**Anatomy**

**The external genitalia**
- **Vulva** includes:
  - Mons pubis
  - Labia majora
  - Labia minora
  - Clitoris
  - External urinary meatus
  - Vestibule of the vagina
  - Vaginal orifice + hymen
- Appearance dependant on: age + hormonal status
- **Labia majora** = male scrotum
- **Clitoris** = penis (imp. Sexual stimulation)
- Vestibule contains openings:
  - Urethral meatus
  - Vaginal orifice
  - Skene’s + Bartholin’s ducts
- **Hymen** = thin fold of skin attached around margins of vaginal orifice

**The internal genitalia**
- Include:
  - Vagina
  - Uterus
  - Fallopian tubes
  - Ovaries
- **Vagina**
  - Muscular tube lined by squamous epithelium
  - H-shaped in cross-section
  - Capable of considerable distension
  - Relations:
    - Anterior: urethra + bladder
    - Posterior: anus, perineal body, rectum, pouch of Douglas + pelvic colon
- **Uterus**
  - Cervix
    - Musculofibrous cylindrical structure
    - Vaginal + supravaginal portion
    - Canal lined by columnar epithelium
    - Ectocervix lined by stratified squamous epithelium
    - External os → vagina
    - Internal os → uterine cavity
  - Isthmus
    - Junctional zone: cervix-corpus uteri
    - Forms lower segment in pregnancy
  - Corpus uteri
    - 3 layers of SMC fibres
      - External – transverse
      - Middle – circular
      - Inner – longitudinal
    - Cavity lined by endometrium
    - Tall columnar epithelium + stromal layers
    - Change with stage of menstrual cycle
- **Supports of the uterus**
  - Direct supports
    - Weak
      - Round ligaments
      - Broad ligaments
      - Pubocervical ligaments
Obstetrics & gynaecology physiology

- Strong
  - Uterosacral ligaments
  - Transverse cervical ligaments
    - Indirect supports – the pelvic floor
      - Levator ani muscles
      - Perineal body
      - Urogenital diaphragm
- Fallopian tubes (oviducts)
  - Thin muscular tubes
  - Lined by ciliated columnar epithelium
  - Consists of 4 sections:
    - Interstitial (intramural)
    - Isthmus
    - Ampulla
    - Infundibulum (fimbriated ends)
- The ovaries
  - Paired almond-shaped organs
  - Surface lies in peritoneal cavity
  - Capsule of dense fibrous tissue (tunica albuginea)
  - Cortex stroma + epithelial cells

**Blood supply**
- Internal iliac arteries
  - Anterior division
    - Visceral
      - 3x vesical branches (inferior, middle, superior)
      - Uterine arteries
    - Parietal
      - Obturator artery
      - Inferior gluteal artery
  - Posterior division
    - Iliolumbar branch
    - Lateral sacral arteries
    - Inferior gluteal branches
- Ovarian arteries
  - From aorta (below renal a.)
  - Rich anastomosis with uterine vessels

**Pelvic lymphatic system**
- Follow blood vessels
- Inguinal (superficial + deep) nodes drain:
  - Lower vagina
  - Vulva
  - Perineum
  - Anus
- Iliac nodes drain:
  - Cervix
  - Lower part of uterus
  - Upper vagina
- Aortic nodes drain:
  - Uterine fundus
  - Tubes
  - Ovaries
  - Iliac nodes
- Some drainage follows round ligaments → inguinal nodes

**Innervation**
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- **Somatic innervation**
  - Pudendal nerve – S2, 3, 4
- **Autonomic innervation**
  - Sympathetic outflow – T10-L2
  - Parasympathetic outflow – T11-S3
- **Pain fibres** – T11-S3

**Perineum**
- **Anterior triangle** – urogenital triangle
  - Includes passage of urethra
- **Posterior triangle**
  - Includes – anus, anal sphincters, perineal body
**Ooogenesis**

