis:** Mutation (PTEN) → ↑ estrogen receptor → sensitive to estrogen → hyperplasia
      iii. **Morphology:** Tumour cells grow in a glandular pattern like normal endometrial gland
      iv. Graded by **FIGO system** into **3 grades:** most differentiated → moderately differentiated → poorly differentiated
   b. **Type 2 endometrial cancer (serous, clear cell, mucinous carcinoma):** Is not associated with estrogen stimulation. Undergoes more rapid growth and worse prognosis. Strongly associated with p53 mutation and typically occurs in post-menopausal women (who are much older (mean age = 67yo)).
2. **Manifestations:**
   a. **Painless, abnormal uterine bleeding (AUB)** is the main symptom.
      v. Postmenopausal → any amount of vaginal bleeding (incl. spotting or staining).
      vi. Perimenopausal/premenopausal → metrorrhagia (abnormal bleeding between regular menstrual periods.) and menometrorrhagia (heavy and irregular menstrual bleeding)
   b. **Later stages:** Weight loss, pelvic pain, palpable abdominal mass, vaginal mass
   c. **Metastasis:** Primarily develop via lymphogenic spread but also hematogenic.
3. **Diagnosis:**
   a. **Lab Tests: CBC + Coagulation panel:** to exclude coagulopathy leading to AUB. **Pregnancy tests** should be performed in patients of childbearing age.
   b. **Imaging Methods:**
      i. **Trans-vaginal US:** Assess for the presence of masses or ddx of AUB. Measure the endometrial thickness. In post-menopausal women, endometrial thickness > 5 mm is an indication for endometrial biopsy.
   c. **Endometrial Biopsy:** Taken either directly (in-office by Novak's curette) or with help of hysteroscopy. If there is no detectable pathology on biopsy and if no further symptoms occur, then cancer can be ruled out.
   d. **Staging studies**: **MRI of the pelvis** in all patients to assess for locoregional disease. Patients with high grade disease or signs of metastatic disease, perform chest, abdominal and pelvic CT scan and PET/CT scan.

4. **DDx**: Differential diagnosis of AUB includes coagulopathies, polyps, other malignancies (such as cervical or ovarian cancer), benign and premalignant diseases of the uterus (endometrial hyperplasia), PID, iatrogenic causes (anticoagulants), uterine leiomyomas.

5. **Staging:**
    a. **Stage 1 (T1/N0/M0):** cancer is confined to the uterus.
        vii. **1A** = < 50% myometrium
        viii. **1B** = > 50% myometrium
    b. **Stage 2 (T2/N0/M0):** tumour invades the cervix
    c. **Stage 3 (T3 or T4/N0 or N1/M0):** regional spread (outside the uterus but in lesser pelvis)
        ix. **3A** = Ovary
        x. **3B** = Vagina/Parametrium
        xi. **3C** = Pelvic/Para-aortic LNs
    d. **Stage 4 (Ant T/ any N0/ M1):** distant metastases (beyond pelvis)



6. **Treatment:**
    a. **Disease confined to the endometrium and myometrium (Stage I/II):**
        i. **Patients who wish to preserve fertility:** May be considered for early stage disease. Involves the use of progestins (methyprogesterone) or SERMs (raloxifene)
        ii. **Post- menopausal women or patients who do not wish to preserve fertility:** Total hysterectomy with bilateral salpingo-oophorectomy. Adjuvant RT is only indicated in high risk patients.
    b. **LN involvement and locally advanced disease (Stage III):** Total hysterectomy with bilateral salpingo-oophorectomy plus adjuvant chemo (paclitaxel, doxorubicin and cisplatin) and/or RT.
    c. **Metastatic disease (Stage IV):** Palliative care. May include surgical tumour reduction and/or medical therapy (palliative chemo, RT, hormonal therapy or immuno).
7. **Prognosis:** Endometrial cancer has the 2nd best prognosis of gynaecological malignancies after cervical cancer. Type II endometrial carcinomas have poorer prognosis.

47. Malignant Tumours of Ovaries

Ovarian cancer is the most deadly gynaecological neoplasm in developed countries. It is the most common ovarian mass in women over 55 and the second most common gynaecological cancer.

- **a. Risk factors:** Age, Genetic predisposition **(**BRCA1, BRCA2, HNPCC (Lynch syndrome), family history), elevated number of lifetime ovulations (due to low number of pregnancies, early menarche and late menopause), endometriosis
- **b. Protective factor:** lactation, pregnancy, hormonal contraceptives (prevent ovulation)
- **c. Classification:**
  - **i. Epithelial tumours:** Arise from the ovarian surface epithelium. Epithelial tumours account for 90% of all ovarian malignancies.
    1. **Serous Cystadenocarcinoma:** cystic tumour with serous content. Most common malignant ovarian tumour and causes inflammation. It is common in postmenopausal women.
    2. **Mucinous Cystadenocarcinoma:** cystic tumour with mucinous content. Causes inflammation and common in postmenopausal women.
       - **i. Pseudomyxoma peritonei:** mucinous material in peritoneal cavity due to a rupture of the tumour.
    3. **Endometrioid carcinoma:** Accounts for 10% of epithelial tumours. Associated with endometriosis.
    4. **Clear-cell carcinoma**
    5. **Manifestations:**
       - **ii.** Abdominal pain and ascites, dyspnea due to malignant pleural effusion, cachexia.
       - **iii.** Disruption of menstrual cycle, abdominal or pelvic mass.
       - **iv.** Symptoms of abdominal displacement may be present (e.g., pain, ↑ urinary frequency)
    6. **Compilations:**
       - **v.** ovarian torsion
  - **ii. Germ cell tumours:** Arise from primordial germ cells. The subtypes are determined by the structural differentiation.
    1. **Dysgerminoma:** Most common malignant GCT. No differentiation of cells. Produced LDH and B-HCG.
    2. **Mature teratoma:** mixed tumour containing of all kinds of tissue. Produces no oncomarkers.
       - **i. Dermoid Cyst**: mostly includes ectodermal tissues of the skin.
       - **ii. Struma Ovarii:** mature thyroid tissue in the ovary.
    3. **Immature teratoma:** contains tissues of embryonic/fetal differentiation. May produce LDH, AFP.
    4. **Yolk sac tumour:** Malignant tumor made of cells forms yolk sac epithelium. May produce LDH or AFP.
    5. **Choriocarcinoma:** tumor of germ cells that differentiate into trophoblastic cells.
    6. **Manifestations of GCT:**
       - **i.** Palpable mass +/- abdominal pain.
       - **ii.** Struma ovarii → hyperthyroidism with low TSH
    7. **Complication:** torsion/rupture/haemorrhage of the tumour mass.
  - iii. **Sex cord tumours:** These tumours arise from sex cord cells or stromal cells.
    1. **Granulosa cell tumour:** Most common malignant sex-cord stromal tumour.
       - **i.** Malignant tumour of the granulosa cell → **estrogen** overproduction → uterine bleeding (menorrhagia and/or metrorrhagia), breast tenderness, early puberty and post-menopausal bleeding.

2. **Sertoli-Leydig cell tumor:** Stromal tumor that looks like embryonal testis. It can secrete testosterone → signs of masculinization (Hirsutism, deep voice)

iv. **Other ovarian tumors:**

1. **Secondary ovarian tumors = metastasis:**
   i. 10-15% of ovarian cancers are due to metastasis.
   ii. Primary tumors are usually in the GIT, breast, cervix or endometrium.
2. **Krukenberg's Tumour:** An ovarian metastasis from a gastric carcinoma. Often causes lymphadenopathy of the left supraclavicular LN (Virchow's node).

d. **Summary of ovarian tumors:**

	Epithelial	Germ-Cell	Sex-Cord	Metastases
Peak Age	> 60yo	< 30yo	Any	Variable
Types	Serous Mucinous Endometrioid Clear-Cell	Dysgerminoma Teratoma Yolk-sac Choriocarcinoma	Granulosa cell Sertoli-Leydig cell	GIT (incl. Krukenberg's) Breast Cervix Endometrium
Unique Sx	Ascites Pleural Effusion Pseudom Peritonei Ovarian Torsion	Hyperthyroidism (struma ovarii)	Precocious Puberty Meno/Metrorrhagia Postmenopausal bleed Virilizing effects	Depends on tumor Krukenberg → Virchow LN
Oncomarker	CA-125	Yolk → AFP Chorio → hCG	Granulosa → estrogen Sertoli → androgens	Depends

e. **Clinical features**: Asymptomatic in early stages. Subacute symptoms (adnexal mass, non-specific pelvic pain, bloating, abdominal discomfort, postmenopausal bleeding) and acute symtpoms (extrapelvic symtpoms such as ascites, malignant pleural effusion, VTE, ovarian torsion and signs of metastatic disease).

f. **Diagnosis:**

i. **Imaging:**

1. **Pelvic US**: Imaging test of choice for evaluation of adnexal masses and suspected ovarian cancer. Both transabdominal and trans-vaginal modalities should be used.
2. **CXR** and **CT/MRI** are used for staging.

ii. **Laboratory Tumour Markers (low sensitivity and specificity):**

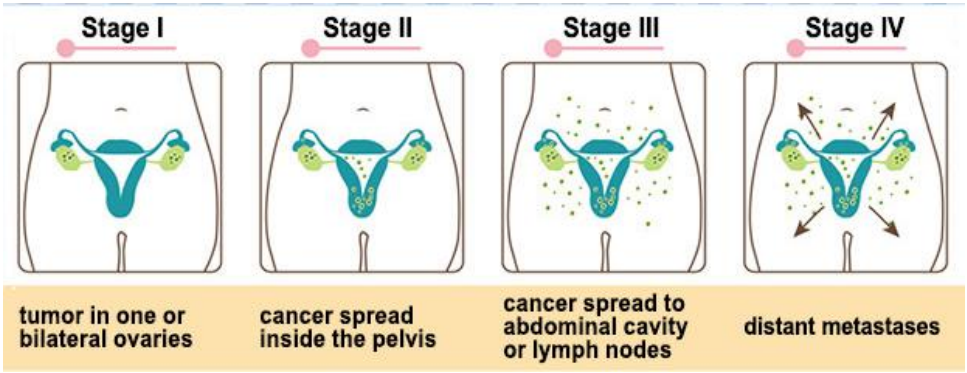
1. **EOC:** CA-125 (N = < 35U/ml).
2. **Dysgeminoma:** LDH and B-HCG
3. **Immature teratoma:** AFP, LDH, CA-125
4. **Yolk-Sac Tumour:** AFP (N = < 10ng/ml).
5. **Choriocarcinoma:** β-hCG (N = < 25mIU/ml)
6. **Granulosa-Cell Tumour:** Estrogen + Inhibin-B.
7. **Sertoli-Leydig-Cell Tumour**: Androgens.

Ultrasound workup of ovarian masses		
	Benign	Malignant
Internal structure	Uniform, thin walls	Irregularly thickened septa
Margins	Smooth	Indistinct borders; papillary projections
Echogenicity	Anechoic	Hypoechoic, anechoic, and hyperechoic components
Content	Cystic	Cystic or solid components
Vascularization	Unremarkable	Possible central vascularization
Pouch of Douglas	Unremarkable	Possible free fluid (ascites)

iii. **Histology: FNA is contraindicated in ovarian tumours because it ↑the risk of spreading** tumour cells to the peritoneum. Therefore, any patient with suspect of ovarian cancer should undergo exploratory laparotomy with intraoperative sampling of suspected areas.

iv. **Mammography:** Crucial in patients who are BRCA+ or those having an Estrogen-producing tumor.

g. **Staging:**



h. **Treatment:**

i. **Surgery:**

1. **1st Step:** Surgical staging to obtain pathological specimens and evaluate the extent of spread (includes peritoneal cytology, hysterectomy with bilateral salpingo-oophorectomy, pelvic and paraaortic LN dissection).
2. **2nd Step:** Surgical debulking with maximal cytoreduction should be performed to improve long-term outcomes.

ii. **Chemotherapy:**

1. **Indications**: Early stage disease in patients with high risk disease, advanced stage disease after cytoreductive surgery
2. **Preferred regimens**: 1st choice is CP regimen (Carboplatin, paclitaxel), BEP (Bleomycin + etoposide + cisplatin).

iii. **Targeted therapy:**

1. Indication: BRCA1 and/or BRCA2 positive disease
2. Agents: Olaparib (PARP inhibitor).

48. Benign and Malignant diseases of Trophoblast

Trophoblasts refers to the cells forming the outer layer of blastocyst, which provide nutrients to the embryo and develops into the large part of the placenta.

Gestational Trophoblastic Disease (GTD) is a group of tumours that arise from the abnormal fertilization of the ovum. It includes benign tumours (partial and complete hydatiform moles) and malignant lesions with tendency to metastasize, especially to the lungs (invasive mole and choriocarcinoma). GTD is characterized by very high levels of **serum b-HCG**.

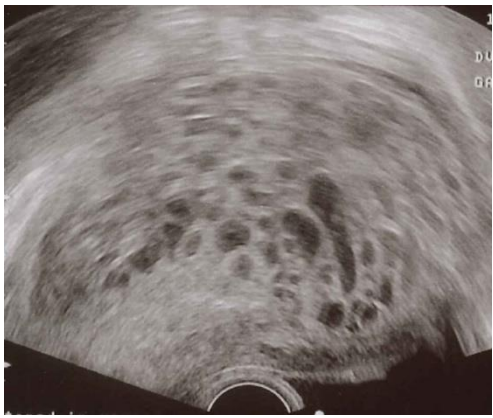
a. Hydatiform mole: is caused by the implantation of a non-viable trophoblast which grows into a benign tumour of the uterus. It is a benign trophoblastic disease that proliferates within the uterus without myometrial infiltration or hematogenous dissemination.

i. **Invasive mole:** When a hydatiform mole develops malignant traits. The trophoblasts infiltrate the myometrium and gain acess to the vascular system. There are no histological signs of malignancy

ii. **Risk factors:** prior molar pregnancy, history of miscarriage, very young or very old patients.

iii. **Types**:

- **Complete mole**: Does not contain any fetal or embryonic parts. It is caused by the fertilization of an empty egg that does not carry any maternal chromosome. The haploid chromosome set contributed by the sperm is duplicated (46XX or 46XY)
- **Partial mole**: Contains fetal or embryonic parts in addition to trophoblastic tissue. It is caused by fertilization of an egg containing a haploid set of chromossomes with two sperms (69 XXX, 69XXY, 69XYY)



iv. **Clinical features**:

- **Complete mole**: Vaginal bleeding in the 1st trimester, Uterine size > than normal for the gestational age, pelvic pain or pressure, passage of vesicles that may resemble a bunch of grapes, endocrine symptoms (due to ↑ b-HCG → pre-eclampsia, hyperemesis gravidarum, hyperthyroidism)
- **Partial mole**: Less severe symptoms (vaginal bleeding, pelvic tenderness)

v. **Diagnosis**:

- **b-HCG measurement**: Initial test of choice. Hydatiform moles present with high b-HCG than expected.
- **TVUS**: Theca lutein cysts, echogenic mass interspersed with many hypoechogenic cystic spaces ("bunch of grapes"), no amniotic fluid, no fetal heart tone.
- **Uterine evacuation via dilation and suction curettage (for definitive diagnosis and treatment)**: histopathological examination of evacuation uterine specimen (complete mole → marked trophoblastic proliferation and p57 negative, partial mole → minimal trophoblastic proliferation and p57 positive).

vi. **Treatment**:

- **Uterine dilation and suction curettage**: Since complete moles have a 20% risk of becoming invasive, uterine cavity evacuation is mainstay of treatment.
- **Monitor b-HCG until levels normalize**.
- **Chemotherapy (with MTX) of unresolved**.

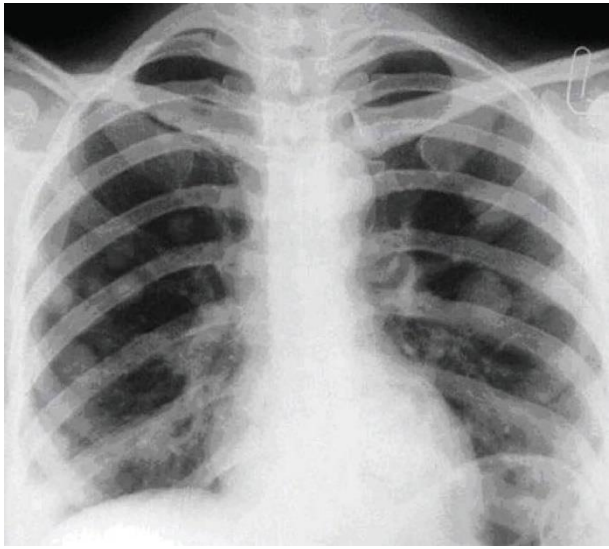
b. Choriocarcinoma: Highly aggressive, malignant tumour consisting of trophoblastic tissue. Exhibits histological signs of malignancy and a tendency for early metastases (in contrast to hydatiform moles). Caused by the malignant transformation of trophoblastic tissue.

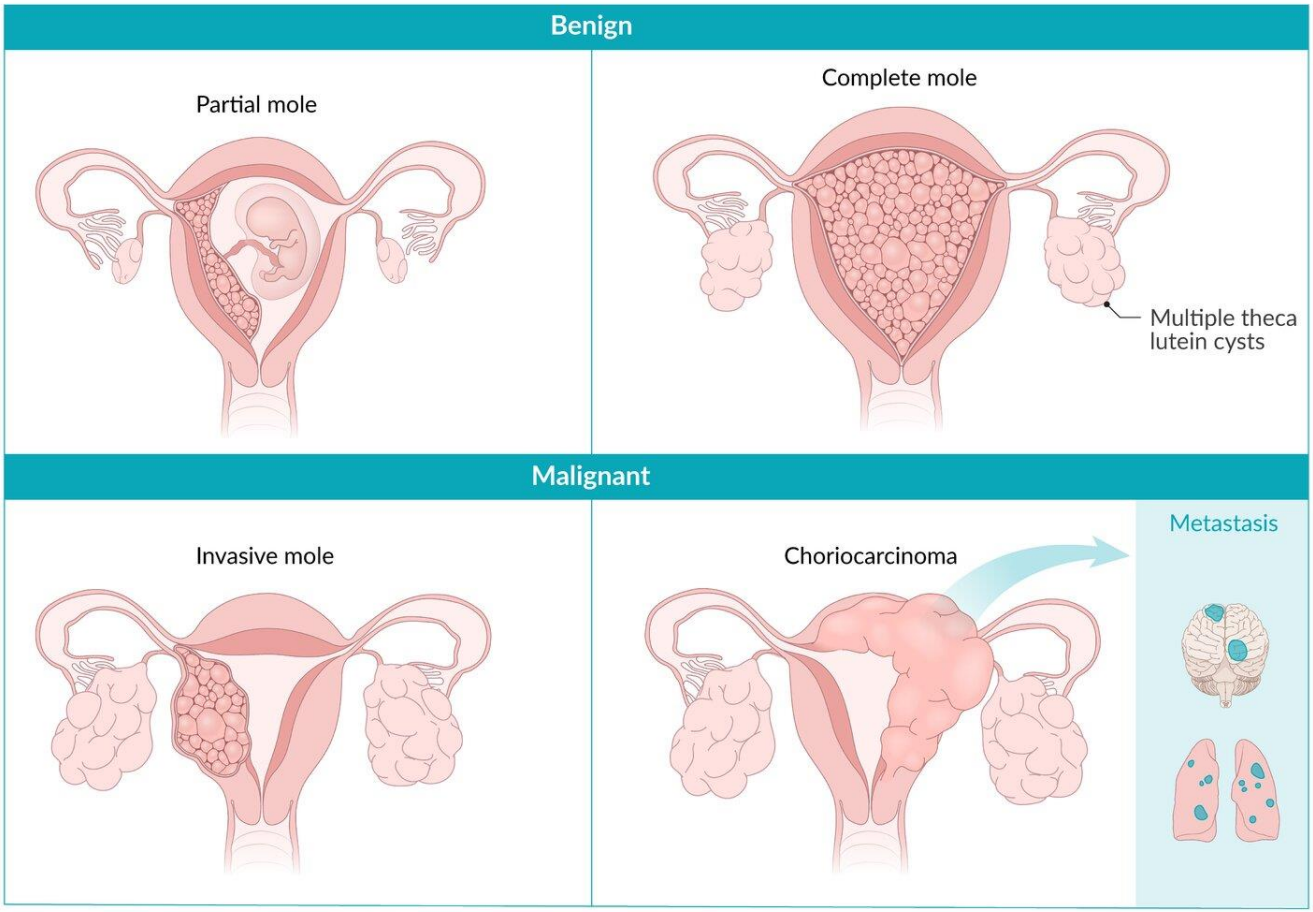
i. **Etiology:** Choriocarcinoma only develops after fertilization and implantation of the egg.

ii. **Clinical features:** Post-partum vaginal bleeding and inadequate uterine regression after delivery, multiple theca lutein cysts. Additional symptoms depend on the site of metastases.

iii. **Diagnostics:**
- **B-HCG measurement**: Initial test of choice. Very high levels in choriocarcinoma.
- **Pelvic US**: Mass of varying appearance that is hypervascular on Doppler.
- **Uterine dilation and curettage (only limited diagnostic value)**: histopathological examination.
- **Staging**: Should involve chest x-ray. Cannonball metastases may be present.

iv. **Treatment:**
- **Chemotherapy**: treatment of choice. MTX or Dactinomycin.
- **Surgical treatment**: hysterectomy may be indicated.





49. Gynaecological operations on tubes and ovaries

Salpingostomy: This is a tube-conserving operation (does not require resection). The fallopian tubes remain functional after procedure.

- **a. Indication:** Removal of an ectopic pregnancy (emergency surgery), Tubal repair to restore fertility (to remove adhesion/scar lysis, trauma repair)
- **b. Method:**
  - **i.** Create an opening in the fallopian tube to remove tubal contents, can be done laparoscopically or open
  - **ii.** Electrosurgery or scissors can be used to make a 10mm longitudinal incision in order to access the lumen of the fallopian tube.
- **c. Complications:** Excessive bleeding, Injury to surrounding organs, Infection, Tubal adhesions/scarring → ↑risk of future ectopic pregnancy. Persistent ectopic pregnancy after this surgical treatment occurs in 5-10% of cases.

Salpingectomy: partial or complete removal of the affected fallopian tube, can be performed via laparotomy or laparoscopy, does not preserve the function of the fallopian tube If this operation is performed bilaterally → leads to irreversible sterilization!

- **a. Salpingo-Oophorectomy:** removal of the fallopian tube & its corresponding ovary.
- **b. Indications:**
  - **i.** Treatment of tubal/ovarian cancer (esp. bilateral salpingo-oophorectomy)
  - **ii.** Removal of an ectopic pregnancy (emergency surgery), this procedure is preferred due to its lack of risk of future ectopic pregnancies.
  - **iii.** Desired sterilization.

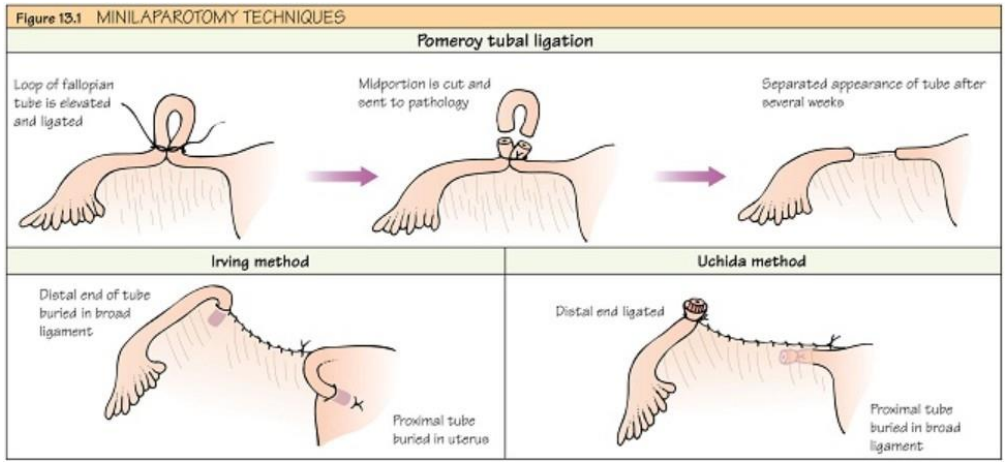
Tuboplasty: Refers to a number of surgical operations that attempt to restore patency (=degree of openness/ remove blockage) and functionality of the Fallopian tube(s). The main aim of tuboplasty is to increase the chances of getting the woman pregnant. Performed through either a laparotomy or laparoscopy approach.

- **a. Main Types:**
  - **i. Tubal Re-Anastomosis:** This involves resection of occluded tubal tissue (i.e., removing the part of the fallopian tube that's blocked) and then joining the healthy segments together.
  - **ii. Fimbrioplasty:** separating agglutinated fimbriae, may be performed if the fimbriae become damaged, scarred or obstructed
  - **iii. Salpingolysis (via Salpingostomy):** removing adhesions from around the tube to restore patency of blocked fallopian tube.
  - **iv. Cornual implantation:** resecting an occluded transmural segment of the tube and connecting the distal patent segment of the tube to the uterus.
- **b. Complications:** Ectopic pregnancy is the main complication after a tuboplasty.

Tubal Ligation: aka having your tubes tied. Tubal ligation is used as a permanent method of sterilization and birth control. The fallopian tubes are cut / tied / blocked permanently to prevent pregnancy. If a patient does have a pregnancy after a successful tubal ligation, 33% chance it will be ectopic. This surgery can be done through: laparotomy, laparoscopy or hysteroscopic approach. A tubal reversal microsurgery can be done to repair the fallopian tube after a tubal ligation. Successful pregnancy rates after reversal surgery are 40-70%.

- **a. Indications**
  - **i.** Sterilization procedure – used to permanently prevent pregnancy
  - **ii.** To decrease risk of ovarian cancer (e.g., may be done prophylactically in women >40yo who have a family hx of ovarian cancer)
- **b. Types:**
  - **iii.** Postpartum Tubal Ligation = performed immediately after delivery.
  - **iv.** Interval Tubal Ligation = performed at > 6wks after pregnancy.

c. **Methods:** Pomeroy (most common!), Irving and Uchida. (See pic)



Oophorectomy: Surgical procedure to remove one or both of your ovaries. It can be mixed with Salpingectomy or Hysterectomy.

a. **Indications:**
   i. Ovarian cancer
   ii. Prophylaxis of ovarian cancer in cases of BRCA mutations (at age 40yo)
   iii. Ovarian Endometriosis
   iv. Ovarian cysts or tumors
   v. Ovarian torsion (only if ovary is already necrotic)
   vi. A tubo-ovarian abscess (may require salpingo-oophorectomy)
b. **Consequences:**
   i. Sterility
   ii. Early Menopause (removal of ovaries → ↓ estrogen)
c. **Complications:**
   i. Adhesive small bowel obstructions (24%).
   ii. Injuring of the ureter at the level of the suspensory ligament of the ovary.

50. Gynaecological operations on uterus

Hysterectomy: Removal of the uterus and cervix, sometimes including the fallopian tubes and ovaries. Most common non-obstetric majour operation on women.

a. **Indications:**
   i. Uterine, Ovarian, Cervical Cancer
   ii. Uterine prolapse (weak pelvic muscles allow uterus to drop into vagina)
   iii. Pelvic pain/ DUB
   iv. **Complications:** Haemorrhage, Immediate onset of post-menopausal symptoms, Infection, Vaginal prolapse
b. **Main Types:**
   i. **Approach:** Abdominal (with incision in lower abdomen) or Vaginal (no incision)
   ii. **Extent:**

Radical Hysterectomy: removes upper vagina, cervix, uterus, tubes, ovaries, pelvic ligaments, all pelvic LN and extensive dissection of ureters and bladder. Indicated for stage 1A2/1B1 cervical cancer and selective patients with stage 2 endometrial carcinoma.

i. **Incision:**
   1. **Midline- Vertical:** vertically from pubic symphysis up to umbilicus. Used for heavier women and women with narrow pelvis.
      a. **Advantages:** great access to pelvic LN and side walls
      b. **Disadvantages:** results in abdominal wall weakness (→ herniation), painful, ugly scar
   2. **Pfannenstiel:** transversely, two finger widths above the pubic symphysis.
      a. **Advantages:** strong when repaired (→ low risk of herniation), not painful, cosmetically better
      b. **Disadvantages:** limited surgical access

ii. **Complications:** damage to surrounding organs (bladder, bowel uterus), upper vagina is removed/ shortened

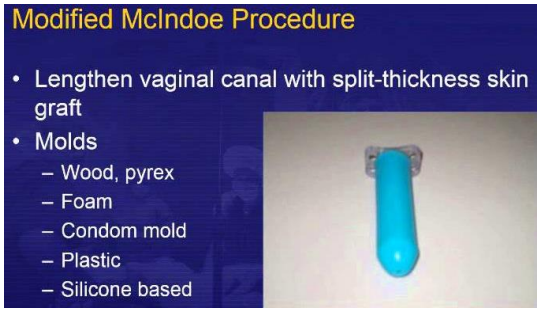
   b. **Total Hysterectomy:** removes uterus and cervix (can be laparoscopic or open)
   c. **Subtotal Hysterectomy:** uterus is removed but cervix is left in place. risk of cervical cancer remains as the cervix hasn't been removed and so patient will need regular cervical screening

Abdominal Myomectomy aka Fibroidectomy: surgery to remove uterine fibroids. Reserved for patients with fibroids who have exhausted all other medical treatments. Performed laparoscopically or via Pfannenstiel incision.

51. Gynaecological operations on vulva and vagina

Operative Vaginoplasty: Surgical procedure that constructs, reconstructs, or tightens the vagina

a. **Indications:**
   i. Create a neovagina in pts with vaginal agenesis (= where the vagina doesn't develop (v. rare))
   ii. Transgender operations
   iii. Treat complications after child birth – e.g., pelvic organ prolapse



b. **Methods:**
   i. **McIndoe procedure (most common):** this lengthens the vaginal canal with split-thickness skin graft
      a. Obtain a split-thickness skin graft (usually obtained from the buttocks).
      b. Create a space for the neovagina (between the bladder & rectum).
      c. Assemble the prosthesis and wrap the skin graft around it (dermis is facing out).
      d. Insert the skin-covered prosthesis into the created space.
      e. Suture the edges of the graft to the edges of the introitus.
   ii. **Vecchietti Method (laparoscopic):**
      a. Via laparoscopic ports, 2 retroperitoneal suture wires are inserted into the abdomen.
      b. A small plastic sphere ('olive') is placed in the introital area, and is sutured to the wires →connected to the traction device.
      c. Upward traction is applied by the device for 1 week, eventually yielding a 7-10 cm long vagina

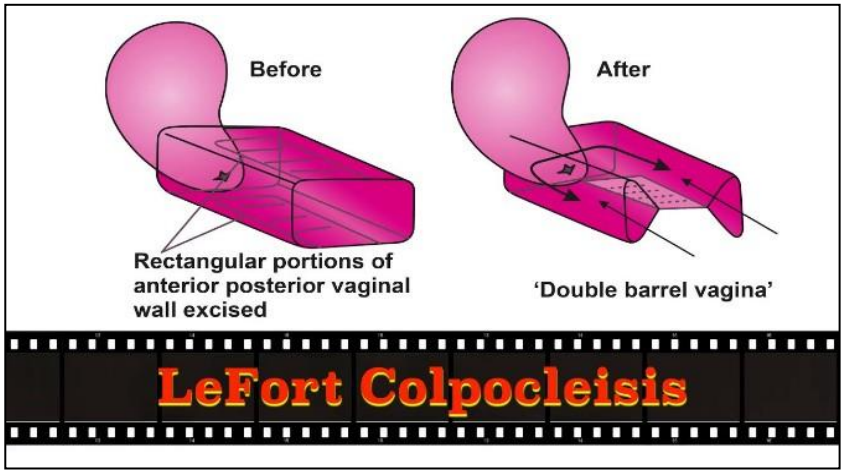
Vaginectomy: Surgical procedure used to remove all or part of the vagina

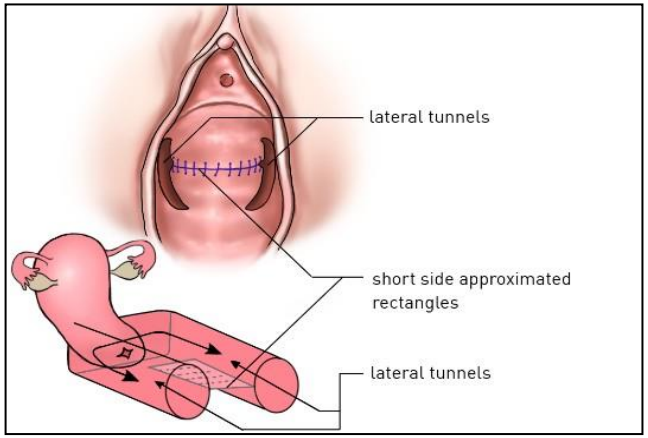
a. **Types:**
   iii. **Simple Vaginectomy:** Vagina is removed without excision of the surrounding tissues. Indicated when patient is suspected with VAIN (vaginal intraepithelial neoplasia). Surgical approach is usually vaginal.
      a. **Types:**
         i. Partial - only part of the vagina is removed
         ii. Subtotal
         iii. Total – all of the vagina is removed
   iv. **Radical Vaginectomy:** vagina is removed along with the supporting tissues around it
      a. **Method:**
         i. **When the uterus is in situ** → radical vaginectomy can be approached vaginally or abdominally. If upper 2/3 thirds of vagina need to be removed → combined approached isneeded to mobilize the distant vagina.
         ii. **If absent uterus** → only abdominal approach (due to high risk of damaging uterus via the vaginal approach)
      b. **Types:**
         i. **Partial -** Frequently performed together with removalof either the bladder or rectum, or both as part of a total pelvic exenteration.
         ii. **Total -** May be performed routinely as part of a radicalhysterectomy for early carcinoma of the cervix.
      c. **Complications:** Urinary/rectal fistula, chronic bladder/rectal dysfunction, Radical vaginal surgery may also alter body image perception and cause severepsychosexual problems.

Vulvectomy: performed in certain cases of cancer, vulvar dysplasia, Vulvar intraepithelial neoplasia (VIN). This procedure brings evere pain n the groin afterwards for some weeks, however sexual function is possible but limited

a. **Types:**
   i. **Simple x Radical** (with deep resection until the fascia + inguinal lymphadenectomy).
   ii. **Partial** (upper/lower/lateral) **x Total**
   iii. **Pelvic Exenteration:** Extensive salvage operation, indicated for patients with recurrent cancer (esp. cervical) after they already had gone through radiotherapy +/- surgery. Look for distant metastasis before operating.
      a. **Types of Exenterations:**
         i. **Anterior Exenteration:** Removal of the uterus, cervix, bladder and urethra. There are 2 phases:
            1. **Perineal phase** → begin by making an incision sufficient to remove theurethra, entire vagina & anus.
            2. **Abdominal phase** → Intraoperative bimanual palpation, ensuring the mass is removed.
         ii. **Posterior Exenteration:** Removal of the uterus, cervix, vagina, rectum and anus.
         iii. **Total Exenteration:** 2 types
            1. **Classic:** Indicated when the levator ani is involved and needs to be resected along with the entire anus. This procedure results in large defects in the perineum, and reconstruction is done via myocutaneous A permanent colostomy & continent urostomy are performed.
            2. **Supralevator:** Same as anterior, but the rectum is also removed. Differs from classic type by performing low colonic anastomosis (to the anus) instead of colostomy.

Colpocleisis (LeFort's Operation): surgery aimed to treat vaginal prolapse. It involves removal of a strip from the anterior and posterior vaginal wall, and then connecting the margins together hence forming a "double-barrel" vagina. Contraindicated in cases of cervical lesion (due to limited access to the cervix).





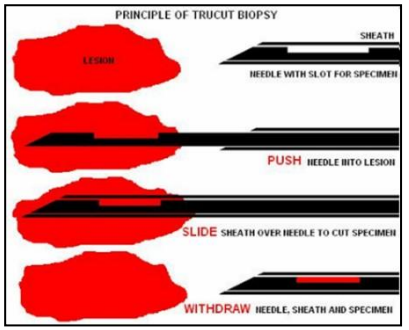
52. Minor gynaecological procedures

1. **Pre-operative evaluation:**
   - **a.** History, physical examination, lab tests (CBC, blood typing, ECG, CXR), anaesthesia evaluation (status I - V)
   - **b.** Antimicrobial prophylaxis
   - **c.** DVT/PE prophylaxis (with LMWH)
   - **d.** Weaning off from anticoagulants
2. **Sounding of cervix and corpus (body of uterus) for patency**: We use a medical instrument (called a 'sound') to probe and dilate the cervix in order to measure the depth of uterine cavity (uterus). If the sound (instrument) can pass through the cervix without difficulty, then there is no obstruction (stricture).

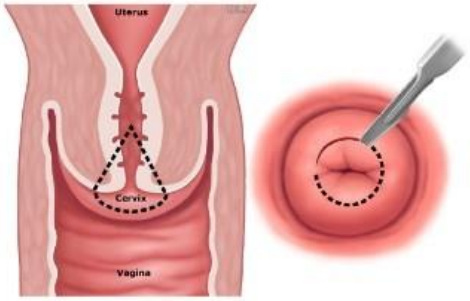
A medical sound is an instrument for probing and dilating passages within the body e.g. the uterus → pic is of a uterine sound

3. **Dilation and curettage**: Is a method that involves dilating the cervix with steel rods (Hegar dilators) of increasing sizes and then using a curette to scrape (curettage) the endometrial surface.
   - **a. Indication:**
     - **i. Diagnostic purposes:** AUB, Uterine cancer, Uterine polyps, Endometrial hyperplasia
     - **ii. Therapeutic purposes:** Hydatiform moles, removal of 'products of conception' (POC) after delivery, removal of polyps/tumours, method for spontaneous abortion (until 13th week), treatment of inevitable, incomplete or missed miscarriage,
   - **b. Method:**
     - **i.** Anaesthesia given
     - **ii.** Bimanual pelvic examination to assess the positions of the cervix, orientation of the uterus, uterine size, and any findings that may impact the procedure.
     - **iii.** A special steel rod is inserted to dilate the cervix
     - **iv.** A sharp curette is inserted into the uterus, and scrapping is performed
   - **c. Complication:** infection, AE to anaesthesia, uterine perforation, Asherman's syndrome (acquired scar tissue in uterus → walls thick and stick→ reduced size of uterus)
   - **d. Contraindications:**
     - **i. Absolute:** pregnancy
     - **ii. Relative:** anticoagulant therapy, coagulopathy, PID
4. **Needle biopsy (FNA):**
   - **a. Indication:** used in diagnosis of advanced and recurrent gynaecologic cancers (uterine, cervical, vulvar, vaginal). FNA is contraindicated in ovarian cancer due to the risk of spilling of cells.
   - **b. Method:** Small-gauge needle is introduced into the uterus. The needle is then used to aspirate a lesion for cytologic analysis (US-guided).

