Biomedicine

Lecture 12:
Reproductive System
Learning Outcomes

In today’s topic you will learn:

- The structure and function of the male and female reproductive systems.
- Sexual reproduction and pregnancy
- The menstrual cycle and menopause
- The signs, symptoms, investigation procedures & some orthodox treatments of reproductive pathologies
Reproduction

“The production of offspring”. There are 2 types:

<table>
<thead>
<tr>
<th>Asexual Reproduction</th>
<th>Sexual Reproduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>• A simpler form of reproduction by simpler organisms.</td>
<td>• A more complex form of reproduction, used by higher organisms.</td>
</tr>
<tr>
<td>• Involves only mitosis.</td>
<td>• Involving meiosis &amp; fertilisation.</td>
</tr>
<tr>
<td>• Only one parent is involved.</td>
<td>• Requires 2 parents, each producing gametes.</td>
</tr>
<tr>
<td>• Quick</td>
<td>• Male gametes = spermatozoa</td>
</tr>
<tr>
<td>• 2 diploid cells produced (46 chromosomes each)</td>
<td>• Female gametes = ova</td>
</tr>
<tr>
<td>• Often occurs in stable environments where cloned offspring are likely to succeed.</td>
<td>• The offspring has a mix of genes inherited from each parent (produces genetic variability).</td>
</tr>
<tr>
<td>• DNA identical to parent.</td>
<td></td>
</tr>
</tbody>
</table>

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Twins

- Siblings that result from the same pregnancy

<table>
<thead>
<tr>
<th>MONOZYGOTIC (30%)</th>
<th>DIZYGOTIC (70%)</th>
</tr>
</thead>
</table>
| **Identical twins**  
(same genetic information) | **Non-identical** |
| **Originate from a single fertilised ovum**  
(One egg, one sperm). | **Release of two ova and fertilisation of each. Implanted independently.**  
(Two eggs, two sperms).  
Can get more (i.e. Triplets) |
| **The zygote splits into 2 embryos, but share one placenta.** | **Two different placenta**. |
| **99% zygote split before 8 day threshold. If not = conjoined.** | **Genetic predisposition.** |

*mono-* = one  
*di-* = two  
*zygote* = fertilised egg
Reproductive System: Functions

Female:
1. Formation of ova (female gametes).
2. Reception of spermatozoa (male gametes).
3. Provide suitable environment for fertilisation/foetus.
4. Parturition (childbirth).
5. Lactation.

Male:
1. Production of spermatozoa (male gametes).
2. Transmission of spermatozoa to the female.
Breasts/Mammary glands

• **Accessory glands of female reproductive system.**

• Within each breast is a mammary gland – a modified sweat gland that produces milk.

• Each mammary gland consists of 15-20 lobes, separated by adipose tissue. Lobes contain small grapelike clusters of glands called **alveoli**.

• ‘**Suspensory ligaments of the breast**’ support the breast between the skin and underlying fascia.

• Immature until puberty (**rudimentary in males**).
LACTATION:

• Contraction of myoepithelial cells surrounding alveoli help propel milk into lactiferous ducts.

• Milk can be stored in lactiferous sinuses.

• After birth, prolactin stimulates milk synthesis, whilst ‘suckling’ stimulates oxytocin, which causes milk ejection.
Uterus

• The uterus serves as a pathway for sperm. It is also the site of implantation of a fertilised ovum and location for foetal development. The uterus contracts to initiate labour.

• The uterine wall has 3 layers of tissue:
  1. **Perimetrium**: Outer layer; part of visceral peritoneum.
  2. **Myometrium**: Contains three smooth muscle layers.
  3. **Endometrium**: The highly vascularised inner layer that is divided into the ‘stratum functionalis’ (*sloughs off during menstruation*) and the ‘stratum basalis’, which is the permanent deeper layer that regenerates the stratum functionalis.

peri- = outer portion
myo- = muscle
endo- = within
- metrium = relating to uterus
stratum = layer

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The uterus consists of the fundus, body and cervix.

The uterus is held in place by pairs of ligaments: Broad, utero-sacral, round, cardinal.

The cervix is the narrowed inferior portion of the uterus that leads into the vagina.

The uterus is situated between the bladder (anteriorly) and rectum (posteriorly); it is the size and shape of an inverted pear.
Activity: Label

- A =
- B =
- C =
- D =
- E =
- F =
- G =
- H =
- I = Ovarian ligament
Endometrium

- The endometrium is the highly vascularised inner layer of the uterus.

- The endometrium changes within a regular monthly cycle to prepare for implantation of a fertilised egg.