- Primordial germ cells appear in the yolk sac
  - 1<sup>st</sup> identified 4<sup>th</sup> week
  - Migrate: dorsal mesentry (developing gut) → genital ridge (44-48d)
  - Genital tubercle → sex cords → cortex of ovary
- @ 20wks – 7 million oogonia
- Falls to 1 million by birth
- Falls to 0.5 million by puberty
- Chromosome number of gametes half of normal cells (haploid)
  - Tetrad = group of 4 homologous chromosomes formed at end of meiosis 1 prophase (before metaphase)
- 1<sup>o</sup> oocyte remains in suspended prophase
  - Meiosis resumed as dominant follicle triggered by LH → ovulation (anaphase)
  - 2<sup>o</sup> oocyte = small cell formed at the end of meiosis 1, almost all nucleus, aka 1<sup>st</sup> polar body
  - 2<sup>nd</sup> polar body = secondary oocyte formed at the end of meiosis 2
- 2<sup>nd</sup> meiotic division occurs as ovum enters tube

**Follicular development in the ovary**

- Most ova never reach advanced maturity
- Aggregation of stromal cells (mesenchymal) around follicles → thecal cells
  - Differentiate → form 2 layers: theca interna + externa
- Innermost layers of granulosa cells adhere to ovum → corona radiata
  - Granulosa cells = oogonia in the cortex of the ovary surrounded by follicular cells
  - Zona pellucida = clear layer of gelatinous material collects around ovum
- Ovulation → corpus luteum
  - Theca interna cells undergo luteniation → full of yellow carotenoid material
  - Degenerates 7d post-ovulation UNLESS implantation occurs
    - Increased vacuolisation of granulosa cells
    - Increased amount of fibrous tissue at centre
    - Finally → corpus albicans (white scar)

**Hormonal events & ovulation**

- GnRH → FSH + LH secretion
  - Made in: median eminence of hypothalamus
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- Decapeptide
- Episodic fluctuations
- No relationship that surges → LH release BUT it is needed for oestrogen-induced LH surge
  - LH, FSH, PL all made in anterior pituitary gland (adenohypophysis)
  - FSH → follicular growth (exclusive to granulosa cells)
  - FSH → LH receptor development (in theca + granulosa cells)
  - LH stimulates + sustains corpus luteum development
  - PL → direct effect on follicle, initiation + maintenance of luteinisation + LT receptor development
  - Follicles → oestrogen producing
  - Corpus luteum → progesterone producing

The endometrial cycle

- 1. Menstrual phase = shedding of functional layers of endometrium (day 1-4)
  - Zona compacta = surface layer covered by compact layer of epithelium
  - Zona spongiosa = endometrial glands lined by columnar epithelium + loose stroma
  - (Zona basalis not shed – thin layer of compact stroma interdigitating with myometrium, little change w/ hormones)
  - Segmental vasoconstriction of spiral arterioles → necrosis + shedding
  - 2^ to fall in oestrogen + progesterone
- 2. Phase of repair = Day 4-7 cycle
  - Formation of new capillary bed (from arterial coils)
  - Regeneration of epithelial surface (zona compacta)
- 3. Follicular/proliferative phase = maximum period of growth of endometrial glands (day 7-ovulation)
  - Elongation + expansion of glands
  - Stromal development
- 4. Ovulation – day 14
- 5. Luteal phase = ‘saw toothed’ (convoluted) endometrial glands, pseudodecidual reaction in stroma
  - Ovulation-day 28
  - Basal vacuolation → visible intracellular secretion by day 20
  - Secretion inspissated
  - Infiltration of stroma w/ leukocytes within 2d of bleeding
  - Entrapped ovulation
    - AKA LUF – luteinized unruptured follicle syndrome
    - Luteinization of follicle without ovulation
    - Normal progesterone production & apparent menstrual cycle

Spermatogenesis

- Full maturation takes 64d in testis
- FSH → spermatogenesis
- LH → stimulation of Leydig cells → testosterone production
- 1N spermatids → mature sperm
Structure of spermatozoon
- Head covered by acrosomal cap (lysins)
  - Flatteened, ovoid shape
- Neck
  - 2x centrioles
- Body – helix of mitochondria (powerhouse of motility)
- Tail – 2x longitudinal contractile fibres + 9x pairs of fibres (form single filament)

Seminal plasma
- Originates from prostate, seminal vesicles, bulbourethral glands
- High conc of fructorse → energy for sperm motility
- High concentration of PG

Sperm transport
- Rapid migration (6mm/min) → receptive cervical mucosa
- Motile sperm reach fimbriated ends of tubes