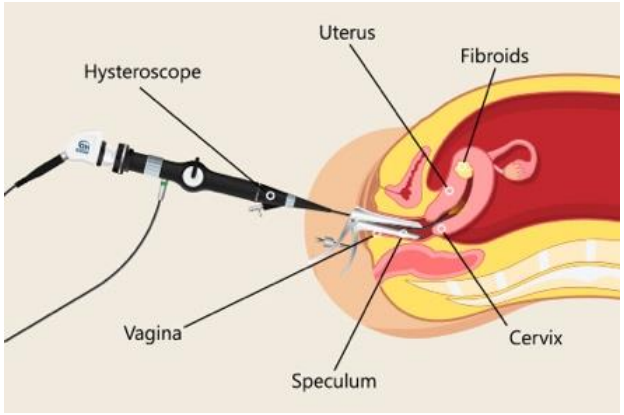
5. **Tru-Cut (Core) Biopsy:**
    a. Similar to FNA, instead of aspiration, a special needle allows direct collection of tissue from a lesion (US-guided).
    b. Risk of bleeding → coagulation must be evaluated.



6. **Conization:** Excision of a cone-shaped sample from the cervix. This sample includes the transformation zone (common site for CIN), endocervical canal (passageway from inside the uterus to the vagina) and ectocervix.
    a. **Indication:**
        i. **Diagnosis of**: squamous intraepithelial lesion, microinvasive carcinomas, intraepithelial lesions, excluding micro invasive carcinomas
        ii. **Treatment of:** cervical intraepithelial neoplasia, Stage 1 or 2 cervical cancer.
    b. **Method:** with a scalpel, laser or electrosurgical loop (most common technique – since there is no bleeding, outpatient setting, fast, good preservation of the margin).
        i. Loop electrosurgical excision procedure (LEEP) uses a wire loop heated by electric current to remove cells and tissue in a woman's lower genital tract.
    c. **Cone biopsy must include the transformation zone - most common site for CIN:**
        i. **Premenopausal**: transformation zone located on ectocervix → shallow cone.
        ii. **Postmenopausal:** transformation zone located on endocervix → deep cone.
    d. **Complications:** Intraoperative or postoperative bleeding, cervical stenosis (→ infertility), cervical Insufficiency (→PTB or pregnancy loss), infection



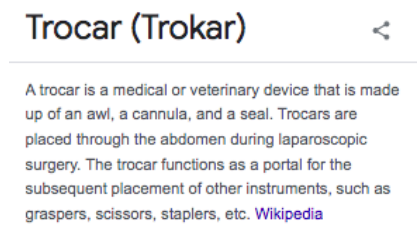
7. **Hysteroscopy:** It is a method that allows direct visual examination of the uterine cavity using hysteroscope passed through the cervical cavity. The cavity is distended using CO2 or fluid (NaCl, lactate ringer) for better visualisation. It is best carried out when the endometrium is relatively thin, i.e. after a menstruation. It can be used for diagnostic purposes (diagnostic hysteroscopy) or for therapeutic purposes (hysteroscopic surgery).
    a. **Indications:**
        i. Resection of polyps (polypectomy), tumours (Transcervical resection of the endometrium → TCRE), fibroids (Transcervical removal of fibroids → TCRF))
        ii. AUB (evaluate etiology + ablate the source)
        iii. Endometrial ablation, to stop or reduce heavy menstrual bleeding
        iv. Investigate infertility or recurrent miscarriage
        v. Asherman syndrome
        vi. Septate uterus – most common structural uterine anomaly
        vii. To locate and to remove IUD.
        viii. Fallopian-tube occlusion (for permanent sterilization)
    b. **Complications**: uterine perforation, fluid overload



53. Miniinvasive surgery in gynaecology:

Mini-invasive surgery encompasses surgical techniques that limit the size of incisions needed, thereby reducing wound healing time, associated pain and risk of infection.

1. **Hysteroscopic surgery:** It is a method that allows direct visual examination of the uterine cavity using hysteroscope passed through the cervical cavity. The cavity is distended using CO2 or fluid (NaCl, lactate ringer) for better visualisation. It is best carried out when the endometrium is relatively thin, i.e. after a menstruation. It can be used for diagnostic purposes (**diagnostic hysteroscopy**) or for therapeutic purposes (**hysteroscopic surgery**).
   a. **Indication:** polypectomy, myomectomy (fibroids → TCRF), adhesion lysis and endometrial ablation (TCRE).
2. **Laparoscopy:** Allows us to visualise the inside of the abdomen and pelvis. Procedures done laparoscopically are considered as minor surgery because there is nolarge abdominal incision.
   a. **Diagnostic laparoscopy:**
      i. Assess the pelvis for sources of acute/chronic pain, ectopic pregnancy, endometriosis, ovarian torsion
      ii. Biopsy collection
   b. **Therapeutic laparoscopy:**
      i. **Tubal sterilization:** Clipping/cauterization of the salpinx in the isthmus (2-3cm from the cornua).
      ii. **Lysis of adhesion:** Adhesions are lysed by sharp dissection.
      iii. **Treatment of endometriosis:** Resection or ablation of lesions by cauterization or ultrasonic scalpel.
      iv. **Removal of ectopic pregnancy**: Salpingostomy or Salpingectomy.
      v. **Ovarian cystectomy:** Removal of ovarian cysts.
      vi. **Oophorectomy (ovary removal):**
         1. More appropriate in postmenopausal women.
         2. Hydrosalpinx, tubal pregnancy or adhesions may also require oophorectomy.
         3. Before oophorectomy, occlude the infundibular ligament! (has vessels).
      vii. **Myomectomy:**
         1. Done in cases of fibroids, in order to preserve fertility.
         2. Large masses can be removed by morcellation (= fragmentation of a larger mass to smaller pieces, so they can be removed).
         3. In case of intramural fibroid, there is ↑ risk of bleeding → an injection ofvasopressin to the uterus be used to preserve hemostasis
      viii. **Hysterectomy:**
         1. Laparoscopic-Assisted Vaginal Hysterectomy (LAVH) – MOST COMMON!
         2. Laparoscopic Hysterectomy (LH)
         3. Laparoscopic Supracervical Hysterectomy (LSH)
   c. **Risks:**
      i. Injury during trocar insertion into the abdominal cavity → abdominal wall hematoma, umbilical hernias, perforation of vessels or bowel.
      ii. Exposure to cold dry gases during insufflation → increased risk of hypothermia and pneumoperitoneum.
      iii. Requires experience (→ otherwise poor stitching and accidental organ injury).
      iv. Intraabdominal Adhesions.

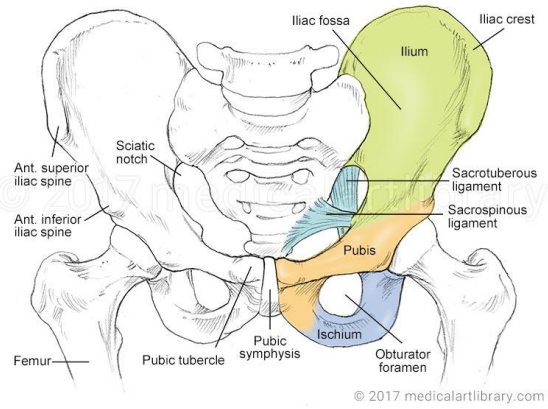


3. **Robotic surgery:** Da Vinci Surgical System. Surgeon controls the instruments from a console located in the same room. It has more widespread application of laparoscopy for complicated gynecological procedures.
    a. **Indications:** Endometrial/Ovarian/Cervical Cancer, Sacrocolpopexy (for POP), Endometriosis/Fibroids
    b. **Advantages:** easier for the doctor to master the da Vinci Surgical system in comparison to traditional laparoscopy, 3D visualization, ↑ dexterity, less blood loss, less infection and hospital stay.
    c. **Disadvantages:** high cost, ↑ operating time, can't reposition the patient once the robotic arms are attached, bulkiness of the system
4. **Natural orifice transluminal endoscopic surgery (NOTES):** using an endoscope (tube with light & camera) to access the abdominal cavity through existing body openings (eg. mouth, rectum, vagina).
    a. **Disadvantage:** ability to perform complex procedures are limited and there is really no real advantage over laparoscopy
5. **Single incision laparoscopic surgery:** doing laparoscopy through a single incision.
    a. **Advantage:** ↓ The number of incisions means less pain, better cosmetics, ↓ risk with 2° port placement.
    b. **Disadvantage:** But the disadvantages are similar to NOTES.

OBSTETRICS STATE

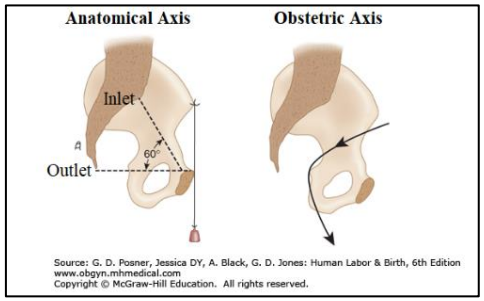
1. **Anatomy of the normal female pelvis and the fetal skull**
2. **Pelvic planes, diameters, shapes, pelvimetry**

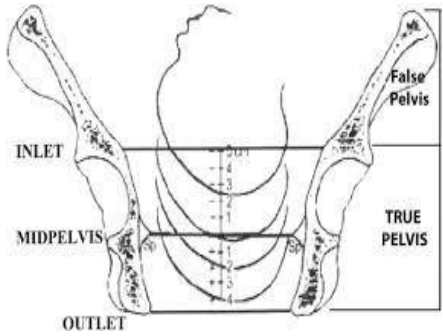
The **female pelvis** is composed of the **sacrum**, **coccyx**, the, **ilium, ischium** and **pubis**. These bones are joined anteriorly at the **pubic symphysis** and posteriorly they connect with the **sacrum** via the **sacroiliac joint**.



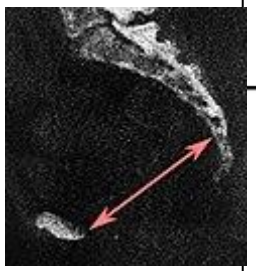
a. **Parts of the female pelvis**:
   i. **False pelvis**: is located above the pelvic inlet. The **plane of the false pelvis** has no obstetrical significance.
   ii. **True pelvis**: is located below the pelvic inlet.
      - **Pelvic inlet**: The line that separates the false from the true pelvis. It runs from the pelvic promontory to the pubic symphysis. **Plane of the pelvic outlet** is the superior strait.
      - **Mid pelvis**: At the level of the ischial spines. The distance between the ischial spines represents the shortest pelvic diameter. **Plane of the midpelvis** has the least dimensions.
      - **Pelvic outlet**: inferior opening of the pelvis. Bordered anteriorly by the pubic arch, laterally by the ischial tuberosity and posteriorly by the tip of the coccyx. **Plane of the pelvic outlet** is the inferior strait.

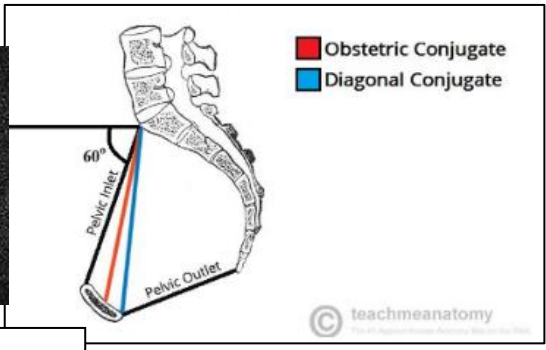
b. **Pelvic axis**: There are two major pelvic axis:
   i. **Anatomical axis**: C-shaped axis (60º) created between the planes of the pelvic inlet and pelvic outlet.
   ii. **Obstetrical axis**: J-shaped axis which represents the path passed by the fetal head during labour.





c. **Pelvic diameters**: The female pelvis is tilted anteroinferiorly, creating a 60º angle with the horizontal plane. **Pelvimetry** refers to the measurement of the female pelvis. The pelvic diameters can be measured using a **pelvimeter** or via **MRI** (**pelvimetry**).
   i. It can be used to identify **cephalo-pelvic disproportion**, which is when the capacity of the pelvis is inadequate to allows proper birth.
   ii. **Important pelvic diameters**:
      - **Transverse diameter of the pelvic inlet**: Widest transverse distance between the illiopectinal lines (13-14,5 cm)
      - **Obstetric conjugate**: Line between the closest bony points of the sacral promontory and the pubic bone next to the symphysis (10-12 cm).
      - **Interspinous diameter**: Line between the closest points of the ischial spines (9.5-11.5 cm).
      - **Sagittal diameter of the pelvic outlet**: Closest bony points of the sacrococcygeal joint and pubic bone next to the symphysis (9.5-11.5 cm)
      - **Intertuberous diameter**: Line between the closest points of the ischial tuberosities.



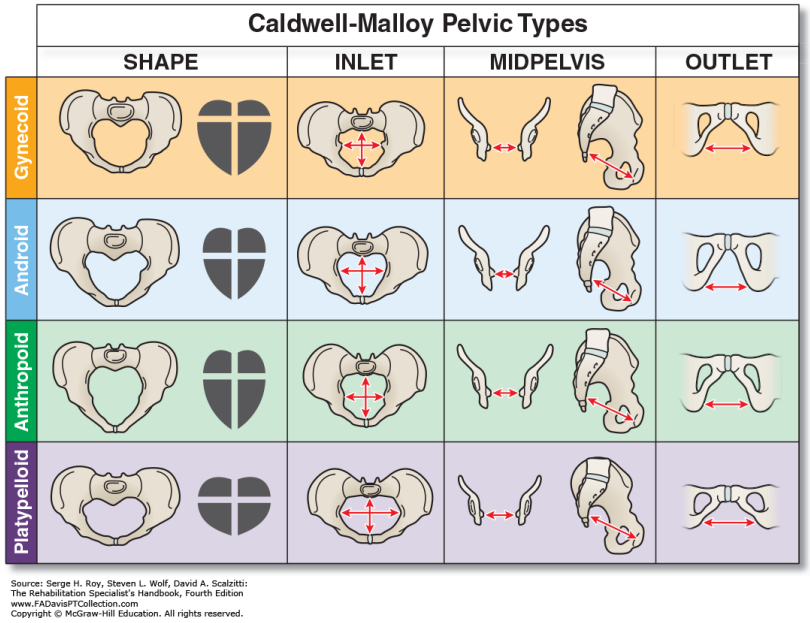


Sagittal pelvic outlet diameter

   iii. Traditional gynaecology relied heavily on pelvimetry in the conduct of delivery to decide if a vaginal or C-section was better.
   iv. Based on the pelvic diameters, 4 types of pelvises were identified (based on the **Cadwell-Mallow classification**). Non-Gynecoid types of pelvis

predispose to birth-related problems.

- **Gynecoid pelvis**: Ideal shape for birth, with a round or slightly oval pelvic inlet.
- **Android pelvis**: Triangular inlet, prominent ischial spines and more angulated pubic arch.
- **Anthropoid pelvis**: the widest transverse diameter is less than the anteroposterior (obstetrical) diameter.
- **Platypelloid pelvis**: Flat inlet with a shortened anteroposterior (obstetrical) diameter.

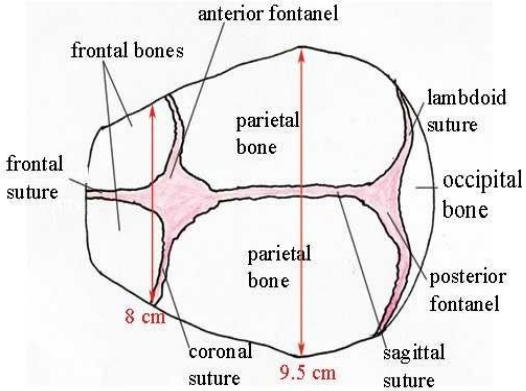


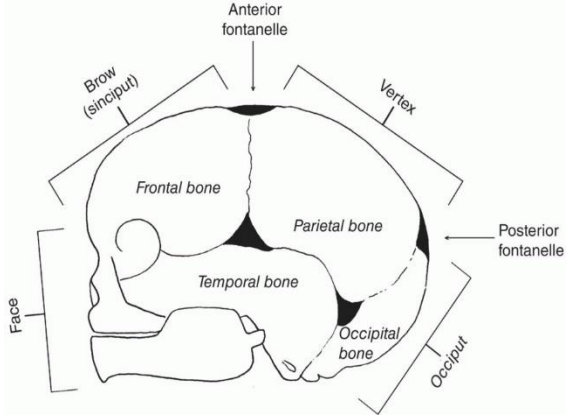
The **fetal skull** is a specific anatomical structure that is designed for childbirth (for passage through the birth canal).

a. The fetal skull has **5 bones** – 2 frontal, 2 parietal, 2 temporal and 1 occipital bone - which are separated by fibrous material called **sutures**.

b. **Fetal skull sutures**: Sutures allow the bones to move during the birth process. They also act as an expansion joint, thereby allowing the bone to enlarge evenly as the brain grows and the skull expands. The result is a symmetrically shaped head. If the sutures close too early, an abnormally shaped head develops (craniosynostosis).

- **Frontal suture**: extends from the top of the head down the middle of the forehead, towards the nose. The two frontal bones meet at this suture.
- **Coronal suture**: extends from ear to ear. Each frontal bone meets with a parietal bone at this suture.
- **Sagittal suture**: extends from the front to the back of the head. The two parietal bones meet at the sagittal suture.
- **Lambdoid suture**: extends in the back of the skull. Each parietal bone meets the occipital bone at this suture.
- **Other sutures**: **Frontonasal suture**, **frontozygomatic suture**, **squamous suture** (btw the parietal and temporal bones), **sphenofrontal** and **occipitomastoid suture**.



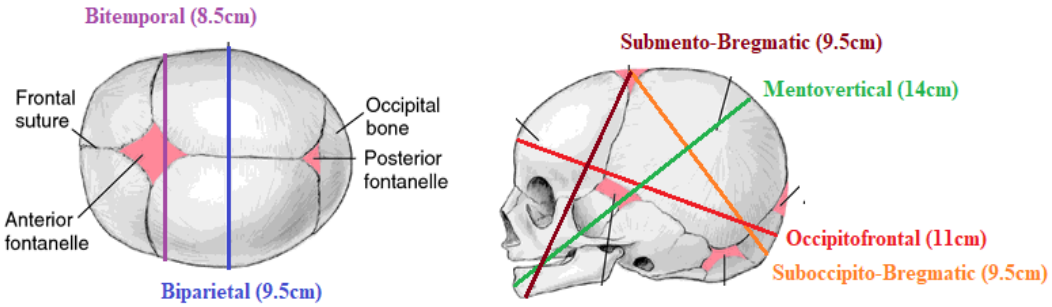


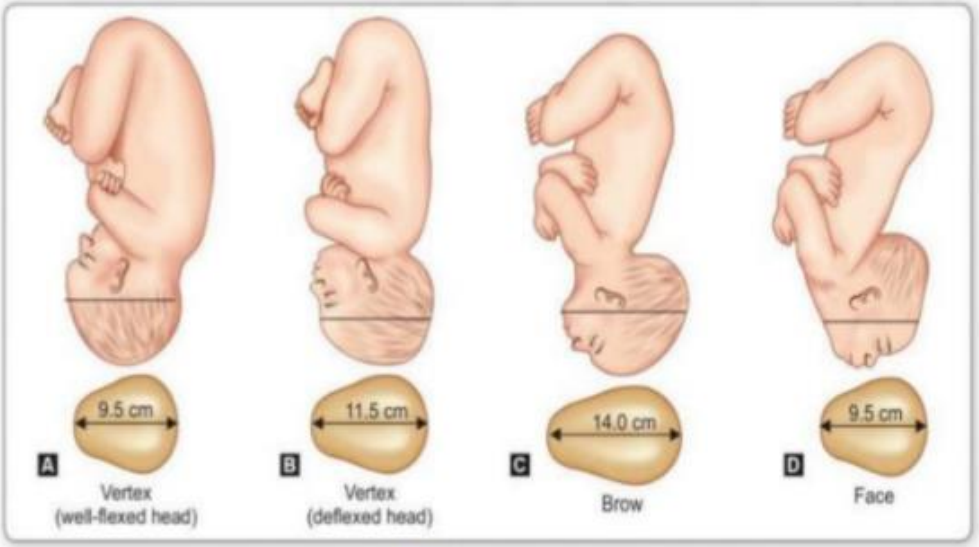
c. **Fetal skull fontanelles**: The fontanelles are the spaces where the sutures intersect. They are covered by though membranes that protects the underlying soft tissues and brain. During birth, the fontanelles allow the bones of the skull to flex, thereby allowing the child's head to pass through the birth canal. The major fontanelles are:

- **Anterior fontanelle**: diamond shaped fontanelle located where the 2 frontal bones meet with the 2 parietal bones. It remains soft until about 18 months to 2 years of age. Doctors can palpate the anterior fontanelle to assess for ↑ ICP (bulging fontanelle → ↑ICP).
- **Posterior fontanelle**: triangular shaped fontanelle located where the 2 parietal bones meet with the occipital bone. This fontanelle closes before the anterior one, at the age of 6-12 months.
- **Other fontanelles**: Two smaller fontanelles are located on each side of the head, more anteriorly the **sphenoidal** or **anterolateral fontanelle** and more posteriorly the **mastoid** or **posterolateral fontanelle**.

d. **Regions of the head**: different names for different regions of the head.
   i. **Occiput**: bony prominence that lies behind the posterior fontanelle.
   ii. **Vertex**: diamond shaped area between the anterior and posterior fontanelles.
   iii. **Sinciput**: the area in front of the anterior fontanelle, which is divided into the brow and the face.

e. **Fetal skull diameters**:
   i. **Biparietal diameter**: 9.5 cm
   ii. **Bitemporal diameter**: 8.5 cm.
   iii. **Suboccipito-Bregmatic diameter**: Engaged diameter of a well flexed-vertex presentation. 9.5 cm.
   iv. **Occipitofrontal diameter**: Engaging diameter of a deflexed vertex presentation. 11 cm.
   v. **Mentovertical diameter**: Engaging diameter of a brow presentation. 14 cm.
   vi. **Submento-Bragmatic diameter**: Engaging diameter of a face presentation. 9.5 cm.





Figs 8.2A to D: Varieties of cephalic presentations in different attitude

3. **Maternal physiology – cardiovascular, circulatory and haematologic changes in pregnancy**
4. **Maternal physiology – respiratory, renal and metabolic changes in pregnancy**

During pregnancy, the maternal body undergoes a variety of physiological changes to accommodate for gestation.

a. **Cardiovascular changes**:
   i. ↑ of progesterone during pregnancy → ↓ vascular tone → ↓ peripheral vascular resistance:
      - ↑ CO by up to 40%, ↑ SV by 10-30%, ↑ HR by 12-18 bpm and ↓ MAP
   ii. During pregnancy, due to the **hyperdynamic state** associated with the ↑ CO and ↑ in plasma volume, a physiological systolic murmur develops.
   iii. ↑ Plasma volume → ↓ oncotic pressure → edema of the lower limbs.
   iv. ↑ Risk of DVT (during pregnancy the pregnant uterus presses against the pelvic veins and vena cava, impairing venous return and subsequently increasing the risk of DVT)
   v. The enlarged uterus may compress the IVC → IVC syndrome.

b. **Haematologic changes**:
   i. ↑ Plasma volume → ↓ hematocrit, especially towards the end of pregnancy → dilutional anemia.
   ii. ↑ Levels of progesterone and estrogen → ↑ production of prothrombic factors (fibrinogen, factor VII, factor VIII) → hypercoagulability that reduces the risk of intrapartum blood loss.
   iii. ↓ Platelet levels → gestational thrombocytopenia
   iv. ↓ Iron and folate (primarily due to increased vitamin and mineral requirement).
   v. ↓ Albumin due to increased plasma volume
   vi. ↑ WBC counts (reactive leukocytosis).

parameters	NON-PREGNANT	PREGNANCY(term)	CHANGE
BLOOD VOL (ml)	4000	5500	↑ 1500
PLASMA VOL (ml)	2500	3750	↑ 1250
RBC VOL (ml)	1400	1750	↑ 350
TOTAL Hb (gm)	475	560	↑ 85
TOTAL PROTEIN (gm)	180	230	↑ 50
PLASMA PROTEIN (gm/100ml)	7	6	↓
FIBRINOGEN-mg%	200-400	300-600	+50%
ESR (mm/hr)	10	40	↑ 4 fold

c. **Respiratory changes**:
   i. Increased oxygen requirements of the pregnant women → ↑ O2 consumption (by approximately 20%).
   ii. Uterine growth → ↑intraabdominal pressure → dyspnea (the diaphragm is displaced upwards → ↓TLC, ↓ RV, ↓ FRC and ↓ERV)
   iii. Progesterone stimulates the respiratory centers in the CNS → hyperventilation (to eliminate fetal CO2 more efficiently) → physiological, chronic compensated respiratory alkalosis (↓PCO2 of ~30 mmHg).

d. **Renal changes**:
   i. The ↑ in CO → ↑ Renal plasma flow → ↑ GFR → ↓ BUN and creatinine levels
   ii. ↓ Peripheral vascular resistance → activation of RAAS → ↑ Aldosterone → ↑ plasma volume and hypernatremia
   iii. ↑ Progesterone and ↑ Intrabdominal pressure → dilation of kidney, pelvis and calyceal system → hydronephrosis, hydroureter and hypomotility of the ureters (→↑ risk of pyelonephritis).
   iv. ↑ Urinary frequency (associated with ↑ GFR and ↑ intrabdominal pressure which compresses the urinary bladder)
   v. ↑ Glycosuria (↑ GFR → overload of glucose carrier responsible for its absorption)

e. **Metabolic changes**:
   i. Weight gain in a normal pregnancy should be between 11-16 kg.
   ii. Diet and Exercise: Pregnancy is associated with increased demands for nutrients. Therefore, caloric intake should be increased by 300 kcal/day.

5. Growth and development of the fetus, duration of gestation, calculation of estimated date of delivery

Pregnancy is the period during which one or more offsprings develops within a women's uterus.

a. **Basic definitions**:
   i. **Gravidity**: number of times a women has been pregnant regardless of the outcome of pregnancy.
   ii. **Parity**: number of pregnancies that a women carries beyond 20 weeks or those that ended with the birth of an infant weighing > 500g (nulliparity x primiparity x multiparity)
   iii. **Gestational age:** estimated fetal age calculated from the first day of the last menstrual period.
   iv. **Conceptional age**: estimated fetal age calculated from the day of conception.

b. **Clinical symptoms of pregnancy**: The presumptive signs of pregnancy include the presence of amenorrhea, N/V, breast enlargement and tenderness, hyperpigmentation of the areola, abdominal bloating and constipation, increased urinary frequency.

c. **Diagnosis of pregnancy**: is made via the **detection of b-HCG in the urine or serum** or via **direct visualisation of the embryo on US**.
   i. Urinary b-HCG may be detected 14 days after fertilization, whereas serum b-HCG is detectable 6-9 days after fertilization.
   ii. In a normal pregnancy, the levels of b-HCG doubles every 2.5 days in early pregnancy (for the first 4 weeks). It then peaks at the 10 week of gestation and slightly decreases in the 2 trimester. Reaches a steady level during the 3rd trimester.
   iii. Pathological dynamics of b-HCG:
      - ↓ levels or slow rise → ectopic pregnancy, abortion, Edwards or Patau's syndrome.
      - ↑ levels or fast rise → b-HCG secreting tumours (hydatiform mole, choriocarcinoma), multiple pregnancy, Down syndrome.

d. **Duration of pregnancy**:
   i. The duration of pregnancy is counted in **weeks of gestation** from the **first day of the last menstrual period** and lasts on **average 40 weeks.**
   ii. **Term pregnancy** occurs when birth occurs between **37-42 weeks.**
   iii. **Post-term pregnancy** is one that extends **beyond 42 weeks**.
   iv. **Fetal viability**: Fetal viability refers to the ability of the fetus to survive, grow and develop outside the uterus. The limit of viability is between 22 weeks. The period between 22-24 weeks is called the "grey zone", since the mortality is up to 50% despite proper management.

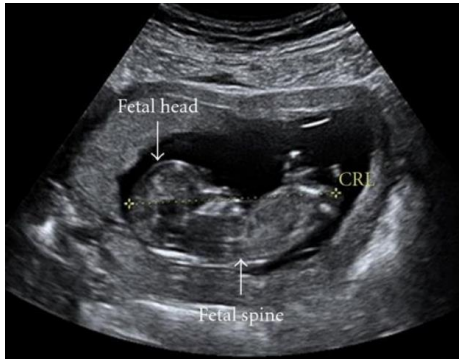
e. **Trimesters of pregnancy**:
   i. **1st trimester**: Period between conception and the first 13 weeks of gestation. In this period, spotting and bleeding may occur in 20% of pregnancies (threatened abortion), 50% of which will continue successfully. An average weight gain of 2,5-4 kg.
      - Complications → spontaneous abortion.
   ii. **2nd trimester**: Period between the 14th and 26th weeks of gestation. In this period, Braxton-Hick contractions may develop and there is a weight gain of 0.5 Kg every week.
      - Complications → cervical incompetence (condition where painless cervical dilation occurs that leads to delivery of a non-viable fetus), PROM
   iii. **3rd trimester**: Period between 27th and 40th weeks of gestation. In this period, the fetal head descends into the pelvis allowing easier maternal breathing. Bloody show, which refers to the passage of bloody endocervical mucus due to cervical dilation, occurs.
      - Complications → PROM, pre-eclampsia, UTIs, gestational diabetes.

f. **Calculation of the estimate date of delivery**:
   i. **Naegele's rule**: Used to calculate the expected date of delivery.
      - Expected date of delivery is first day of the menstrual period + 7 days +1 year – 3 months.

- Inaccurate if the late of the last menstrual period is not known, if the patient has irregular menstrual cycles or if the patient conceived while taking contraceptives.

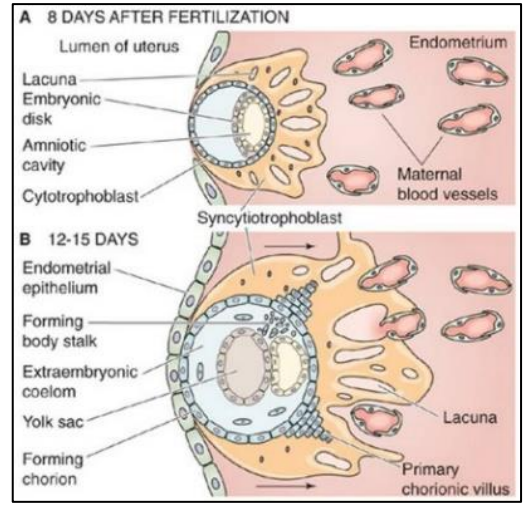
ii. **US**: more accurate than the Naegele's rule.
- 1st trimester → we determine the EDD based on the **crown-rump length** (CRL). CRL is the longest straight line measurement of the embryo measured from the outer margin of the cephalic pole to the rum.
- 2nd and 3rd trimester (starting at the 13th week) → we determine the EDD based on the **Biparietal diameter**, **fetal femoral length** and **abdominal circumference**.

iii. **Symphysis fundal height**: the length from the top of the uterus to the top of the pubic symphysis.
- Used to assess fetal growth and development from 20th week of gestation onwards.



Growth and development of the fetus by gestational age.

a. **Embryonic stage (week 0-8)**:



i. **Week 1-2**: Ovulation occurs 14 days after the last menstrual cycle.

ii. **Week 3**:
- Fertilization occurs 24 hours after ovulation, causing the formation of a zygote.
- Zygote undergoes mitosis, forming a 16-cell morula (by day 4) a 100 cell blastocyst (day 5)
- On the 5th day the blastocyst reaches the uterine cavity and, after zonal hatching, implantation occurs on the 6th or 7th day after fertilization.

iii. **Week 4**:
- During this time, the outer layer of the blastocysts develops into the syncitiotrophoblast (→ grows into the endometrial stroma and produces b-HCG) and the inner layer develops into the cytotrophoblast (→ develops into the primary placental villi)
- Early gastrulation with development of the bilaminar disc and primitive stalk.

iv. **Week 5**:
- Late gastrulation occurs, when the cells of the primitive stalk streak downwards forming the tri-laminar disc (ectoderm, mesoderm and endoderm).
- The mesoderm invades the 1º placental villi to form the 2º placental villi. The blood vessels of the latter then differentiate into 3º placental villi.
- At this point, the neural plate, primitive heart tube and vasculature start to develop.

v. **Week 6 (CRL: 4-6 mm)**:
- At this point, the heart develops and starts beating (which is detectable on US)
- The neural tube closes and there is the appearance of the arm buds.

vi. **Week 7**:
- At this point, the primitive brain consists of 5 vesicles, the leg buds form and the hands form as flat paddles.
- There is formation of the metanephros, which will develop into the future kidneys.

vii. **Week 8** (CRL: 12-13 mm)
- At this point, the arms and legs are distinguishable, with hands/feet having visible digits.
- The differentiated gonads and external genetalia start to develop.

b. **Fetal stage (week 9-delivery)**:

i. **Week 9 (CRL: 18 mm)**:
- Spontaneous limb movement may be seen on US.
- All essential organs have developed.

ii. **Week 12 (CRL: 8 cm)**:
- The head comprises almost 50% of the fetal length. Facial features develop.

iii. **Week 13-16 (CRL: 15-16 cm)**:
- The fetus moves actively.
- Genetalia are differentiated (from 13^{th} week, sex prediction with US is accurate).

iv. **Week 18 (CRL: 18-20 cm):** Quickening begins to occur (palpable fetal movements are felt).

v. Week 23 (CRL: 28 cm):
- The fetus is > 500 g.
- After 23 + 6, fetus is considered to be able to survive extra-uterine conditions.

vi. Week 27 (CRL: 37-38 cm):
- The fetus is app. 1200g.
- Fetal eye opening starts to occur.

vii. Week 31 (CRL: 43 cm):
- The fetus is app. 2000g.
- Breathing movements start to occur.

viii. Week 35 (CRL: 48 cm):
- The fetus is app. 2500g-3000g.
- Surfactant concentration in the lungs reaches a sufficient amount.

ix. Week 38-40 (CRL: 50 cm): The fetus is app. 3500 g.

6. Clinical examination in pregnancy and labour

Obstetrical history: The obstetrical patient is usually a healthy woman undergoing a normal life event. Nevertheless, history and physical examination are essential to safeguard both the fetus and the mother.

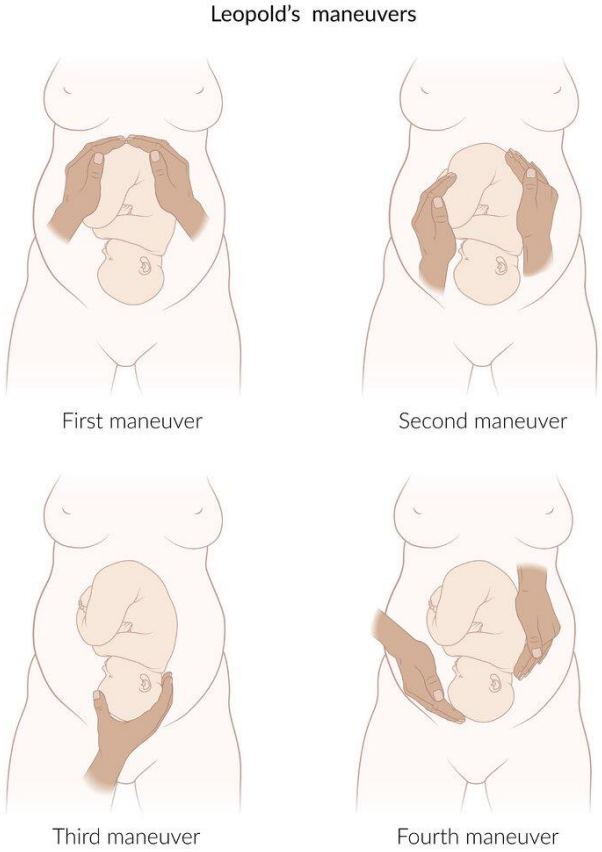
a. **Personal details**: Name, age, occupation, marital status.
b. **Past obstetrical history** (**GTPAL system**):
    i. **G**ravida (number of conceived pregnancies including term, pre-term, abortions)
    ii. **T**erm pregnancies (>37 weeks) → mode of delivery, birth weight and gender, maternal or perinatal complications, use of assisted reproductive techniques.
    iii. **P**reterm pregnancies (<37 weeks)
    iv. **A**bortions (elective or spontaneous before 20 weeks)
    v. **L**iving children or live births
c. **Current obstetrical history**:
    i. Assess any complaints. Common reasons for admission include hypertension, pain, ante-partum hemorrhage, PROM.
    ii. Assess type of conception (spontaneous or via ART). Assess menstrual history (date of the last menstrual cycle, duration, regularity, characteristics of the flow, presence of any intermenstrual bleeding).
    iii. Assess Gestational age and expected day of delivery (via Naegele's rule, US or symphysic height).
    iv. Assess for the presence of complications such as bleeding, anemia, UTIs.
    v. Prenatal care, history of use of teratogenic drugs, history of maternal infections and immunizations
    vi. Previous diagnostic tests, presence and frequency of fetal movements and contractions.
d. **Other history**: **Gynecological history** (brief and directed at procedures and difficulties in conception), **Past medical history** (any operation and/or disease), **Pharmacological history** (ask any drugs that she was taking at conception and after conception), **Family history** (ask about first-degree history of especially DM, pre-eclampsia, VTE, autoimmunity), **Personal history** (ask about smoking, drinking or drug related habits), **Social history** (Assess social support) and **Allergological history** (especially to penicillin and latex).

Physical examination: First introduce yourself and confirm patient identity.

a. **General examination:**
    i. Examine the **general appearance**, **temperature** and **pulse rate**.
    ii. On the booking visit, examine the **height**, **weight** and **BMI** and assess the **chest**, **CVS** (auscultation may display flow physiological flow murmurs due to ↑ blood volume and flow) and **legs** for any abnormalities.
    iii. **Blood pressure** and **urinalysis.**
    iv. Examine the **thyroid** to exclude goiter.
b. **Abdominal examination:**
    i. **Inspection:** look for size of pregnant uterus and look for linea nigra, protruding umbilicus, stretch marks, fetal movement, superficial veins and surgical scars.
    ii. **Palpation:** Palpation allows determination of the **symphysis fundal height**, **fetal lie**, **presentation** and **degree of engagement** and **amniotic fluid volume** (base on how easily fetal part can be palpated). Palpation follows three steps:
        - **1st**: Assess **symphysis fundal height** by measuring the distance between of the fundus to the pubic symphysis. This allows the detection of "small for date" foetuses.