- If the egg is fertilised, the zygote is embedded in the endometrium.

- In the first 8 weeks, the embedded zygote is an embryo.

- After 8 weeks, the embedded zygote is a foetus.

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Placenta

- The placenta is the site of exchange of nutrients and wastes between the mother and foetus. It is attached to the uterine wall.

- The placenta also **produces hormones** that are needed to maintain the pregnancy.

- By the beginning of the twelfth week, the placenta contains two distinct regions.

- The placenta is unique because it develops from two individuals (*maternal part from endometrium*).

- The actual connection between the placenta and embryo/foetus is through the **umbilical cord**, which is 50–60 cm in length.
Placenta

• The placenta allows oxygen and nutrients to diffuse from maternal blood into foetal blood, whilst carbon dioxide and wastes move in the opposite direction.

• Provides a protective barrier because most micro-organisms cannot pass through it. HIV, measles, polio etc. can. Many drugs and alcohol can pass freely and can cause birth defects.

• Blood cells can not cross the placenta.

• Nutrient transfer to the foetus is mediated by proteins called nutrient transporters.
Placental Endocrinology

• The placenta produces the following hormones:

<table>
<thead>
<tr>
<th>Hormone</th>
<th>Function</th>
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</thead>
<tbody>
<tr>
<td>Progesterone</td>
<td>• Maintains endometrial lining to sustain and nourish the foetus.</td>
</tr>
<tr>
<td></td>
<td>• Produced by corpus luteum until 8 weeks.</td>
</tr>
<tr>
<td>Oestrogen</td>
<td>• Promotes growth of breast tissue and myometrium.</td>
</tr>
<tr>
<td></td>
<td>• Produced by corpus luteum until 8 weeks.</td>
</tr>
<tr>
<td>Human Chorionic Gonadotropin (hCG)</td>
<td>• Only produced during pregnancy (= pregnancy test)</td>
</tr>
<tr>
<td></td>
<td>• Maintains corpus luteum for 8 weeks and increases transfer of nutrients to foetus (<em>initially produced by chorionic sac</em>)</td>
</tr>
<tr>
<td></td>
<td>• Related to morning sickness.</td>
</tr>
<tr>
<td>Human Placental Lactogen (hPL)</td>
<td>• Increase the amount of glucose &amp; lipids in maternal blood.</td>
</tr>
<tr>
<td>Relaxin</td>
<td>• Targets ligaments and relaxes them.</td>
</tr>
<tr>
<td></td>
<td>• Produced by the corpus luteum and placenta.</td>
</tr>
<tr>
<td>Corticotropin releasing hormone (CRH)</td>
<td>• <em>Triggers release of cortisol from the adrenal cortex</em></td>
</tr>
<tr>
<td></td>
<td>• Prevents rejection of foetus/placenta.</td>
</tr>
</tbody>
</table>

*endocrine = hormones*
*-ology = study of*
Placental Complications: Placenta Praevia

- Occurs when the placenta attaches to the lower part of the uterine wall, potentially occluding the opening of the cervix.

- Risk with multiple births because more placentas.

- 1st trimester can resolve itself as uterus stretches.

- 2nd or 3rd trimester (>20 weeks) prone to haemorrhage. Wall of cervix stretches and can detach from the placenta. Uterine vessels rupture and often presents as painless, ante-partum vaginal bleeding.

- Treatment depends on the condition of the baby and mother. Ultrasound is used to monitor heart sounds.

- C-section preferred method of delivery

praevia = “going before”
Placental Complications:

Placenta Accreta

- Abnormally deep attachment of the placenta through the endometrium into the myometrium

- If invades muscle = increta. If through uterine wall to viscera such as the bladder = percreta.

- Due to inadequate (thin) basalis layer of endometrium. The placenta has to “dig in deeper” when implanting.

- Occurs due to: C-section, curettage (scraping procedure), fibroid removal or placenta praevia.

- Risk of post-partum haemorrhage.

- Usually requires hysterectomy.
Placental Complications:

**Placental Abruption**

- Rupture of blood vessels adhering the placenta to the uterine wall leading to separation of the placenta from the uterus.

- Risk factors include smoking & maternal hypertension (pre-eclampsia).

- Presents as severe abdominal pain and ante-partum bleeding.

- An obstetric emergency after 20 weeks of gestation.
  - >30 weeks: delivery
  - <30 weeks and stable vitals monitor until baby is old enough to safely deliver

- Occurs in 1% of pregnancies worldwide.

- Significant contributor to maternal mortality.
Fallopian tubes

- The fallopian (or uterine) tubes extend laterally from the uterus. They measure about 10cm in length.