Capacitation
- Final sperm maturation (in passage through tube) → allows penetration of ZP
- Inhibitory substances produced in caudo-epididymis + seminal plasma

Fertilisation – see notes in SUGER
- Small number of sperm → oocyte
- Adherence of sperm → acrosome reaction = loss of plasma membrane over acrosomal cap
- Sperm head fuses with oocyte plasma membrane
- Sperm head + midpiece engulfed into oocyte
- Fusion of male + female chromosomes = syngamy
- 36 hours post fertilisation → morula = 16-cells become solid ball
- Blastocyst = fluid filled cavity develops within the morula
- 6d post fertilisation → implantation = embryonic pole of blastocyst attaches itself to endometrium
- Decidual reaction = endometrial cells destroyed by cytotrophoblasts & cells incorporated by fusion & phagocytosis into trophoblast. Endometrial stromal cells become large & pale

Physiology of coitus
- Compression of venous channels → penile erection
  - Mediated by parasympathetic plexus (S2, 3)
- Plateau phase
  - Penis engorged, testis bigger
  - Scrotum + testis elevated
  - Bulbourethral gland secretion → clear fluid at urethral meatus
  - Systemic: increased sketeal m. tension, hyperventilation, tachycardia
- Impotence
  - Drugs (over 200!)
  - Recreational drugs
  - Neurological problems
    - Spina bifida
    - MS
    - Diabetic neuropathy
- Ejaculation mediated by contraction of bulbo- and ischiocavernosus
  - Sympathetic nervous system
  - Expulsion by SMC contraction in seminal vesicles, ejaculatory ducts + prostate
- Female excitation → nipple + clitoral erection
- Lubrication comes from vaginal transudation, Bartholin’s glands secretions
- Orgasm → clitoral retraction + contraction of pelvic floor muscles
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Physiological changes in pregnancy

Primigravidae = first pregnancy
Multigravidae

Maternal weight gain
- Water retention – increase up to 8.5L
  - Laxity of joints (pelvic ligaments, pubic symphysis)
- Maybe no wt gain in first 12wks: morning sickness, loss of appetite
- Normal values:
  - <18wks: 0.3kg/week
  - 18-28wks: 0.45kg/week
  - >28wks: 0.4kg/week
- Primigravidae > multigravidae
- Acute excessive weight gain – risk of pre-eclampsia
- Pregnancy is an anabolic state
- Increased fat storage in 2nd trimester: back, upper thighs, buttocks, abdominal wall
- Delivery loss = 6kg

Initiation of lactation
- Hypertrophy of sebaceous glands in nipple areola = Montgomery’s tubercles
- Progesterone + prolactin → alveolar growth in oestrogen primed breast
- Sudden decrease in oestrogen + progesterone at delivery
  - Release of inhibition of prolactin → milk production at in alveolar cells → lactiferous sinuses
- Prolactin production increased by nipple stimulation
- Milk expulsion reflex stimulated by: suckling + release of oxytocin (posterior pituitary from supraoptic + paraventricular nuclei of hypothalamus)
  - Band-like myoepithelial cells surrounding milk-secreting alveoli are oxytocin sensitive
  - Also activated by
    - Seeing infant
    - Hearing it cry
    - Thinking about feeding!
- Milk production inhibited
  - DA agonist
  - Catecholamines
  - Adverse emotional/environmental factors
- Full milk flow @ day 5
  - Gradual increase over next 3wks
  - Colostrum = thick, glossy, protein-rich fluid expressed from breast first 30hrs postpartum
  - DA agonist (bromocriptine) stops PL release – inhibits milk production

Changes in the cervix – ‘cervical ripening’
- 1st function: retain the conceptus = embryo in the womb
- Increased vascularity
- Reduction in collagen (1/3 prior to pregnancy)
- Accumulation of GAGs and water
- Hypertrophy of cervical glands
  - Appearance of cervical erosion
  - Increased mucous secretions → antibacterial plug of mucous in cervix
    - + Fall in vaginal pH 2 to lactobacilli (Doderlein’s bacilli) breaking down glycogen → lactic acid
- Uterine isthmus develops by regular contractions → thinning & stretching → lower uterine segment
  - Extension to birth canal
  - Minimal aid to foetal expulsion
  - Choice for incision for caesarean delivery
    - Avascularity
    - Quiescence in puerperium
- Uterus changes shape from pear → globular
Vascular changes in the pregnant uterus