- **2nd**: Use both hands to palpate down the fetus towards the pelvis (**1st maneuver**). Use the dipping movements to palpate the fetal parts and estimate the liquid volume. Liquid volume can be evaluate based on the ease of palpation. Excessive amniotic fluid (polyhydromnios) is felt as tense and deeper palpation will be needed. This allows detection of the **fetal lie** (longitudinal, oblique and transverse), **fetal presentation** (cephalic vs breech presentation) and **quantity of amniotic fluid**.
- **3rd**: Perform the **2nd, 3rd and 4th maneuvers**. These allow detection of the fetal presentation, engagement and degree of head flexion.
- **Leopold's maneuvers**: Four abdominal palpation maneuvers used during physical examination to determine the lie, presentation, position and engagement of the uterus.
    1) **1st maneuver**: bimanual examination of the fetal position.
    2) **2nd maneuver**: bimanual examination of the location of the fetal back (maternal right or left side)
    3) **3rd maneuver**: One hand grasps above the pubic symphysis in an attempt to determine if the presenting part of the fetus is engaged. This is measure as "fifths palpable". If only 2/5 of the head are palpable, then the head must be engaged.
    4) **4th maneuver**: Bimanual examination of the location of the fetal brow and degree of flexion of the fetal head.

c. Auscultation: Listening of the fetal heart should be possible after 28 weeks with a Pinard's stethoscope. The stethoscope is positioned over the shoulder. Fetal heart rate should be between 110-160 beats/min.



7. **Antenatal care**
8. **Antenatal care in high risk pregnancy**
9. **Routine laboratory tests during pregnancy**

Antenatal or **Prenatal care** refers to medical care that women receive throught pregnancy. Guidelines for routine prenatal care determine the scope and frequency of prenatal visits and screening. Prenatal visits aim to **detect high-risk pregnancies** and to **monitor the course of pregnancy and fetal development**.

a. Aims of antenatal care:
   i. Prevention, detection and management of pre-existing maternal conditions, maternal and fetal complications of pregnancy.
   ii. Detection of congenital fetal problems.
   iii. Planning with the mother the circumstances of pregnancy and delivery, to ensure maximum safety and satisfaction.
   iv. Provision of education and advice regarding lifestyle and minor conditions.

b. Many of the aims of prenatal care could be better fulfilled before conception and, as such, health check- ups are essential. Pre-conception assessment of rubella status, optimization of chronic diseases (eg. strict glucose control in DM) and optimization of medications is essential.

c. Schedule:
   i. **1st visit (booking visit – before 10 weeks):** after first missed menstrual period
   ii. **1st and 2nd trimester (until week 28):** monthly visit
   iii. **28 - 36 week:** every two weeks
   iv. **After 36 week:** weekly (delivery expected at 38 - 40 weeks)

d. 1st visit: It is aimed at confirming the pregnancy, filling out the maternity card and planning pregnancy.
   i. History: Age (<17 and > 35 → Higher risk of obstetric and medical complications), personal history, family history, social history, gynecological and obstetrical
      - **Gynecological and obstetrical history:** Should include maternal age, gynecological history, menstrual history (last menstrual period, frequency, duration, characteristics of bleeding), way of conception, past obstetrical history (GTPAL system) and current obstetrical history (any complaints).
   ii. General examination: general appearance, height, weight, BMI (> 30 → higher risk of complications) and **BP** (useful to compare later on)
   iii. Gynecological examination: including general inspection, breast examination and pelvic examination (inspection, bimanual vaginal and rectovaginal examination, speculum examination). **Pap smear** should be taken.
   iv. Confirmation of pregnancy (either via an urinary or blood b-HCG test)
   v. Standard lab tests:
      - CBC → If there is anemia, test Fe, Vit.B9 and Vit.B12.
      - Hemoglobin, Hct, MCV, MCHC.
      - TSH (in individuals with signs or symptoms of thyroid disease)
      - Blood typing (ABO and Rhesus) → screen for hemolytic disease of the newborn (Rh neg. women receive prophylactic anti-D immunoglobulin at 28 weeks to prevent alloimmunization)
      - Urine dipstick (performed in every prenatal visit) → test for proteinuria
      - Urine culture → screening for asymptomatic bacteriuria (source for pyelonephritis in pregnant women)
      - Screening for STIs:
         1. HIV, Syphilis, Hep.B (HbsAg, anti-Hbc IgM), Hep. C testing → all pregnant women.

2. Gonorrhea and Chlamydia → In all pregnant women <25 years or >25 years with high risk of infection
- Rubella and Varicella antibody testing (unless there is evidence of immunity)

vi. **Booking visit US:** confirm pregnancy and make sure it is not ectopic or molar. Assess estimated gestational age through CRL.

vii. **Education:**
- **Medication**: Medications are generally avoided in the 1st trimester, but teratogenicity is rare. Ideally, regular medication should be adjusted preconceptually.
- **Nutritional and lifestyle recommendations**:
  1. Limit caffeine intake (1-2 cups a day), avoid alcohol and tobacco use, avoid unwashed or uncooked fish (contamination of bacteria and parasites), milk products (risk of congenital listeriosis) and red meat (high risk of congenital toxoplasmosis).
  2. Exercise is recommended, especially swimming. Sleeping should be on the side from 28 weeks.
  3. Prescribe folic acid (0.4 mg/day until 12 weeks. Higher dose of 5mg for those with BMI>30, DM), vitamin D (10 ug/day), Vit. B12, Fe, Ca and Iodine supplements.
- **Vaccination**: Recommend DPT vaccination (preferentially at 27-36 weeks) and inactivated influenza vaccines

e. 1st and 2nd trimester (until 28th week): monthly visit to OBGYN department. These tests should be performed during each prenatal visit regardless of pregnancy-related complaints or symptoms:

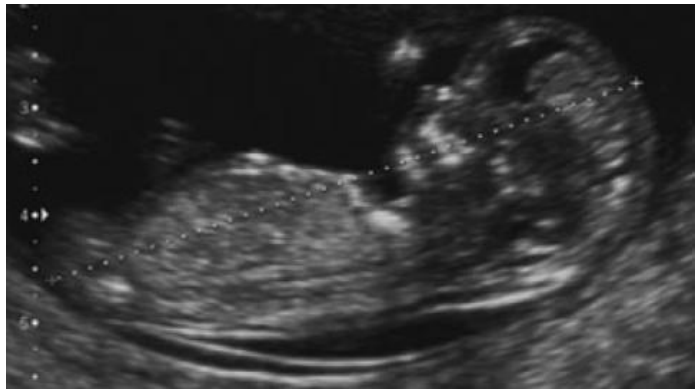
i. **Physical examination at every consultation**: Assessment of the symphysis fundal height and position of the fetus and fetal heart monitoring (via US).

ii. **Measure maternal weight at every consultation** → to avoid fetal developmental problems, fetal macrosomia and maternal obesity (if the weight is less than the recommended amount).

iii. **Measure maternal BP at every consultation** → early detection of pregnancy induced hypertension.

iv. **Urinalysis at every consultation** → for signs of infection and proteinuria (screening for pre-eclampsia)

v. **1st trimester US** (8-13th weeks), **2nd trimester US** (18-20th weeks)



vi. **Estimate the date of delivery (EDD):** can be done either via calculation or ultrasound
- **Calculation (Naegele's rule):** EDD = first day of last menstrual period + 7 days + 1 year – 3 months
- **Ultrasound:** measure the **crown-rump length -** most accurate estimate when performed in the 1st trimester. During 2nd and 3rd trimester, measurements can be based on the Biparietal diameter, femoral length or abdominal diameter.

vii. **Routine lab testing:**
- **Hb testing** (**from 24th week** of gestation) → maternal anemia
- **OGTT** → screening at **24-28 weeks** of gestation to test gestational DM

viii. **Prenatal diagnosis**: All pregnant women should be offered non-invasive prenatal screening tests. Possible tests may include testing the **maternal serum** (for specific biomarker + US markers that indicate ↑ risk of aneuploidy) or **cell-free fetal DNA testing**. Any abnormal non-invasive test result should be followed-up by an invasive test.
- **Non-invasive screening test**:
  1. **First trimester triple screening** → Performed between the **10-13th weeks**. Triple screening with **US nuchal translucency** + **b-HCG** + **PAPP-A** (pregnancy associated protein A) in the maternal serum.
  2. **Second trimester quadruple screening** → Performed between **15-22 weeks**. Quadruple screening with **b-HCG** + **AFP** + **Estriol** + **Inhibin A**.
  3. **Cell-free fetal DNA testing** → Can be performed from 10 week onwards. Fetal DNA is isolated from a maternal blood sample for genetic

testing. Most sensitive and specific screening after US.

- **Invasive screening test**:
    1. **Chorionic Villus sampling**, **Amniocentesis** and **Cordocentesis**.

f. 3rd trimester: visit every 2 weeks between 28 - 36 weeks and, then, every week after > 36 weeks.

i. Measure **symphysis-fundal height** and plot it on the chart

ii. GBS screening → screening between the **35 and 37 weeks** of gestation (vaginal and rectal swab for culture and gram staining).

- Positive results→ Intrapartal IV penicillin G or ampicillin every 4 hours until delivery

iii. Give **anti-D IgG prophylaxis to Rh- mother if baby's blood is Rh+** (at 28 weeks).

iv. Go over delivery options and postnatal care.

v. Arrange admission to maternity ward prior to expected delivery.

vi. 3rd trimester US (30-32th weeks) and US prior to labour.

High risk pregnancies refers to those with higher risk of pregnancy, perinatal or postnatal complications. Early identification of high-risk pregnancies is vital to prevent the occurrence of maternal or fetal complications.

a. Risk factors for a complicated pregnancy:

i. Family history of complicated pregnancy;

ii. Personal history of advanced maternal age (>35 years), first pregnancy, multiple pregnancies, multiparity, medical conditions (antiphospholipid syndrome, hypertension, DM, epilepsy and malignancies).

iii. Personal history of drug use, stress, pre-existing gynecological conditions (eg. uterine leiomyomas, uterine surgery)

iv. Personal history of prior complicated pregnancies, including premature delivery, baby with low birth weight, baby born with defects, prior C-section and Rhesus incompatibility

b. The following tests are performed at high risk pregnancies to assess the risk of antenatal fetal death:

i. **Biophysical profile**: non-invasive test that evaluates the risk of antenatal fetal death, usually performed after the 28th gestational week.

- **Measured parameters**: Each parameter receives a score of 0 (abnormal) to 2 (normal) points.
- **Parameters** → US exam of fetal movement, fetal tone, fetal breathing and amniotic fluid volume and Non-stress test.
- **Interpretation:**
    1. Score > 8 points → no signs of fetal compromise → reassurance.
    2. Score 5-7 points → unclear risk → repeat BPP in 24 hours.
    3. Score < 4 points → potential fetal compromise → delivery is indicated (if pregnancy duration is < 32 weeks → administer steroids and continue close monitoring).

10. Ultrasound assessment in pregnancy and labour

Ultrasound provides a cheap, reliable method of visualization of the fetus and gestational sac during pregnancy. It allows identification of the expected date of delivery and a variety of fetal abnormalities.

a. Types of ultrasound used in pregnancy and labor:

i. **Transabdominal ultrasound:** less invasive, has a greater view of the pelvic cavity than transvaginal ultrasound. It requires a distended bladder (full bladder).

ii. **Transvaginal ultrasound:** provides a better view of the uterus and adnexa during early pregnancy. Does not require distended bladder (→ empty bladder).

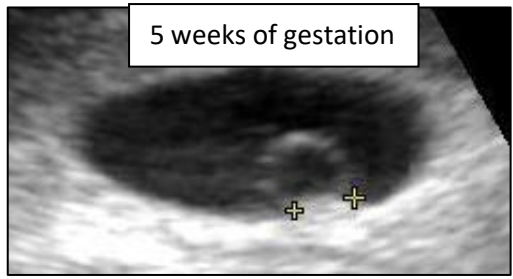
iii. **Doppler ultrasound**

- **Uterine a. Doppler:** pulsatile wave in the uterine a. indicates ↑ resistance within placenta and suggest the risk of **pre-eclampsia** and/or fetal growth restriction. Not recommended to all women.
- **Umbilical a. Doppler:** decline or loss of flow velocity or negative flow suggests **placental failure.**
- **Middle cerebral a. Doppler:** Increased diastolic flow velocity suggests centralization in **fetal hypoxia.**

b. Schedule:

i. **First visit (< 10th week):**

- US is used to **confirm pregnancy** (based on the location and size of the gestational sac and embryo → "double ring"). US also allows exclusion of ectopic or molar pregnancy.



ii. **1st trimester (8th - 13th week):**

- Determination of the expected date of delivery (by CRL).
- Evaluate chromosomal aneuploidy (measuring nuchal translucency and other markers of Down syndrome such as nasal bone hypoplasia and tricuspid regurgitation).
- Assess fetal growth, measure amniotic fluid volume and guide the needle for chorionic villi sampling.

iii. **2nd trimester (18- 20th week) (~ anomaly scan):**

- Determination of the expected date of delivery (by biparietal diameter, abdominal circumference or by femolar length)
- Check for congenital malformation (eg. anencephaly, posterior urethral valve, diaphragmatic hernia),
- Fetal anatomic survey (fetal position, heart, amniotic fluid volume, gestational age assessment, weight estimation)
- Assess fetal growth, guide the needle for amniocentesis.

iv. **3rd trimester (30th – 32th weeks):** most pregnant woman do not require US examination unless they are considered to be high risk (> 35 y/o, bleeding, low amniotic fluid volume, fetal malpresentation).

- May be performed to assess size of the fetus and position of the placenta and for determination of the Amniotic fluid index (normal 8-18cm).

v. **Prior to labour:**

- To determine the fetal position, evaluate the amniotic fluid, visualize the placental location and evaluate fetal cardiac activity.

11. Prenatal diagnosis of inborn errors

Prenatal diagnosis refers to a group of screening methods during pregnancy aimed at the diagnosis of chromosomal and structural abnormalities. All pregnant women should be offered non-invasive prenatal screening tests. All pregnant women should be offered the alternative to undergo invasive genetic testing.

a. Possible tests may include testing the **maternal serum examination** (for specific biomarkers that indicate ↑ risk of abnormalities), **US markers**, **cell-free fetal DNA testing** or **invasive methods**.

b. Non-invasive screening test:

i. **First trimester triple screening** → Performed between the **10-13th weeks**. Triple screening with **b-HCG** + **PAPP-A** (pregnancy associated protein A) in the maternal serum + **US (nuchal translucency** + **Nasal bone** + **Tricuspid regurgitation**)

ii. **Second trimester quadruple screening** → Performed between **15-22 weeks**. Quadruple screening with **b-HCG** + **AFP** + **Estriol** + **Inhibin A**.

iii. **2nd and 3rd trimester US exams:** Asses fetal heart, bowel, kidneys and limbs and placental assessment.

iv. **Cell-free fetal DNA testing** → Can be performed from 10 week onwards. Fetal DNA is isolated from a maternal blood sample for genetic testing. Most sensitive and specific screening after US.

v. The risk of aneuploidy is evaluated based on the maternal age, lab results and US. If risk is elevated, counselling and invasive genetic testing should be offered.

First trimester combined screening test

MAXIMIZE TABLE TABLE QUIZ

Overview of first trimester combined screening test

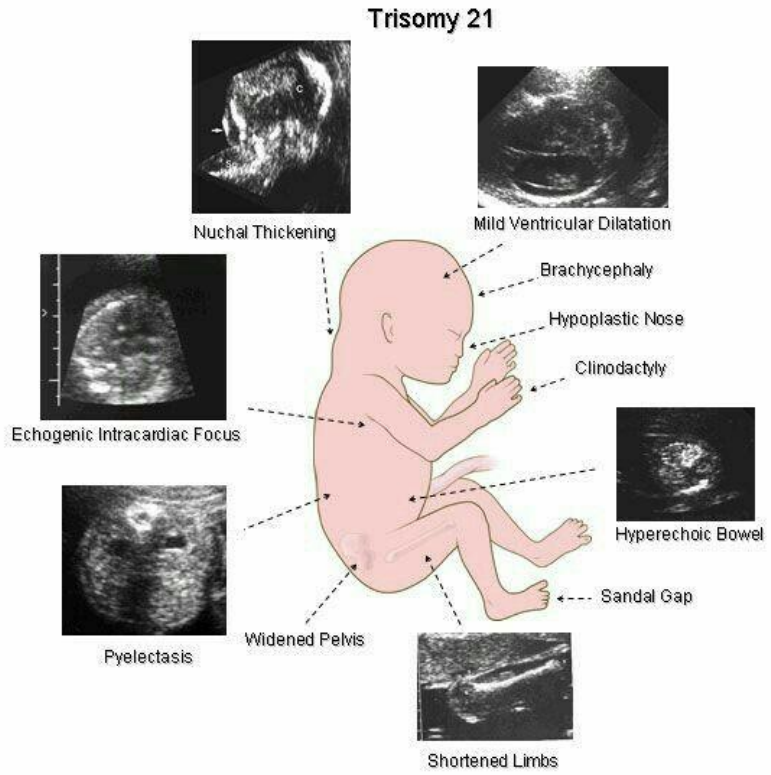
Condition	HCG	PAPP-A	Nuchal translucency
Trisomy 21	↑	↓	Thickened nuchal fold (> 95th percentile)
Trisomy 18	↓	↓↓	↑
Trisomy 13	↓	↓↓	↑
Molar pregnancy	↑↑	-	-
Ectopic pregnancy	↓	-	-

Quad and triple screening tests

MAXIMIZE TABLE TABLE QUIZ

Overview of quad and triple screening tests

Condition	HCG	AFP	Estriol	Inhibin A
Trisomy 21	↑	↓	↓	↑
Trisomy 18	↓	↓↓	↓↓	↔ or ↓
Neural tube defects	↔	↑	↔	
Abdominal wall defects				

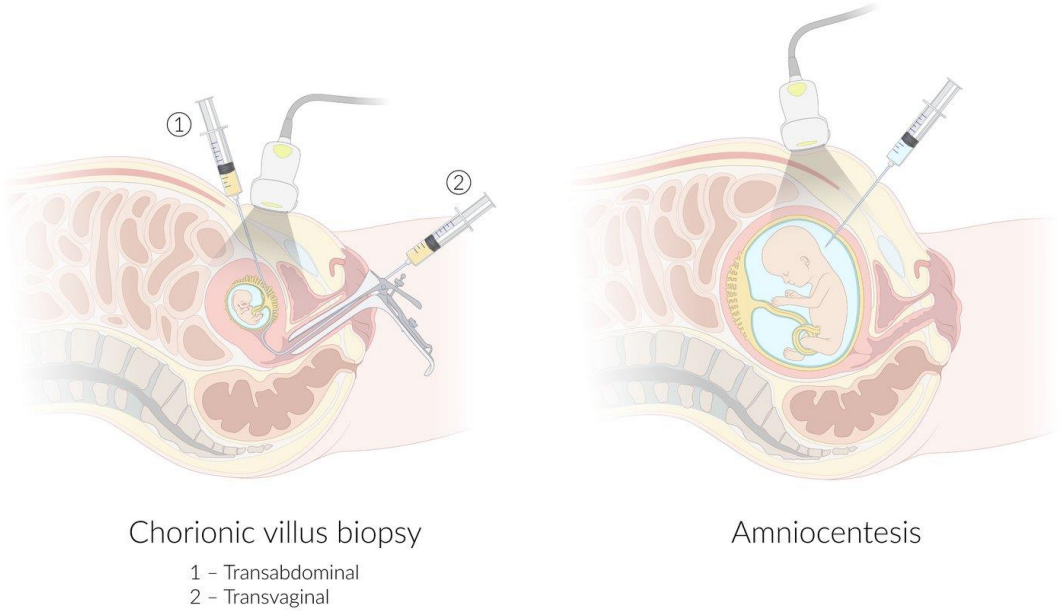


c. Invasive screening test:

i. **Chorionic Villus Sampling**: Transcervical or transabdominal removal of chorionic tissue under sonographic guidance. Analysis of the DNA for genetic diagnosis. Performed between the **10 and 13th week**. Cells are examined for karyotype, PCR, FISH and specific genetic testing.
   - **Complications**: Miscarriage and limb defects.

ii. **Amniocentesis**: Amniotic fluid is extracted from the uterine cavity under US guidance via a transabdominal puncture. Performed **after the 15th week**. Cells are examined for karyotype, PCR, FISH and specific genetic testing.
   - **Complications**: Miscarriage and PROM.
   - **Indications of CVS and Amniocentesis**:
     1. **Early pregnancy**: Sonographic appearance of fetal nuchal edema, abnormal findings of 1st trimester triple screening, maternal age > 35 years, suspected toxoplasmosis.
     2. **Late pregnancy**: Determination of billirubin levels in rhesus incompatibility, monitoring of electrolytes in suspected renal failure, estimation of lung maturity in imminent premature delivery, drainage or addition of amniotic fluid (in poly or oligohydramnios).

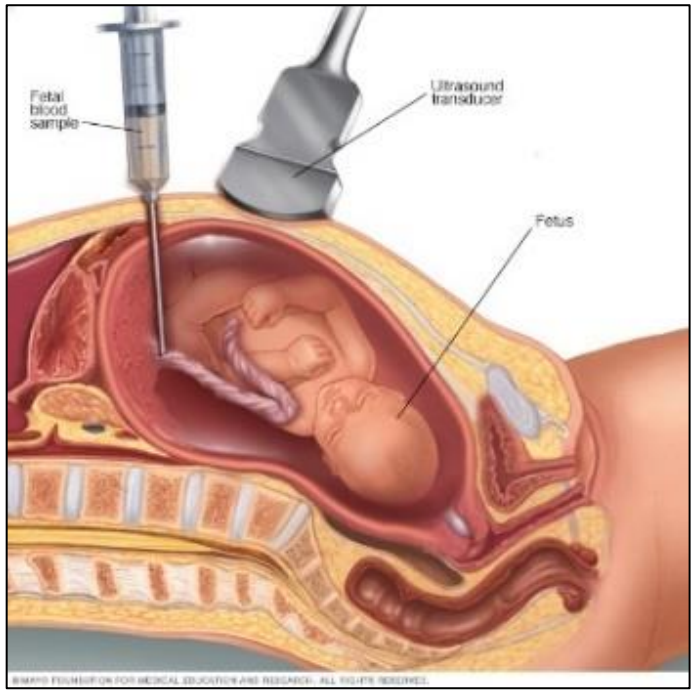
iii. **Cordocentesis**: Fetal blood sampling via US guided transabdominal needle insertion into the umbilical cord. Performed **after the 17th week**.
   - **Indication**: identification of type of fetal hemoglobin, diagnosis of fetal genetic defects and diagnosis of fetal infections.



Chorionic villus biopsy

1 – Transabdominal
2 – Transvaginal

Amniocentesis

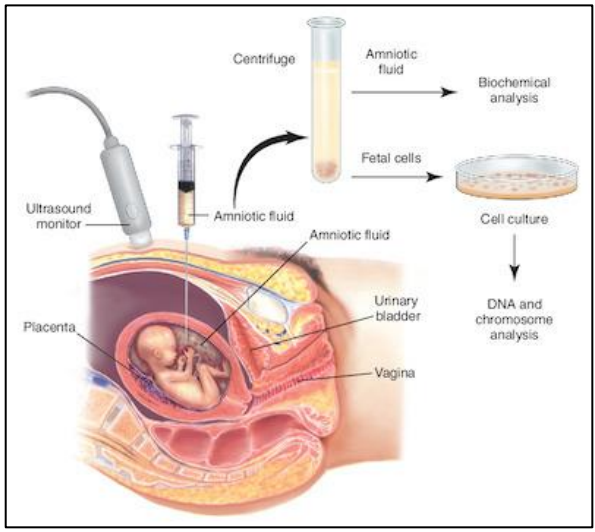


12. Amnioscopy, amniocentesis, PROM – confirmation of diagnosis

Amnioscopy refers to the examination of the amniotic fluid using an **amnioscope** introduced through the cervical canal. The main purpose of amnioscopy is to assess if the amniotic fluid is stained with meconium (occurs in 8-20% of pregnancies).

a. **Meconium stained amniotic fluid** has 3 main implications:
   i. May suggest fetal hypoxia
   ii. May be a physiological findings (eg. in breech presentation)
   iii. It may lead to meconium aspiration syndrome (characterized by respiratory failure and persistent pulmonary hypertension).

Amniocentesis is an invasive procedure performed under US guidance that involves removal of amniotic fluid using a fine gauge needle. It is safest performed after 15 weeks of gestation.



a. **Uses**: Amniocentesis enables prenatal diagnosis of chromosomal abnormalities, some infections and inherited disorders.
   i. **Genetics**: Allows diagnosis of chromosomal abnormalities via Karyotype, FISH, PCR and specific genetic testing.
   ii. **Infections**: Allows assessment of glucose levels, WBC counts and gram stain. Allows diagnosis of infections including CMV and toxoplasmosis.
   iii. **Lung maturity**: Allows assessment of lung maturity based on **Lecithin: Sphingomyelin ratio** and **Surfactant: Albumin ratio**.
   iv. Allows decompression in **polyhydromnios**.
b. **Complications**: Miscarriage (0,5-1 % of cases), fetal trauma, chorioamnionitis and amniotic fluid embolism.

Diagnosis of PROM is based on a clinical diagnosis and sterile speculum examinations.

i. **Clinical diagnosis**: History of a sudden "gush" of pale yellow or clear fluid from the vagina.
ii. **Sterile speculum examination**: Clinical uncertainty is common in PROM and PPROM. A variety of sterile speculum examination tests exist to confirm PROM.
   - **Pool test**: In PROM, amniotic fluid exits the cervix and pooling in the vaginal fornix.
   - **Tests to detect amniotic fluid**:
     1. **Litmus test or nitrazine test**: These tests measure pH. Amniotic fluid is alkaline and will turn the strips blue. In contrast, the vaginal fluid is normally acidic and will turn the strips red.
     2. **Fern test**: Vaginal fluid is placed on a glass slide and allowed to dry. Amniotic fluid creates a characteristic fern-like pattern under microscopy.
     3. **IGF test**: IGF1 is normally present in the amniotic fluid. Positive IGF1 measurement from the cervicovaginal fluid indicates PROM.
     4. **Placental alpha microglobulin 1**: PAMG-1 levels are usually higher in the amniotic fluid than in the cervicovaginal fluid. Elevated levels of PAMG-1 in the cervicovaginal fluid indicates PROM.

13. Drugs in pregnancy and lactation

1. **Antibiotics during pregnancy:**
    a. **Drugs of choice**:
        i. Penicillin group: ampicillin, amoxicillin, flucloxacillin, penicillin V, propicillin
        ii. Cephalosporins
        iii. Macrolides: erythromycin, azithromycin
        iv. Metronidazole
        v. Fosfomycin
    b. **Drugs to avoid**:
        i. **Tetracycline**: inhibits bone growth, causes malformation and permanent discolouration of primary teeth
        ii. **Aminoglycoside**: ototoxicity and hearing loss
        iii. **TMP/SMX**: cardiovascular birth defects, neonatal jaundice (risk of kernicterus)
        iv. **Chloramphenicol**: Grey baby syndrome (accumulation of chloramphenicol in the body which leads to ashen grey colour of the skin, cardiovascular collapse, and abdominal distension)
        v. **Clarithromycin**: embryotoxic
        vi. **Fluoroquinolones**: bone and cartilage damage
2. **Other medical therapy during pregnancy**:
    a. **Antihypertensives:**
        i. **Drugs of choice**:
            1. Methyldopa in arterial hypertension and hypertensive crisis
            2. Beta blockers (metoprolol and labetalol)
            3. Dihydralazine in uncontrolled hypertension
            4. Nifedipine
        ii. **Drugs to avoid**:
            1. Diuretics: reduces placental perfusion, especially in 3rd trimester
            2. ACEi: 1st trimester: CVS & CNS malformations, 2nd and 3rd trimesters: oligohydramnios, foetal renal hypoplasia, poor cranial ossification, foetal death
            3. ARB: severe renal malformation, oligohydramnios
            4. Atenolol: intrauterine growth retardation, ↓ placental growth
    b. **Antifungals**:
        i. **Drugs of choice:** topical: imidazoles, vaginal: nystatin, systemic: amphotericin B
        ii. Drugs to avoid:
            1. Ketoconazole, flucytosine, griseofulvin, itraconazole, fluconazole: teratogenic and/or embryotoxic
            2. Iodides: congenital goiter
    c. **Antivirals**:
        i. **Drugs of choice:**

1. Acyclovir, valacyclovir → herpes
2. Oral oseltamivir, zanamivir → influenza
3. Zidovudine + lamivudine + nevirapine + atazanavir → HIV infection

ii. Drugs to avoid:

4. Efavirenz: foetal neural tube defects
5. Ribavirin, interferon-α: preterm birth, significant teratogenic and/or embryocidal effects
6. Didanosine and stavudine combination: lactic acidosis and hepatic failure leading to death
7. Nevirapine: potentially fatal hepatotoxicity

d. **Anticoagulants**:

i. **Drugs of choice:**

1. Heparin is the anticoagulant of choice (does not cross the placental barrier)
2. Aspirin (ASA): low doses may be prescribed for high-risk preeclampsia, high doses should be avoided especially in 3rd trimester

ii. **Drugs to avoid**:

1. Warfarin, phenprocoumon: can pass the placental barrier and cause spontaneous abortion, stillbirth, preterm death, cerebral haemorrhage → CNS abnormalities, atrophy of optic nerve, bone deformities
2. **Non-vitamin K OACs**: low data on these so avoid in pregnancy

e. **Analgesics**:

i. **Drugs of choice:**

1. **Non-opioid analgesics**: acetaminophen (especially in 3rd trimester), NSAIDs (1st trimester only)
2. **Opioid analgesics** (e.g., fentanyl, codeine) for moderate to severe pain

ii. **Drugs to avoid**:

1. **NSAIDs** (2nd and 3rd trimesters): premature closure of ductus arteriosus, persistent pulmonary hypertension, inhibits uterine contractility
2. **Metamizole**: 1st and 2nd trimesters: increased occurrence of nephroblastoma in embryo/foetus, 3rd trimester: premature closure of ductus arteriosus
3. **Drugs in lactation:** mothers should take medications immediately after breastfeeding, or 3-4hrs before the next feed (allows the drug to clear from the body)

f. **Contraindicated drugs**:

i. Chemotherapeutics (doxorubicin, MTX, cyclophosphamide), radiopharmaceuticals
ii. CNS-acting drugs (stimulants, BDZs), lithium, chloramphenicol
iii. Aspirin (Reye syndrome), methimazole

g. **Suppress lactation:** dopamine agonists (levodopa, bromocriptine), contraceptives, thiazides
h. **Stimulate lactation:** dopamine antagonists (domperidone, metoclopramide, haloperidol, methyldopa
i. **Antibiotics in lactation:** same as antibiotics in pregnancy

14. Infection diseases in pregnancy, HIV

1. **Course of HIV infection:**
    a. **Acute Infections:** mononucleosis- like illness start 2-4 weeks after exposure and last 1-2 w
    b. **Clinical Latency:** lasts 3-20 yrs. During this time, CD4 levels drop but remain >200/μL. Some patients have generalised LAN.
    c. **AIDS:** when CD4 drops <200/ μL. Often presents with cachexia, esophageal candidiasis, and opportunistic infections
2. **Transmission:** Risk depends on maternal viral load
3. Management of HIV positive pregnancies:
    a. **Antiretroviral therapy (ART):** ART is the primary way to reduce the risk of mother-to-child transmission of HIV. ART involves taking acombination of medications to suppress the virus and lower the viral load. ART should be started as soon as possible after a positive HIV test, and should be continued throughout pregnancy, delivery, and breastfeeding.
        i. Tenofovir + Lamivudine + Ritonavir
    b. **Elective cesarean delivery (C-section):** C-section can significantly reduce the risk of mother-to-child transmission of HIV, especially whenthe viral load is undetectable. C-section is usually recommended for women with a high viral load, but may also be recommended for womenwith a lower viral load, depending on individual circumstances. Vaginal delivery should only be performed if viral loas is <1000 and he mother has received HAART during pregnancy
    c. **Infant prophylaxis:** Antiretroviral medication may be given to the baby after birth to reduce the risk of transmission. This is known as infantprophylaxis. (Lamivudine)
    d. **Breastfeeding:** Women with HIV are typically advised not to breastfeed, as breastfeeding can increase the risk of mother-to-childtransmission. Formula feeding is recommended instead.
    e. **Monitoring:** Regular monitoring of the mother's and baby's health is important to ensure that both are healthy and to detect and treat anyproblems as soon as possible. This may include regular monitoring of the mother's viral load, monitoring of the baby's weight and development, and regular medical check-ups.
    f. **Support and counselling:** Women with HIV may need support and counselling to help them manage their illness and to cope with theemotional and practical aspects of living with HIV.

1. **TORCHES Infections:** Congenital infections (1st trimester) bu pathogens that can cause congenital malformations. Transmissions can be throughascending infection, through birth canal (at birth) or haematological (transplacenetal).
    i. **Types**:
        a. **Toxoplasmosis:** intracranial calcification, hydrocephalus, chorioretinitis
        b. **VZV:** skin scarring, limb hypoplasia, chorioretinitis, microcephaly
        c. **Parvovirus B19:** anemia, hydrop fetalis (extreme swelling of fetus)
        d. **Rubella:** Most risky before 8w can result in an abortion or malformation. Patent ductus arteriosus, sensorineural hearing loss, congenitalcataract, blueberry muffin rash
        e. **CMV (most common):** blueberry muffin rash, intracranial calcification, jaundice, hepatosplenomegaly
        f. **HIV:** weight loss, growth failure, constant lymphadenopathy, recurrent infections
        g. **Herpes virus:** most are acquired during delivery → neonatal herpes (9-2)

h. **Syphilis:** saddle nose, saber shin, Hutchinson teeth, mulberry molar, SNHL, snuffle

ii. **Prevention**:

a. **Toxoplasma:** avoid cat feces, wash veg, cook meat well

b. **STI:** protected sex and regular screenings

c. **Rubella:** MMR vaccine before pregnancy

d. **Listeria:** avoid milk products

1. **Viral Hepatitis in Pregnancy**:

a. **Hep B:** Early transmission during delivery or during breastfeeding. Baby may develop acute/ chronic hepatitis

i. **Prevention:** HBIG, vaccine

b. **Hep E:** most common in eastern Asia. Causes gastroenteritis

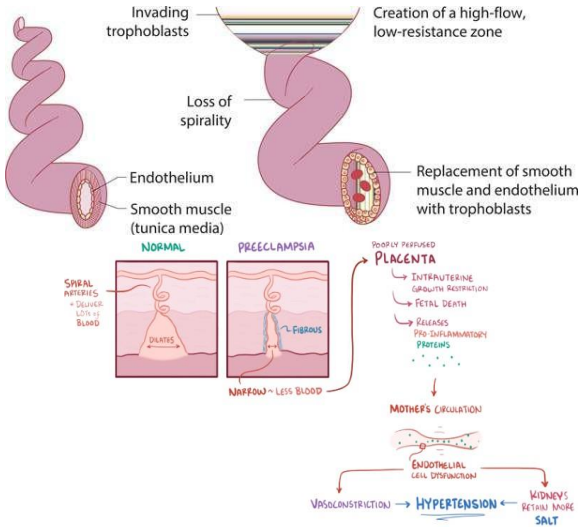
15. Pre-eclampsia, HELLP syndrome

Hypertension is the most common medical problem encountered during pregnancy, complicating up to 10% of pregnancies. Hypertensive disorders during pregnancy are classified into 4 categories:

i. **Chronic hypertension before pregnancy** (90-95% of cases).
ii. **Gestational hypertension** (onset after 20th week, resolution 12wks postpartum).
iii. Preeclampsia
iv. **Preeclampsia superimposed on chronic hypertension**

	Systolic (mmHg)	Diastolic (mmHg)
Mild	**140-149**	**90-99**
Moderate	**150-159**	**100-109**
Severe	**>160**	**>110**

Pre-eclampsia refers to a new-onset gestational hypertension with proteinuria and end-organ dysfunction **>20 weeks** of gestation



1. **Etiology:** Abnormal development of placenta
2. **Risk Factors:** family history of preeclampsia, previous pregnancy preeclampsia, nulliparity, age>40, chronic diseases (e.g. HTN, DM, SLE, APS), ↑ BMI, smoking
3. **Pathophysiology**:
   a. Normally during pregnancy, spiral arteries dilate x10 to supply the placenta. In preeclampsia → there is fibrosis/scarring of the walls of the spiral arteriesmaking the dilation minimal → poor perfusion of the placenta.
   b. Poor perfusion of the placenta leads to
      i. **Fetal:** IUGR & death
      ii. **Maternal:** placenta releases cytokines → systemic endothelial dysfunction:
         a) Hypertension
         b) Target end-organ microangiopathy (kidneys, liver, brain)
         c) Intravascular fluid leakage into interstitium
         d) Microangiopathic intravascular hemolysis
         e) Placental thrombosis, sclerosis, infarction
4. **Clinical manifestations**:
   a. **Preeclampsia without severe features**: hypertension (>140/90) proteinuria (>300mg/24 hours) urine protein:creatinine (>0.3)
   b. **Preeclampsia with severe features**: severe HTN (>160 systolic OR >110 diastolic), proteinuria (□GFR, glomerular damage), thrombocytopenia,, epigastric pain (sign of advanced disease), peripheral edema, dyspnea (pul. edema), oliguria**, severe headache, altered mental status** (cerebral edema), **visual disturbances** (photopsia, scotoma, blurred vision), hyperreflexia, ankle clonus, sudden, rapid weight gain (fluid retention)
   c. **HELLP syndrome**: **H**emolysis (↑Hb, ↓haptoglobin, ↑LDH and ↑ UCB), **E**levated **L**iver enzymes (↑AST, ↑ALT), **L**ow **P**latelets (<100,000 cells/mm3
5. **Diagnosis**:
   a. **Blood pressure**: >140/90mmHg (on 2 separate measurements at least 4 hours apart)
   b. **Ultrasound**: fetal (IUGR, oligohydramniosis), placenta (infarction, hematoma, cystic lesion), uterine, umbilical cord doppler (□ flow resistance)
   c. **ECG**: ↓ left ventricular function, ↑ filling pressure, cardiotocography (monitor fetal HR and uterine contractions)
   d. **Look for signs of fetal distress** (reduced movement, abnormal/absent breathing, reduced/absent tomne)
   e. **Labs**:

i. **sFlt-to-PlGF ratio > 200** (normal: 50-100): a high ratio is associated w/ an risk for preeclampsia
ii. **RFT**: proteinuria (>300mg/24 hours), ↑ serum creatine, albumin:creatinine ratio >30
iii. **LFT**: ↑ALT, ↑ AST
iv. **CBC**: ↓ Hb, ↓ platelet count, PBS (schistocytes, helmet cells)
v. **Hyperuricemia**
vi. **Coagulation studies**: ↑ d-dimer, ↑ PT/aPTT, ↓ fibrinogen, ↓ AT3 (suggests DIC)

6. **Treatment**: There is no cue other than delivery, the aim of management is to stabalize the maternal blood pressure and prevent seizures and cerebral bleeding.
   a. **Hydralazine, Labetolol, Methyldopa, Nifidipine** (He Loves My Neonate), **MgSO4** (seizure prophylaxis), **aspirin** for preeclampsia prophylaxis (given to high risk for preeclampsia), **Dexamethazone** (corticosteroids for fetal lung maturity given 24-24 weeks gestation), **Furosemide** (pul edmea)
      i. **Mild preeclampsia** = vaginal delivery performed at 37th week
      ii. **Severe preeclampsia = c-section** (if >34 weeks → immediate, if <34 weeks deliver only iafter 24-48 hrs after steroids)
7. **Complications**:
   a. **Maternal**: **cerebral haemorrhage, ischemic stroke**, **ARDS**, liver failure, renal failure, HELLP syndrome, **plalcental abruption**, eclampsia (seizures), death
   b. **Fetal**: **IIUGR**, **premature birth**, seizure-induced fetal hypoxia, fetal death

HELLP syndrome: a life-threatening form of preeclampsia characterized by: **H**emolysis, **E**levated **L**iver enzymes, and **L**ow **P**latelets

a. May occur w/ or without hypertension or proteinuria
b. **Management**: administer blood products (platelets, RBCs, FFP) to manage hemmorhage and coagulopathy
   i. **>34 weeks**: deliver immediately
   ii. **24-34 weeks:** administer corticosteroids for fetal lung maturity. Delibery may be delayed 24-48hrs after corticosteroids if maternal and fetal statusremains stable

16. Renal disorders in pregnancy

Women with chronic kidney disease (CKD) are less able to make the renal adaptations necessary for a healthy pregnancy and pregnancy in women with renal disease therefore requires increased maternal and fetal surveillance.