- The tubes provide a route for the sperm to meet the ova and for the ova (or fertilised ova) to reach the uterus.

- Finger-like projections called fimbrae surround the ovary and ‘sweep the ova’ into the fallopian tube.

- The tubes are lined with ciliated columnar epithelium, which function to help move the ova towards the uterus.

- The middle, muscularis layer contains smooth muscle and performs peristalsis to assist in ova movement.

fimbrae = projections resembling a ‘fringe’
cilia = hairs

The tubes lie between the broad ligament.
The ovaries are the female gonads and exist as paired glands.

The ovaries resemble almonds in their shape and size, although atrophy after menopause.

The ovarian ligament anchors the ovaries to the uterus, whilst the broad ligament also assists in maintaining the position of the ovaries.

The ovaries produce female gametes (‘secondary oocytes’ via oogenesis).

Ovaries secrete sex hormones: oestrogen & progesterone.

http://news.bbc.co.uk/1/hi/health/7447942.stm
Oogenesis: Pre-pubertal

• Oogenesis is referring to the formation of female gametes (ova) in the ovaries.

• Oogenesis begins in the foetus

• Germ cells (oogonia) undergo mitosis to produce millions of germ cells. Even before birth most of these germ cells degenerate/die.

• Some, however develop into larger cells called primary oocytes (2n)

• Formation of primary oocytes stops at birth (leaving approx. 20,000-2,000,000).

• Primary oocytes are surrounded by a layer of follicular cells – the entire structure is called a primordial follicle.

• During a women’s reproductive life-time about 400 follicles will mature & ovulate. The remainder degenerate.

Remember that spermatogenesis begins in puberty!
Every month anterior pituitary hormones stimulate the development of a primordial follicle into a mature ovum.

- **FSH** stimulates maturation of the primordial follicles → primary follicles → secondary follicles → mature follicle.

- A surge of **LH** triggers ovulation – release of the ovum (the secondary oocyte = n = 23 chromosomes)

- After ovulation, the remaining follicles become the corpus luteum. This produces progesterone & some oestrogen.

- Corpus luteum degrades into the corpus albicans if the egg is unfertilised.

- If fertilisation occurs, hCG prevents degradation of corpus luteum.
Oogenesis

• Whilst rapid maturation during final stages only takes about 14 days, follicle growth from primordial stage to full maturity takes about a year – meaning that a follicle that ovulates started its growth to maturity 10-12 ovarian cycles earlier.

• FSH drives development of the most mature follicle into a mature ovum.

• If you were to look inside an ovary you’d see follicles at different stages of maturity.
Female Reproductive System

- Note the position of the female reproductive organs.
- The bladder sits most anteriorly, whilst the uterus flexes over the bladder. The rectum is posterior to the uterus.
- The ovaries are located in the pelvic cavity lateral to the uterus.
Pain Referral Patterns

- The image highlights some common visceral pain patterns.
- Other than the location of symptoms, consider how might you differentiate whether symptoms are relating to the Hip/pelvis? Lower back? GIT? Urinary tract? Reproductive structures? Etc.

**visceral = organs**
Summary Quiz!

1. Name the THREE layers of the uterine wall.
2. Name the TWO main hormones involved in lactation.
3. Describe the role of the placenta.
4. Name TWO placental complications.
5. Name THREE hormones produced by the placenta.
6. Describe how identical twins are formed. Do they have their own placenta?
7. At what week does an embryo become a fetus?
8. Name the ‘fingerlike projections’ in the lateral fallopian tubes.
9. What hormone triggers ovulation?
10. Briefly explain how the corpus luteum is formed.
Menstrual Cycle

- Generally lasts 24-35 days.
- **28 days is average.**

**Four phases:**
1. **Menstrual phase (day 1-5)**
2. **Pre-ovulatory phase (day 6-13)**
3. **Ovulation (day 14)**
4. **Post-ovulatory phase (day 15-28)**
# Menstrual Cycle:

<table>
<thead>
<tr>
<th>Menstrual phase (Days 1-5)</th>
<th>Pre-ovulatory phase (Days 6-13)</th>
<th>Ovulation phase (Days 14)</th>
<th>Post Ovulatory phase (Days 15-28)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Menstruation</strong></td>
<td><strong>Time between the end of menses &amp; ovulation.</strong></td>
<td><strong>Release of the egg by the ovary- triggered by LH</strong></td>
<td><strong>Time between ovulation &amp; next menses.</strong></td>
</tr>
<tr>
<td><strong>IN THE OVARIIES:</strong></td>
<td><strong>IN THE OVARIIES:</strong></td>
<td><strong>IN THE OVARIIES:</strong></td>
<td><strong>The corpus luteum forms from the follicle wall &amp; produces progesterone &amp; some oestrogen</strong></td>
</tr>
<tr>
<td>Follicles are developing under the influence of FSH</td>
<td>Follicle starts to mature &amp; secretes oestrogen.</td>
<td>High oestrogen levels create negative feedback loop which stimulates LH secretion.</td>
<td>Progesterone &amp; oestrogen maintain the uterus lining in preparation for pregnancy.</td>
</tr>
<tr>
<td></td>
<td>Follicles also secrete <strong>inhibin</strong> which decreases the secretion of FSH. This <strong>stops other follicles developing</strong></td>
<td>LH causes rupture of the mature follicle and expulsion of the egg = <strong>ovulation.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>IN THE UTERUS</strong></td>
<td><strong>IN THE UTERUS</strong></td>
<td></td>
<td><strong>The corpus luteum is now essential in establishing &amp; maintaining pregnancy</strong></td>
</tr>
<tr>
<td>Endometrium is being shed in response to a sudden drop in oestrogen &amp; progesterone levels</td>
<td>The endometrium thickens in response to rising oestrogen levels</td>
<td>Ovulation tests work by detecting rising levels of LH</td>
<td></td>
</tr>
</tbody>
</table>
• Pituitary hormones (FSH & LH) control the ovaries (following release of GnRH)

• Ovarian hormones (oestrogen & progesterone) control the uterus.
Female Reproductive System: Changes in pregnancy

Fertilised egg:

- The zygote embeds in the uterine wall.
- Human chorionic gonadotropin (hCG) (produced by the embryo) maintains & stimulates the corpus luteum to produce more progesterone & oestrogen.
- After a few weeks the placenta takes over the role of producing hCG & progesterone maintaining pregnancy & nourishment for the baby.

Non-fertilised egg:

- After 14 days the corpus luteum degenerates into the corpus albicans.
- The levels of progesterone & oestrogen drop & a new cycle starts with menstruation.
Puberty (Females)

- The period when secondary sexual characteristics develop and potential for sexual reproduction is reached.

- Occurs between 10–14 years of age.

- The onset of puberty is marked by pulses of LH and FSH, each triggered by a burst of Gonadotropin Releasing Hormone (GnRH).

- As puberty advances, the hormone pulses occur during the day as well as night, increasing over 3-4 years.

- Internal reproductive organs reach maturity → menarche.

- Breast development, hair growth (pubic/axillary/legs), hips widen (more fat deposited in hips & breasts), voice deepens.

*menarche = first menses*
Menopause

• The menopause is the permanent cessation of menstruation for 12 consecutive months.

• Naturally occurs at 45 – 55 years of age.

• Occurs as a result of ‘ovarian aging’, whereby the number of follicles become exhausted.

• ↓ oestrogen production > decline in ovulation > ↓ progesterone production

• Declined oestrogen & progesterone levels affects negative feedback leading to high FSH & LH levels (detected in blood).

• Menopause can be surgically induced following hysterectomy.
Menopause

SIGNS & SYMPTOMS:

• Hot flushes & increased sweating

• Vaginal dryness and atrophy of mucosal lining leads to painful intercourse

• Increased risk of UTIs due to urogenital atrophy

• Mood changes, irritability, anxiety

• Decreased libido & sleep disturbances

• Breast shrinkage. Sparse pubic & axillary hair.

• Osteoporosis (loss of oestrogen = \downarrow osteoblasts)

Hot flushes occur due to dysregulation of thermal control in the hypothalamus, which is sensitive to adrenaline/noradrenaline. Oestrogen normally down-regulates these receptors.

UTI = Urinary Tract Infection
Menopause

HRT:
• Can be used to relieve menopausal symptoms and reduce the risk of osteoporosis, but only delays the menopause.
• HRT increases the risk of breast cancer, endometrial cancer, heart disease, stroke and DVT.

ALTERNATIVE APPROACHES:
• Herbal medicine: Many to help with menopause e.g. Dong Quai, Red Clover, Peony, Liquorice, black cohosh.
• Diet: foods high in phyto-oestrogens managing blood glucose levels (hypoglycemia hot flashes), avoid caffeine.
• Encourage regular exercise, wear light clothing, carry hand fan, reduce stress, regular bed time, relaxation techniques.
Male Reproductive System

Consists of:

• 2 testes
• 2 epididymis
• 2 vas / ductus deferens
• 2 spermatic cords
• 2 seminal vesicles
• 2 ejaculatory ducts
• 1 prostate gland
• 1 penis
Penis

- Consists of a root (within pelvic cavity) and body.
- Urethral canal both reproductive and urinary function.