- Hypertrophy of uterine vessels
  - Non-pregnant: almost all by uterine arteries
  - Pregnant: up to 20-30% by ovarian a.
  - Small contribution: superior vesical a.
- Uterine blood flow from 50-500 ml/min 10 weeks to term
- Trophoblast invasion of spiral arterioles up to 24wks
  - Effect to turn spiral arterioles ➔ flaccid sinusoidal channels
    - Failure: feature of pre-eclampsia + IUGR
    - Vessels sensitive to vasoactive stimuli
- 100-150 spiral arterioles supply ➔ intervillous space
  - 2/3 arising from each radial artery
- One spiral arteriole per placental cotyledon
- Cervix vessels: cholinergic
- Adrenergic nerves in cervical + uterine vessels

Uterine contractility

- Myometrium functions as a syncytium = contractions pass through gap junctions linking cells, produces coordinated waves of contractions
- Pregnant myometrium compliance>non-pregnant (greater distension)
  - Changes in connective tissue mean no increase in intrauterine pressure
- Suppressed by progesterone
  - Increased resting membrane potential
  - Impaired conduction
  - Progesterone antagonists (mifepristone) ➔ induce labour
- Contractions by 7wks – frequent, low intensity
- Late pregnancy contractions – stronger, more frequent
  - 2nd trimester – stronger, low freq
  - 3rd trimester – stronger, freq
- Braxton Hick’s contractions = contractions during pregnancy, Tightening feeling.
- Labour contractions ➔ cervical dilatation
- Ferguson’s reflex = stretching of the cervix & upper vagina ➔ oxytocin release
  - Afferent: cervix ➔ hypothalamus

Changes in the skin

- Increased pituitary MSH secretion
  - Facial pigmentation – chloasma
  - Pigmentation of nipple areola
  - Linea nigra (pigmented linea alba) on lower abdominal wall
- Striae gravidarum
  - Primigravidarae – purplish
  - Silverish in other pregnancies
  - Disruption of collagen fibres in subcuticular zone ➔ stomach, thighs, breasts
  - Increased production of adrenocortical hormones + increases tension in abdomen.

Cardiac output

- Heart displaced by foetus & is larger to accommodate increased volume
  - Valve rings stretched ➔ more common regurgitant flow
  - Longer myocardial fibres ➔ positive inotropic effect
- 40% increase in 1st trimester
  - Likely to ppt HF in women with HD
- Further increase of up to 2 L/min in labour
  - Elevated for 24hrs post + decreases after 2wks
- Decrease in late pregnancy: supine position ➔ uterus impedes venous return by compressing IVC
- 15% increment with twin pregnancy
- Heart rate increased by 15 bpm (N.B. lady's with pacemakers rely on SV alone)
• Stroke volume increase: 64 → 71ml
• BP decreases by 10%. Measurements must be taken in same position each time with correct sized cuff.
  o  Supine hypotension syndrome = profound decrease when mother supine due to compression of IVC
    ▪  Aorta also compressed: different brachial + femoral BP
• TPR decreases as CO increases
  o  Expansion of vascular space in utero-placental bed + renal vasculature
  o  Skin vasodilation

Nutrients in blood
• Increased tendency to clotting in pregnancy + the puerperium
• Glucose is major substrate for foetus (insulin controlled via maternal BM)
  o  Foetal blood glucose levels 20% lower than maternal
• Albumin falls during pregnancy
• Globulin rises (10%)
• AA decrease except alanine + glutamic acid
• Pregnancy → hyperlipidaemic state (TG, cholesterol, phospholipids)
• FFA elevated
• Fat-soluble vitamins increased conc, water soluble decreased

Immunological responses
• Uterus not immunologically privileged as other tissues implanted in uterus → rejected
• Trophoblasts do NOT elicit allogenic responses
• Foetus has non-immunogenic interface with maternal circulation
• Filters out harmful antibodies in the placenta
• Maternal immune response is locally manipulated
• Thymus involutes in pregnancy
• Splenomegaly - ?increased production of Ig producing cells
• LN draining uterus (para-aortic chain) enlarge