1. **Physiological changes in pregnancy**:
    a. **Kidney size**: ↑ progesterone and ↑ intraabdominal pressure→ smooth muscle relaxation → dilation of kidney, ureters and renal pelvis → kidney size ↑ by 1-1.5cm (hydronephrosis and hydroureter)
        i. **Hypomobility of ureters** → urinary stasis → **pyelonephritis**
    b. **GFR**: ↑ 40-50% immediately after conception, ↑ urinary frequency
    c. **Renal plasma flow**: ↑ cardiac output →↑ renal perfusion
    d. **Urine**:
        i. ≤ 300mg/day of proteinuria can be normal in pregnancy
        ii. >300mg/day: indicates worsening pre-existing disease, de novo kidney disease, dev. Of preeclampsia (particularly after20th weeks of gestation)
2. **Urinary tract infections**
    a. **Risk factors during pregnancy:** dilated collecting system and delayed emptying, urinary stasis, VUR
    b. **Etiology:** E.Coli (m/c), GBS, Klebsiella, Enterobacter, Proteus
    c. **Clinical features by type of UTI**:
        i. **Cystitis**: frequency, dysuria, urgency, suprapubic pain, polyuria, haematuria
        ii. **Acute pyelonephritis**: fever, rigors, vomiting, loin pain/tenderness, costovertebral pain, associated cystitis, cystitis symptoms, sepsis shock
        iii. **Fetal complications**: Preterm birth, Low body weight, neonatal sepsis, perinatal death
    d. **Treatment**:
        i. **Bacteriuria/cystitis**: ↑ hydration + amoxicillin/nitrofurantoin
        ii. **Pyelonephritis**: IV gentamicin + ampicillin or IM ceftriaxone
        iii. **AVOID** fluoroquinolones, sulphonamides and tetracyclines
3. **Urolithiasis**
    a. It is the most common cause of non-infectious abdominal pain that requires hospitalization during pregnancy
    b. 80-90% of cases occur after 1st trimester and mostly located in **ureters** or **renal pelvis**
    c. **Types of stones**:

Type & Composition	Risk factors	Radiopacity	Urine pH
Calcium: most common 1. **Ca oxalate** 2. **Ca phosphate**	**Ca oxalate:** hypercalciuria, hyperoxaluria, hypocitraturia 1. A/w vit C, ethylene glycol, IBD (↑ oxalate absorption) **Ca phosphate:** hyperparathyroidism, type 1 RTA (distal RTA)	Radiopaque	Acidic: Ca oxalate Alkaline: Ca phosphate
Uric acid	Gout, hyperuricemia, high cell turnover (tumor lysis syndrome, blood cell cancer)	Radiolucent	Acidic
Struvite (Mg ammonium PO4, Staghorn calculi)	UTI with **urease-producing bacteria** (Proteus, Klebsiella): urease converts urea into ammonia. Ammonia alkalinize urine → predispose to struvite (can be very large - Staghorn calculi)	Radiopaque	Alkaline
Cystine	Cystinuria (defect amino acid transporter in PCT)	Radiolucent	Acidic

d. Risk factors during pregnancy:
   i. Urinary stasis due to hormonal changes (↑ progesterone),
   ii. Late pregnancy: ↓ fluid intake resulting from ↓ bladder capacity due to altered position and ↑ size of uterus
   iii. ↓ ureteral peristalsis, dilation of renal pelvis,
   iv. ↑ calciuria, ↓ excretion of Mg and citrate (both are protective factors against stone formation)

e. Clinical features: Flank pain radiating to the groin, Renal colic, Dysuria, frequency, urgency, Nausea & vomiting, **Haematuria**

f. Diagnosis:
   i. US (first line): obstructive uropathy = hydronephrosis, hydroureter, perinephric fluid OR stone: hyperechoic w/ acoustic shadowing
   ii. If renal US inconclusive: MRI or low dose CT preferred than X-ray as safer for baby

g. Prevention:
   i. Calcium: thiazide (↓ urine Ca), citrate supplement, diet rich in fruit & vegetable (alkalinize urine)
   ii. Uric acid: allopurinol, low purine diet, citrate supplement, diet rich in fruit & vegetable (alkalinize urine)
   iii. Cystine: tiopronin, citrate supplement, diet rich in fruit & vegetable (alkalinize urine)
   iv. Struvite: ABX for UTI, cranberry juice, dairy products (acidify urine)

h. Treatment: focuses on pain control because majority of stones pass spontaneously

i. Analgesics that are safe for pregnancy (NSAIDs, opioids), fluid, ABX if UTI
   i. < 5 mm: often pass spontaneously
   ii. < 10 mm: medical expulsive therapy (α-blocker (tamsulosin), CaCB)
   iii. > 10 mm: shock wave lithotripsy (extra- or intracorporeal) or ureterorenoscopy – generally avoided in pregnant women
   iv. > 20 mm: percutaneous nephrolithotomy – **generally avoided** in pregnant women

j. **Complication**: ureteral obstruction, hydronephrosis, recurrent UTI, AKI

4. Renal failure in pregnancy:

a. Etiology:

	Early pregnancy (<20 weeks)	Late pregnancy (>20 weeks)

Pre-renal	Hyperemesis gravidarum Misscarriage → blood loss	Preeclampsia/HELLP syndrome TTP/HUS Antenatal hemmorhage
Renal	Acute PN ATN/RCN (mostly by miscarriage)	Ischemic acute tubular necrosis MPGN, PSGN
Post renal	Urolithiasis of bladder outlet	Pregnancy induced bilateral compression of ureters

Stage	Description	Estimated GFR (ml/min/1.73m²)
1	Kidney damage with normal/raised GFR	>90
2	Kidney damage with mildly low GFR	60–89
3	Moderately low GFR	30–59
4	Severely low GFR	15–29
5	Kidney failure	<15 or dialysis

GFR, glomerular filtration rate.

b. Management:

i. Obstetric follow up every 2 weeks until 32nd week → followed by weekly visits until birth

ii. **Routine checks**:

1. Blood pressure, RFTs, Nephrotic syndrome parameters, LFTs, fetal surveillance (from week 28-30)
2. Renal parameters must be monitored every 4-6 weeks
3. If progressive renal failure occurs → **dialysis** needs to be considered

17. Gastrointestinal and hepatic disorders in pregnancy

1. **Hyperemesis gravidarum (HEG):**
   a. **Definition**: severe, persistent nausea and vomiting associated with >5% loss of pregnancy weight and ketonuria with no other identifiable cause
   b. **Etiology**: Unknown, associated with high levels of hCG, estrogen and thyroxine
      i. Severe cases lead to malnutrition and vitamin deficiencies (Wernicke's encephalopathy)
      ii. Intractable retching predisposes to oesophageal trauma and Mallory-Weis tears
   c. **Risk factors:** multiple gestation, hydatidiform mole, nulliparity, migraine headaches, GERD
   d. **Clinical features**: nausea, vomiting, signs of dehydration, hypersalivation, orthostatic HoTN, malnourishment
   e. **Diagnosis**: clinical diagnosis, electrolyte imbalance (hypokalemia and hypochloremic metabolic alkalosis or metabolic acidosis,) signs of dehydration(↑hematocrit), ketonuria
   f. **Treatment**: IV fluid replacement (normal saline or lactated ringers), electrolyte & thamine supplement, antiemetics (phenothiazides)
   g. Complications:
      i. **Maternal:** hypokalemia, wernickes encephalopathy (because of thiamine def due to malnutrition)
      ii. **Fetal:** IUGR, low birthweight, preterm birth
2. **GERD**: very common.
   a. **Etiology:** ↑ abdominal pressure +↓ LES tone
   b. **Symptoms:** recurrent heartburn (pyrosis), regurgitation & epigastric pain/discomfort.
   c. **Treatmen**t: Smoking cessation, light meals, avoid fully lying down, avoid alcohol
      i. **Pharmacological:** OTC antacids (calcium carbonate), PPIs (omeprazole), H2 antagonists (ranitidine)
3. **Constipation**: results from a combination of hormonal and mechanical factors that slow gut motility
   a. **Etiology:** ↓peristalsis, ↓water absorption, Fe supplementation
   b. Diagnosis:
      ii. History (dietary habits, medications, defecations).
      iii. DRE (to exclude fecal impaction) + Lab tests (for TFTs, DM, Ca+, K+).
      iv. Flexible Sigmoidoscopy in case of suspicion of anorectal lesions.
   c. **Treatment**: drink lots of water, ↑ physical activity, high fibre diet (fruits, veg, whole grain), lactulose, bulk-forming laxatives (psyllium)
4. **Haemorrhoids**:
   d. **Etiology:** ↑progesterone, pressure on rectal veins by gravid uterus, ↑ circulating volume (↑CO)
   e. **Treatment:** local anaesthetic(lidocaine)/ anti-irritant creams + high fibre diet
5. **Intra-hepatic cholestasis of pregnancy**: is a common pregnancy associated liver disease, mostly manifesting in the 2nd and 3rd trimesters with pruritus and elevated serum bile acid levels.
   i. **Clinical features**: Pruritus and jaundice
   ii. **Diagnosis**: ↑ total serum bile acid levels in a patients with pruritus in the 2nd or 3rd trimester is diagnostic for the disease. LFTs (↑ AST, ↑ALT) may be altered.
   iii. **Treatment**: 1st line is **ursodeoxycholic acid**. Consider **1st generation antihistamines** (hydroxazine) for pruritus and **glucocorticoids** for lung maturation if premature birth is anticipated
   iv. **Complications**: Loss of pregnancy, fetal growth restriction, premature labour and still birth

6. **Acute fatty liver of pregnancy**: idiopathic, rare, life-threatening obstetric emergency characterized by extensive fatty liver infiltration, which can result in acute liver failure.
    i. **Clinical features**: Sudden onset of jaundice, RUQ pain, N/V, coagulopathy, hypoalbuminemia and ascites, encephalopathy
    ii. **Diagnosis**: LFTs (↑ AST, ↑ALT, hyperbilirubinemia), hyperurecemia, hypoglycemia, coagulopathy (↑PT/aPTT), US (hyperechogenic fatty liver)
    iii. **Treatment**: Stabilization and immediate delivery regardless of the gestational age
    iv. **Complications**: ALF, acute renal failure, encephalopathy and death (both maternal and fetal)
7. **Acute viral hepatitis**: Viral hepatitis E is associated with an increased risk of fulminant hepatitis in pregnant women.

18. Diabetes in pregnancy

Gestational diabetes mellitus: impaired glucose tolerance diagnosed during pregnancy

- **a. Pregestational DM:** T1DM/T2DM diagnosed prior to pregnancy. Ass w/ significantly ↑ risk of maternal complications during pregnancy and delivery and congenital malformations.

1. **Epidemiology:** occurs in 5-9% of all pregnancies. Usually in the 2nd and 3rd trimester
2. **Risk factors:** same as T2 DM (BMI >30, obesity, PCOS, age>30, smoking, family history of DM, dyslipidaemia, physical inactivity)
   - **a. Obstetric risk factors:** GDM prior to pregnancy, recurrent pregnancy loss, at least 1 birth of child w/ fetal macrosomia
3. **Pre-pregnancy advice** to optomize diabetes**:**
   - **a.** Optimization of glycaemic control to achieve an HbA1c of <42 mmol/mol without inducing hypoglycaemia.
   - **b.** High-dose folic acid (5 mg daily) to reduce the risk of neural tube defects.
   - **c.** Planning periconception adjustments to other medications such as statins and angiotensin-converting enzyme (ACE) inhibitors before pregnancy.
4. **Pathophysiology**:
   - **a.** Insulin requirement varies during pregnancy
   - **b.** In the first trimester, insulin sensitivity increases → hypoglycaemia
   - **c.** The the 2nd and 3rd trimester → hormonal changes trigger progressive insulin resistance → hyperglycemia (particularly after mealtimes)
5. **Clinical features:** mothers are usually asymptomatic, may present with edema.
   - **a. Warning signs for fetus include:** polyhydramnios or large for gestational age infants (>90th percentile)
   - **b. Maternal morbidity: pre-eclampsia**, diabetic retinopathy, nephropathy, neuropathy, chronic HTN, CVD (↑risk of IHD), ↑ **risk of infection**, severe hyper/hypoglycaemia, DKA
   - **c. Fetal morbidity:** miscarriage, ↑ risk for congenital malformation (cardiac or neural tube defects), **fetal macrosomia**, traumatic birth, **shoulder dystocia**, stillbirth, IUGR
6. **Maternal-fetal metabolism in diabetes:**
   - **a. Surging maternal and fetal glucose levels → hyperglycemia → stimulation of fetal pancreas →**
     - **i. Fetal hyperinsulinemia**
       1. **Macrosomia:** fetal hyperinsulinemia → promotes excess nutrient storage → **macrosomia**
     - **ii. Fetal hypoxia:** energy expenditure ass w/ the conversion of excess glucose into fat → **depletion in fetal oxygen levels**
     - **iii. ↑ Metabolic effects and oxygen demands**
       - **a.** Fetal hypoxia induces catecholamines synthesis → HTN & stimulation of EPO → **polycythaemia**
       - **b.** Polycythaemia (hct>65%) occurs in 5-10% of newborns of diabetic mothers.
7. **Screening and diagnostics**:
   - **b. NICE guidelines:** diagnosis of GDM with a **fasting glucose ≥ 5.6 mmol/l** and/or a **2 hour (post-75 g glucose load) of 7.8 mmol/l**
     - **i.** Screening with a fasting glucose or HbA1c should be offered 6–13 weeks after childbirth (exclude development of T2DM after pregnancy)
   - **c. 2nd trimester (24-28 weeks)**: recommended in all pregnancies
     - **i. Early screening (prior to 24weeks):** recommended in women with high risk factors for GDM
     - **ii. Initial screening:** 50g, one-hour oral glucose challenge test
       1. Blood glucose should be <7.8mmol/L

iii. **Confirmation test:** 100g, three-hour OGTT >7.8mmol/L

iv. **Cz screening programme**:

1. 75g 2hr-OGTT**:** normal <7.5mmol
2. Fasting plasma glucose >7.0mmol/L = DM
3. Random plasma glucose >11.1 = DM

8. **Treatment**:

a. **Glycemic control:** dietary modification and regular exercise (walking), strict blood glucose monitoring (x4-6/day)

b. **Insulin therapy:** 50% long-acting insulin before bed + 50% short acting insulin before meals (bolus)

i. **Start if pre**-meal glucose >6mmol/L

ii. **Post**-prandial glucose >7.5mmol/L

c. **Fetal US:** assess fetal size every 4-6 weeks from 26-36 weeks

i. Macrosomia may need c-section to avoid complications such as shoulder dystocia etc.

d. **Complete assessment of vulnerable systems: cardiovascular, renal & ophthalmologic**

i. Labs in 1st trimester**:** HbA1C, RFTs, TFTs, urine dipstick

ii. Labs in 2nd trimester**:** 24hr urine collection, RFTs, LFTs, urate levels, CBC, OGTT

19. Rhesus isoimmunization

Hemolytic disease of the newborn is a condition characterized by blood group incompatibilities between the mother and fetus that lead to the destruction of fetal RBCs and subsequent anemia. It is commonly caused by a **Rhesus (Rh) or ABO incompatibility** between the mother and fetus. Other blood incompatibilities (eg. Kell blood group incompatibility) and other conditions not caused by RBC alloimmunization (eg. Congenital heart defects) can also cause HDN.

a. **Etiology**:
   i. ABO incompatibility: present in ~20% of all pregnancies. However, only 5-10 % of newborns from these pregnancies are symptomatic.
   ii. Rh incompatibility: rare following routine anti-D prophylaxis.
   iii. Kell group system incompatibility: 2nd most common cause of severe HDN after Rh disease.

b. **Risk factors**: Any condition that predisposes to maternal exposure to fetal blood during pregnancy can cause HDN:
   i. Antenatal procedures → amniocentesis, caesarean delivery, termination of pregnancy
   ii. Pregnancy related complications → ectopic pregnancy, placental abruption, placenta praevia
   iii. Trauma

c. **Pathophysiology**:
   i. **ABO incompatibility**: Mother with blood group O (highest risk in this blood group) has anti-A and anti-B Ab (even if sensitization hasn't happened)→ these Ab may cross the placenta and cause HDN (especially IgG Ab)
   ii. **Rh incompatibility**:
      - In **Rh- mothers with Rh+ newborns** → maternal exposure to fetal blood (fetomaternal hemorrhage) → production of maternal IgM Ab against the Rh antigen → seroconversion to anti-Rh IgG.
      - In subsequent pregnancies with Rh+ newborn (the first newborn is not affected)→ rapid production of anti-Rh Ab → Abs cross the placenta → Anti-Rh Ab agglutinate fetal RBCs → risk of hemolysis, fetal hydrops and death.
   iii. **Kell blood system group**: The Kell blood group system includes K1, K2, KPa, KPb, Jsa, Jsb antigens and it is responsible for 10% of severe cases of HDN.
      - Similar mechanism of Rh incompatibility.
      - Maternal exposure to Kell antigen in previous pregnancy through placenta or blood transfusions → sensitization and production of mater anti-Kell Ab → Ab enter Kell positive fetus → destruction of fetal RBCs and RBC precursors → ↓ RBCs production and ↓ hemolysis → severe anemia.

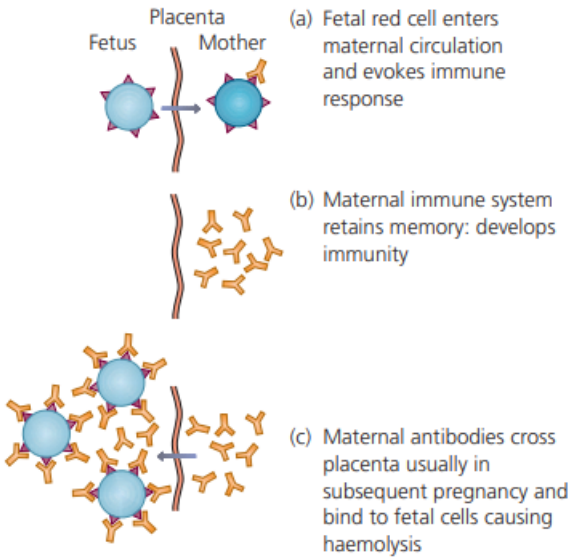


Fig. 22.2 The mechanism of red cell isoimmunization.

d. **Clinical features**:
   i. **Prenatal**: Hydrops fetalis (fetal condition characterized by generalized edema and accumulation of fluid in serous cavities – eg. pleural effusion, pericardial effusion. Diagnosed by US).
   ii. **Postnatal**:
      - **Neonatal anemia** (Hb <10mg/dl → due to rapid AB-fetal RBC breakdown)
      - **Hepatosplenomegaly** (↑ RBC destruction in the spleen → ↑ erythropoiesis in the liver)
      - **Neonatal jaundice** (Present at birth or within 24 hours. In Rh incompatibility, unconjugated levels of billirubin may be high enough to cause kernicterus → long-term sequela include hearing impairments, movement disorders, intellectual disability and dental enamel hypoplasia).
      - **Hypoxia**

- **Prematurity**

e. **Diagnostics**: Diagnosis of HDN requires evidence of hemolysis in the presence of fetomaternal blood incompatibility.
   i. **Prenatal**: US examination
      - US can be used to determine the **presence of hydrops** (hydrops may indicate hemolysis. US findings include fetal pleural, pericardial effusion and fetal ascites).
      - **Doppler US** of fetal middle cerebral artery shows increased flow rate (→anemia).
   ii. **Postnatal**: If the infant has signs of hemolysis (anemia, jaundice, hepatosplenomegaly) → conduct a combs test.
      - Rh incompatibility → positive result
      - ABO incompatibility → mildly positive or negative

f. **Treatment**:
   i. **Prenatal**: **Intrauterine blood transfusions** via the umbilical vein or artery.
   ii. **Postnatal**:
      - Anemia → **Iron supplementation** and, if necessary, **RBC transfusion**.
      - Hyperbillirubinemia → **phototherapy, exchange transfusion**
      - **IVIG** can be used in severe cases.

g. **Prevention**:
   i. **Screening**: Rh positive mothers do not require screening. Screening for Rh negative mothers:
      - **Anti-D Abs screening** is performed at the **booking visit**, **28 weeks of gestation** and **at delivery**.
      - If Abs are found → **fetal genotype** needs to be assessed (either via assessment of paternal genotype or based on Fetal cell free DNA on maternal blood)
      - **Fetomaternal hemorrhage in Rh – mother → Rosette test** or **Kleihauer-Betke test** (qualitative tests to assess whether fetomaternal hemorrhage has occurred)
      - **Fetal Rh genotyping**
   ii. **Prophylaxis**: **Anti-D prophylaxis** protects newborns in subsequent pregnancies. It is only indicated in **unsensitised mothers**. It acts by binding to fetal RBCs D antigens that have gained acess to the maternal blood and by preventing recognition by the mother's immune system.
      - **Indications**: Anti-D Ab should be administered to Rh- mothers **if the Rhesus status of the fetus is unknown or if the fetus is Rh+** during the **28th week of gestation** and **within 72 hours of any sensitizing event (including following the birth of an Rh+ babe**).
      - **Other indications: miscarriage**, **ectopic pregnancy**, **termination of pregnancy**, **bleeding during pregnancy**, **following invasive procedures** (amniocentesis, CVS) and **ECV**.

20. <u>Stillbirth</u>

Stillbirth is defined as the spontaneous loss of pregnancy **after 20 weeks of gestation** (also called intrauterine fetal demise). Women who have had one stillbirth are much more likely to experience another.

a. **Etiology**:
   i. **Maternal causes**:
      - Pre-existing maternal disease (DM, autoimmune diseases and SCD).
      - Pregnancy related maternal diseases (hypertensive pregnancy disorders, gestational diabetes).
      - Fetal-maternal hemorrhage, uterine rupture
      - Advanced age and heavy smoking
   ii. **Fetoplacental causes**:
      - Chromosomal and congenital abnormalities
      - IUGR (most commonly due to placental insufficiency),
      - Placental abnormalities (placental abruption, vasa praevia),
      - Infection (Bacterial by GBS or viral by parvovirus and CMV).
      - Intrapartum stillbirth is primarily associated with hypoxia.
b. **Clinical features**: Still birth is characterized by **absence of fetal movements and cardiac activity**.
c. **Diagnosis**:
   i. **US**: Confirms death of the fetus based on cessation of fetal heart activity.
   ii. Various tests are indicated to ascertain the cause of death:
      - Maternal and family history
      - Examination of the placenta, fetal membranes and umbilical cord (both gross and pathological examination)
      - Fetal autopsy
      - Genetic analysis
d. **Treatment**: Do not rush delivery unless maternal health is at risk.
   i. Spontaneous labour usually starts within 2 weeks of intrauterine fetal death.
   ii. Labour may be induced with oxytocin if maternal disease develops (eg. coagulation abnormalities). Vaginal delivery is safer than C-section.
   iii. Express empathy and acknowledge the patient's grief. Patients should be offered a fetal autopsy to determine cause of death.
e. **Complications**: The major complications are **retained products of conception** and **endometritis**.

21. <u>Placental, umbilical cord, amniotic fluid disorders</u>

1. **Disorders of Placenta**
    a. **Placenta Previa**:
        i. **Definition:** placenta either partially or completely covers the internal os
        ii. **Risk factors:** maternal age >35, multiparity, short intervals between pregnancies, previous curettage or C-section, previous placenta previa
        iii. **Types**:
            1. **Type I (low lying):** The placenta encroaches on the lower segment of the uterus but does not cover the internal cervical os.
                a. Lower edge of the placenta lies less than 2cm from internal cervical os
            2. **Type II (marginal):** The placenta reaches but does not cover the internal cervical os.
            3. **Type III (partial):** The placenta partially covers the internal cervical os.
            4. **Type IV (complete:)** The placenta completely covers the the internal cervical os.
        iv. **Clinical features:** Sudden, painless, bright red vaginal bleeding, self-limiting
    b. **Placental abruption**:
        i. **Definition:** partial or complete separation of placenta from uterus prior to delivery
        ii. **Risk factors:** Hypertension (most common cause), Preeclampsia/eclampsia, Abdominal trauma, Twin pregnancy, PPROM, Previous abruption, chorioamnionitis, short umbilical cord, Maternal age**:** < 20 years and > 35 years, alcohol and cigarette consumption, cocaine use
        iii. **Clinical features**:
            1. **Maternal:** Sudden onset of continuous vaginal bleeding, Concealed abruptio placentae, Sudden onset of abdominal pain or back pain,Uterine tenderness, Uterine contractions
            2. **Fetal:** Acute placental insufficiency leads to fetal hypoxia and subsequent bradycardia, Possible diminished or absent fetal movement
    c. **Placenta variants:**
        i. **Placenta succenturiate:** variation of placental morphology with one or more accessory lobes developing separately from main placental body
            1. **Complication:** vasa previa**:** a condition in which fetal vessels are in the membranes near the internal os of the cervix
            2. **Treatment:** c-section birth prior to ROM to avoid bleeding in vaginal birth
        ii. **Placenta biptita/trupartita:** presence of 2 or 3 lobed placenta. Main clinical impact is after delivery, 1 may retain in utero after delivery
        iii. **Circumvallate placenta:** a small central chorionic plate
        iv. **Battledore placenta:** placenta where the cord is inserted marginally
    d. **Abnormal placental separation:**
        i. **Retained placenta:** Retention of placental tissue inside the uterine cavity
            1. **E:** atonic uterus, premature closure of cervix
            2. **Risk factors:** prior history of retained placenta, placenta previa, prior c-section, uterine fibroids, uterotonic use, preterm labor, IVF
            3. **Classification**:
                a. **Adherent:** placenta not detached because of insufficient uterine contraction
                b. **Trapped:** detached placenta that cannot be delivered spontaneously or with light cord traction b/c of cervix closure
            4. **Clinical features:** severe bleeding before placental delivery
            5. **Diagnosis:** postpartum manual palpation and speculum inspection**, US:** shows focal endometrial mass

6. **Treatment:** manual removal of placenta or suction curettage

ii. **Abnormal placentation:** defective decidual layer of the placenta leading to abnormal attachment and separation during postpartum period

1. **Classification:** depend on the depth of implantation of the trophoblast in the uterine wall
    a. **Placenta accrete:** chorionic villi **attach** to the myometrium (but do not penetrate the myometrium) rather than the decidua basalis (up to 75%)
    b. **Placenta increta:** chorionic villi will **invade** or penetrate into the myometrium
    c. **Placenta percreta:** chorionic villi **perforate** the myometrium, penetrate the serosa, in some cases adjacent structures
2. **Pathophysiology:** non known. 2 theories include**:**
    a. Defective decidua**:** complete or partial lack of decidua in an area of previous scarring within the endometrial myometrial interface
    b. Excessive trophoblastic invasion**:** abnormal growth → uncontrolled invasion of villi through the myometrium, including the vascular system
3. **Risk factors:** history of uterine surgery (endometrial ablation, hysterectomy etc), prior c-sections, placenta previa, multiparity, advanced maternal age
4. **Clinical features:** abnormal uterine bleeding, PPH
5. **Diagnosis:** abnormal placental attachment is usually detected during prenatal screening
    a. **US:** thinning of uterine myometrial wall, placental lacunae, disruption of junction between the bladder wall and uterine serosa, loss of clear space behind the placenta
    b. **Doppler US** (confirmatory testing)**:** shows turbulent blood flow (seen as interrupted colour flow)
6. **Treatment**:
    a. Prevention of predelivery**:** scheduled delivery, avoid pelvic exams, avoid sex, preop planning for PPH
    b. D & C or vacuum removal of retained products of conception
    c. Cesarean hysterectomy**:** after failed attempts for placental detachment, persistent bleeding or prostaglandin resistance

2. Umbilical cord disorders:

a. Umbilical cord prolapse: condition in which part of the umbilical cord lies between the fetal head and pelvic wall causing rupture of membranes and acute,life threatening hypoxia to fetus

i. Usually occurs during ROM

ii. Mechanism of fetal hypoxia by cord prolapse:

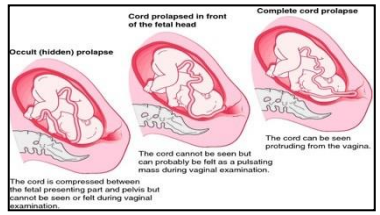
1. Occlusion of umbilical cord
2. **Vasospasm (exposure to the cord to the cold atmosphere)**

iii. **Risk factors:** breech presentations, multiple pregnancy, long umbilical cord or abnormal fetal movement, polyhydramnios, prematurity

iv. The risk of cord prolapse is high if fetal head does not engage correctly in the true pelvis, allowing the umbilical cord to slide through

v. **Types**:

1. **Overt (m/c):** umbilical cord descends before the presenting part and is lower than the presenting part inthe pelvis
2. **Occult:** umbilical cord has not advanced past presenting fetal part. Lis just below the presenting part, butnot beyond i
3. **Cord:** prolapsed cord lies just below the presenting part and adjacent to it



vi. **Diagnosis:** thick, pulsating cord is palpable on vaginal examination, doppler US

vii. **Treatment**: Intrauterine resuscitation

1. Position that reduces cord compression
2. Manual elevation of fetal head (presenting part)
3. Knee-chest position- relive pressure off the cord
4. If uterine tachysystole present (>5 contractions in 10 min)**:** administer tocolytics(terbutaline)
5. Emergency caesarean delivery

b. Short and long umbilical cord:

i. **Average length = 55cm**
ii. **Short (<35cm):** limit fetal movement in utero, associated w/ placental abruption & cord rupture, may cause inability for vaginal delivery
iii. **Long (>80cm):** associated w/ fetal entanglement, true knots, and thrombosis

c. Velamentous cord insertion:

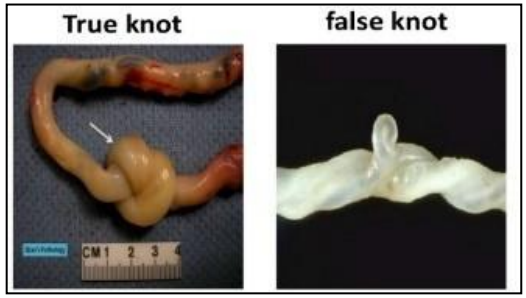
i. Abnormal cord insertion into chorioamniotic membranes → exposed vessel surrounded by only thin fetal membrane
ii. ↑ risk of antepartum haemorrhage (vessels are torn upon ROM)
iii. Complications: LBW, prematurity, abnormal FHR at birth
iv. Management: monitor fetal growth in 3rd tri. Consider c-section to avoid bleeding upon ROM.

d. Vasa Previa:

i. Definition: condition in which fetal vessels are located in the membranes near the internal os of the cervix, putting them at risk of injury if themembrane ruptures
ii. Risk factors: Placental anomalies (velamentous umbilical cord insertion, bilobate placenta), multiparity, low lying placenta
iii. Clinical features: painless vaginal bleeding suddenly after ROM
iv. Diagnosis: TVUS w/ doppler
v. Treatment: emergency cesarean section if signs of fetal distress (bradycardia, decelerations, FHR)

e. Cord knots:

i. Risk factors: advanced maternal age, multiparitty, and long umbilical cords
ii. True knot vs false knot.



f. Nuchal cord:

i. Cord encircles the neck. Single cord observed in ~20% of births. Multiple cord loops around neck <1% births
ii. Most often caused by activity/turning of fetus
iii. **Symptoms:** facial paleness/petechia, subconjunctival bleeding
iv. **Types**:
    1. Type A**:** free – wrapped around neck but is free sliding
    2. Type B**:** locked – ends up as a true knot
v. **Main complications**:
    1. Compression of cord vessels → fetal hypoxia
    2. Impaired cerebral blood flow (severe looping)

g. Cord stricture: constriction of umbilical cord of unknown etiology

i. May lead to insufficient fetal perfusion → stillbirth

3. Disorders of amniotic fluid and membranes:

a. **MSAF:** presence of meconium in the amniotic fluid. Relatively common.
   - **i.** MSAF has 3 implications:
     1. It may suggest fetal stress (□ relaxation of the anal sphincters), esp. hypoxia.
     2. It may be a physiological finding (e.g. in breech presentation).
     3. It may lead to meconium-aspiration syndrome (2-6% of MSAF cases)
   - ii. **Complications:** airway obstruction, surfactant dysfunction, chemical pneumonitis, PPHN (persistent pulmonary hypertension of the newborn
b. **Chorioamnionitis**: infection of the amniotic fluid. Most commonly due to ascending cervicovaginal bacteria.
   - i. **Etiology:** Ureaplasma urealyticum (50%), mycoplasma hominis (30%), Gardenella vaginallis, bacteriodes, GBS, E.Coli
   - ii. **Risk factors**: prolonged labour, PROM, poor maternal hygiene
   - iii. **Clinical features:**
     1. **Maternal:** fever (>38 degrees), tachycardia (>120bpm), uterine tenderness, foul smelling purulent discharge
     2. **Fetal:** tachycardia>160bpm in CTG
   - iv. **Complications:** maternal sepsis, fetal early-onset sepsis, fetal death, premature birth
   - v. **Diagnosis**:
     1. Leucocytosis > 15000 cells/ microL, ↑ CRP
     2. **Bacterial culture** from urogenital secretion
     3. **Amniocentesis -** amniotic fluid (most reliable, but rarely conducted)
     4. **GBS screening** – cervicovaginal and rectal swabs
   - vi. **Treatment**:
     1. **Maternal ABX therapy:**
        - IV ampicillin PLUS gentamicin (vaginal birth)
        - V ampicillin and gentamicin PLUS clindamycin (caesarean delivery)
     2. **Delivery** – swift delivery indicated to minimize complications for both mother and fetus
     3. Caesarean not generally indicated but often necessary b/c of obstetric complications (insufficient contractions)
c. Oligohydramnios: Condition where the amount of amniotic fluid is less than expected for gestational age (less than 500mL)
   - **i. Etiology**: ↓ URINATION
     1. **Fetal anomalies:** urethral obstruction, bilateral renal agenesis, ARPKD, TORCHEs infections(intrauterine)
     2. **Maternal conditions:** placental insufficiency, late or post term pregnancies, PROM, preeclampsia
   - ii. **Signs:** fewer fetal movements, smaller uterine size
   - iii. **Diagnosis**:
     1. **US** → largest liquid pool is less than 2cm
     2. **Amniotic fluid index** (AFI)**:** a semiquantitative tool used to assess amniotic fluid volume (normal**:** 8-18cm)
        - Oligohydramnios**:** <5
     3. Visualization of emptying of fetal bladder to rule out urinary tract abnormality
   - iv. **Treatment:** Amnioinfusion (infusion of fluid into amniotic cavity through amniocentesis), treat underlying cause, delivery is advised close to term
   - v. **Complication**:
     1. Compression by the uterus on the fetus → IUGR,

2. Compression of the uterus on the cord → umbilical cord compression,
5. **Potter sequence:** oligohydramnios→ uterine compression and ↓ amniotic fluid ingestions →↓ space for fetal development → internal andexternal deformations
    - Low set ears, beaked nose, prominent epicanthic folds and downward slant eyes
    - Pulmonary hypoplasia → respiratory failure
    - Limb deformities (bowed legs, clubbed feet)
    - **POTTER: P**ulmonary hypoplasia (lethal), **O**ligohydramnios (origin), **T**wisted facies, **T**wisted skin, **E**xtremity deformities, and **R**enal agenesis (classic form)

d. Polyhydramnios: Condition characterized by excessive amniotic fluid volume expected for gestational age (more than 2000mL) that results in uterine distention.

i. Etiology:

1. ↓ fetal swallowing**:** TEF (tracheoesophageal fistula), duodenal atresia, IUGR, TORCHeS
2. ↑ fetal urination**:** GDM → fetal hyperglycemia → fetal polyuria
3. Others**:** Rh issoimmunization, placental chorioangioma, multiple pregnancy (Twin-to-twin transfusion syndrome)

ii. **Clinical features:** maternal abdominal distention, nausea, heartburn

iii. **Diagnosis**:

1. **PE:** abdominal girth and uterine size large for gestational age
2. **US:** AFI >25, assess for fetal anomalies
3. Others**:** Rh screen, blood glucose

iv. **Treatment**:

1. All patients should get regular biophysical profile with nonstress test
2. **Amnioreduction:** drainage of excess amniotic fluid
    - **Indications:** severe abdominal discomfort, uterine irritability, severe SOB
    - **Complication:** preterm labor, PROM
6. **Treat underlying condition:** glycaemic control in GDM, intrauterine exchange transfusion in HDFN

v. **Complications:** Cord prolapse, PROM, PTB, fetal malposition

22. Intrauterine growth retardation (IUGR)

IUGR is the pathologic intrauterine restriction of fetal growth.