Body consists of:
- 3 cylindrical masses of **erectile tissue:**
  - 2 lateral corpora cavernosa (hollow)
  - 1 corpus spongiosum (surrounds urethra).
- Fills with blood during sexual arousal (& REM sleep).
- Contains the glans penis, foreskin (prepuce) & corona.
- Erectile tissue and involuntary muscle are stimulated by the **parasympathetic** nervous system – produce **Nitric Oxide** that causes vasodilation.
Testes

- Develop in the pelvic cavity (near kidneys) and descend into the scrotum via inguinal canals between 7-9 months utero.

  **Site of spermatogenesis:**
  - In the Seminiferous tubules (*takes about 70 days*).
  - Regulated by FSH.

  **Site of testosterone production and secretion:**
  - From cholesterol in the Leydig cells.
  - Regulated by LH.

- Each testis divided into 200-300 lobules. Each lobule contains seminiferous tubules. Seminiferous tubules contain:
  - Spermatogenic cells: form sperm
  - Sertoli cells: provide nourishment

- Spermatozoa mature & are stored in the epididymis.

_Spermato- = sperm
genesis = formation/creation_
Seminiferous tubules
Cross section:

Leydig (Interstitial) cells
in spaces between
seminiferous tubules

Muscle layer – helps to propel
sperm into the epididymis to
mature & storage
• **300 Million produced each day by spermatogenesis.**

• Sperm can live for several months in the epididymis.

• Normally 100 million per ml/ejaculate,

• Spermatogenesis occurs best at **3°C below body temperature.**

• Sperm have a head, body & tail:
  • **Head** filled with the nucleus (23 chromosomes).
  • **Acrosome** is a vesicle covering the head of the sperm that contains enzymes to penetrate the egg.
  • **Body** filled with mitochondria to fuel tail action.
  • **Tail** to swim.
Ejaculate

- Spermatozoa are expelled from the epididymis through the vas deferens in the spermatic cord and into the ejaculatory duct.

- Here seminal fluid is secreted and mixed with the sperm.

Two glands produce seminal fluid:

1. **SEMINAL VESICLES**
   - A pair of glands located behind the bladder.
   - Secrete **alkaline seminal fluid** (60% of semen)
   - Contains nutrients (e.g. fructose) to nourish sperm

2. **PROSTATE GLAND**
   - Secretes a thin milky fluid (30% of semen)
   - Contains nutrients for ATP production and anticoagulants to **fluidity**: citric acid, proteolytic enzymes: Prostate Specific Antigen, pepsinogen. Also contains lysozymes & amylase.

http://www2.highlands.edu/academics/divisions/scipe/biology/faculty/harnden/2122/notes/repro.htm
Ejaculate

- Seminal fluid (semen) is alkaline to protect sperm from urethral & vaginal acidity.

- Sperm comprises only 10% of the semen.

**Bulbourethral glands (Cowper’s Glands):**

- Secrete an alkaline, mucous fluid that neutralises urinary acids in the urethra prior to ejaculation and lubricates the end of the penis.

- During sexual arousal contraction of smooth muscles in the epididymis & vas deferens propels spermatozoa into the ejaculatory ducts.

- Muscles surrounding the base of the urethra cause the semen to eject out of the penis during orgasm.

*vas deferens = the duct that transports sperm from the testicle to the urethra*
Case History Considerations

- Menstruation: Bleeding time & cycle, amount of blood flow, duration, blood quality.
- Breasts: Tenderness, galactorrhoea.
- Relationship of symptoms to cycle.
- Hirsutism and acne.
- Problems with intercourse.
- Altered libido & impotence.
- Past and future fertility plans.
- Operations.
- Methods of contraception used.
- Additional symptoms e.g. urinary problems.
- Family history.