Urinary system changes
• Renal enlargement (cell size) 70% by 3rd trimester (physiological)
  o  GFR increases by 50% by 16wks, decreases 26-36wks
  o  Glycosuria
  o  Change in PCT reabsorption
  o  Increased renal blood flow
  o  Increased effective renal plasma flow
  o  Decreased serum Cr + urea
  o  Decreased uric acid clearance
• 2.5 fold increase in plasma renin activity (+ prorenin) BUT reduced vascular sensitivity to AT2
  o  Pre-eclampsia – sensitivity increases prior to HTN onset
• Ureteric and pelviccalceal dilatation (90%)
• Vesico-ureteric reflux (30%)
• Both above → increases urinary stasis → UTIs

GI changes
• Increased intra-abdominal pressure + decreased LOS response → reflux oesophagitis (heartburn)
• Delayed gastric emptying
• Tendency to constipate (more water absorbed in LI)

Endocrine changes
• Pituitary glands enlarge
• Increase prolactin secretion
  o  Oestrogen → increase number + secretory activity of lactotrophs → PL increase
• Placenta → CRH + ACTH
• Suppression of: GH, LH, FSH
• Oxytocin receptors increased in uterus + increased sensitivity
  o  Related to oestrogen:progesterone ratio
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- Function: stimulates uterine contraction, breast feeding role
  - Thyroid function increases
    - Increased TRH ?placental source as well as hypothalamic
  - Aldosterone + deoxycorticosterone levels increase in pregnancy
Early placental development

- Fertilisation → morula → blastocyst → implantation → syncytium formation → decidual reaction
- Trophoblastic cells invade spiral arteries within first 10wks
- Implantation of the blastocyst occurs by day 7
- Cords of cytotrophoblasts/Langhans cells → primary placental villi formation (d7)
  - Functional unit of placenta
  - Grow into basal layers of decidua → penetrate endometrial venules + capillaries
    - Form lacunae (filled with maternal blood) = intervillous space
    - 1º villi branch → 2º → 3º free floating villi
  - Central core of villi → capillary network of villi
  - Body stalk attaching foetus to placenta → umbilical vessels
- Chorion frondosum = branched and thickened area that develops into the placenta
- Chorion laeve = forms outer layer of foetal membrane. Villi atrophy → smooth surface
- Decidua basalis = decidua under the placenta
- Decidua capsularis = decidua between membranes & myometrium

Further placental development

- Total SA chorionic villi in mature placenta 11m²
  - Increased by microvilli on foetal side & villi
- Maternal cotyledons form by 6 weeks after ovulation
  - ~ Free floating 2º and 3º capillaries pushed into tent-shapes by maternal blood
  - ~12 large, 40-50 smaller

Umbilical cord structure

- 2x arteries (deoxy from foetus) + umbilical vein (oxy to foetus)
  - Helical shape
    - Absorbs torsion .'. protects patency of vessels
    - No risk kinking/snaring vessels
  - Arterial pressure late pregnancy: 70/60mmHg
  - Low pulse pressure
  - Very high venous pressure: 25mmHg
    - Pressure in villus capillaries>cord venous pressures
    - Foetal pressures>choriodecidual
    - Foetal blood cells enter maternal circulation BUT rarely other way around
- Surrounded by Wharton's jelly = hydrophilic mucopolysaccharide
- Covered by amniotic epithelium
- 30-90cm long

Uteroplacental blood flow

- Some SMC destroyed by trophoblastic invasion of spiral arteries → flaccid dilated
- Mean pressure at term: 10 mmHg + high flow
- Mean flow at term: 500-750 ml/min
- Regulating factors:
  - Anything that affects foetal heart, aorta, umbilical vessels & chorionic villi
  - Can be impaired by haemorrhage, uterine contractions, adrenaline, noradrenaline
  - AT2: vasodilator, vasoconstrictor (high conc)
- Impairment → foetal growth impairment
- Acute foetal asphyxia
  - Supine position in late pregnancy → compression of IVC
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- Sudden reduction in blood flow via uteroplacental bed
- Anaerobic glycolysis activated (uses glycogen reserves)

**Placental transfer + function**

- **Function**
  - Gaseous exchange by simple diffusion
  - Foetal nutrition/excretion
  - Hormone synthesis

- **Other transport mechanisms**: facilitated diffusion (glucose), active transport (AA, water soluble vits), pinocytosis (globulins, phospholipids)