1. **Birth weight**: normal birth weight is 2.5-4.5kg. It only describes the weight of the newborn: a. Low (1500-2500g) b. Very low (1000-1500g) c. extremely low (<1000g)
2. **Size for gestational age:**
   a. **Small for gestational age (SGA):** birthweight **<10th percentile** for gestational age (hypotrophic newborn)
   b. **Appropriate for gestational age (AGA):** birth weight **b/w 10-90th percentile** for gestational age
   c. **Large for gestational age (LGA):** birth weight **>90th percentile** for gestational age
3. **Risk factors:** can be divided into **maternal, placental** and **fetal**
   a. **Maternal:** malnutrition, anaemia, substance abuse (smoking, alcohol, cocaine), chronic disease (HTN, renal disease, autoimmune disease)
   b. **Placental:** placenta previa/acreta, placental abruption (all cause placental insufficiency)
   c. **Fetal:** congenital infection (TORCHES), multiple gestation, chromosomal syndromes, congenital malformations
4. **Types**:
   a. **Symmetric:** height, weight and head circumference are **equally** affected
      i. Caused by **intrinsic factors** (e.g. aneuploidy, early intrauterine infection) that affect the fetus in the **early stage of gestation** (1st trimester)
   b. **Asymmetric:** height, weight, and head circumference are **unequally** affected → normal head, but small and thin body and limbs
      ii. Caused by **extrinsic factors** (e.g.. placental insufficiency) that affect the fetus in the **later stages of gestation** (2nd or 3rd tri.)
5. **Clinical features**:
   a. **Fetal signs:** SGA, decreased or absent fetal movements, asymmetric/ symmetric
   b. **Maternal signs:** mostly asymptomatic, ↓ symphysis-fundal height, small uterus
6. **Diagnosis:** fetal US measurement, fundal height measurement, oligohydramnios
7. **Treatment**:
   a. Treatment of underlying condition
   b. If there are signs of nonreassuring fetal status**:** perform immediate c-section
8. **Complications**:
   a. **Perinatal asphyxia:** placental insufficiency → IUGR → contraction during delivery compresses the placental arteries → ↓ O2 even more → asphyxia
   b. **Low birth weight** (<2500g) with ↑ risk of sudden infant death syndrome
   c. **Hypoglycemia:** low glycogen storage and ↓ gluconeogenesis and ketogenesis
   d. **Hypothermia:** impaired thermoregulation due to ↓ subcutaneous fat, ↓ brown fat and ↑ surface to volume ratio
   e. **Stillbirth**
   f. **Preterm labor**

23. <u>Cervical incompetence, cerclage</u>

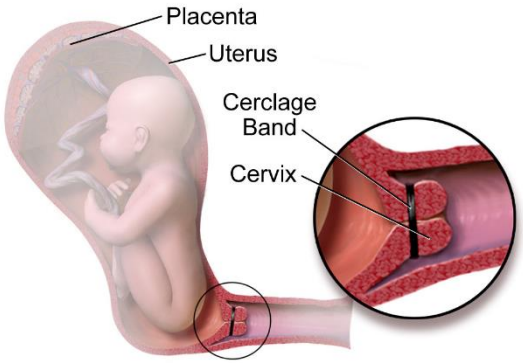
Cervical incompetence or **insufficiency** refers to the painless dilation of the cervix in the second trimester, which occurs in the absence of uterine contractions and/or labour. Most cases of the disease are idiopathic.

a. **Risk factors**:
   i. History of midtrimester pregnancy loss and/or preterm labour
   ii. Previous gynecological or obstetrical trauma to the cervix (eg. termination of pregnancy, rapid delivery, multiple gestations or cervical conization)
   iii. Short cervical length (transvaginal cervical length < 25 mm before 24 weeks of gestation)
   iv. Cervical CT weakness (eg. in Ehlers-Danlos syndrome)
   v. DES exposure

b. **Clinical features**: Presents as a **painless dilation of the cervix** with or without membrane prolapse. Pelvic cramps, backache and changes in vaginal discharge may also occur.
   - Important risk factors for pregnancy loss or preterm labour.

c. **Diagnostics**:
   i. **Clinical diagnosis** (based on speculum examination and detection of dilation) before 24 weeks of gestation
   ii. **TVUS**: Used to assess the cervical length. Small cervical length before 24 weeks of gestation is abnormal (after 24 weeks the cervix normally reduces in length).

d. **Management**:
   i. In women with risk factors → serial cervical US monitoring between 16-24 weeks of gestation
   ii. **Cervical cerclage**: refers to the placement of a supportive suture in the Cervicovaginal junction to prevent early pregnancy loss or preterm birth.
      - **Methods**:
         1. **McDonald's cerclage** → removable suture in the cervix that allows vaginal delivery. Removal is performed between 36-37 weeks.
         2. **Shirodkar cerclage** → permanent suture placed in the cervical submucosal tissues. Caesarean delivery is necessary.
      - **Timing**: Cerclage placement is performed before 24 weeks of gestation (mostly between 13-16 weeks).
      - **Indications**:
         1. Multiple previous preterm births or pregnancy losses in the second trimester.
         2. Previous preterm birth and current US diagnosis of a shortened cervix (<25 mm <24 weeks).
         3. Painless cervical dilation on inspection at <24 weeks of gestation.
         4. Prior cerclage placement.
      - **Contraindications**: Preterm labour, PROM, >24 weeks of gestation, vaginal infection.
   iii. **Progesterone supplementation**: Vaginal or IM progesterone administration in women with no history of preterm birth.



Cerclage Correction of the Cervix

24. <u>Multiple pregnancy (aetiology, incidence,antepartum management)</u>
25. <u>Multiple pregnancy (management of labour, perinatal outcome)</u>

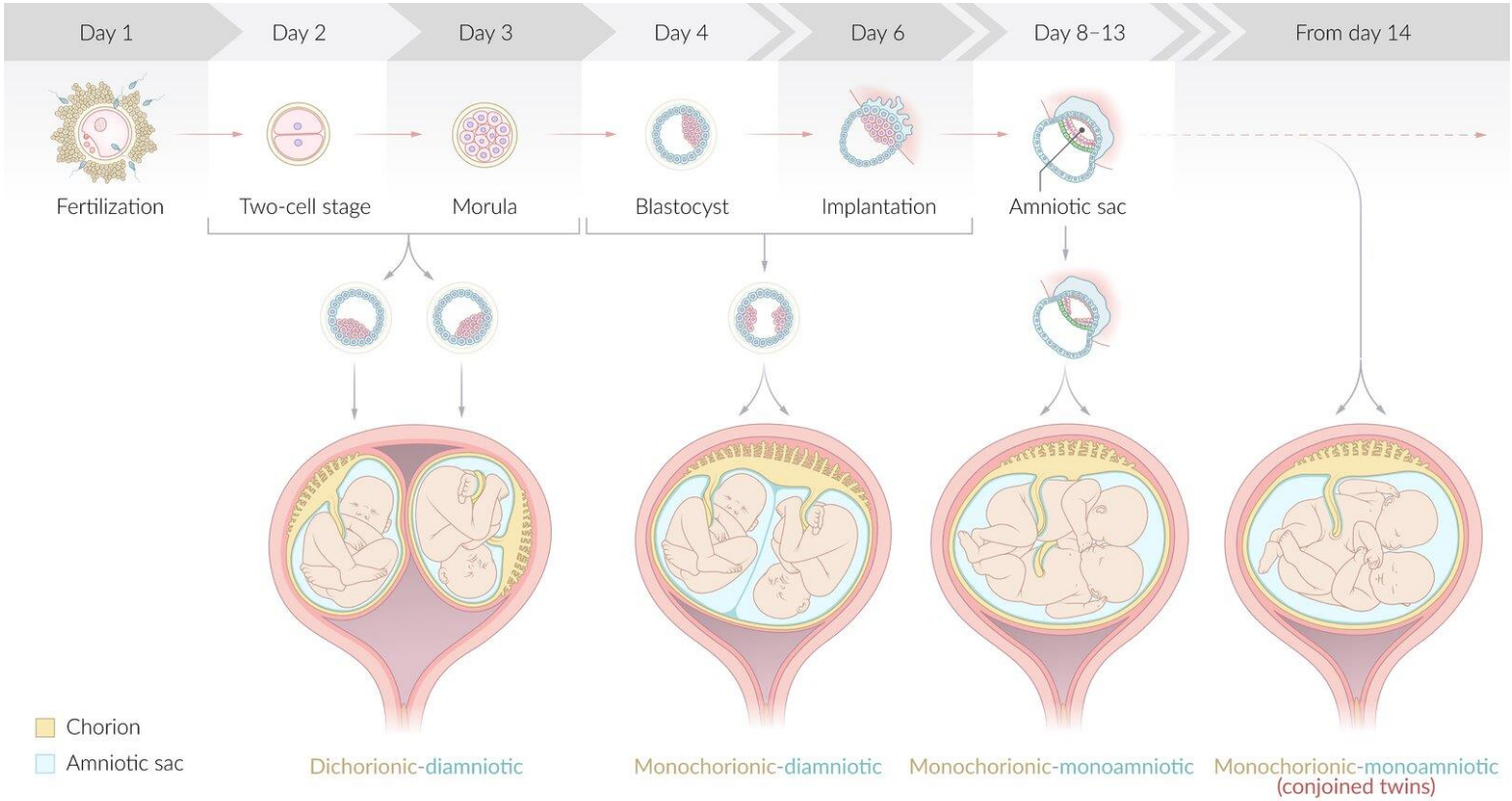
Multiple pregnancy refers to pregnancy with two or more foetuses. Twin pregnancies can be divided into **monozygotic twins** (derived from the division of the fertilized oocyte into two embryonic layers) and **dizygotic twins** (that arise from the fertilization of two oocytes by two spermatozoa).

a. **Epidemiology**: Twins occurs 1 in every 80 pregnancies and triplets 1 in a 1000 pregnancies. The incidence of multiple pregnancy has increased since the 1980s as assisted reproductive technology has become readily available (eg. about 20% of IVF conceptions are multiple).
b. **Etiology**:
    i. **Predisposing factor** → Advanced maternal age (>35 years), previous multiple pregnancies, high parity, use of assisted reproductive technology and maternal family history.
c. **Classification**: Multiple pregnancies are classified based on how the amniotic sac and placenta are divided among the foetuses, which is determined by US.
    ii. **Monozygotic vs Dizygotic twins**:

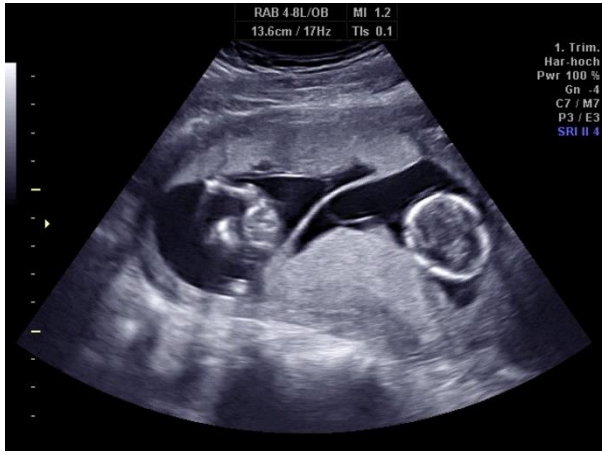
	Identical twins (monozygotic twins)	**Fraternal twins (dizygotic twins)**
Frequency:	1/3 of all twin pregnancies	2/3 of all twin pregnancies
Origin:	Division of the fertilized oocyte into two embryonic layers	Fertilization of two oocytes with two mature spermatozoa
Genetics of the individual:	Genetically identical	Genetically different
Chorionic cavity and amniotic sac	Varies	Dichorionic-Diamniotic

    iii. **Special features of monozygotic twins**: In monozygotic twins, there are various ways in which the amniotic sac and placenta are shared based on the timing of zygote division:

	Description:	**Time of zygote division:**	**Frequency in monozygotic twins:**
Dichorionic-Diamniotic	The twins have separate chorionic sacs (placentas) and separate amniotic sacs	**Within the first 3 days after conception**	~20-30%
Monochorionic-Diamniotic	The twins share one chorionic sac (placenta) but have separate, individual amniotic sacs	**Day 4-7 after conception**	~70%
Monochorionic-Monoamniotic	The twins share a single chorionic sac (placenta) and a single amniotic sac	**Day 8-11 after conception**	~1-5%
Monochorionic-Monoamniotic (conjoined twins)	The twins share the placenta and amniotic sac and are conjoined	**From day 12 of conception onwards**	<0.1%



d. **Diagnosis**: Diagnosis of multiple pregnancy is based on clinical examination and US findings.
   i. **Physical examination**: **Symphysis fundal height** and **abdominal girth** are unusually large for the gestational age. **Two or more heart rates** can be heard on auscultation.
   ii. **US**: Will display evidence of more than one fetus.
      - US allows differentiation between monochorionic and dichorionic twins in early pregnancy.
         1. Dichorionic twins (lambda sign) → Both chorionic cavities are separated from one another and this separation resembles a lambda symbol of US.
         2. Monochorionic twins (T sign) → Only of chorionic is present and each twin has an individual amniotic sac. Separation of the amniotic sacs resembles the letter T on US.



e. **Complications**: Almost all complications associated with normal pregnancies are more likely with multifetal pregnancies.
   i. **Maternal illness**: Preterm labour and birth, hyperemesis gravidarum, gestational diabetes, hypertensive pregnancy disorders, anemia, cervical incompetence, hypotrophy and intrauterine malnutrition of one fetus, uterine atony, prolonged first stage of labour.

ii. **Fetal illness**: All multiple pregnancies have higher risk of handicap of the foetuses.
- **Preterm labour** (main cause of perinatal mortality in multiple pregnancies).
- **Vanishing twin syndrome** (type of miscarriage characterized by death of the infant in the first trimester and disappearance of a twin on US).
- **Cord entanglement**:
- **Increased risk of neonatal morbidity** (IUGR, prematurity, cerebral palsy, congenital abnormalities) **and mortality**.
- **Twin-to-Twin transfusion syndrome (occurs in monochorionic twins)**: Condition where blood is continuously shunted from one twin to the other through vascular anastomoses on the shared placenta, posing risks to both foetuses. Affects 10-15% of monochorionic twin pregnancies.
    1. **Donor twin** (blood depleted) → anemia, growth retardation, hypovolemia and oligohydramnios (in diamniotic pregnancies).
    2. **Recipient twin** (blood overloaded) → Polycythemia, hypervolemia and polyhydromnios (in diamniotic pregnancies).
    3. Both twins are at very high risk of in utero death or preterm delivery.
    4. **Treatment**: Laser ablation using US and fetoscopy.
- **Twin reversed arterial perfusion (occurs in monochorionic twins)**: rare abnormality on MC twins. Here an abnormal, often acardiac fetus is perfused by a normal twin, which is therefore at risk of heart failure.
- **Co-twin death (occurs in monochorionic twins)**: If one of the twins in a MC twin pregnancy dies, the drop in blood pressure allows acute transfusion of blood from the other twin. This results in hypovolemia and, in 30% of cases, death or neurological damage.

iii. **Intrapartum complications**:
- **Malpresentation of the first twin (**occurs in 20%) → indication for C-section.
- **Fetal distress** is more common. The **2nd twin delivered** has **higher risk of death** due to hypoxia, cord prolapse, uterine contraction or placental abruption.
- **Post-partum hemorrhage** is more common.

f. **Management**:

i. **Prenatal care**: Multifetal pregnancies are considered to be **high-risk pregnancies** and require more frequent prenatal care visits. From the 32th week of gestation, **weekly prenatal visits**, including US, are indicated to monitor fetal growth and assess for IUGR.
- **Timing of delivery**: Delivery at 37 weeks is advised for dichorionic twins and at 36 weeks for uncomplicated monochorionic twins.
- **High order multiple pregnancy**: Selective reduction to a twin pregnancy at 12 weeks should be discussed (as it reduces the risk of preterm labour).
- **Fetal abnormalities**: When one of the twins has a fetal abnormality, selective termination should be discussed.

ii. **Childbirth**:
- **Vaginal delivery** → indicated when the first twin has a **cephalic presentation**.
- **Caesarean section delivery** → indicated when the fetus is a **breech** or **transverse lie**, with **higher order multiples** and if there have been **antepartum complications**.
- Since multiple pregnancies are considered **high risk** → **Intrapartum fetal assessment** with **CTG** is essential.

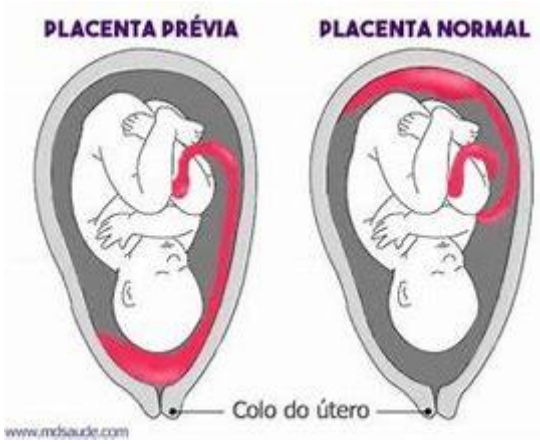
26. <u>Antepartum haemorrhage – placenta praevia</u>
27. <u>Antepartum haemorrhage – abruption placentae</u>

Antepartum hemorrhage refers to vaginal bleeding occurring after 20 weeks of gestation. It most commonly occurs during the 3rd trimester and is associated with significant fetal and maternal morbidity and mortality.

a. Etiologies:
- i. **Blood show associated with labour**: A small amount of blood mixed with cervical mucus passed prior to labour or in early labour.
- ii. **Placenta praevia**: Presence of the placenta in the lower uterine segment, which can lead to partial or full obstruction of the internal os.
- iii. **Placental abruption**: The partial or complete separation of the placenta from the uterus prior to birth.
- iv. **Stillbirth**: Pregnancy loss after the 20 weeks of gestation.
- v. **Cervical trauma**: Typically associated with sexual intercourse
- vi. Rarer cases include **vasa praevia** (condition in which the fetal vessels are located in the membranes near the internal os of the cervix, putting them at risk of injury if the membranes rupture) and **uterine rupture**.

b. Management of antepartum hemorrhage:
- i. If unstable → ABCDE approach and start immediate hemodynamic stabilization.
- ii. Conduct maternal and fetal status assessment.
- iii. Rh- mother → Administer anti-D immunoglobulin.
- iv. Severe bleeding, hemodynamic instability and fetal distress are indications for urgent delivery.
- v. Interventions for preterm labour may be initiated in stable patients (Induction of fetal lung maturity with corticosteroids → betamethasone).

c. Placenta praevia: Presence of the placenta in the lower uterine segment, which can lead to partial or complete obstruction of the internal cervical os. It is associated with a high risk of hemorrhage and birth complications. Affects ~0.5% of all pregnancies.
- i. **Risk factors**: Associated with poor vascularization of the upper portion of the placenta.
  - Maternal age >35, multiparity, previous curettage, C-section or placenta praevia, IU fibroids, smoking
- ii. **Classification**:
  - **Placenta praevia**;
  - **Low-lying placenta**: lower edge of the placenta lies less than 2 cm from the internal cervical os.
- iii. **Clinical features**: The lower uterine segment normally grows as part of gestation → disrupt placental blood vessels → vaginal bleeding
  - Sudden, painless, bright red vaginal bleeding. Possible signs of shock.
  - Usually occurs in the 3rd trimester (typically after 20 weeks)
  - Soft, non-tender uterus.
  - Usually no signs of fetal distress.
- iv. **Diagnosis**: Placenta praevia is diagnosed during **TAUS** or **TVUS** (as part of the normal prenatal care).
- v. **Treatment**:
  - **Placenta praevia detected on routine antenatal US**:
    1. Monitor placental placement. If the placenta praevia persists at ~32 weeks of gestations (it may regress in early pregnancy) → repeat



US at **36 weeks** and schedule **C-section delivery** between **36-37th weeks**.

- **Placenta praevia presenting as antepartum hemorrhage**: Immediate management of antepartum hemorrhage.
  2. > 37 weeks → immediate C-section delivery.
  3. < 37 weeks, consider **interventions for preterm labour** and **C-section**.

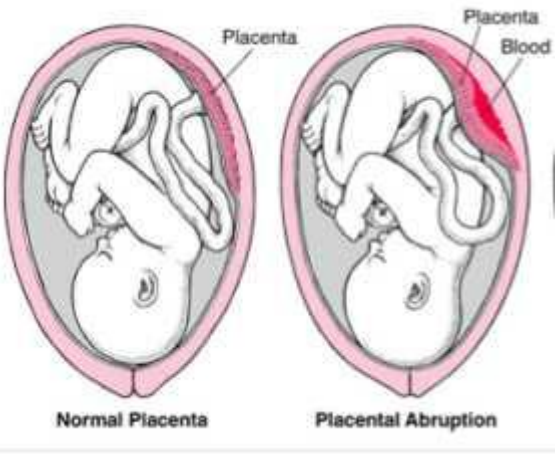
> In contrast to placental abruption, bleeding in patients with placenta previa is painless.

vi. **Complications**: Maternal blood loss, fetal hypoxia and preterm labour.

d. Placental abruption: The partial or complete separation of the placenta from the uterus prior to delivery. Subsequent hemorrhage occurs from both maternal and fetal vessels. Occurs in ~0.7-1.2% of pregnancies and mostly on the third trimester. Placental abruption is an **obstetrical emergency**.

i. **Risk factors**:
- Vascular changes → hypertension and preeclampsia/eclampsia.
- Abdominal trauma → car accident, falls, domestic violence.
- Twin pregnancy
- Sudden decrease in intrauterine pressure → PROM or delivery of the first child in multiple pregnancies.
- Previous abruption, chorioamnionitis.
- Alcohol, cigarrete, cocaine use.

ii. **Clinical features**:
- **Maternal symptoms**:
  1. Sudden onset of vaginal bleeding accompanied by abdominal pain
  2. Concealed abruption of the placenta → hemorrhage is retroplacental and no vaginal bleeding occurs (~20% of cases).
  3. Uterine tenderness.
- **Fetal symptoms**: Diminished or absent fetal movement, decelerations on CTG.



iii. **Diagnosis**: US (low sensitivity, placental position and biophysical profile should be assessed, presence of retroplacental hematoma), CTG (fetal heart rate tracing), lab tests (CBC, coagulation studies).

iv. **Treatment**:
- **Hemodynamically unstable or severe bleeding** → Hemodynamic support and emergency C-section.
- **Hemodynamically stable with mild bleeding**:
  1. Good fetal status and <34 weeks → expectant management and observation
  2. Good fetal status and 34-36 weeks → If active uterine contractions → vaginal delivery
  3. Good fetal status and >36 weeks → vaginal delivery
  4. Intrauterine fetal demise → Induction of vaginal delivery with amniotomy and oxytocin.

v. **Complications**: Intrauterine fetal death, Maternal DIC (placenta is rich is tissue thromboplastin), hypovolemic shock, Sheehan syndrome

28. Preterm labour and PROM

Rupture of the amniotic membrane typically occurs spontaneously during the first stage of labour. The following are abnormal variants of ROM.

a. **Premature rupture of the membranes (PROM)**: PROM refers to the rupture of the membranes occurring before the onset of an at term labour. It occurs in 5-10% of all deliveries.
   i. **Risk factors**: It is associated with ascending infection, smoking, multiple pregnancy, previous PROM.
   ii. **Complications**: PROM may lead to the development of:
      - Umbilical cord prolapse or injury (→ the umbilical cord may exit the uterus through the cervical opening and predispose to fetal distress).
      - Placental abruption,
      - Chorioamnionitis (→ infection is more likely due to open amniotic sac)
      - Preterm labour and birth, fetal distress, stillbirth, pulmonary hypertension and hypoplasia and endometritis.

b. **Preterm PROM**: P-PROM refers to the rupture of the membranes occurring before the onset of labour and before 37 weeks of gestation. It occurs in 2-5% of pregnancies.
   i. **Risk factors** and **complications** are similar to PROM.

c. **Prolonged rupture of the membranes**: Rupture of the membranes that occurs > 18 hours before the onset of uterine contractions in term or preterm pregnancies.
   i. **Risk factors**: young maternal age, smoking, STDs, low socioeconomic status.

d. **Diagnosis**: is based on a **clinical history** and **sterile speculum examinations**.
   i. **Clinical diagnosis**: History of a sudden "gush" of pale yellow or clear fluid from the vagina.
   ii. **Sterile speculum examination**: Clinical uncertainty is common in PROM and PPROM. A variety of sterile speculum examination tests exist to confirm PROM.
      - **Pool test**: In PROM, amniotic fluid exits the cervix and pools in the vaginal fornix.
      - **Tests to detect amniotic fluid**:
         1. **Litmus test or nitrazine test**: These tests measure pH. Normally, the vaginal fluid is acidic and will turn the strips red. However, in PROM the amniotic fluid released is **alkaline** and will turn the strips **blue**.
         2. **Fern test**: Vaginal fluid is placed on a glass slide and allowed to dry. Amniotic fluid released creates a characteristic **fern-like pattern** under microscopy.
         3. **IGF test**: IGF1 is normally present in the amniotic fluid. **Positive IGF1 measurement** from the cervicovaginal fluid indicates PROM.
         4. **Placental alpha microglobulin 1**: PAMG-1 levels are usually higher in the amniotic fluid than in the cervicovaginal fluid. **Elevated levels of PAMG-1 in the cervicovaginal fluid** indicates PROM.

e. **Management**: The management of PROM and PPROM depends on the age of gestation, on the presence of intramniotic infection and on the presence of nonreassuring fetal status.
   i. In all cases, monitor for **signs of intramniotic infections** (body temperature, uterine tenderness, WBC count), perform **CTG** to assess for fetal distress and consider **intrapartum risk factors** and **GBS screening and prophylaxis**.
   ii. **Unstable patients**:
      - **Delivery** (in patients with signs of intramniotic infection, cord prolapse, placental abruption or signs of fetal distress).
      - **Collect cervical cultures** and **start empiric ATB therapy** (**ampicillin and gentamycin**).
   iii. **Stable patients**: Management depends on gestation age.

	Treatment:
>37 weeks of gestation (PROM)	▪ Deliver by induction ▪ Expectant management for up to 12-24 hours may be performed in uncomplicated cases and in the absence of infection
34- 37 weeks of gestation (PPROM)	▪ Deliver by induction or expectant management
24 – 34 weeks of gestation (P-PROM)	▪ Expectant management with: 1. Bed rest and pelvic rest 2. Prophylactic ATBs (Ampicillin IV + Erythromycin IV + Amoxiclav PO + Azithromycin PO) 3. Single course antenatal corticosteroids (betamethasone or dexamethasone) 4. Tocolysis (can be used to delay delivery in cases where chorioamnionitis, nonreassuring fetal signs, placental abruption and cord prolapse are absent). 5. MgSO4 (< 32 weeks of gestation for fetal neuroprotection).

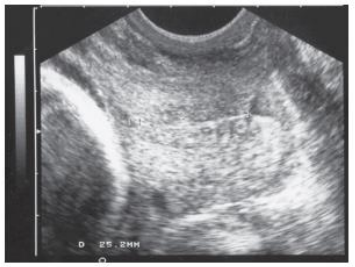
29. <u>The onset of labour, preterm labour, post- term pregnancy – definitions, management</u>

The **onset of labour** refers to the beginning of labour and lasts until the begging of the 1st phase of labour.

1. During the **third trimester**, involuntary contractions of uterine smooth muscle can be felt as **Braxton-Hicks contractions (false labour)**. These are irregular and uncoordinated contractions of moderate intensity. They do not change in frequency, intensity or duration.
2. **Prelabour contractions** start 3-4 days before birth. These are irregular contractions of high intensity, which occurs before phase 1 begins. They serve to correctly position the fetal head in the pelvis.
3. Labour starts when **painfull, regular contractions of increasing frequency and intensity** lead to the **effacement and dilatation of the cervix**. **Cervical effacement** refers to the thinning of the cervix that occurs during labour (the cervix becomes thin and flat).
4. This is accompanied by **rupture of the membranes**, causing the release of liquor.
5. **Phase 1 of labour** then follows, where uterine contractions and the pressure exerted by the fetal head induce complete dilation and effacement of the cervix (until 10 cm).

Preterm labour is defined as the development of regular uterine contractions and cervical changes before 37 weeks of gestation. **Preterm birth** is defined as live birth between 20 0/7 weeks and 36 6/7 weeks of gestation.

a. **Epidemiology**: **Complications of preterm birth** are the leading cause of death of children <5 years of age worldwide. Around 12% of births are preterm.
b. **Etiology**: Important risk factors for preterm labour include:
    i. **Non-modifiable risk factors**: Previous history of preterm labour, cervical insufficiency, multiple gestations, polyhydromnios, PROM and PPROM, antepartum hemorrhage (caused by placenta praevia or placental abruption).
    ii. **Modifiable risk factors**:
        - Maternal and fetal infections (UTIs, STIs, vaginal infections → bacterial vaginosis, trichomoniasis)
        - Hypertensive pregnancy disorders (eg. preeclampsia and HELLP syndrome)
        - DM and gestational diabetes.
        - Lifestyle and environmental factors → smoking, substance abuse, maternal or fetal stress, very young or very old maternal age and short interval between pregnancies.
c. **Clinical features**: Preterm labour presents with **normal features of labour** (regular uterine contractions, loss of mucus plug, cervical effacement and dilatation and ROM) occurring before the 37 weeks of gestation.
d. **Diagnosis**: The diagnosis of preterm labour is based on preterm contractions and cervical changes. The presence of risk factors can help establish the diagnosis.
    i. Assess for **clinical features of labour occurring preterm**.
    ii. Perform **speculum examination** → evaluate degree of cervical effacement and dilatation and ROM
    iii. **Cervicovaginal fetal fibronectin test** → ↑ levels in cervical secretions → ↑ risk of preterm labour.
    iv. **TVUS** → cervical length of more 3 cm → low likelihood of delivery within 14 days.



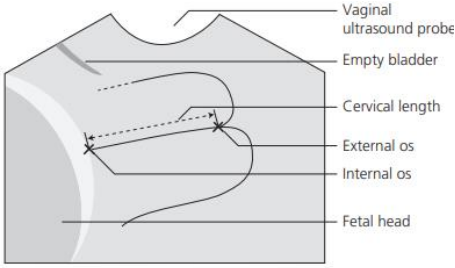


Fig. 23.4 Cervical length.

e. **Management**: Management depends on the age of gestation:
    i. **Between 34 and 37 weeks of gestation**: Proceed with normal labour and delivery.

ii. **Between 32 and 34 weeks of gestation**:
- **Tocolytics**: Inhibit uterine contractions. Are used for **short-term prolongation of pregnancy** in order to allow steroids and MgSO4 to take effect.
  1. Duration of up to 48 hours.
  2. **Options**: **Nifedipine** (CCB), **Indomethacin**, **Terbutaline** (beta2 agonist), **MgSO4**.
  3. **Contraindications**: Nonreassuring fetal CTG, intrauterine fetal demise, chorioamnionitis, antepartum hemorrhage and preeclampsia.
- **Steroids**: Antenatal steroids are used to promote surfactant production and improve neonatal survival and fetal lung maturity.
  1. **Indications**: all patients at **24 to 34 weeks** of gestation at risk of delivery with 7 days.
  2. **Options**: Betamethasone, Dexamethasone.
- If **PPROM** → consider **ATBs.**
- **GBS prophylaxis** (since cultures are only taken between the 35-37 the week of gestation): **Intrapartum IV peniciliin or ampicillin.**

iii. **Less 32 weeks of gestation**:
- **MgSO4**: Administration of antenatal MgSO4 to reduce the risk and severity of neurological disorders (fetal neuroprotection).
  1. **Indication**: preterm labour <32 weeks of gestation.

f. **Complications**:
i. **NRDS**, **patent ductus arteriosus** and **bronchopulmonary dysplasia**.
ii. **Neurological**:
- **Periventricular leukomalacia** → symmetrical, periventricular injury to the cerebral white matter caused by ischemia in premature infants and presenting with spastic cerebral palsy, intellectual impairment and visual disturbances.
- **Intraventricular hemorrhage** → Intraventricular bleeding from vessels of the germinal matrix. Most infants are **asymptomatic** but may present with lethargy, hypotonia, irregular respiration, seizures and bulging anterior fontanelle.
  1. **Diagnosis**: **Cranial US**. Since most patients are asymptomatic, screening US are routinely performed in premature infants.
  2. **Treatment:** Lumbar puncture, diuretics and/or ventriculoperitoneal shunts.
- **Cerebral palsy**, **learning disabilities**, **ADHD**.

iii. **Anemia of prematurity, Retinopathy of prematurity, infection and sepsis.**

g. **Prevention**: **Avoidance of modifiable risk factors**, **treatment of cervical insuffiency** and **vaginal progesterone administration** (in women with previous premature pregnancy).

Postterm pregnancy is defined as a pregnancy that progresses beyond 42 weeks of gestation. The exact cause for the delay in delivery is unknown.

a. **Risk factors**: Prior post term pregnancies, advanced maternal age, primiparity and male fetus.
b. **Management**:
i. **After 42 +6 weeks of gestation**: **Induction of labour**.
c. **Complications**:
i. **Placental insufficiency** which can lead to **fetal dysmaturity** (small for gestational age foetuses with longs nails, dry and peeling skin), **oligohydramnios**, and **stillbirth**.
ii. **Excessive fetal growth** (which may lead to **macrosomia** and **obstructed labour**).

Induction of labour refers to artificially starting labour. It differs from **labour augmentation** (where the contractions of an established labour are strengthened). Labour

induction is performed in situations where allowing pregnancy to continue would expose the fetus and/or mother to risk greater than that of induction.

a. **Methods of induction**: The success of labour induction is dependent on the state of the cervix. This is determined by the **Bishop score**. The lower the score, the more unfavourable the cervix.

	0 points	**1 point**	**2 points**	**3 points**
Cervical position	Posterior	Midline	Anterior	
Cervical consistency	Firm	Moderately firm	Soft	
Cervical effacement	Up to 30%	30-50%	50-80%	>80%
Cervical dilation	Closed or 0 cm	1-2 cm	3-4 cm	>5 cm
Fetal station	-3	-2	-1 or 0	+1 or +2

   i. **Prostaglandin induction**: Involves administration of **prostaglandin E2** into the posterior vaginal fornix.
   ii. **Amniotomy +- oxytocin**: **Artificial rupture of the membranes** is performed with an **amnihook** (**amniotomy**). An **oxytocin infusion** is then started within 2 hours if labour was not ensued.
   iii. **Mechanical induction**: Involves the use of a Cook catheter (double ballooned catheter introduced into the cervix).

b. **Indications**:
   i. **Fetal indications**: Postterm pregnancy, IUGR or compromise, antepartum hemorrhage and PROM.
   ii. **Materno-fetal indications**: Pre-eclampsia and gestational diabetes.

c. **Contraindications**: Absolute contraindications include acute fetal compromise (including abnormal CTG), abnormal lie, placenta praevia, pelvic obstruction due to masses.

d. **Management of an induced labour**: Inducing labour increases the fetal risks. **CTG monitoring** is essential in all induced labours.

e. **Complications**:
   i. **Uterine overactivity**: paradoxically uterine overactivity may develop. This is associated with a risk of fetal distress and uterine rupture.
   ii. **Intrapartum hemorrhage** and **Intrapartum and post-partum infections** are more likely.

30. Uterine contractility and dystokia

Myometrial cells of the uterus contain filaments of actin and myosin, which interact → contractions in response to an increase in intracellular calcium.

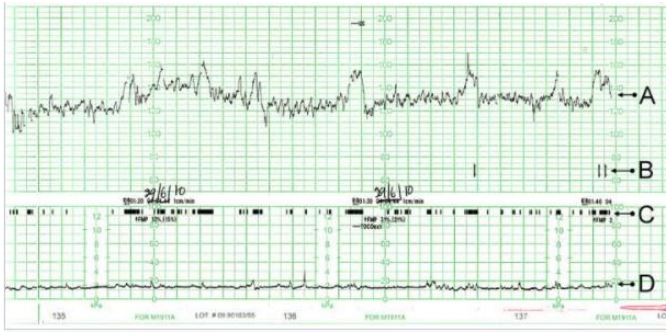
- **a.** Prostaglandins (PGE2, misoprostol) and oxytocin → ↑ intracellular free calcium ions.
- **b.** beta-adrenergic agonists (terbutaline) and calcium-channel blockers (nifedipine) do opposite → relaxes

1. **Physiological stimulants of uterine contraction**:
   - **a.** Large fetal size (late pregnancy) → uterine & cervical stretching → ↑ expression of oxytocin receptors → local synthesis of PGE2
   - **b.** synthesis of oxytocin by mother → at the start of labor
   - **c.** Fetal descent during labour → uterine & cervical stretching → ↑ expression of oxytocin receptors → local synthesis of PGE2
   - **d.** Fetal distress in uterus → ↑ fetal synthesis of cortisol
2. **Uterotonics**: Stimulate uterine contractions.
   - **a.** Oxytocin
   - **b.** Prostaglandins (misoprostol)
3. **Tocolytics:** Inhibit uterine contractions and prolong pregnancy
   - **a. B2-agonist (terbutaline)**
     - **i.** AE**:** fetal and maternal cardiovascular and metabolic conditions (tachycardia, neonatal hypoglycaemia, arrythmias)
   - **b. Calcium channel blockers (nifedipine)**
     - **ii.** AE**:** maternal hypotension and reflex tachycardia
   - **c. NSAIDs (indomethacin)**
     - **iii.** AE**:** fetal renal dysfunction leading to oligohydramnios, premature closure of fetal ductus arteriosus
   - **d. MgSO4**
     - **iv.** AE**:** respiratory depression in mother and newborn, maternal pulmonary edema, maternal hypocalcaemia, fetal harm due to hypocalcaemia,
4. **Dystocia** (obstructed labor) refers to the arrest of vaginal delivery because of a mechanical obstruction
   - **a. Risk factors**: **PPP**
     - **i.** Power (uterine contraction)**:** uterine scar/inflammation, tumor, drugs
     - **ii.** Passage (birth canal)**:** small pelvis, cervical rigidity, tumor/mass
     - **iii.** Passenger (fetus)**:** large fetus, malpresentation, hydrocephalus
   - **b. Clinical features:** caput succedaneum (scalp swelling caused by prolonged engagement of the head in the birth canal), high presenting part (not engaged)
   - **c. Diagnosis:** digital vaginal exam, CTG, US
   - **d. Treatment**:
     - **i.** Assess need for oxytocin
     - **ii.** Changing posture of mother during labor can help progress to labor
     - **iii.** Operative vaginal delivery (FAVD or VAVD)
     - **iv.** If all measures fail → c-section
   - **e. Complications:** fetal injury, fetal asphyxia, uterine rupture
5. **Shoulder dystocia** is an obstetric emergency in which anterior shoulder of the fetus becomes impacted behind maternal pubic symphysis during vaginal delivery (**less commonly posterior shoulder)**

a. **Risk factors: history of shoulder dystocia, fetal macrosomia**, prolonged 2nd stage of labor, maternal DM, maternal obesity
b. **Clinical features:** turtle sign (fetal head is partially delivered but retracts against perineum), features of arrested active phase of labor
c. **Diagnosis:** clinical
d. **Treatment**: **ALARMER**
    i. **A** = ask for help
    ii. **L**= leg hyperextension (McRoberts maneuver)
    iii. **A**= add posterior pressure on ant.shoulder vaginally (Rubin maneuver) or suprapubic
    iv. **R**== release the posterior shoulder from inside vagina
    v. **M(W)** = Wood's screw maneuver (rotate baby 180 degrees so posterior shoulder becomes anterior)
    vi. **E**= Epiostomy
    vii. **R**= Roll onto all fours (try to use gravity)
e. **If ALARMER fails**:
    i. **Fracturing of clavicle of fetus**
    ii. **Zavanelli's maneuver** (pushing baby's head back, with attempting c section)
    iii. **Symphsiotomy:** anterior fibres of symphyseal ligament are surgically separated allowing pubic bones to widen.
        1. Performed under local anasthesia
f. **Complications**:
    i. **Fetal:**
        1. brachial plexus injury
        2. Clavicle or humerus fracture
        3. Hypoxia over an extended period as a result of umbilical cord compression
    ii. **Maternal**:
        1. Perineal lacerations
        2. PPH

31. Antenatal and intrapartal cardiotocography – CTG (fetal heart rate - FHR monitoring)

Cardiotocography (CTG) refers to the **electronic monitoring of fetal heart rate (FHR)** and **uterine contractions** during pregnancy. In a CTGs, the FHR is designated as the baseline or basal heart rate and is normally 110-160 beats/min.