Hirsutism = male pattern hair growth in women
# Reproductive Terminology

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MENARCHE</td>
<td>The age of the first period.</td>
</tr>
<tr>
<td>METORRHAGIA</td>
<td>Mid-cycle bleeding, bleeding between cycles.</td>
</tr>
<tr>
<td>MENORRHAGIA</td>
<td>Increased menstrual bleeding.</td>
</tr>
<tr>
<td>AMENORRHOEA</td>
<td>Absence of periods.</td>
</tr>
<tr>
<td>DYSMENORRHOEA</td>
<td>Painful periods, heavy bleeding.</td>
</tr>
<tr>
<td>POLYMENORRHEA</td>
<td>Short cycle, frequent periods / bleeding.</td>
</tr>
<tr>
<td>OLIGOMENORRHEA</td>
<td>Infrequent cycles, generally upwards of 32 days</td>
</tr>
<tr>
<td>GALACTORRHOEA</td>
<td>Presence of lactation, not due to pregnancy.</td>
</tr>
<tr>
<td>DYSpareunia</td>
<td>Pain on intercourse in a female.</td>
</tr>
<tr>
<td>Azoospermia</td>
<td>Absence of sperm in the ejaculate.</td>
</tr>
<tr>
<td>Oligospermia</td>
<td>Reduced number of sperm in the ejaculate.</td>
</tr>
<tr>
<td>Virilisation</td>
<td>Male 2° sex characteristics in a female.</td>
</tr>
<tr>
<td>Gynaecomastia</td>
<td>Presence of enlarged breast tissue in a male.</td>
</tr>
</tbody>
</table>

*a-* = absence  
*dys-* = “abnormal/bad”  
*poly-* = many  
*oligo-* = few  
*-rrhagia = excessive flow  
*menorrhoea = menses*
Absence of menstruation.

**PRIMARY AMENORRHOEA:**
- Failure of the menses to occur by expected onset (16, 17 years)
- Mostly caused by congenital defects: failure of ovarian follicles to develop (Turners syndrome)

**SECONDARY AMENORRHOEA:**
- Lack of menstruation for 3 months in previously menstrual woman.
- Hormonal: Pituitary tumour, PCOS, hypothyroidism, stress.
- Anorexia, excessive exercise, uterine obstruction, medications (i.e. antipsychotic drugs)
Dysmenorrhoea
Painful and heavy periods

PRIMARY DYSMENORRHOEA:
• Excessive release of uterine prostaglandins during menstruation causing the myometrium to contract.
  - Usually occurs shortly (6-12 months) after menarche.
  - No association with identifiable pelvic disease.

SECONDARY DYSMENORRHOEA:
• Associated with specific pelvic or systemic pathologies such as endometriosis, adhesions, fibroids, pelvic inflammatory disease.

TREATMENT:
• **Allopathic:** Contraceptive pill (inhibits ovulation), painkillers, NSAIDs
• **Alternative:** Treat cause e.g. hormone balancing, anti-inflammatory diet. Magnesium, B-vitamins, omega-3/6, address iron-deficiency anaemia if heavy bleeding

The increase in prostaglandins may be due to low progesterone before onset of menses.

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Premenstrual Syndrome

• Characterised by cyclic physiological, psychological and behavioural changes during the luteal phase. (second half of the menstrual cycle).

• Chronic symptoms may be magnified during this period.

CAUSES:
• Definitive cause unknown – varies between individuals.

• Hormone imbalance: rapid shifts in levels of oestrogen and progesterone.

• Drop in progesterone in the luteal phase of the cycle and an increased production of prostaglandins.

• Other theories include serotonin deficiency or elevated prolactin.

The ‘luteal phase’ refers to the ‘corpus luteum’
PMS Signs & Symptoms

Over 150 symptoms have been attributed to PMS

1. Tension
2. Anxiety
3. Reduced concentration
4. Aggression
5. Depression
6. Listlessness
7. Confusion
8. Fatigue
9. Insomnia
10. Headache (migraines)

11. Abdominal bloating
12. Oedema: face, legs, hands, feet
13. Backache
14. Pelvic pain
15. Aching legs
16. Ovarian pain
17. Sweating
18. Hot flushes
19. Bladder problems
20. Constipation (bowel changes)

21. Excessive weight gain
22. Fluid retention
23. Low blood sugar
24. Cravings - sugar and chocolate
25. Pica
26. Increased appetite
27. Thirst
28. Breast tenderness
29. Greasy skin and hair
30. Pimples
31. Palpitations

32. Sore eyes
33. Decreased libido
34. Hives
35. Nausea
36. Bruising
37. Muscular tenderness
38. Joint tenderness
39. Blood spotting
40. Increased allergic response

Over 150 symptoms have been attributed to PMS.
Premenstrual Syndrome

ALLOPATHIC TREATMENT:
• Oral contraceptive pill, anti-depressants, counselling.

ALTERNATIVE TREATMENT:
• Support hormone and blood sugar dysregulation
• Exercise (decreases anxiety, stress hormones, blood glucose control)
• Homeopathy, acupuncture, herbal medicine.

Herb: Vitex agnus-castus
Pelvic Inflammatory Disease (PID)

- An infectious and inflammatory disorder of the upper female genital tract including the uterus, fallopian tubes, and ovaries.