- Oxygen rapidly taken up by foetal circulation (even at low pressures)
  - Higher affinity for O2
  - Hb conc higher
  - Bohr effect = shift of oxygen concentration curve to R by low pH, PCO2 and temperature; means lower more O2 released from Hb

- Excess glucose stored as glycogen (liver, muscle, placenta, heart) or fat (behind scapulae, around heart)

- Hormones involved in glucose control: insulin, GH, glucagon and human placental lactogen (can’t cross placenta)

- Immunoglobulins made by foetal lymphoid tissue (20wks)
  - IgM first → IgA → IgG
  - Selective placental transfer of IgG

- Ammonia transfers across placenta → foetal nitrogen source

**Endocrine function**

- **hCG** *(human chorionic gonadotrophin)* – peaks between 10-12wks gestation
  - Trophblast produces it
  - Similar structure to LH
  - Function: maintains corpus luteum until placenta takes over prog production
  - Used in pregnancy tests (97% urine positive by 2wks) – *agglutination inhibitin techniques*

- **hPL** *(human placental lactogen)* AKA chorionic somato-mammotrophin
  - Synciotrophoblast produces it
  - Similar structure to GH
  - Levels increase during pregnancy
  - Function: lower BM, increase FFA and insulin
  - Low in placental failure
  - Tested by *immunoassay*

- **Progesterone** – placenta produces about 350mg/day at term
  - Placenta takes over corpus luteum at 17th week
  - Dependent on maternal cholesterol
  - Renal + hepatic metabolism → urinary excretion (pregnanediol)

- **Oestrogens** – placenta major source, 20 diff hormones
  - Major ones: oestrome, oestradiol-17B and oestril
  - Urinary excretion
  - Sources: foetal adrenal gland (DHEA), syncytiotrophoblast and ovaries (minimal)

**Foetal development**

- Rate of foetal growth increases after 10 weeks (diminishes towards term)

- Final weight ~3.5 kg
  - FFA stored as brown fat: around neck, behind scapulae, behind sternum and around kidneys
  - White fat: SC fat covering body

- **12 weeks**
  - Translucent skin. No SC, vessels visible on skin!
  - Reacts to stimuli
  - Upper limbs at final relative length

- **16 weeks**
  - Crown-rump: 122mm
  - Lower limbs at final relative length
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- External genitalia can be differentiated
  - 24 weeks
    - Crown-rump: 210mm
    - Separated eyelids, skin opaque & wrinkles (no SC fat)
    - Fine hair covering body
  - 28 weeks
    - Eyes open
    - Scalp growing hair
- CVS
  - Single tube + heartbeat 4-5wks
  - Definitive circulation 11wks, HR 140bpm
  - Cardiac output at term – 200ml/min/kg (entirely dependent on HR)
    - Entirely dependent on HR, under ANS control (matures in 3rd trimester)
  - Ductus venosus + ductus arteriosus
- Respiratory system
  - Resp movements 12wks
    - Regular respiratory pattern – mid-trimester. Shallow breaths only into bronchioles.
      - Hypoxia – gasping leads to inhalation of amniotic fluid deeper into alveoli. Often meconium stained.
    - 40-60 movements/min – 34wks
      - Increased by: hypercapnia, maternal hyperglycaemia
      - Decreased: hypoxia, maternal smoking
        - Foetal apnoea increases towards term (up to 120mins!!)
  - Principal surfactants: lecithin + sphingomyelin
    - Lecithin production reaches functional levels – 32wks
      - Measurement in amniotic fluid = indication of foetal lung maturity
    - Surfactant production maybe delayed in maternal diabetes – administer corticosteroids to mother
- GIT
  - Mucosal glands – 16-20wks
  - Most digestive enzymes present – 26wks
  - Amylase activity – neonatal period
  - Peristaltic movement (initiated by amniotic fluid swallowing) – mid pregnancy
    - Digestion of this → meconium = foetal faeces formed by digestion of protein + cells in amniotic fluid
      - Only present in fluid if foetal stress/asphyxia
- Kidney
  - Filtration starts (functional renal corpuscles present) – 22wks
  - Foetal kidney completely formed – 36wks
    - Most excretory functions performed by placenta
- Special senses
  - USS ear – 10wks
  - Middle ear + 3 ossicles – 18wks
  - Inner ear – 24wks
  - Perception of sound – 16-24wks