A typical CTG output for a woman not in labour. A: Fetal heartbeat; B: Indicator showing movements felt by mother (caused by pressing a button); C: Fetal movement; D: Uterine contractions

a. **Indication for CTG:**
   i. **Prelabour risk factors** include pre-eclampsia, IUGR, previous C-section and induction.
   ii. **Inlabour risk factors** include the presence of meconium, the use of oxytocin, the presence of high temperature and during the administration of epidural analgesia.

b. **Method:**
   i. **External cardiotocography:** two transducers are placed on the mother's abdomen (one above the fetal heart for FHR and the other at the fundus of the uterus to measure frequency of contractions)
   ii. **Internal cardiotocography:** electronic transducer connected directly to the fetal scalp (requires rupture membranes).

c. **CTGs are classified as reassuring or non-reassuring based on:**
   i. **Baseline rate:** level of FHR when it is stable and not affected by acceleration and deceleration.
      - **Normal:** FHR between **110 - 160 beats/min**
      - **Bradycardia:** FHR < 110 beats/min (→ fetal heart defects, CNS anomalies, severe hypoxia)
      - **Tachycardia:** FHR > 160 beats/min (→ stress, hypotension, maternal fever, chorioamnionitis, hypoxia)
   ii. **Baseline variability:** degree to which the baseline varies. Determined by measuring the amplitude between the highest and lowest turning point of the FHR curve.
      - **Marked**: variation **> 25 beats/min** (→ fetal hypoxia, umbilical cord compression).
      - **Normal**: variation between **5 - 25 beats/min** (→ Physiological variability).
      - **Reduced**: variation between **0 - 5 beats/min** (→sleeping fetus, fetal hypoxia, effects of opioids).
      - **Absent:** Undetectable variability (→ hypoxia)
   iii. **Acceleration:** A temporary increase in FHR from the baseline by > 15bpm for more than 15 secs but less than 10 mins. Accelerations are reassuring.
      - The presence of >2 FHR accelerations within a span of 20 mins indicated a reactive fetal heart rate.
   iv. **Deceleration:** A temporary decreased in FHR of > 15bpm for a maximum duration of 3 mins.
      - **Early deceleration:** Peak of deceleration coincides with the peak of contraction. It is physiological and should only be seen during active 2nd stage of labour because it is induced by head compression.
      - **Late deceleration**: Peak of deceleration follows the maximum contraction curve. It is pathological and associated with uteroplacental insufficiency.
         1. **Intrauterine resuscitation** is indicated. If FHR pattern does not improve despite IU resuscitation → **emergency C-section**.
      - **Variable decelerations**: Variable presentation and temporal relation of decelerations with contractions. Decelerations are abrupt. If **recurrent** (>50% of contractions are variable) is pathological and associated with umbilical cord compression/prolapse.
         2. **Intrauterine resuscitation** is indicated. If FHR pattern does not improve despite IU resuscitation → **emergency C-section**.
      - **Prolonged:** A decrease in FHR of >15bpm from the baseline, lasting >2 minutes. Same causes as other types of deceleration but more severe.

3. **Intrauterine resuscitation** is indicated. If FHR pattern does not improve despite IU resuscitation → **emergency C-section**.

MNEMONIC for etiology of fetal HR alterations: VEAL CHOP	
Variable decelerations	→ Cord compression/prolapse
Early decelerations	→ Head compression
Accelerations	→ OK
Late decelerations	→ Placental insufficiency/Problem

d. Interpretation of findings:

i. **Reassuring findings (→Fetal well-being)**:
- Normal FHR baseline (btw 110-160 bpm), normal variability (5-25 bpm), >2 accelerations within a 20 mins period and no evidence of fetal distress (e.g fetal brady- or tachycardia, late or variable decelerations).

ii. **Non-reassuring findings (→ Fetal distress, requires IU resuscitation and/or immediate delivery)**:
- Fetal bradycardia (<110 bpm), fetal tachycardia (>160 bpm), Loss of baseline variability, late decelerations, recurrent variable decelerations.

e. Management of fetal distress:

i. **Intra-uterine resuscitation**:
- Reposition the mother into positions that reduce umbilical cord compression such as lying on the left or right side, Trendelenburg position or lateral Semi-Fowler's position.
- Administer O2 and possibly fluids.

ii. **If initial steps fail to return the CTG to normal findings, consider**:
- **Fetal blood sampling**: If resuscitate measures fail, a FBS is performed for analysis of pH and lactate levels. If pH< 7.20, emergency delivery is indicated.
- **Amnioinfusion**: Installation of saline into the amniotic cavity after artificial rupture of the membranes.
- If there is **uterine tachysystole** (>5 contractions every 5 mins) → consider **tocolytics** (contractions temporarily reduce uteroplacental circulation)
- **Emergency C-section**.

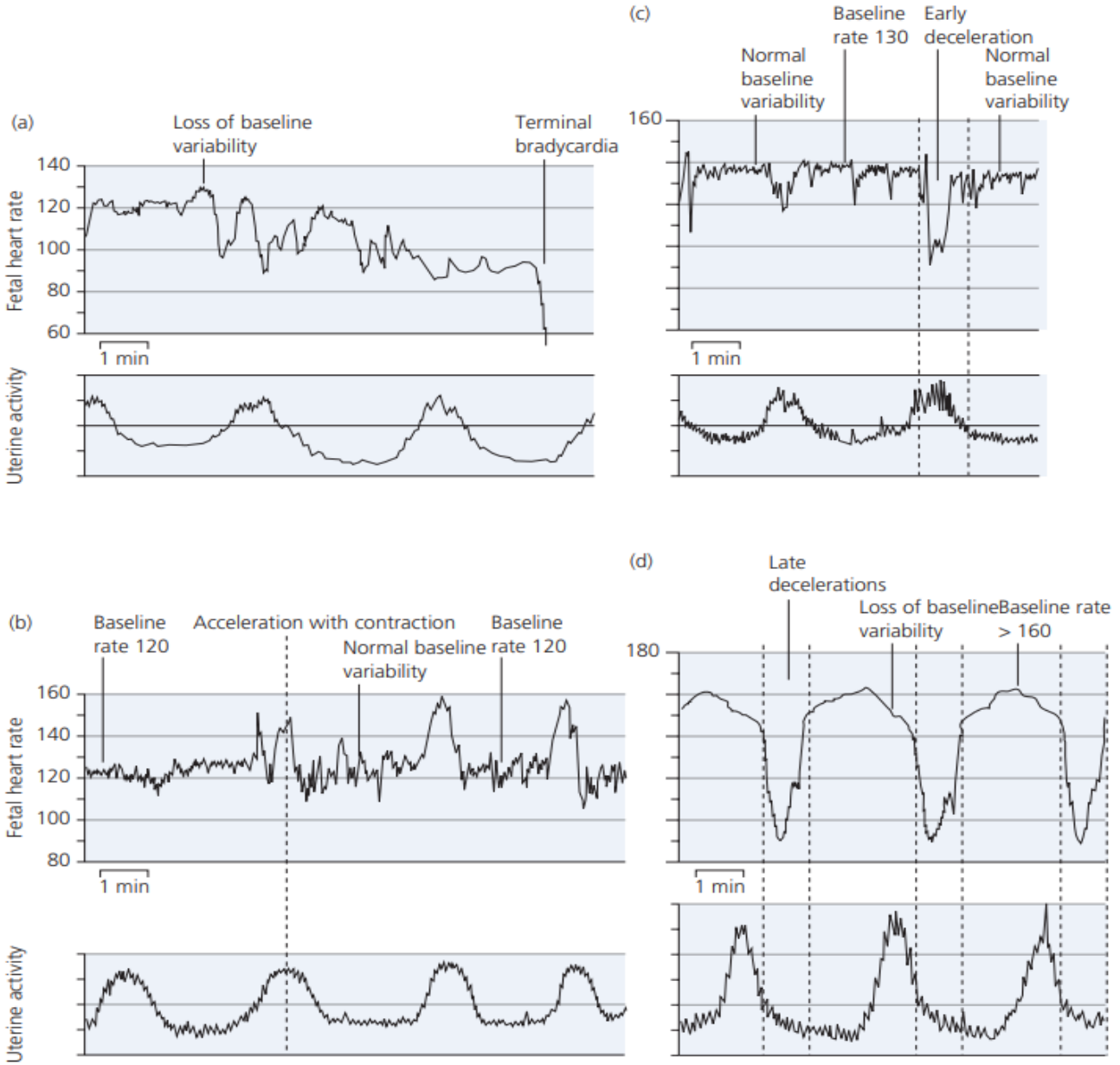


Fig. 29.11 (a) Acute fetal distress; the fetus is dying. (b) Normal cardiotocography (CTG); acceleration of the fetal heart with contractions. (c) Early decelerations are synchronous with a contraction. (d) Late decelerations, tachycardia, reduced variability suggestive of fetal distress.

32. <u>Stages of labour</u>
33. <u>Mechanism of normal labour</u>

Labour refers to the process whereby the fetus and placenta are expelled from the uterus, which normally occurs between the **37th and 42th week of gestation**. Childbirth begins with the **onset of labour**, which consists of contractions that lead to the progressive dilation and effacement of the cervix, eventually resulting in the birth of the infant and expulsion of the placenta. Diagnosis of labour is performed when painful uterine contractions accompany dilatation and effacement of the cervix. Labour is divided into stages.

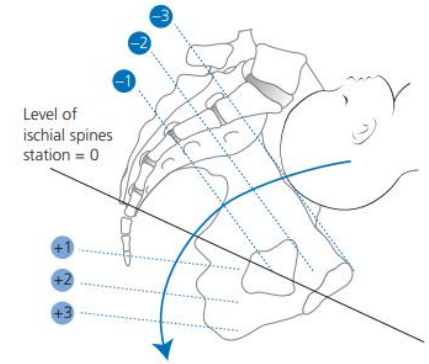


Fig. 28.3 Descent of the head in labour in relation to the ischial spines.

a. **Anatomical and mechanical aspects**: Three mechanical factors determine progress during labour:
   i. **Power (force expelling the fetus)**: Once labour is established, the uterus contracts for 45-60 secs every 2-4 minutes. This contractions pulls the cervix up (effacement) and causes dilatation, aided by the pressure of the head. Poor uterine activity is a common feature in nulliparous women.
   ii. **Passage**:
      - **Bony pelvis**: This has 3 main planes, the **pelvic inlet**, **mid pelvis** and **pelvic outlet**. In the lateral wall of the mid pelvis, bony prominences called **ischial spines** can be palpated transvaginally. These are landmarks used to assess the descent of the fetal head ("**station**"). The level of descent is measured in cm in relation to these spines (station +2 means that the fetal head is 2 cm below the ischial spines).
      - **Soft tissues**: **Cervical dilatation** is a pre-requisite for delivery and is dependent on uterine contractions and the pressure exerted by the fetal head. Other soft tissues, including **vagina** and **perineum**, also need to be overcome during the 2nd stage of labour
   iii. **Passenger**: Several factors determine how easily the fetal head fits throught the pelvic planes.
      - **Fetal attitude**: The attitude is the degree of flexion/extension of the fetal head. The ideal attitude is maximal flexion, called **vertex presentation**, and the engaging diameter is 9,5 cm (**sub-occipito-bregmatic diameter**). Extension of 90º causes a **brow presentation**, with a much larger engaging diameter of 14 cm (**mentovertical diameter**). Further 30º extension causes a **face presentation**, with a 13 cm engaging diameter (**submento-bregmatic diameter**). Over-extension of the fetal head may cause its diameter to be too big for vaginal delivery.
      - **Position**: The position is the degree of rotation of the neck of the infant. For easy passage through the **inlet**, the sagittal suture must be **transverse**, whereas passage through the outlet requires a **vertical position**. This means that the fetal head must rotate 90º during labour.
      - **Moulding**: The fetal head can reduce its diameters as it passes through the pelvis because the sutures allow it. Rarely, **cephalopelvic disproportion** may occur.

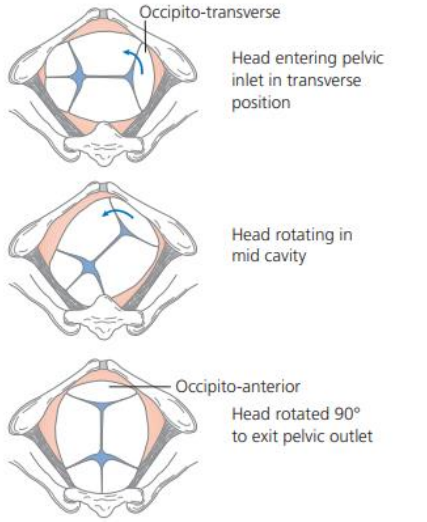


Fig. 28.6 View from below showing rotation of the head (position) according to the three planes of the pelvis.

b. **Orientation of the fetus in utero**:
   i. **Fetal lie**: relation of the long axis of the fetus to the long axis of the mother.
      - **Longitudinal lie**: fetus has the same axis has the mother.
      - **Transverse lie**;
      - **Oblique lie**;
   ii. **Fetal presentation**: part of the fetus that overlies the maternal pelvic inlet.

- **Cephalic presentation**: head first
- **Breech presentation**: buttocks or feet first (→ vaginal delivery is impossible).
    1. **Frank breech** (flexed hips and extended knees), **Complete breech** (hips and knees flexed), **Single and Double footling** (one or both hips and knees are flexed).
- **Shoulder presentation**: Shoulder first.

iii. **Fetal position**: Relationship of the presenting fetal part to the maternal pelvis.

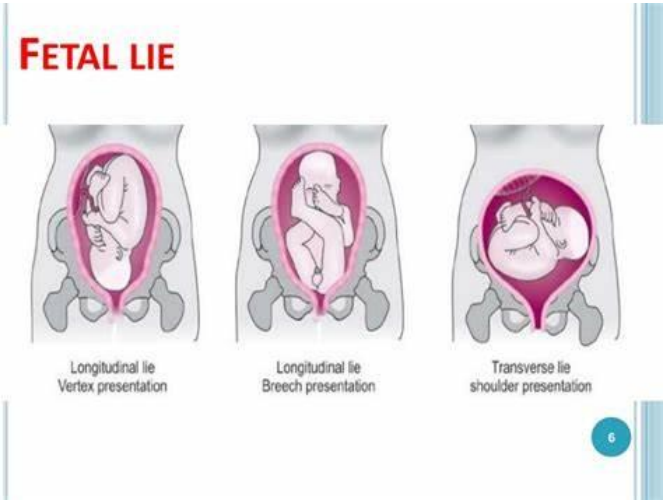
- **Occipito-anterior position**: Fetal occiput points towards the maternal pubic symphysis
    2. **Left OA position**: Fetal back faces the maternal left side (most common position)
    3. **Right OA position**: Fetal back faces the maternal right side.
- **Occipito posterior position**: fetal occiput faces the maternal sacral promontory.
- **Sacrum in breech presentation**.

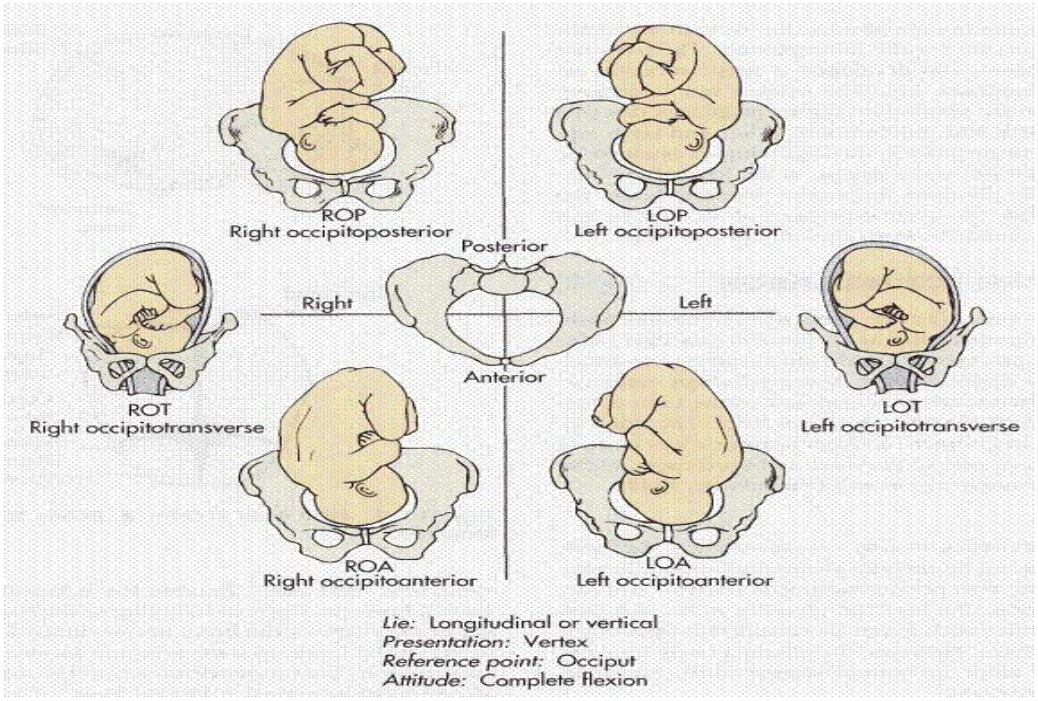
iv. **Fetal attitude**: Degree of extension/flexion of the head during cephalic presentation.

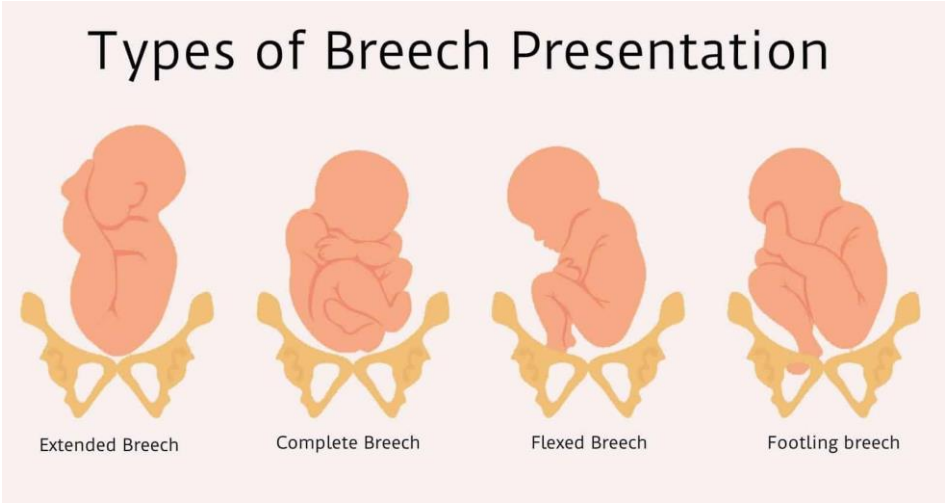
- **Vertex presentation** (maximally flexed);
- **Forehead presentation** (partially flexed) → vaginal delivery is possible
- **Brow presentation (partially extended)** → vaginal delivery is not possible.
- **Face presentation (maximally extended)** → vaginal delivery is possible

v. **Fetal station**: Measurement of the presenting part above and below the maternal ischial spines.

- **Engagement** is when the presenting part passes through the pelvic inlet.







c. **Stages of labour**:

i. **Initiation and diagnosis of labour**:

1. Involuntary contractions of uterine smooth occur throught the third trimester and are often felt as **Braxton Hicks contractions** (irregular, uncoordinated, moderate intensity contractions whose frequency and intensity remain the same and which are not associated with cervical changes).
2. Labour is diagnosed when **painfull, regular contractions** lead to the **effacement and dilatation of the cervix**. **Cervical effacement** refers to the thinning of the cervix that occurs during labour.
3. This is accompanied by **rupture of the membranes**, causing the release of liquor.

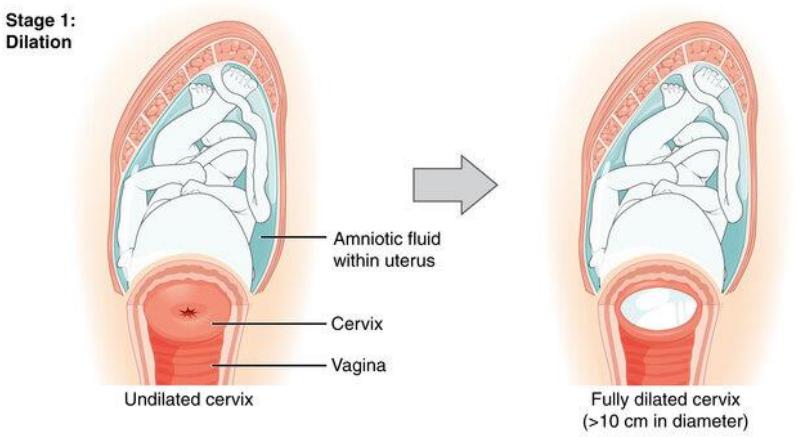
ii. **First stage of labour**:

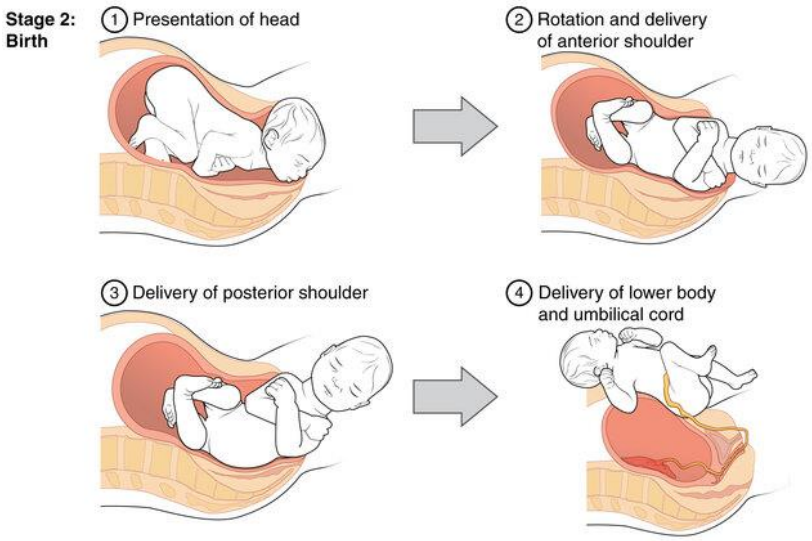
- This lasts from the **diagnosis of labour** until the cervix is **completely dilated at 10 cm.** The **descent, flexion and internal rotation** occur to different degrees. If the membranes haven't rupture so far, they do so now.
    1. **Latent phase (20 hours)**: Initial phase where the cervix dilates slowly for the first 4 cm. Contractions are irregular and of low intensity.
    2. **Active phase**: Follows the latent phase and is characterized by rapid dilation until 10 cm. Contractions of increasing intensity and frequency.

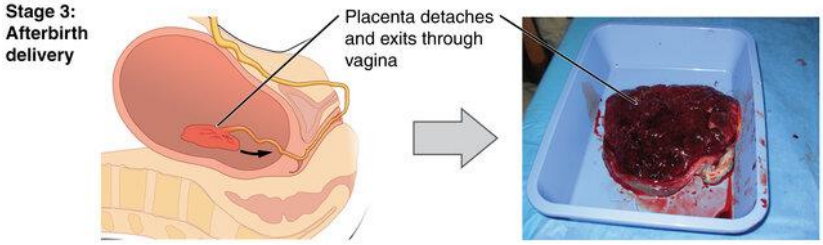
iii. **Second stage of labour**:

- This phase lasts from **full dilatation of the cervix** until **delivery of the fetus**. The descent, flexion and internal rotation are completed and followed by **extension** as the head delivers.
- In this phase has regular uterine contractions increasing in frequency and intensity.
    1. **Passive stage**: Lasting from full dilatation until the head reaches the pelvic floor.
    2. **Active stage**: The mother pushes the baby. The fetus is delivered on average on 40 mins.
- **Delivery**:
    1. As the head reaches the perineum, it **extends** to come out of the pelvis (**crowning**). The perineum stretches and often tears (**perineal lacerations**). It might also be cut (**episiotomy**), usually if the birth is prolonged or if fetal distress is seen.
    2. The head then restitutes, **rotating 90º** to adopt the transverse position in which it has entered the pelvis.
    3. With the next contraction, the **shoulders deliver**. First the anterior shoulder and then the posterior.
    4. The rest of the body follows.

iv. **Third stage of labour**:







- This phase lasts from **delivery of the fetus** to **delivery of the placenta**. It normally lasts 15 mins and normal blood loss is up to 500 ml.
- Firm uterine contractions expel the placenta during this phase. Cord lengthening and a gush of vaginal blood are signs of **placental separation**.

v. **Forth stage of labour**:

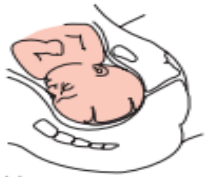
- Accounts for 1-2 hours of the postpartum period.
- Uterine contractions expel any remaining contents. Start of the uterine involution.

d. **Mechanics of a normal labour** refers to the changes in the fetal body part position during birth (during the 2nd stage of labour).

1) **Engagement**: The head of the fetus enters the pelvis in the **occipito-transverse position**. This allows it to enter the pelvis through the inlet, which has a wider transverse than antero-posterior diameter.
2) **Descent and flexion**: The head **descends** into the round mid pelvis and **flexes** as the cervix dilates.
3) **Rotation**: In the mid cavity, the **head rotates 90º** (internal rotation), so that the face is facing the sacrum and in an **occipito anterior position**. This allows it to pass through the outlet, which has a wider antero-posterior than transverse diameter.
4) **Further descent**.
5) **Extension of the head and delivery**. Crowing (appearance of the fetal head) occurs.
6) **Restitution**: The head rotates 90º (external rotation) to the same position in which it entered the inlet (OT position). This allows passage of the shoulders through the pelvic outlet and under the pubic symphysis.
7) **Expulsion:** The anterior shoulder sleeps under the pubic symphysis, followed by the posterior shoulder and, finally, the rest of the body.


(a) Engagement: The oblong-shaped head normally enters the pelvis in the occipito-transverse (OT) position, because the transverse diameter of the inlet is greater than the antero-posterior diameter.


(b) Descent and flexion: The head descends into the round mid-cavity and flexes as the cervix dilates. Descent is measured by comparison with the level of the ischial spines (see Fig. 28.3) and is called station.


(c) Rotation: In the mid-cavity, the head rotates 90° (internal rotation) so that the face is facing the sacrum and the occiput is anterior, below the symphysis pubis (occipito-anterior, OA). This enables it to pass through the pelvic outlet which has a wider antero-posterior than transverse diameter. In 5% of cases, the head rotates to occipito-posterior (OP).


(d) Rotation completed, further descent: The perineum distends.


(e) Extension and delivery.


(f) Restitution: The head then rotates 90° (external rotation) to the same position in which it entered the inlet, facing either right or left, to enable delivery of the shoulders.

34. <u>Management of normal labour</u>
35. <u>Obstetric analgesia and anesthesia, antenatal classes</u>

Labour is a physiological process and most women will deliver without any management. However, obstetrical management of labour has contributed to its safety.

a. **General care of women in labour**:
   i. **Observations** → during labour, **temperature** and **BP** should be monitored every 4 hours and **pulse** every hour. **Contraction frequency** is recorded every 30 minutes.
   ii. **Delivery positions** → Most women delivery in a semi-recumbent position (**squatting** or the **left lateral position**).
   iii. **Hydration and food** → Women should be encouraged to drink water and small amounts of food is also appropriate.
   iv. **Pyrexia during labour** → Defined as **>37,5 C during labour** and associated with epidural analgesia and prolonged labour. Manage with paracetamol, IV ATBs and CTG. It is associated with increased risk of neonatal illness.

b. **Monitoring of labour**: A **partogram** is used to record progress in dilatation of the cervix and descent of the head. This is assessed on vaginal examination and plotted against time.
   i. The partogram allows record of the **degree of dilatation**, **descent**, **contractions**, **maternal vital signs**, **FHR**, **contraction frequency** and **liquor colour** → aids in the detection of abnormal progression.

c. **Problems in labour and their management**: Labour is dependent on the **powers**, **passage** and **passenger** → abnormalities in any of this factors leads to labour difficulties.
   i. **Powers**:
      - **Weak uterine contractions** is the most common cause of slow progress during labour. It is common in nulliparous women and in induced labours.
         1. Persistently slow progress during labour → **birth augmentation** with **amniotomy** (artificial rupture of the membranes) and then with **oxytocin** (tocomimetic → increases cervical dilatation).
         2. If these methods fail → consider **C-section**.
      - **Hyperactive uterine contractions:** occurs with excessively strong or frequent contractions and may cause a ↓ placental blood flow and fetal distress. It is associated with placental abruption, too much oxytocin or as a side effect of labour induction.
         3. Treat with a **tocolytic** (salbutamol) or **C-section**.
   ii. **Passenger**: The fetus can contribute to a poor progress of labour.
      - **Occipito-transverse position**: This occurs when the normal internal rotation of the fetus during the second stage has been **incomplete**. The position is significant only if delivery hasn't been achieved after one hour of pushing in the second phase.
         1. **Rotation and traction** with a ventouse is required.
      - **Occipito-posterior position, Brow presentation, Face presentation, Transverse and Oblique presentations** and **Breech presentation** all require special management.

d. **Care of the mother**:
   i. **Pain relief in pregnancy**: Labour is normally an extremely painfull event, but the use of analgesia is a **mother choice** based on their tolerance to pain and attitude towards childbirth. In some situations, analgesia may be medically advisable.
      - **Non-medical approaches**: **Preparation at antenatal classes**, the **presence of a birth attendant** and the **maintenance of mobility** can all help the women cope with pregnancy.

1. Other methods → TENS, hypnotherapy, acupuncture and application of superficial heat.

- **Inhalation analgesia:** Inhalation analgesia may be achieved via the use of **entonox** (equal mix of O2 and NO). It has a rapid onset and is mildly analgesic.
  1. Effect → usually insufficient for most women
  2. Side-effects → it is associated with light-headiness, nausea and hyperventilation.
- **Systemic drugs: Pethidine** and **diamorphine** are widely used as intramuscular injections for obstetric analgesia.
  1. Effect → usually a small effect.
  2. Side-effects → it is associated with sedation and confusion. Opiates also cause **respiratory depression** in the neonate (→ may require reversal with naloxone).
- **Epidural anesthesia: Epidural anesthesia** is an anesthetic method that involves the injection of a combination of an opiate (eg. fentanyl) and local anesthetic (eg. bupivacaine or ropivacaine) into the epidural space bellow the L2 level via an epidural catheter.
  1. A loading dose is best followed by intermitant "low dose" top-ups. The effect is variable but in ideal situations, pain sensation is abolished while no motor blockade occurs. It is suitable for the entire labour.
  2. Advantages → Only method where complete pain loss if possible. Also useful to reduce blood pressure in hypertensive women.
  3. Disadvantages → Transient hypotension, mobility reduction, urinary retention (due to ↓ bladder sensation), transient fetal bradycardias.
  4. Complications of the procedure → inadvert puncture of the dura matter (→ CSF leak and headache), inadvert administration of anesthetic into arterial system (→ cardiac arrest, convulsions) and inadvert injection into the spinal cavity (may lead to total spinal anesthesia → respiratory arrest).

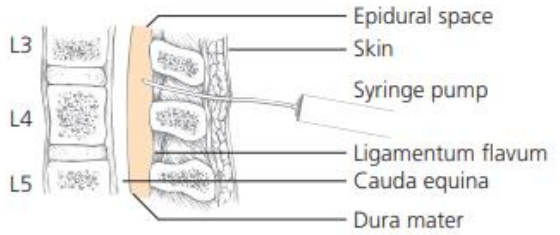


Fig. 29.14 Epidural analgesia; transverse section of the spinal column of L3–4.

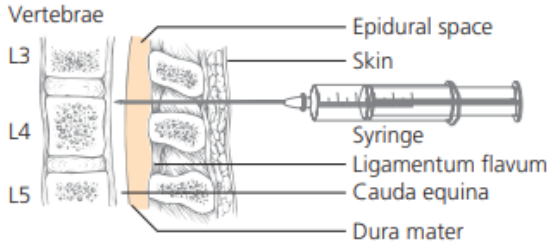


Fig. 29.15 Spinal analgesia, transverse section of the spinal column.

- **Spinal anesthesia: Spinal anesthesia** is an anesthetic method that involves injection of a single shot of anesthetic into the spinal space.
  1. It produces a short-lasting but effective total analgesia that is suitable for obstetric procedures (C-section and mid-cavity vaginal instrumental delivery).
- **Pudendal nerve block:** Involves injection of local anesthetic bilaterally around the pudendal nerve where it passes through the ischial spines.
  1. Suitable for low-cavity instrumental vaginal deliveries.

e. **Care of the fetus**: Permanent fetal damage attributable to labour is uncommon. The most common causes of damage are:

i. **Fetal hypoxia ("Fetal distress")**: "**Fetal distress**" is defined as hypoxia that might result in fetal damage or death if not reversed or the fetus delivery urgently. The convention is that pH < 7,20 in fetal capillary blood indicates significant hypoxia.

- **Etiology**: placental abruption, hypertonic uterus, use of oxytocin, prolapse of the umbilical cord and maternal hypotension.
- **At risk foetuses**: Foetuses with these risk factors are monitored during labour with CTG.
  1. **Antepartal risk factors** include pre-eclampsia and IUGR.
  2. **Intrapartal risk factors** include long labour, meconium, the use of epidural and oxytocin.

- **Diagnosis**: Diagnosis is based on detection of significant **fetal acidosis** (pH 7.20) or **non-assuring CTG findings**. The presence of **meconium** in the amniotic fluid is associated with ↑ risk of fetal hypoxia.
- **Management**:
    1. **Intra-uterine resuscitation**: Reposition the mother into positions that reduce umbilical cord compression such as lying on the left or right side, Trendelenburg position or lateral Semi-Fowler's position. Administer O2 and possibly fluids.
    2. **If initial steps fail to return the CTG to normal findings, consider**:
        i. **Fetal blood sampling**: FBS is performed for analysis of pH and lactate levels. If **pH< 7.20**, **emergency delivery** is indicated.
        ii. **Amnioinfusion**: Installation of saline into the amniotic cavity after artificial rupture of the membranes.
        iii. If there is **uterine tachysystole** (>5 contractions every 5 mins) → consider **tocolytics** (contractions temporarily reduce uteroplacental circulation)
        iv. **Emergency C-section**.

ii. **Infection/inflammation in labour**: Infection with GBS and maternal fever are associated with development of seizures, fetal death and cerebral palsy.
- **Management** → prenatal screening of mothers, intrapartal ATBs and antipyretics.

iii. **Meconium aspiration leading to chemical pneumonitis**;

f. **Management of labour**:

i. **Initiation and diagnosis of labour**: Women should present to the hospital when contractions become **regular, painfull and occurring every 3-4 mins** or if the **membranes have ruptured**. When the mother arrives:
- **Temperature**, **BP**, **pulse** and **urinalysis** are recorded;
- The **presentation** is checked and a vaginal examination is performed to check for **cervical dilatation** and **effacement** (→ to confirm the diagnosis of labour).
- The **degree of descent** and **colour** of any leaking fluid is also assessed.
- If the pregnancy is high risk → **CTG** is performed.

ii. **1st stage**:
- Provide **analgesia** upon request.
- Determine the fetal position via abdominal (Leopold's maneuvers) and pelvic examination.
- Assess every 4 hours the **degree of cervical dilatation** and **descent of the fetal head** digitally by vaginal examination.
- If progress is slow, consider **labour augmentation** with **amniotomy** or **oxytocin**.
- If the cervix is not fully dilated by 12-16 hours → consider **C-section**.

iii. **2nd stage**:
- If **no epidural is in place** → pushing is encourage only when the mother has the desire to push.
- If **an epidural is in place** → it is normal to wait at least one hour before pushing. When numb from the anesthesia, the mother is encourage to push about 3 times for 10 secs per contraction.
- If delivery is not eminent after 2 hours of pushing → instrumental delivery with **ventouse** or **forceps** is indicated.