**CAUSES:**
- Infection typically results from spread of microorganisms (bacteria) ascending from the cervix.
- Sexually transmitted infective causes include *Neissseria gonorrhoea* & *Chlamydia trachomatis*.
- Insertion of intra-uterine device (IUD)
- Abortion or delivery under non-sterile conditions.
Pelvic Inflammatory Disease (PID)

SIGNS & SYMPTOMS:
- **Lower abdominal pain** (gradual or sudden & severe) - may increase with walking
- Deep dyspareunia. Purulent discharge.
- Occasional dysuria, fever, nausea & vomiting.

COMPLICATIONS:
- Ectopic pregnancy, infertility, peritonitis, abscesses and septicemia.

TREATMENT:
- **Allopathic**: Antibiotics (*side effects*)
- **Alternative**: Support immune system (nutrition, herbs, acupuncture, homeopathy)
• **Endometrial tissue found outside uterine cavity.**

• Commonly affects **ovaries, fallopian tubes, utero-sacral ligaments, pelvic cavity, intestines.**

• May be found in more distant places: lungs, joints, rarely the brain.

• Affects up to 25% of women, estimated that 30-40% of women being treated for **infertility** are affected.

• Greater risk with family history, women who haven’t given birth, menses >7 days.

• **Ectopic endometrial tissue follows the menstrual cycle but there is no exit point for the blood that accumulates during menstruation. This leads to irritation, inflammation and pain.**
Endometriosis

CAUSES: Unknown. Several theories include:
1. Retrograde menstruation: migration of endometrial tissue back through the fallopian tubes or transplant of tissue during surgery.
2. Primordial cells lining other body cavities or organs differentiate into endometrial cells.
3. Transfer of endometrial tissue through blood & lymphatics
4. Altered immune surveillance in pelvis, affecting the ability of the body to recognise ectopic endometrial tissue.

SIGNS & SYMPTOMS:
• Dysmenorrhoea.
• Menorrhagia.
• Pelvic pain occurring around menstruation, lessening after.
• Dyspareunia.
• Bloating, lower back pain, bowel changes.
• Infertility.

Video: www.youtube.com/watch?v=fuxqTFtVAB8
Endometriosis

COMPLICATIONS:
- Recurrent inflammation leads to formation of fibrous tissue (scarring), which can produce adhesions.
- Adhesions can obstruct or displace the uterus or fallopian tubes, which can contribute to infertility.
- Chocolate cysts may develop – sac containing old blood.

DIAGNOSIS:
- Ultrasound, laparoscopy.

ALLOPATHIC TREATMENT:
- Induce amenorrhea – (COCP).
- Surgery to remove ectopic tissue (45% grows back within a year).

ALTERNATIVE TREATMENT:
- Manage multifactorial influences.
- Reduce inflammation, encourage detoxification, immune support, Gut bacteria. Herbs, homeopathy & acupuncture.

Important to rule out malignancies & other pelvic disease with ultrasound.
Benign tumours of the myometrium of the uterus.

Reported to occur in 50% of women by age 50.

Can vary in number and size (can be 15cm+).

Consist of smooth muscle cells and connective tissue.

More common in reproductive years, tend to subside post menopause.

CAUSES:

Poorly understood. The development is linked to levels of oestrogen and progesterone

Increased risk with earlier menses & family history
Fibroids

SIGNS & SYMPTOMS:
• 50-80% are asymptomatic

• Menstrual changes: *menorrhagia*, prolonged menses, spotting/mid-cycle bleeding → *iron deficiency anaemia*

• Pressure on bladder or rectum causing *urgency*, *frequent urination*, *constipation*

• *Bloating & heaviness* in abdomen.

• Infertility (2-10% of infertility cases)

• Large fibroids can occlude their blood supply causing *necrosis*. It may calcify which causes *pain* as they degenerate.

*menorrhagia* = increased menstrual bleeding
*necrosis* = tissue death
INVESTIGATION:
• Ultrasound

ALLOPATHIC TREATMENT:
• NSAIDs (*side effects!*).
• Hormonal therapies (including OCP), surgery (myomectomy or hysterectomy)

COMPLEMENTARY TREATMENT:
• Hormone balancing support (oestrogen detoxification) -dietary phytoestrogen.
• Traditional herb protocols have been used to shrink uterine fibroids (i.e. Scutellaria barbata).
• Acupuncture & homeopathy.
Ovarian Cysts

- Fluid-filled sac within the ovary
- Most common type is a follicular cyst: failure to ovulate and instead fills with fluid.
- Diagnosis is usually made by ultrasound and/or laparoscopy.