Amniotic fluid
- Develops from inner cell mass of blastocyst
- Formed by secretion & transudation of fluid through amnion & foetal skin and from the passage of foetal urine → amniotic sac
- Foetal urine – major contributor!!
- Total volume turned over every 2-3hours
  - Reabsorption via foetal gut, skin & amnion
- Oligohydramnios - minimal amniotic fluid (impaired secretion)
  - Assc. with intrauterine growth impairment + congenital abnormalities (e.g. renal agenesis)
  - May cause:
    - Pulmonary hypoplasia
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- Club foot
- Skull deformity
- Wry neck
- Foetal hypoxia in labour

• **Polyhydramnios** - excessive amniotic fluid (impaired absorption)
  - **Acute polyhydramnios** (rare)
    - 2nd trimester/early 3rd
    - Painful for mother – dyspnoea + vomiting
    - Acute distension of uterus – relieve by amniocentesis (ST relief)
    - Premature onset labour
  - **Chronic polyhydramnios**
    - Maybe assoc. with large placenta (multiple pregnancy, diabetes) or congenital abnormality e.g. (in order of freq)
      - Anencephaly
      - Oesophageal atresia
      - Duodenal atresia
      - Iniencephaly
      - Hydrocephaly
      - Diaphragmatic hernia
    - May cause:
      - Unstable lie
      - Cord prolapse
      - Placental abruption (if sudden release of amniotic fluid)
      - Postpartum haemorrhage (assoc. w/ overdistended uterus)
      - Maternal discomfort + dyspnoea

**Clinical tests**

- **Amniocentesis (15-16wks)**
  - Indications
    - Prenatal neural tube defect
    - Chromosomal abnormalities + sex-linked diseases
    - Metabolic disorders
    - Rhesus isoimmunisation (foetal anaemia cause: spectrophotometry)
    - Estimation of lung foetal maturity (if prem delivery likely)
    - Detects foetal sex
  - 2 types of cells in fluid:
    - Foetal – larger, anucleate
    - Amnion – smaller, prominent nucleolus contained within vesicular nucleus, stain well with eosin
    - Nile blue staining maturing sebaceous cells
Stillbirth = child born after 24 weeks of gestation & didn’t breathe or show any signs of life post-expulsion from mother
Neonatal death = death of live born infant within 28d of birth
Early neonatal death = death during 1st week of life (0-6d)
Perinatal death = foetal death after 24 weeks gestation & death before 6 completed days (early neonatal deaths + stillbirths)

Low birth weight = live birth <2500g

Perinatal mortality

- UK stillbirth rate 2001 5.3/1000
- Neonatal death rate 3.5/1000
  - Decrease 2º to:
    - Improved antenatal + intrapartum care
    - Improved socioeconomic conditions
    - Reduced parity
    - Active screening for common congenital abnormalities (Down’s) + neural tube defects
- Perinatal mortality rate 7.8/1000
  - Factors affecting this:
    - Social class
    - Country of birth of mother
    - Maternal age
    - Parity
    - Marital status
    - Smoking

Aetiology

- Stillbirths
  - 70% uncertain
  - 12.5% congenital abnormalities
  - 9.5% intrapartum stillbirths
  - 2% infections
- Neonatal deaths
  - 50.3% immaturity
    - Respiratory distress syndrome + hyaline membrane disease
    - Pneumonia
    - Intracranial haemorrhage + cerebral damage in labour/delivery/early neonatal period
    - Necrotising enterocolitis
  - 24.5% congenital malformations
  - 8% intrapartum factors
  - 6.9% infections

Maternal mortality

- Confidential enquiry 1997-99:
  - Indirect obstetric causes>direct
  - Direct obstetric death = obstetric complications of the pregnant state (pregnancy, labour, puerperium) from interventions, omissions or incorrect tx or from chain of events from above
  - Indirect obstetric death = previous existing disease/one that developed during pregnancy aggravated by physiological effects of pregnancy

Commonest cause of direct mortalities

- Thromboembolism
- Pre-eclampsia
- Uterine haemorrhage
- Amniotic fluid embolism
- Infection (sepsis, excluding abortion)
Commonest indirect causes
  • Cardiac disease
  • Suicide (& other psychiatric causes)
  • Cancer