- **Normal labour**:
    1. When the fetal head distends the perineum, the attendant waits with "hands poised". If necessary, episiotomy is performed after the injection of local anesthetics into the perineum.
    2. The mother is asked to stop pushing as the head starts to deliver and the attendant may press on the perineum and head to prevent perineal damage. The head then restitutes.
    3. With the next contraction, maternal pushing and gentle downward traction on the head deliver the anterior shoulder.
    4. Traction is then directed upwards to deliver the posterior shoulder.
    5. Unless requiring resuscitation, the baby is given to the mother to promote bounding.

iv. **3rd stage**:

- **Oxytocin** is administered IM to help with uterine contraction.
- Once **placental separation** is evident (cord lengthening or a gush of blood are seen) → gentle traction on the placenta together with pressure on the supra-pubic region are performed to aid in delivery of the placenta.
- The placenta is checked for **cotyledons** and the vagina and perineum for **tears**. Once these are sutured, the mother is cleaned and encouraged to breast feed.
- **Maternal observation** is continued for 2 hours.

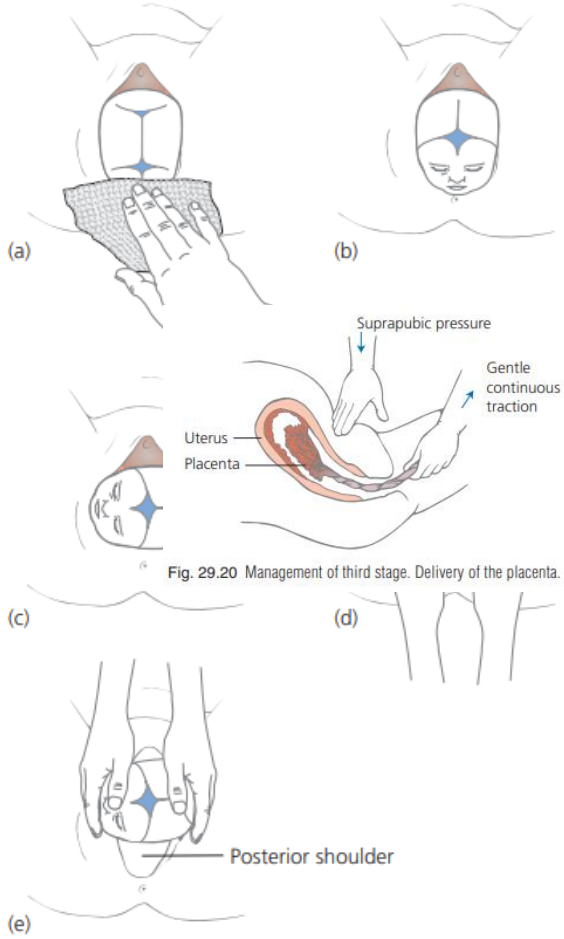


Fig. 29.19 Normal delivery. (a) 'Guarding' the perineum as the head distends it. (b) The head delivers. (c) The head restitutes. (d) The anterior shoulder is delivered by gentle downward traction until the next contraction. (e) The posterior shoulder is delivered by gentle upward traction.

Fig. 29.20 Management of third stage. Delivery of the placenta.

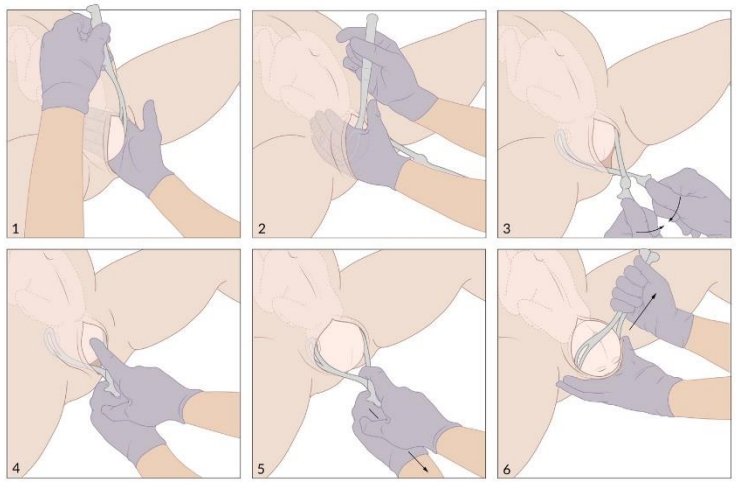
36. <u>Forceps delivery</u>

Instrumental delivery refers to the use of instruments to improve traction if delivery needs to be expedited in the second stage of labour. Since, the shape of the pelvis will only allow delivery if the occiput is anterior, rotation is sometimes also needed.

a. **Aim** → to prevent fetal and maternal morbidity associated with a prolonged second stage of labour or to expedite labour when the fetus is compromised.
b. **Maternal analgesia and CTG** predispose to instrumental delivery.
c. With either instrument, if moderate traction does not produce immediate and progressive descent, **C-section** is indicated.

Obstetric forceps delivery refers to a delivery where a forceps is used to aid labour. A **forceps** is a metal device that enables **gentle rotation and/or traction of the fetal head** during vaginal delivery. The blades of the forceps fit around the fetal head.

a. **Types of forceps**: Non-rotational vs rotational forceps.
    i. **Simpson**: Only enables traction of the fetal head.
    ii. **Kielland**: allows both rotation and traction of the fetal head.
    iii. **Piper**: Used to deliver fetal head during a breech presentation.
    iv. **Barton**: Used for occiput transverse position
b. **Classification of instrumental delivery** (based on the station):
    i. **Outlet**: fetal head lies on the pelvic floor:
    ii. **Low cavity**: fetal head is below 2+ station (below the level of the ischial spines and both forceps and ventouse delivery are appropriate).
    iii. **Mid cavity**: fetal head is below 0 (but above 2+) station (at or just below the level of the ischial spines, typically attempted in the operating room → "trial" of forceps or ventouse)
c. **Indications**:
    i. Prolonged second stage of labour is the most common indication (usually if 1-2 hours of maternal pushing has failed to deliver the baby).
    ii. Breech presentation (occasionally used for delivery of the aftercoming head)
    iii. Nonreassuring FHR (signs of fetal distress)
    iv. To avoid/assist maternal pushing efforts.
d. **Prerequisites**: Forceps delivery requires a skilled clinician, adequate pelvic dimensions, full cervical dilatation, engagement of the fetal head and knowledge of the exact position and attitude of the fetal head.
e. **Advantages (when compared to vacuum delivery)**: Scalp injuries are less common.
f. **Complications**:
    i. **Failure**: Both methods of instrumental delivery can fail, but ventouse fails more commonly
    ii. **Maternal**: Obstetrical lacerations of the cervix, vagina or uterus, perineal hematomas, urinary tract injury, sphincter injury
    iii. **Fetal**: head and soft tissue trauma (scalp lacerations, injured ears), facial nerve palsy, intracranial hematoma, skull fractures.



37. <u>Vacuum extraction (ventouse)</u>

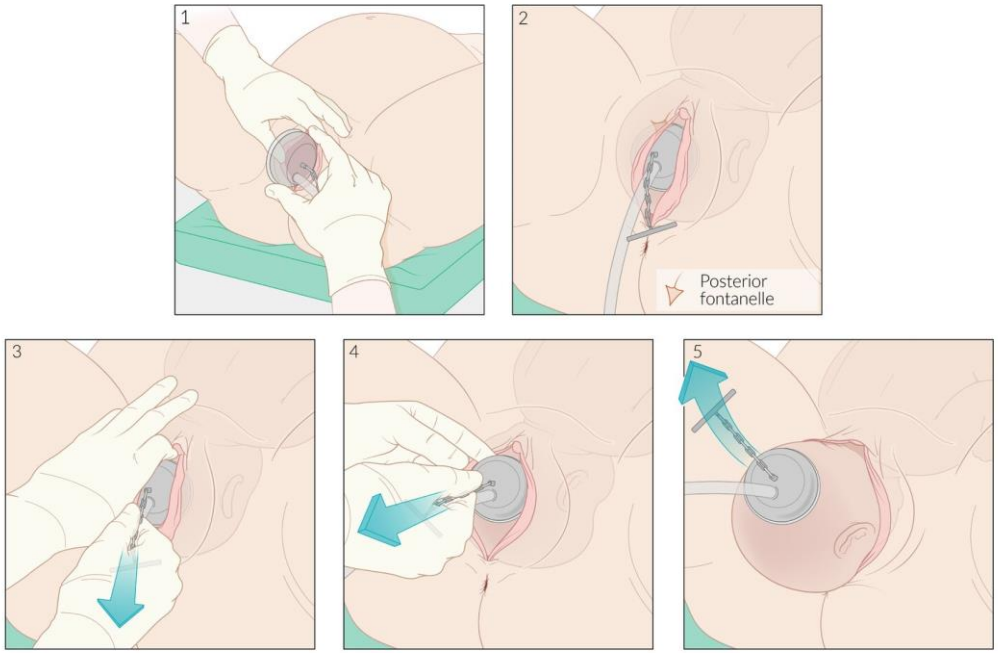
Vacuum extractor delivery refers to a vaginal delivery where a vacuum extractor is used. A **vacuum extractor** is a metal or plastic cup, attached to the fetal head with a suction device, which enables traction of the fetal head during delivery. Traction during maternal pushing allows delivery of OA positioned head.

a. **Indications**:
   i. Prolonged second stage of labour is the most common indication (usually if 1-2 hours of maternal pushing has failed to deliver the baby).
   ii. Nonreassuring FHR (signs of fetal distress)
   iii. To avoid/assist maternal pushing efforts (eg. maternal fatigue or cardiopulmonary conditions).

b. **Prerequisites**: Vacuum extractor delivery requires a skilled clinician, clinically adequate pelvic dimensions, gestation >34 weeks, engagement of the fetal head, full cervical dilatation and vertex presentation.

c. **Advantages (when comparing to forceps delivery)**: It requires minimum space, is associated with ↓ incidence of 3rd and 4th degree perineal tear and less knowledge about fetal position is required.

d. **Complications**:
   i. **Failure**: Both methods of instrumental delivery can fail, but ventouse fails more commonly
   ii. **Maternal**: suction of maternal soft tissue may lead to development of hematomas and lacerations.
   iii. **Fetal**: Cephalohematoma, scalp lacerations, neonatal jaundice, life-threatening head injury.



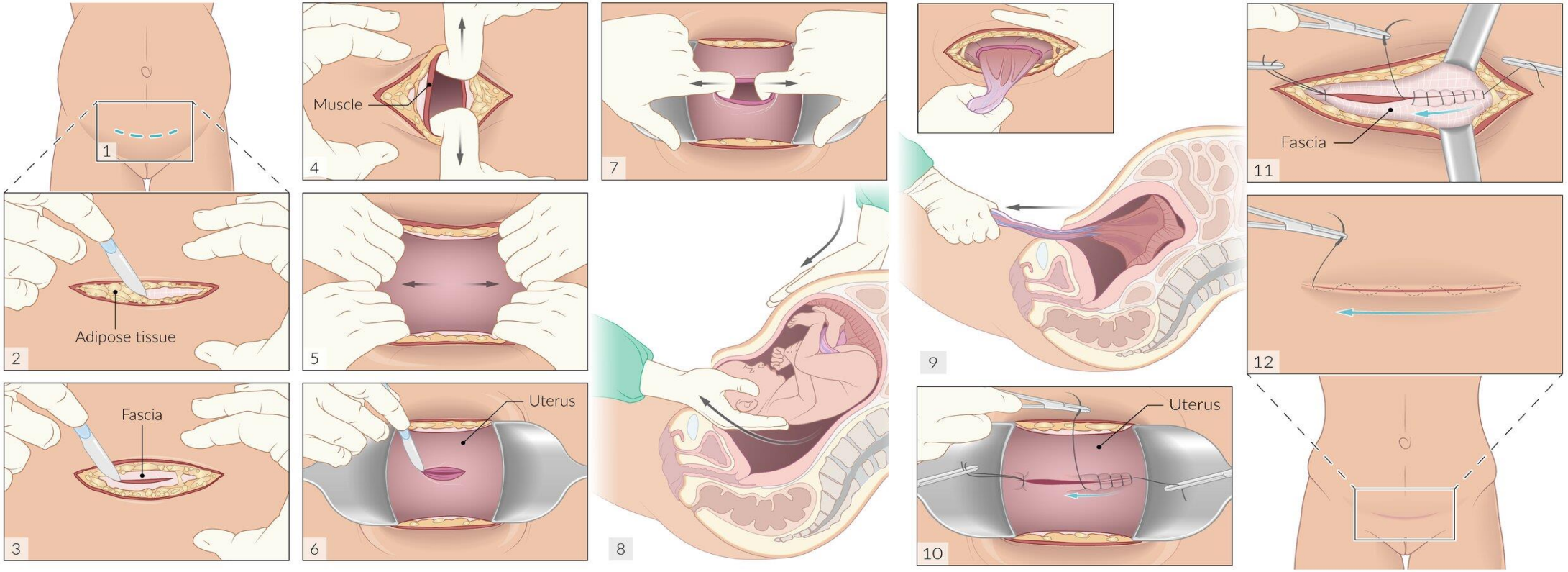
38. <u>Caesarean section</u>

Caesarean delivery refers to the delivery of newborns via a vertical or horizontal surgical incision in the abdominal wall and uterus. It is typically performed in situations where **maternal and/or fetal health is at risk** or compromised, but can also be performed as an alternative to vaginal delivery in routine pregnancies. Occurs in 25% of births in developed countries.

a. **Advantages**: Safest method os birth if maternal and/or fetal health is compromised by vaginal delivery. Fetal birth trauma is rare.
b. **Disadvantages**: It is associated with longer recovery period than vaginal birth. Post-operative complications may develop.
c. **Indications**:
    i. **Maternal indications**:
        - **Primary caesarean delivery**: Placental praevia, refractory HELLP, severe preeclampsia, severe uterine abnormalities (eg. myomas), maternal skeletal abnormalities, severe maternal diseases (cardiopulmonary disorders), maternal HIV infection, cephalopelvic disproportion and breech presentation.
        - **Secondary caesarean delivery** (after PROM and/or onset of phase 1): Prolonged labour in premature birth, intramniotic infection, abnormal fetal position (eg. breech presentation), maternal exhaustion.
        - **Emergency caesarean delivery**: Immediate threat to the life of the mother, including suspicion of placental abruption and suspected uterine rupture, prolonged first stage of labour (diagnosed when full dilatation is not seen 12-16 hours after birth onset).
    ii. **Fetal indications**:
        - **Primary caesarean delivery**: IUGR with circulatory depression, premature birth if further risk factors are present, fetal malformation that hinder normal birth.
        - **Emergency caesarean delivery**: Immediate threat to the life of the fetus, including pathological CTG and fetal acidosis (fetal distress).
    iii. **Caesarean delivery on maternal request**: Refers to a primary caesarean delivery performed on maternal request and in the absence of medical indications.
        - Possible reasons → Fear of pain of labour, prior negative labour experience, concerns about fetal harm during delivery.
        - Explore the patient's reasons, address concerns of labour and provide information about prenatal childbirth information, obstetric analgesia. Inform the patient about the risks of C-section.
        - If the patient insists on having a caesarean delivery → schedule the procedure for **after 39 weeks of gestation**.
d. **Procedure**: The most common procedure is the **lower segment caesarean surgery** (LSCS), in which the abdominal wall is opened with a suprapubic transverse incision and the lower segment of the uterus is also incised transversely to deliver the baby.
    1) Suprasymphyseal transverse incision of the anterior abdomen. A common transverse incision is the **Pfannenstiel type**.
    2) Dissection of the subcutaneous fat and fascia.
    3) Dissection of the rectus fascia.
    4) Separation of the abdominal, rectal muscles in the midline by lateral blunt finger traction.
    5) Lateral extension of the incision.
    6) Transverse hysterotomy after insertion of retractors.
    7) Lateral digital extension of the uterine incision.
    8) Delivery: fetal extraction.
    9) Removal of the placenta via controlled cord traction.
    10) Continuous closure of the hysterotomy via corner sutures.

11) Continuous facial closure using corner sutures.
12) Continuous subcuticular suture.

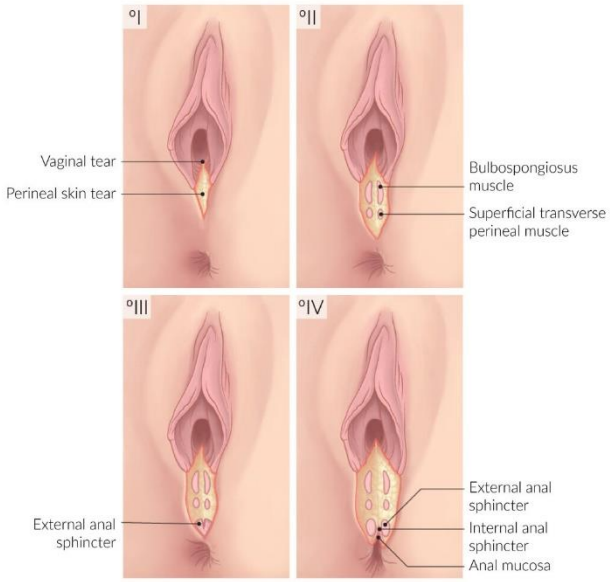
e. In cases of extreme prematurity, multiple fibroids or when the fetus is transverse → the uterus may be incised vertically (**classical caesarean section**).
f. **Complications**: Although serious complications are rare, these are greater than with a normal vaginal delivery.
    i. **Maternal complications**: Complications include hemorrhage and need for blood transfusion, infections of the uterus and wound, surgical injuries, postoperative incisional pain, neuropathy, thromboembolic events and uterine rupture.
        - **Preoperative ATBs** and **thrombophylactic measures** are routinely employed.
    ii. **Fetal complications**: ARDS and fetal lacerations.
g. **Subsequent births**: Patients who have undergone a previous caesarean delivery have two options for mode of delivery:
    i. **Trial of labour after caesarean**: Refers to an attempt of vaginal delivery in a mother who has had a previous caesarean delivery.
        - Contraindicated in patients with history of >2 prior low-transverse caesarean delivery or prior classic caesarean delivery.
    ii. **Repeat Caesarean delivery**: Refers to a caesarean delivery in a patient who has had a previous C-section.



39. <u>Episiotomy, perineal lacerations, cervical injury</u>

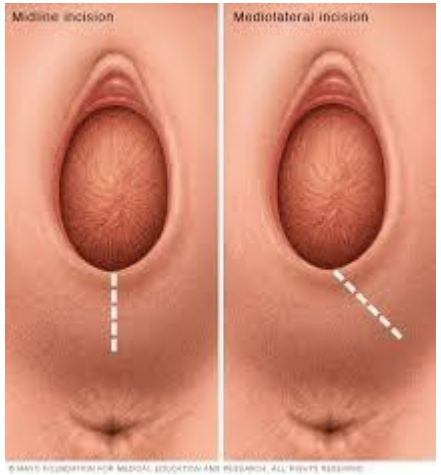
Perineal lacerations refer to a tear of the perineal area due to significant or rapid stretching forces during delivery (during the 2nd stage of delivery). It is the most common obstetrical injury of the pelvic floor.

a. **Risk factors**: Macrosomia, Forceps delivery, no previous delivery, prolonged second stage of labour, occipito-posterior delivery.
b. **Classification**:
    i. **First degree**: Cutaneous to subcutaneous tear.
    ii. **Second degree**: First degree laceration plus involvement of the perineal muscles.
    iii. **Third degree**: Second degree laceration plus involvement of the external anal sphincter.
    iv. **Fourth degree**: Third degree laceration plus involvement of the anterior wall of the anal canal or rectum.
c. **Clinical features**: Perineal pain and edema, hematoma, dysuria, symptoms of pelvic floor dysfunction (fecal incontinence, pelvic organ prolapse), signs of infection (foul-smelling discharge, fever).
d. **Diagnosis**: During birth, **inspection of the perineum** provides a diagnosis. **DRE** may show a palpable defect and/or decreased anal sphincter tone.
e. **Treatment**:
    i. 1st and 2nd degree lacerations → NSAIDs, local anesthesia and suturing.
    ii. 3rd and 4th degree lacerations → Regional or general anesthesia and reconstructive surgery.
f. **Complications**: Pain, dyspareunia, rectovaginal fistulae, hemorrhage, infection.



Episiotomy refers to an incision of the perineum to enlarge the vaginal opening during surgery. It is not routinely recommended.

a. **Indications**: Can be considered if vaginal delivery needs to be expedited and maternal perineal tissue it thought o pose a significant obstacle.
    i. Complicated vaginal delivery → breech and shoulder dystocia.
    ii. Fetal distress during active pushing.
    iii. Risk of 2nd or more degree perineal tears (the clean cut from episiotomy is easier to manage than the natural tear.
    iv. Large baby
    v. Instrument delivery (forceps or ventouse) is indicated.
b. Type:
    i. Mediolateral: cut is made from the fourchette laterally → less risk of anal sphincter injury
    ii. Midline: cut is made from the fourchette towards the anus.
c. Complications: Bleeding, hematoma, pain, scarring and dyspareunia.



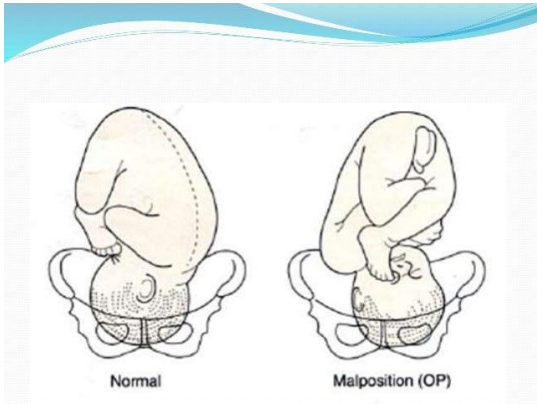
40. <u>Occipito-posterior presentation, cephalo-pelvic disproportion</u>

Obstructed labour refers to the arrest of vaginal delivery due to mechanical obstruction. Predisposing factors include excessive fetal size (macrosomia), uterine abnormalities (eg. uterine leiomyomas), placenta praevia, oligohydramnios and polyhydromnios. It may be associated with:

a. **Fetal malpresentation**: Any fetal lie or presentation that is not cephalic and can pose a risk to safe spontaneous vaginal delivery:
   i. Breech presentation (Frank breech, complete breech, single or double footling breech)
   ii. Shoulder presentation
   iii. Transverse or oblique lies.
b. **Fetal malposition**: A type of fetal position that can pose a risk to safe spontaneous vaginal delivery:
   i. Occipito-posterior position;
   ii. Occipito transverse position.

Occiput posterior presentation is a type of cephalic lie presentation, where the occiput of the fetus points towards the maternal sacral promontory. It is a common disorder that is often accompanied by varying degrees of extension → that lead to a larger diameter to pass through the outlet. The end result is a longer and more painfull birth.

a. **Complications**: prolonged 1st and 2nd stage of labour, ↑ need for C-section and its risks, risk of fetal hypoxia and fetal birth trauma.
b. **Diagnosis**: **Digital vaginal examination** (→ fetal frontal and sagittal sutures and anterior fontanelle are anteriorly in the maternal pelvis) and **US**.
c. **Management**:
   1. If progress of labour is normal → no action is needed.
   2. If progress of labour is slow → **birth augmentation** is used (involves the use of amniotomy and/or oxytocin)
   3. If occipito posterior position persists (happens in 5% of births because many foetuses rotate to a OA position during the 2nd stage of labour) → delivery is "**face to pubis**" (meaning that birth is completed by flexion rather than extension over the perineum) or **manual, ventouse or forceps rotation to an OA position** is attempted.
   4. If the delivery does not progress to full dilatation → consider **C-section**.



Cephalo-pelvic disproportion refers to the situation where the female pelvis is simply too small to allows passage of the fetal head. It depends on the size of the pelvis and fetal head.

a. It is a **retrospective diagnosis** (only diagnosed after labour has failed), best defined as the innability to deliver a particular fetus despite adequate uterine contractions and in the absence of any positional abnormality.
b. **Etiology**: **Fetal factors** (fetal macrosomia, fetal masses such as thyroid and neck tumours, macrocephaly due to fetal hydrocephalus) and **maternal factors** (small pelvis).
c. **Diagnosis**:
   i. Cephalo-pelvic disproportion is suspected if → labour fails to progress, medical therapy (oxytocin) fails, fetal head is not engaged, caput formation.
   ii. CPD can be estimated based on → pelvimetry, MRI
d. **Management**:
   i. A diagnosis of CPD during labour → **C-section**

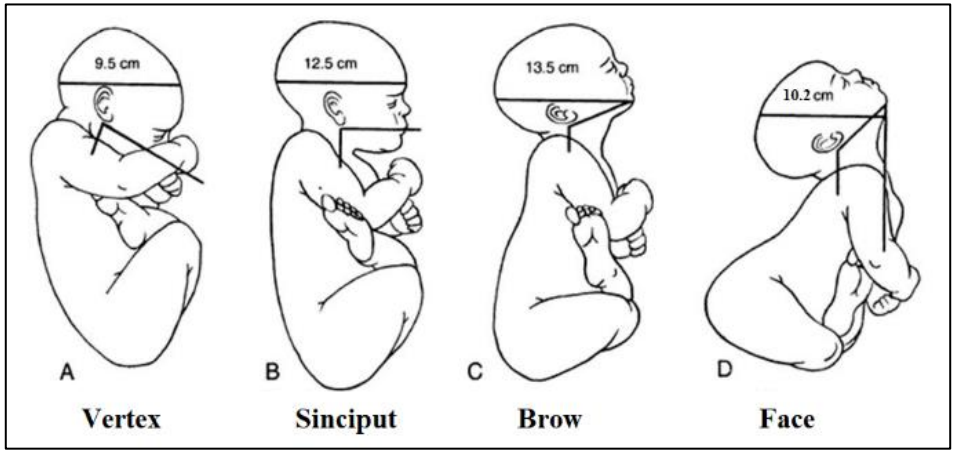
41. <u>Fetal malpresentations – face and brow presentation</u>

Brow presentation is a rare subtype of cephalic presentation, where the head of the infant is partially extended resulting in a large engaging diameter that will **not deliver vaginally**. It may be seen in early pregnancy, but it often flexes into a vertex presentation.

a. In a brow presentation, the engaging diameter is called **mentovertical diameter** and is 14 cm (longest fetal head diameter).
b. **Diagnosis**: **Abdominal palpation** (4th maneuver allows assessment of the degree of flexion of the fetal head) and **vaginal examination** (allows palpation of the anterior fontanelle and nose).
c. **Management**: Up to 50% of brow presentations will convert to vertex or face presentation before the 2nd stage of labour.
    i. If fetal head flexion occurs during the 1st stage of labour → deliver vaginally
    ii. If further fetal head extension occurs during the 1st stage of labour → deliver vaginally
    iii. If the fetal head remains in brow presentation → impossible to deliver vaginally → C-section is indicated

Face presentation is a rare subtype of cephalic presentation, where the head of the infant is completely extended. The result is that the face becomes the presenting part of the fetus.

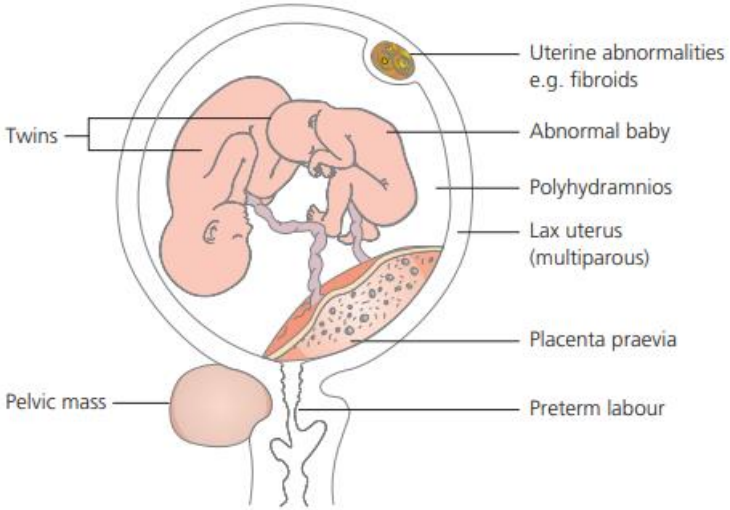
a. In a face presentation, the engaging diameter is called the submento-bragmatic diameter and measures 9.5 cm (making vaginal delivery possible).
b. **Etiology**: Face presentation is associated with cephalopelvic disproportion, pelvic contracture, multiple gestation, prematurity and fetal abnormalities.
c. **Diagnosis**: **Abdominal palpation** (4th maneuver display complete flexion of the neck) and **vaginal examination** (allows palpation of the mouth, nose and eyes).
d. **Management**: The mode of delivery of foetuses in face presentation depends on the orientation of the chin in relation to the maternal pelvis:
    i. **Mentum anterior**: Vaginal delivery is possible.
    ii. **Mentum posterior**: If the chin of the infant is posterior, vaginal delivery is not possible because the fetal neck can no longer further extend.
        - **C-section** is indicated.
e. Neonates delivered in a face presentation exhibit significant **facial** and **skull edema**, which usually resolves within 24-48 hours.

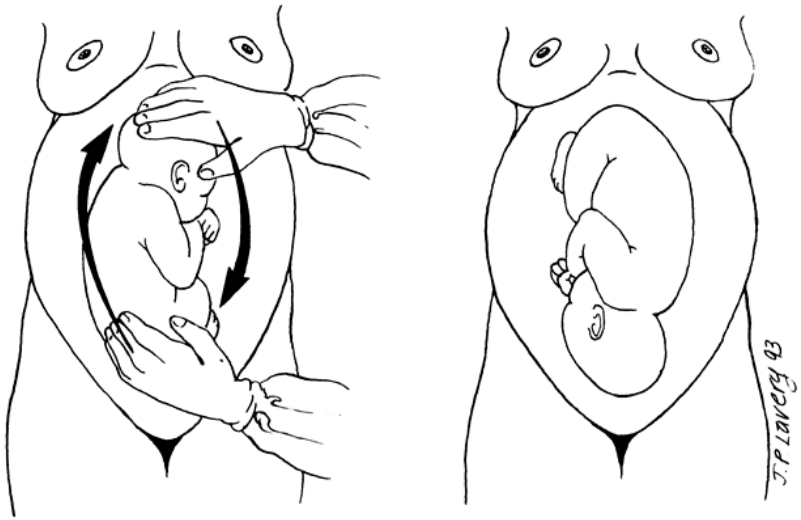


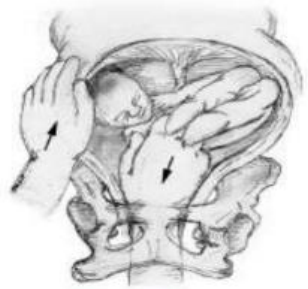
42. <u>Fetal malpresentations – transverse and oblique lie (shoulder presentation)</u>

Transverse and oblique lies are abnormal fetal lies that occur when the long axis of the fetus has an angle of 90º and 45º (respectfully) angle in relation to the maternal long axis. The engaging part is the shoulder (shoulder presentation). Occurs in 0.5% of pregnancies.

a. It is an obstetrical emergency, because labour is obstructed and there is a risk of uterine rupture and fetal distress.
b. **Etiology**: Preterm labour is more commonly complicated by an abnormal lie than a full term labour.
    i. Polyhydromnios or high or multiparity (→ these conditions allow more space for the fetus to turn)
    ii. Fetal and uterine abnormalities and twin pregnancy (→ these conditions prevent turning and contribute to a persistent abnormal lie)
    iii. Placenta praevia, pelvic tumours or uterine deformities (→ these conditions prevent engagement)
c. **Complications**: If the head or the breech cannot enter the pelvis, labour cannot occur.
    i. There is a higher risk of **uterine rupture** and **cord prolapse** (after ROM, the umbilical cord delivers → obstructs blood flow → fetal distress).
d. **Diagnosis**:
    i. **Inspection of the abdomen** shows a suspicious belly with a longer transverse than longitudinal diameters.
    ii. **Abdominal examination** (1st maneuver will not display the presence of a head or breech) and **US**.
e. **Management**:
    i. No action is required for transverse or unstable lie before 37 weeks (unless labour occurs)
    ii. **Before labour**:
        - **External cephalic version** (ECV) can be attempted 4-6 weeks before delivery.
        - If ECV fails → delivery should be planned as a C-section
    iii. **After labours**:
        - Before ROM → attempt **ECV** between contractions.
        - After ROM → attempt **internal podalic version** (IPV)
        - If these methods fail → **C-section** is indicated.







Internal podalic version

43. <u>Breech presentation, management of pregnancy, mechanism of labour, vaginal delivery versus Caesarean section</u>
44. <u>Breech presentation, partial breech extraction, delivery of aftercoming head (Mauriceau-Smellie-Veit maneuver)</u>

Breech presentation is an abnormal type of fetal presentation, where the presenting part is the **fetal buttocks** or **legs**. It occurs in 3-4% of pregnancies and, like abnormal lies such as transverse or oblique lie, it is more common earlier in pregnancies and therefore, more common if the labour is pre-term.

a. **Types of breech presentation**:
   i. **Frank breech** (hips are flexed but the knees are extended)
   ii. **Complete breech** (both hips and knees are flexed)
   iii. **Single or double footling breech** (one or both feet present below the buttocks).
b. **Etiology**: No cause is found in most cases. Associated risk factors include **previous breech presentation**, **conditions that prevent fetal movement** (fetal and uterine abnormalities or twin pregnancies) and **conditions that prevent engagement** (eg. placenta praevia).
c. **Diagnosis**: Breech presentation is commonly missed and is only relevant from 37 weeks or if the women is in labour (this is because most foetuses convert spontaneously to cephalic presentation)
   i. **Abdominal palpation** (1st maneuver allows detection of the fetal head at the uterine fundus)
   ii. **US** (confirms the diagnosis, helps detection of fetal abnormalities, pelvis tumours or placenta praevia)
d. **Complications**: Both perinatal and long-term morbidity and mortality are increased in breech presentation.
   i. Fetal abnormalities are more common.
   ii. Labour has increased risk of hypoxia and birth trauma.
e. **Management**:
   i. **External cephalic version**: From 37 week, an attempt is made to turn the baby to cephalic presentation. The success rate is 50% and 3% of successfully turned breeches with turn back.
      - **Technique**: ECV is done without anesthesia, but it is made easier with the use of a tocolytic. With both hands in the abdomen, the breech is disengaged from the pelvis, pushed upwards and to the side, and rotation is attempted.
         1. It is performed under US guidance and in a hospital to allow immediate delivery if complications occur.
         2. CTG is performed straight after and Anti-D Ig is given to Rh- mothers.
      - Lower success rates are seen in nulliparous women, where the breech is engaged, where the head is not easily palpable, when the uterine tone is high and with obese women.
      - The maneuver is CI in the case of fetal compromise, when vaginal delivery is CI (eg. placenta praevia), if there are twins or if there has been recent antepartum hemorrhage.
   ii. **Mode of birth**: If ECV has failed or if breech presentation was missed → **planned C-section** or **planned vaginal breech birth** based on maternal choice and patient factors.
      - The difference in risk between both types of labour is very small.
      - **Vaginal breech birth**:
         1. **Patient selection** → vaginal breech birth is more risky if fetal > 3.8 kg, evidence of fetal compromise and footling breech presentation.
         2. **Intrapartal care** → Pushing is discouraged until buttocks are visible. CTG is advised. If poor cervical dilatation or poor descent of the fetus are seen, C-section is advised.

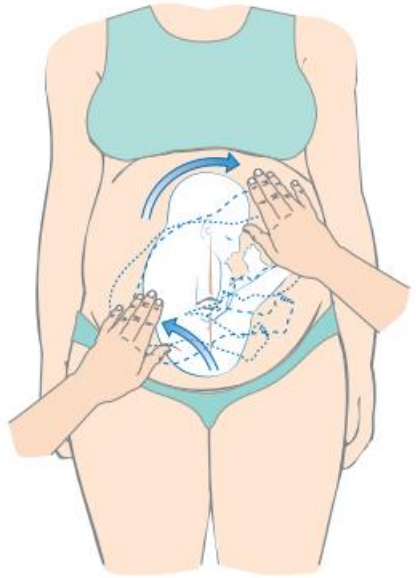


Fig. 26.5 External cephalic version (ECV).

3. **Vaginal breech birth:**
    a) Once the buttocks reach the perineum, an episiotomy may be made but is not essential.
    b) The fetus delivers with maternal effort until the umbilicus. The legs can be flexed out of the vagina, while the fetal back is kept anterior.
    c) Once the scapula is visible, the anterior and then the posterior arms are "hooked" down by a finger over the shoulder.
    d) Once the back of the neck is visible, the operator supports the weight of the fetus on one palm and forearm, with their finger in its mouth to guide the head over the perineum and maintain flexion. With the same intent, the other hands pushes against the occiput (**Mauriceau-Smellie-Veit maneuver**).
    e) If this fails, forceps are applied to deliver the head.

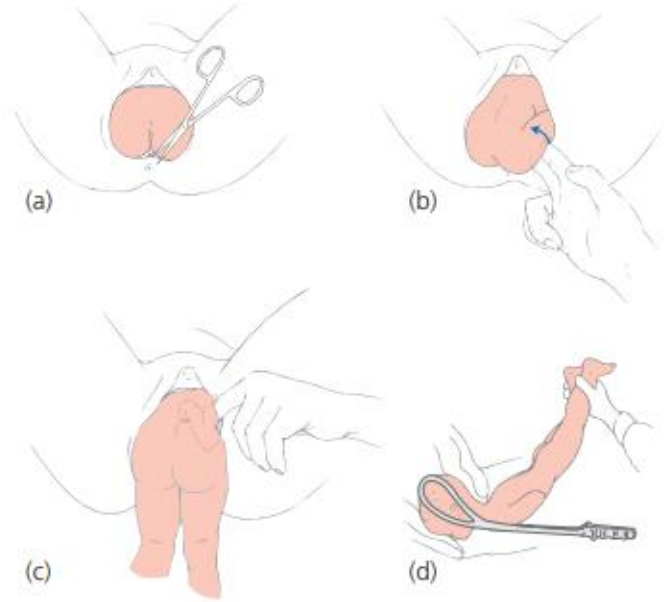
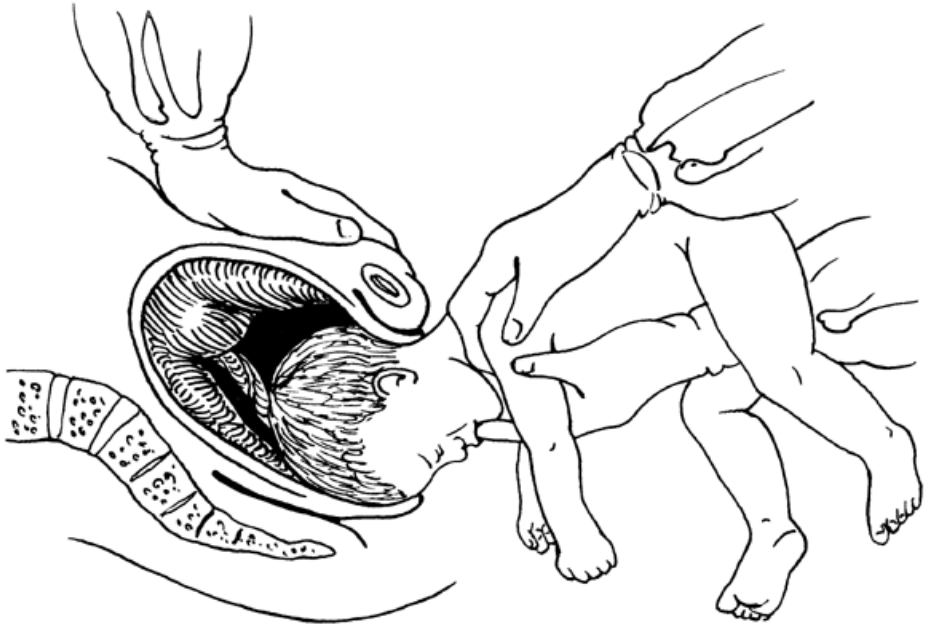


Fig. 26.6 Breech delivery. (a) As the buttocks distend the perineum, perform the episiotomy. (b) A finger behind the knee delivers the legs. (c) A finger hooks each arm down. (d) Forceps delivering the head once the arms are delivered.



45. Postpartum haemorrhage (birth injury, uterine atony, retained part of placenta)

Postpartum hemorrhage is an obstetric emergency characterized by blood loss ≧1000 mL or blood loss manifesting with features of hypovolemia within 24 hours of delivery.

a. **Primary PPH**: blood loss ≦24 hours postpartum (more common)
b. **Secondary PPH:** blood loss from 24 hours to 12 weeks postpartum

1. **Birth Trauma**:
   a. **Etiology:** Iatrogenic injury (Cervical laceration**,** lower vaginal trauma (episiotomy), puerperal hematoma, Uterine rupture, Fetal macrosomia, malpresentationof the fetus
   b. **Clinical:** features of hematoma or bleeding of the female genital tract (labia or rectal pain, signs of hypovolemia), pelvic pain, uterine rupture (fetal distress, severe abdominal pain, light/moderate bleeding)
   c. **Treatment**:
      i. **Following vaginal delivery**
         1. **Supportive measures** (e.g., fundal massage, fluid therapy, uterotonic agents)
         2. **Immediate repair of visible bleeding lacerations**
         3. **Hemodynamically stable patient:** arterial embolization
         4. **Hemodynamically unstable patient**
            a. Incision and drainage of hematoma
            b. If the cause of bleeding is not identified: immediate laparotomy
      ii. **Following cesarean delivery:** Supportive measures. Uterine artery ligation
2. **Uterine atony:** Failure of the uterus to effectively contract after complete or incomplete delivery of the placenta, which can lead to severe postpartum bleeding from the myometrial vessels
   a. **Etiology:** overdistention of uterus (large baby, multiple pregnancies, polyhydramnios), exhausted myometrium (multiparity, postterm pregnancy, prolonged delivery, prolonged oxytocin use), anatomical abnormalities (fetal, uterine, abnormal placental implantation), chorioamnionitis, halogenated anesthetics (↓ contractions)
   b. **Clinical:** profuse vaginal bleeding, soft, enlarged boggy ascending uterus
   c. **Diagnosis:** bimanual pelvic exam
   d. **Treatment**:
      i. **Empty bladder**
      ii. **Hemorrhage control**
         1. **Uterotonic agents**: IV oxytocin, IM methylergonovine: if no hypertension or arterial disease is present, misoprostol
      iii. **Tranexamic acid:** Given concomitantly with uterotonic agents
      iv. **Surgical procedures:** Uterine balloon tamponade or packing: if severe bleeding persists, Compression sutures, Surgical ligation of uterine or internaliliac arteries, Last resort: hysterectomy
3. **Retained part of placenta**:
   a. **Etiology:** placenta accreta, assisted vaginal delivery, preterm birth, multiple gestation, retained placenta

b. **Clinical:** abnormal uterine bleeding, fever, lower abdominal pain, amenorrhea
c. **Diagnosis**:
    i. **US:** thickening of endometrial echogenic complex or focal endometrial mass
    ii. **Color doppler:** vascularity of endometrial echogenic material (key finding) or endometrial mass
d. **Treatment**:
    i. **Uterotonic agents** (e.g., prostaglandin E1 analogs)
    ii. **Surgical procedure:** Dilation and curettage or Hysteroscopic removal

46. Amniotic fluid embolism

Amniotic fluid embolism is a rare life-threatening condition caused by the entry of fetal cells and debris (from amniotic fluid) into the maternal circulation. It occurs in <10 per 100000 live births but is a significant cause of maternal death.

a. **Pathophysiology**: Amniotic fluid can enter into the maternal circulation throught any exposed or severed blood vessel in the uterus or birth canal.
   i. Desquamated fetal cells or lanugo from the amniotic fluid enter maternal circulation → embolize to pulmonary arterioles → ↑ pulmonary resistance, RSHF and pulmonary edema.
   ii. Entry of procoagulants (eg. thromboplastin) from amniotic fluid into maternal circulation → DIC
   iii. Entry of leukotrienes into maternal circulation → triggers an immune response → pulmonary vasospams, pulmonary edema and hypotension.

b. **Risk factors**: Maternal age >30 years, multiparity, complicated labour (placenta praevia/abruption, forceps or caesarean delivery, eclampsia), invasive procedures (eg. amniocentesis, abortion) and blunt abdominal trauma.

c. **Clinical features**: AFE typically manifests during labour or immediately after delivery but can occur up to 48 hours postpartum.
   i. Symptoms of ARDS → dyspnea, tachypnea, cough, hypoxia and basal crackles.
   ii. CVS collapse → hypotension, arrhythmias, cardiac arrest
   iii. Neurological symptoms → altered mental status and seizures.
   iv. Symptoms of DIC → uterine hemorrhage, bleeding from all IV catheter sites, skin bruising.
   v. MODS.

> AFE typically manifests with a classic triad of sudden hypoxia and hypotension followed by coagulopathy. [7][8]

d. **Diagnosis**: AFE is a clinical diagnosis based on sudden onset of typical peripartum clinical features.
   i. Supportive lab tests:
      - ABG analysis: hypoxemia and AB disorders.
      - CBC: anemia and thrombocytopenia.
      - Coagulation panel: ↑aPTT, ↑PT and ↓ fibrinogen

e. **Management**: AFE is a life-threatening condition and must be treated as an emergency.
   i. ABCDE survey: Assess airways, breathing and circulation. Provide respiratory support and hemodynamic stabilization as needed.
   ii. Management of cardiac arrest in pregnancy: Start CPR, while performing left uterine displacement.´
   iii. Treat DIC.

47. Disseminated intravascular coagulation (DIC), trigger mechanisms, diagnosis and therapy

DIC is an acquired coagulopathy characterized by systemic simultaneous clotting and fibrinolysis leading to the formation of microthrombi, resulting in theconsumption of platelets and exhaustion of all clotting factors

1. **Triggers:**
   a. **Obstetric causes:** Placental Abruption, Preeclampsia, Amniotic Fluid Embolism, , Placenta Previa/Accreta, Postpartum Bleeding, , Intrauterine Infection, Acute Fatty Liver
   b. **Non-Obstetric causes:** Infection (sepsis) – Bacteremia, Trauma (Burns, Crush Injury), Malignancy – e.g. Leukemia (esp. APL), Acute Pancreatitis, AcuteLiver Failure, Transplant Rejection
2. **Mechanism**:
   a. **Tissue injury/underlying disease** → release **Tissue Factor** (procoagulant) into circulation → activates coagulation cascade → this ↑ activation of thrombinand generation of fibrin
      i. **Widespread intravascular coagulation** → thrombosis → tissue ischemia & microangiopathic hemolytic anemia
      ii. Consumption of platelets (thrombocytopenia) & low clotting factors → bleeding
3. **Clinical manifestations**:
   a. **Severe uterine bleeding**: may not be seen at presentation if it is "concealed abruption"
   b. **Diffuse oozing of blood**: skin (IV) or mucosa (bladder catheter)
   c. **Intraabdominal bleeding** (uncommon): can occur in cases of hepatic rupture related to preeclampsia, eclampsia, or HELLP syndrome
   d. **Shock**: tachycardia, hypotension, weak pulses, altered mental status, cool extremities, narrow pulse pressure) and/or organ dysfunction may be present
   e. **Organ dysfunction**: acute renal failure, hepatic dysfunction, acute lung injury, neurologic dysfunction
4. **Diagnosis**:
   a. **Labs:**
      i. **Coagulation panel:** ↑ D-dimer, ↑ aPTT, ↑ PT, ↓ Fibrinogen↑ Bleeding time
      ii. Thrombocytopenia
5. **Treatment:**
   a. **Treat underlying cause**
   b. **Blood products:**
      i. **Cryoprecipitate:** contains factor 8, factor 13, vWF, and fibrinogen
         - **Indication:** bleeding and fibrinogen levels < 150 mg/dL despite FFP or when FFP transfusion is not possible
      ii. **Fresh frozen plasma**: containing all coagulation factors
         - **Indication**: PT or aPTT >1.5 x the normal value
      iii. **Platelet concentrate:** if platelet count is decreased to 20k-50K
   c. **Anticoagulation:** should only be considered in rare case of DIC with thrombosis predominating heparin

48. Fetal distress assessment

Fetal distress refers to signs before/during childbirth indicating that the fetus is not well due to inadequate oxygenation

- **a.** It typically indicates fetal hypoxia → may result in permanent brain damage or death if not immediately reversed by treating its cause.

1. **Nonreassuring fetal status**:
   - **a. Fetal HR in response to fetal hypoxia and metabolic acidosis**
     - **i.** Fetal tachycardia (FHR>160-180/min)
     - **ii.** Fetal bradycardia (FHR <110/min)
     - **iii.** Loss of baseline variability
     - **iv.** Recurrent variable/late decelerations
   - **b. US:** ↓ fetal movements, MSAF
   - **c. Biochemical signs:** assessed from scalp or umbilical blood
     - **i.** ↑ lactate
     - **ii.** Fetal lactic acidosis
2. **Antepartum assessment of fetal distress**:
   - **a. Physical examination:**
     - **i.** Auscultation of fetal heart**:** using a hand-held doppler or pinard stethoscope. Confirms the fetus is alive
     - **ii.** Fetal size and fundal height**:** evaluate changes in growth
   - **b. Daily fetal movement count:** <10 movements in 12 hours → risk of fetal distress → non stress test indicated
   - **c. US**:
     - **i.** Gestational age (measure head circumference, biparallel diameter, abdominal circumference, femur length) + EFW (estimated fetal weight)
     - **ii.** Viability of fetus
     - **iii.** Amniotic fluid volume (AFI)
     - **iv.** Localization of placenta
     - **v.** Doppler US (uterine artery, umbilical artery and MCA)**:** Resistance within placenta can be measured from maternal side as screening test at 23 weeks.

Vessel	Pathological finding	Explanation
Uterine artery	Early diastolic notch	↑ risk of pre-eclampsia and/or fetal growth restriction (IUGR)
Umbilical artery	Decline or loss of end diastolic flow velocity or negative flow	Due to increase resistance to placental vascular bed ↑ indicator of placental failure
Fetal middle cerebral artery	Increased diastolic flow velocity	Signs of centralization (brain sparing effect) in fetal hypoxia Screening for anaemia

   - **d. Hormonal studies**:
     - **i.** Urinary estriol – low urinary estriol suggests fetal distress
     - **ii.** Human placental lactogen (hPL)**:** low levels after 36th week – ass. w/ fetal distress

e. **CTG**:
   i. **Non stress test:** a non-invasive test that measures FHR reactivity to fetal movements
      1. **Indications:** maternal medical conditions (GDM, preeclampsia) or fetal conditions (e.g. fetal heart defects, fetal growth restriction) that increase the risk of fetal hypoxic injury or death
      2. Usually performed in the third trimester
      3. **Reactive nonstress test:** >2FHR accelerations is considered normal
      4. **Non-reactive nonstress test:** < 2FHR accelerations
         a. **Causes:** quiet fetal sleep or prolonged sleep cycle, fetal immaturity or maternal smoking/drug use
   ii. **Oxytocin test:** oxytocin is administered to provoke uterine contractions. Measure FHR in response to uterine contractions

f. **Biophysical profile:** a non-invasive test that evaluates risk of antenatal fetal death, usually performed after 28th gestational week
   i. Measured parameters**:**

Scoring criteria	
Parameter	**Normal result = 2 points**
Fetal movement	>3 body or limb movements within 30 mins period
Fetal tone	>1 episode of fetal extremity or spine extension with return to normal
Fetal breathing	>1 rhythmic breathing episode >30seconds within 30 min period
Amniotic fluid volume	Single deepest vertical pocket >2cm with horizontal dimension >1cm
Nonstress test	>2 episodes of FHR accelerations of 15 bpm and >15 seconds associated with fetal movement within 20 min period
> 8 → no signs of fetal compromise at the time of testing **:** reassurance 5-7**:** unclear risk of fetal compromise → repeat BPP within 24 hours <4 → delivery is indicated (if pregnancy is <30 weeks, administer steroids and deliver)	

3. **Intrapartum fetal monitoring**:
   a. **Electronic fetal heart rate monitoring:** used during 3rd trimester and labor to detect signs of fetal distress
      i. During birth it's placed on the scalp of the fetus. Used when external monitoring is difficult
   b. **Fetal HR:** normally 110-160 bpm
      ii. Nonstress test (NST) or contraction stress test (oxytocin test)

49. <u>Neonatology, examination of newborn</u>
50. <u>Neonatology, resuscitation of newborn</u>

Term newborns are those born between the **37th and 42nd week of gestation**. A physiological newborn is born form a physiological pregnancy in estimated term +- 2 weeks. Around 10% of births occur before this period and are defined as **preterm birth**. **Neonatal care** is refers to the medical management given to neonates until discharge from the hospital. Most infants born at term require very little medical attention.

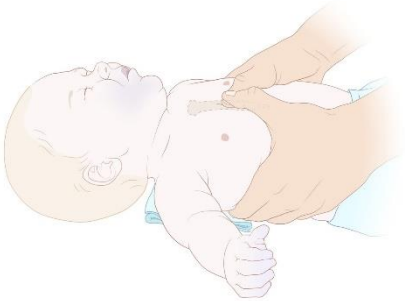
a. Basic terminology:
- i. **Perinatal period** → the period between 22nd weeks of gestation to the 7th day after birth.
- ii. **Postpartum period** → first 6-8 weeks after birth.
- iii. **Newborn** → a child under 28 days of life
- iv. **Infant** → a child under 1 year of life.
- v. **Birth weight**:
  - i. **Small for gestational age** → birth weight < 10th percentile
  - ii. **Large for gestational age** → birth weight >90th percentile
  - iii. **Low birth weight** → <2500 g regardless of the gestational age (associated with ↑ mortality, particularly due to sudden infant death syndrome).

b. Immediate care of the newborn:
- i. Immediately after birth, wipe the newborn's mouth and nose to **clear airway secretions**. **Dry and stimulate the newborn**.
- ii. **Provide warmth** (using a blanket or radiant heat source. Newborns are at high risk of hypothermia due to thin layer of subcutaneous tissue and large body surface to volume ratio).
- iii. Assess **newborn status** for the need of **neonatal resuscitation.**
- iv. Infants who are **born at term** and are **breathing and moving satisfactorily** should be immediately given to their mother for **skin-to-skin contact** and **initiation of breast feeding**.
- v. Infants who are **born prematurely**, **lack muscle tone**, are **not breathing or crying** and/or has **poor heart rate** may require **supplemental oxygen** or **neonatal resuscitation**.
- vi. Assess the **Apgar score** and **gestational age**.
- vii. **Identify the newborn** and **clamp the umbilical cord** (after at least 1 min).
- viii. **Preventive measures directly after birth → prophylactic eye drops** for opthalmia neonatorum (erythromycin or silver nitrate - creidization) and **Vitamin K**.

- **Apgar score**: Used for the standardized clinical assessment of newborns at 1, 5 and 10 minutes after birth. It assesses 5 components, **Appearance** (skin color), **Pulse** (pulse rate), **Grimace** (reflex irritability upon tactile stimulation), **Activity** (muscle tone and movement) and **Respirations**.
  1. Assessing the need for and beginning of **neonatal resuscitation** should be done independently and before the Apgar score.
  2. **Reassuring score** → 7-10, **Moderately abnormal score** → 4-6, and **Low score**→ 0-3.
- **Neonatal resuscitation**: Immediate assessment of the neonatal breathing, heart rate and pulse rate should be performed immediately after birth. If signs of arrest are found, start neonatal resuscitation.
  1. Perform pulse oximetry.

Sign	0	1	2
Heart rate	Absent	<100 bpm	>100 bpm
Respiratory effort	Absent	Slow, irregular	Good, crying
Muscle tone	Flaccid	Some flexion extremities	Active motion
Reflex irritability	No respond	Grimace	Vigorous cry
Color	Pale	Cyanotic	Completely pink

2. If there is **inadequate respiratory effort** (eg. gasping or apnea) or **HR < 100** → start **positive pressure ventilation** (bag-mask ventilation) at **40-60/min**.
    I. **Intubation** is indicated if PPV is ineffective or compressions are required.
    II. **Restrict the use of supplementary O2 based on SpO2.**
3. If **HR < 60** despite adequate ventilation for 30 secs → start **chest compressions** (either via **two finger technique** or **two thumb encircling hands technique**)
    I. 3 chest compressions followed by 1 inflation.
4. **Resuscitation drugs**: **IV epinephrine** is given if the **HR < 60 bpm despite adequate ventilation and chest compression** for at least 30-60 secs.
5. If there is **no evidence of ROSC within 20 minutes** → consider **termination of resuscitation**.



c. Care of the newborn at the nursery: Measurements and a detailed examination of the newborn, should take place within the first 24 hours of birth.

i. **Measurements**: The examiner measures **length**, **weight** and **head circumference** and plots them on standard growth curves to determine the newborn's percentile for gestational age.
    - Normal range (btw 10^{th}-90^{th} percentile), length (~50 cm), weight (2,5-4.5 Kg) and head circumference (~33-37 cm).
    - Note: Normally, infants lose 7% of weight after birth. Birth weight should be regained at day 7-10.

ii. **Vital signs**: **HR** (120-140 bpm), **RR** (40-50 bpm)

iii. Examine for the posture, appearance and reactions of the newborns. Assess for any birth injuries (including clavicular factures). Palpate the large and small fontanelles for any bulging, size and pulsation.

iv. Examine the head shape, face (for any abnormality), earlobes and patency of the ear canal. Assess the oral cavity for cleft palate.

v. Examine the **neck** for any lymph nodes, resistances or fistulas. Palpate the **clavicles** for signs of fracture due to birth.

vi. Examine the **abdomen** for the presence of hernias or any mass.

vii. Examine the **genitals** for any abnormality (Assess openings of the urethra, assess for the presence of the testis by palpation). Palpate the **pulse of the femoral arteries** (to assess for coarctation of the aorta).

viii. Perform **brief neurological examination**, including muscle tone, symmetry of movement and neonatal reflexes (Rooting, suckling, palmar and plantar grasps, Moro's and Babinski's)

ix. **Billirubin and pH in the blood.**

x. Assess for the **first passage of urine** and the **passage of meconium**.

xi. Provide the **first shot of the HBV vaccination**.

xii. Encourage and provide counseling regarding breastfeeding.

d. Newborn screening: Before leaving the hospital, newborns should be screened for serious and life-threatening conditions. The optimal time for screening is 48-78 hours after birth. Screening involves:

i. **Screening of congenital and metabolic conditions**: Performed 48-72 hours after birth, typically via capillary heel stick (**dried blood test** – involves collection of blood from the heel → transfer it to a piece of paper → send it to the lab).
   - Allows detection of PKU, CF, Homocysteinuria, Galactosemia, SCID, and SMA, Congenital Hypothyrosis (via cord screening), CAH.

ii. **Glucose screening**: Indicated for SGA, LGA, premature or infants from diabetic mothers.

iii. **Billirubin screening**: At >24 hours of age or prior to leaving the hospital.

iv. **Screening for DDH**: Hip examination (Ortolani and Barlow's tests) and US by orthopedist.
   - **Triple screen**: at birth, 6 weeks and 3 months

v. **Visual screening**: Using ophthalmoscope to look for red reflex (normal finding) or abnormalities (leukocoria).
   - **Leukocoria** → congenital cataracts, retinoblastoma, toxoplasmosis

vi. **Screening of congenital heart defects**: At >24 hours of age, via simultaneous pulse oximetry of the right hand and foot.
   - Allows detection of cyanotic CHD.

vii. **Screening of congenital deafness (optional)**: Performed prior to hospital discharge, via otoaccoustic emissions.

viii. **Screening for kidney abnormalities (optional)**: Via US of the kidneys and calyceal system.

e. **Discharge**: Before the discharge of the neonate, family education is performed. Discharge is possible if there is a rising weight curve, no neonatal icterus and no signs of disease.

51. Normal puerperium, breast feeding, rooming-in

Puerperium refers to the period of time from delivery of the placenta to 6 weeks after delivery, during which the body returns to the non-pregnant state

- **a. Uterus:** weighs approximately 1000g during pregnancy and shrinks to 50-100g within 6 weeks after delivery
- **b. Endometrial lining:** rapidly regenerates and by 7 days, endometrial glands are already evident
- **c. Lochia:** vaginal discharge after delivery, changes from red to brownish red to yellow over a period of approximately 5 weeks
- **d. Cervix and vagina** revert to a non-pregnant state but never return to the nulliparous state
- **e. Perineum and abdominal** wall take several weeks to regain muscle tone and return to a prepregnant state
- **f. Ovary function and menstrual periods** return within 12 weeks, influenced by breastfeeding
  - **i.** Women who breastfeed have a longer period of amenorrhea and anovulation

1. **Routine postpartum care:** occurs in the hospital setting for 2-5 days after delivery (3-5 days after c-section)
   - **a. General:** used for recovery, monitoring of the mother and education of newborn care
     - **i. Monitor for:** blood loss, signs of infection, abnormal BP, contraction of uterus, ability to void
     - **ii. Routine:** check baby's blood type, administration of RhoGAM vaccine to the Rh-negative mothers with Rh+ babies, encourage walking and eating a regular diet
   - **b. Vaginal Delivery**:
     - **i. Pain control**: NSAIDS, low-dose opioids
     - **ii. Perineal care**: patients with episiotomies or lacerations must use ice packs around the clock for the first 24 hrs for pain and edema
     - **iii. Hemorrhoids:** treated with corticosteroid creams, witch hazel compresses, and local anesthetics
   - **c. Caesarean delivery**:
     - **i. Routine care:** Local wound care and observation for signs of infection or separation (cellulitis, wound abscess, skin/subcutaneous tissue/rectus fascialevel wound separation)
     - **ii. Pain control:** Opioids (may cause postoperative ileus or constipation), NSAIDs (for cramping pain caused by uterine involution), stool softeners and occasional laxatives for patients on opioids
     - **iii. Infection prophylaxis:** 1st or 2nd gen cephalosporin
2. **Breastfeeding**:
   - **a. Lactogenesis:** triggered by the delivery of the placenta, which results in falling levels of estrogen and progesterone with continued presence of prolactin
     - **i.** Prolactin levels decrease and return to normal if mother is not breastfeeding
   - **b. Breastmilk composition:** contains all the required nutrients (except vitamin D and vitamin K) for infants up to 6 months of age.
     - **i. Colostrum:** the first milk produced during late pregnancy until 3–4 days postpartum; rich in proteins and immunoglobulins. Sucking by newborntriggers its release
     - **ii. Mature milk**: Proteins, lactose and oligosaccharides, fats, minerals, trace elements, and vitamins
       - **Passive immunity in neonates** → Immunoglobulins (secretory IgA), lactoferrin, lysozymes, Lymphocytes, macrophages
   - **c. Benefits**:
     - **i. Infant**: ↓ risk of middle ear, respiratory, gastrointestinal, UTI, asthma, allergies and DM
     - **ii. Maternal:** Faster uterine involution, post-partum weight loss, ↓ risk of ovarian and breast cancers, Postpartum contraception (lactationalamenorrhea),

Improved bonding with the infant, Reduced costs

d. **Contraindications: Absolute:** HIV infection (maternal), galactosemia (infant), **Relative:** TB, active herpes on breasts, tetracycline, chloramphenicol, chemotherapy agents, lithium
e. **Complications:** breastfeeding jaundice, breast milk jaundice, mastitis, nipple injury, breast engorgement

3. **Rooming in:** Baby stays with mother all the time. This builds the mother's confidence in caring for the baby and helps her to learn feeding signals, and how tocomfort the baby.

52. Postnatal complications (infections, secondary postpartum haemorrhage, trombo-embolism, lactation suppression, complication of breast-feeding, postpartum blues)

1. **Puerperal pyrexia** refers to a fever > 38 degree in the first 14 days after delivery. It is a major cause of maternal death
   a. **Uterine infection (endometritis)**:
      i. **Risk factor:** C-section, premature rupture of membrane, prolonged labour, intrapartum chorioamnionitis
      ii. **Manifestation:** fever, foul smelling & profuse & bloody discharge, tender uterus on examination
      iii. **Treatment:** antibiotics (e.g., clindamycin + aminoglycoside)
   b. **Perineal wound infections:** such as infection of episiotomy wounds and repaired lacerations. Can cause the wound to breakdown
   c. **Breast infection:** mastitis, abscess. It is most often caused by S. aureus usually in the first few weeks after delivery. Mainly in primiparity.
      i. **Aetiology:** milk stasis, ↓ emptying of breast, nipple cracking
      ii. **Manifestation:** tender and swollen breast, redness, fever, nipple cracking
      iii. **Complication:** breast abscess (tender, 'wavy' breast mass with overlying erythema)
      iv. **Treatment:** antibiotic + continued breastfeeding ± drainage for abscess
   d. **UTI:** bladder may be hypotonic & predispose to UTI postpartum. Most common causes are E. coli, Proteus, and Klebsiella.
      i. **Risk factor:** C-section, FAVD/VAVD, tocolysis, induced labour, maternal kidney disease, bladder catheterisation
      ii. **Manifestation:** frequency, urgency, dysuria, haematuria, suprapubic pain
      iii. **Treatment:** 3-7 days antibiotic (amoxicillin/cephalexin/nitrofurantoin)
   e. **Abdominal wound infection:** most often seen in CS, prophylactic ATB should be initiated prior to CS.
2. **2° postpartum haemorrhage** refers to a bleeding occurring b/w 24hrs - 6 weeks after delivery (1° PPH: bleeding within 24 hr of delivery)
   a. About 50% of females require surgical evacuation and it is a major cause of maternal death
   b. **Aetiology:** retained products (placental tissue), endometritis, or tear
3. **Thromboembolism:** second major cause of maternal death. May be asymptomatic until presents with PE
   a. **DVT:** leg pain, discomfort, swelling, tenderness, erythema
   b. **PE:** dyspnoea, collapse, chest pain, haemoptysis, ↑ JVP
   c. **Septic pelvic thrombophlebitis:** inflammation of a thrombosed pelvic vein (usually ovarian) due to infectious endometritis after delivery
      i. SPT is more common after C-section than vaginal delivery
      ii. **Manifestation:** fever > 38°C, tender palpable cordlike mass extending superiorly from uterine horns
      iii. **Complication:** septic thromboembolism to lung → effusion/pneumonia/abscess
      iv. **Treatment:** IV heparin + antibiotic (gentamicin & clindamycin)
4. **Lactation insufficiency:** insufficient milk production by the mother
   a. **Aetiology:** 1° due to breasts with insufficient glandular tissue (e.g., after surgery), 2° due to hypoprolactinemia, poor milk transfer due to tongue-tie/cleft palate, medical conditions such as malabsorption of nutrients
      i. **Hypoprolactinemia:** ↑ progesterone (retained placenta, hCG-producing masses, contraceptives), ↑ testosterone (PCOS), hypopituitarism (Sheehan syndrome, ↓ TRH)
   b. **Evaluation of infant:** to assess whether milk supply is actually insufficient
      ii. By age 3-5 days: should have 3-4 stools and 3-5 urines/day, by age 5-7 days: should have 3-6 stools and 4-6 urines/day

iii. Should be alert, have good muscle tone, no signs of dehydration
iv. Consistently gaining weight and growing (newborns should regain birth weight by 2 weeks and gain at least 150g/week)

c. Treatment: increasing skin-skin contact between mother & baby, ↑ duration of breastfeeding, breast massage, if baby isn't feeding then drainage of milk from breasts manually/via breast pump

i. **Pharmacological treatment:** galactagogues (domperidone (D2-blocker), herbs like fenugreek), last resort = formula feeding

5. Complication of breastfeeding:

a. Inadequate milk production/intake

b. Breastfeeding jaundice: neonatal jaundice caused by insufficient breastfeeding

i. Insufficient breastfeeding → lack of calories & reduced bowel movements → ↓ bilirubin excretion → ↑ bilirubin reabsorption → hyperbilirubinemia.

c. Mastitis

d. Galactocele: soft, cystic collection that forms in the breast after obstruction of a milk duct

e. Nipple injury

f. Breast engorgement: tenderness, firmness, and fullness of the breast

ii. **Aetiology:** 1° is initial swelling due to increased milk production postpartum, 2° is insufficient removal of breastmilk
iii. **Treatment:** frequent feedings, warm compresses prior to feeding and cold compresses between, analgesia, expressing breastmilk

6. Postpartum blues: Depression, fatigue, tearfulness starting 2 - 3 days after delivery and resolves within 2 weeks.

a. It is quite common and probably due to the sudden lifestyle changes associated with newborn babies.

b. It is called **postpartum depression** if the symptoms meet MDD criteria with onset within 1 year after delivery

53. Perinatal morbidity and mortality, maternal mortality

1. **Definitions:**
   a. **Perinatal period:** begins at 20-28th week of gestation and ends 1-4 weeks after delivery
   b. **Morbidity:** suffering from a disease
   c. **Mortality:** death
2. **"High-risk" newborn:** these factors are a/w neonatal morbidity and mortality

Maternal status	
Socioeconomic status	- Age ≤ 16y or ≥ 40y - No partner (single mother) - Low socioeconomic status
Medical status	- GDM/hypertension - Genetic diseases in the family
Pregnancy status	
Previous pregnancies/labours	- Previous IUGR/abortion - History of neonatal death/congenital defects
Present pregnancy	- Vaginal bleeding - PROM, preeclampsia/HELLP - Placental abnormalities, vasa praevia - Problematic foetal lie - Non-reassuring foetal CTG
Birth & neonate status	
Present labour	- Dystocia, forceps labour, need for C-section - Signs of foetal distress
Neonate status	- IUGR - Low birth weight (< 2500g) or high birth weight (> 4500g) - Preterm birth (< 34th week)

3. **Perinatal morbidity**:
   a. **Perinatal respiratory insufficiency:** NRDS, meconium aspiration syndrome (MAS), diaphragmatic hernia, bronchopulmonary dysplasia (BPD)
      i. **Treatment**:
         1. Improve oxygenation (100% O_2) + ventilation (intubation)
         2. NRDS → intratracheal surfactant application
         3. MAS → suction of upper airways + resuscitation protocol
   b. **Perinatal asphyxia:** due to perinatal respiratory insufficiency or central hypoventilation (cerebral haemorrhage, intrapartum anaesthesia) → can lead tohypoxic-ischaemic encephalopathy (HIE) → CP, epilepsy, mental retardation

i. **Treatment**:
    1. Improve oxygenation (100% O_2) + ventilation (intubation)
    2. Prevention of HIE = **therapeutic hypothermia:** within 6h of birth the baby is cooled to 33-34°C and left like this for several days. The brain ismonitored by amplified EEG which can differentiate short-term and long-term brain damage

c. **Neonatal infections**:
    i. TORCHeS → pneumonia, retinitis and cataracts, cerebral calcification, PDA, hepatosplenomegaly, microcephaly, 'blueberry-muffin' rash
    ii. Neonatal sepsis (meningitis, pneumonia, gastroenteritis, PN)
        1. Early-onset (≤ 72h)**:** mostly vertical transmission (GBS, TORCHeS)
        2. Late-onset (≥72h)**:** mainly nosocomial (E. coli, Listeria)

d. **Necrotising enterocolitis:** idiopathic full-thickness necrosis and perforation of the intestinal wall, typically seen in 2^{nd}-3^{rd} week of life in premature formula-fed infants
    i. **Manifestations:** vomiting, diarrhoea, abdominal distension and/or tenderness, ileus (decreased bowel sounds), haematochezia
    ii. **Diagnosis:** abdominal XR (pathognomonic 'pneumatosis intestinalis'), blood tests for sepsis (WBC, CRP, IL-6) and bleeding (platelets, Hb)
    iii. **Treatment:** total parenteral nutrition + gastric decompression + ATB (ampicillin + gentamicin + metronidazole)
        1. **Surgical:** resection of necrotic bowel segments

e. **Neonatal jaundice:** haemolytic disease (Rh disease, genetic haemolytic anaemias, G6PDD), Gilbert syndrome (genetic deficiency of UGT), physiologic jaundice of neonates, breastmilk jaundice, cephalohematoma (due to degradation of the haematoma), Rotor & Dubin-Johnson syndromes (genetic deficiency of secretion of CB into bile), hepatic disease, cholestatic disease, sulpha drugs (displace bilirubin from albumin)
    i. **Complication:** kernicterus (bilirubin deposition in basal ganglia)
    ii. **Treatment**:
        1. Non-severe**:** phototherapy (monitor baby temperature to avoid hyperthermia)
        2. Severe**:** plasmapheresis

f. **Intraventricular haemorrhage:** hypoxic-ischaemic insult → vasodilation → leakage/rupture of vessels
    i. Can occur in head trauma in delivery (especially in VAVD)
    ii. **Grading**:
        1. **Grade 1:** bleeding occurs in small area of ventricles
        2. **Grade 2:** bleeding also occurs inside ventricles
        3. **Grade 3:** hemocephalus (hydrocephalus by bleeding)
        4. **Grade 4:** bleeding occurs in brain tissues around the ventricles
    iii. **Treatment:** aimed on treating cause + giving supportive care
        1. Most patients have **spontaneous resolution** within weeks of onset
        2. **Definitive treatment** = ventriculoperitoneal shunting

g. **Delivery trauma:** can occur due to cephalopelvic disproportion (large foetus + small pelvis), rapid/prolonged delivery, abnormal birth position, asynclitism (where the head of the baby is tilted to the shoulder and no longer in line with the birth canal), FAVD/VAVD
    i. **Manifestation:** caput succedaneum (oedema of scalp, resolves quickly), cephalohematoma, brachial plexus injury (Erb's palsy), facial nerve

palsy,fractures of clavicles & long bones, subcapsular hepatic haematoma

h. Twin-to-twin transfusion syndrome: due to sharing a single placenta, the blood supplies of monochorionic twin foetuses can become connected so theyshare a blood circulation

i. **Characterised by:**

1. **Donor twin:** often anaemic, has lower weight (20% less than recipient). This twin becomes hypovolemic and oliguric → oligohydramnios.Hydrops fetalis can occur due to anaemia-induced high-output HF
2. **Recipient twin:** plethoric (has 50g/L more Hb than donor). This twin becomes hypervolemic and polyuric → polyhydramnios. Hydrops fetaliscan occur due to fluid overload. This twin is also at risk of developing hypertension, cardiomegaly, DIC and jaundice after birth.

ii. Both foetuses develop BP instability → can lead to periventricular leukomalacia, porencephaly, microcephaly and cerebral palsy
iii. Donor foetus has higher mortality than recipient foetus
iv. Mothers carrying twins with TTTS notice **rapid enlargement of abdomen over 2-3 weeks** (due to developing polyhydramnios of recipient foetus)
v. **Management**:

a. **Therapeutic amniocentesis:** drainage of recipient's polyhydramnios improves circulation, also to the donor twin. This may need to be performedseveral times during the pregnancy
b. **Fetoscopic photocoagulation of connecting chorionic vessels:** reserved only for severe/refractory cases. 80% survival rate of at least one foetus.

4. **Perinatal mortality**:

a. Classification of foetal/neonatal death:

Late foetal loss	Baby delivered between 22+0-23+6 weeks of gestation with no breathing or signs of life after delivery
Stillbirth	Baby delivered after 24th week of pregnancy with no breathing or signs of life after delivery
Early neonatal death	Death of a live-born baby occurring < 7 days from birth
Late neonatal death	Death of a live-born baby occurring from 8th-28th day of life

b. Epidemiological parameters:

i. Foetal mortality rate (FMR) = number of late foetal losses + stillbirths per 1000 births
ii. Perinatal mortality (PNM) = number of late foetal losses + stillbirths + early neonatal deaths per 1000 births

4. Most developed countries have PNM < 10/1000

iii. Neonatal mortality rate (NNM) = number of neonatal deaths (early and late) per 1000 live births

c. Risk factors:

i. Advanced maternal age (> 35y)
ii. Ethnicity (black > Asian > Caucasian)
iii. Low socioeconomic status
iv. Gestational age (SGA/LGA → higher mortality)
v. Low birth weight
vi. Multiple pregnancy (3/4x higher SB and 6/8x higher NNM rate)

5. **Maternal mortality**:

a. Definitions:

Maternal (obstetric) death	Death of a woman while pregnant/within 42 days of termination of pregnancy from any cause related to/aggravated by the pregnancy or its management, but not from accidental/incidental causes
Late maternal death	Death occurring between 42 days and 1y after termination of pregnancy, miscarriage, or delivery due to direct/indirect causes
Pregnancy-related death	Death of a woman during pregnancy, up to 42nd day postpartum **from any cause**

b. Causes of maternal death:

- **i. Direct maternal death:** results directly from obstetric complications of pregnancy/labour/puerperium or medical interventions in this period
  - **1. Includes:** preeclampsia, PPH, complications of procedures
- **ii. Indirect maternal death:** arise from aggravation of pre-existing disease by physiological effects of pregnancy
  - **2. Includes:** epilepsy, HF, DM, hormone-dependent malignancies

c. Epidemiological parameters:

- **i.** Maternal mortality rate**:** number of maternal deaths (direct + indirect) in a given period per 100,000 women of reproductive age (15-44y)
  - **1.** MMR in CZ = 4/100,000
  - **2.** MMR in UK = 9/100,000
- **ii.** Maternal mortality ratio**:** number of maternal deaths per 100,000 live births
- **iii.** This is a measure of the risk of maternal death once a woman becomes pregnant