**SIGNS & SYMPTOMS:**
- Often asymptomatic *(and often harmless)*
- Dull ache or sudden sharp/severe pain if rupture.
- Large cysts may affect bladder function.

**COMPLICATIONS:**
- Bleeding, peritoneal inflammation.

**TREATMENT:**
- **Allopathic:** Surgery (>5cm)
- **Alternative:** Hormone balancing using herbs, acupuncture and diet. Homeopathy.

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Polycystic Ovarian Syndrome (PCOS)

- It is important to distinguish between polycystic ovaries and PCOS.

POLYCYSTIC OVARIES:
- The presence of many cysts within the ovaries. At least one of the following criteria should be present to establish polycystic ovaries:
  1. 12 or more follicles measuring 2–9 mm in diameter.
  2. Increased ovarian volume (>10 cm³).

POLYCYSTIC OVARY SYNDROME (PCOS):
- An endocrine metabolic condition presenting clinically as a group of symptoms associated with polycystic ovaries. Associated with:
  1. Menstrual dysfunction
  2. Ovulatory dysfunction
  3. Chronic Oligoovulation / anovulation
  4. Hyperandrogenism
  5. Metabolic disturbances ie. hyperinsulinaemia.

hyper- = elevated
androgen = male sex hormones
oligo- = few

Ultrasound showing polycystic ovaries:
Polycystic Ovarian Syndrome (PCOS)

- Affects approx. 10% of women during their lives.
- Endocrine abnormalities tend to begin soon after menarche.
- **Exact cause unknown**
- **Inheritable (genetic) links** – ↑ risk with first degree relatives.
- **Obesity’s** been shown to increase risk and expression of PCOS.

**Pathophysiology:**
- **Dysfunction of the hypothalamic-pituitary (HPO) axis**
  - LH:FSH imbalance: high circulating LH (promotes ↑ ovarian androgen formation)
- **Insulin resistance**
  - Occurs in approx. 40% irrespective of body weight
  - Suppresses Sex Hormone-Binding Globulin (SHBG) = ↑ free circulating androgens.
  - The excess androgen production will suppress ovulation.

So insulin resistance is a promotor of excess ovarian androgen output.
Polycystic Ovarian Syndrome (PCOS)

SYMPTOMS:

- Amenorrhoea / Oligomenorrhoea.
- Lack of ovulation
- Infertility
- Hisutism (60-80%)
- Acne & oily skin
- Acanthosis nigricans
- Alopecia/baldness
- Weight gain & difficulty losing weight
- Increased risk of miscarriage.
- Anxiety & depression

Acanthosis Nigricans: A sign of insulin resistance. Associated with rough, dry & thickened, dark skin often around the neck, axillae, elbows & knuckles.
**Polycystic Ovarian Syndrome (PCOS)**

### INVESTIGATIONS:

- **Blood tests:**
  - Increased androgens (testosterone, androstenedione & DHEA-S).
  - Low sex hormone binding globulin (SHBG).
  - High LH: normal or low FSH.
  - High oestrogen (oestrodiol).
  - Hyperinsulinemia & blood glucose levels

- **Ultrasound:** To investigate for PCO.

- **Laparoscopy**

### DIAGNOSIS:

The following diagnostic criteria must be present for PCOS diagnosis:

1. **Oligo/anovulation AND/OR polycystic ovaries**

2. **Clinical or biochemical signs of hyperandrogenism** (hirsutism, acne, male pattern baldness, elevated testosterone).

3. **Exclusion of other causes of hormonal & metabolic dysfunction** (congenital adrenal hyperplasia, androgen-secreting tumours, Cushing’s Syndrome).
Polycystic Ovarian Syndrome (PCOS)

COMPLICATIONS:
- Infertility.
- Amenorrhoea increases risk of endometrial cancer.
- Increased risk of type II diabetes.
- Hyperinsulinaemia increases risk of cardiovascular disease.

ALLOPATHIC TREATMENT:
- Oral contraceptive pill.
- Anti-androgen topical creams.
- Metformin \textit{(increases insulin sensitivity, if insulin resistance)}
- Selective Oestrogen Receptor Modulator (SERM)
  Eg. Clomiphene \textit{→} Stimulates ovulation

ALTERNATIVE APPROACHES:
- Weight loss & exercise

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Ectopic Pregnancy

- Fertilised ovum implants outside of the uterine cavity.
- Can occur in the fallopian tube (97%), ovary, cervix, abdomen.
- Increased risk with Intra-Uterine Devices and endometriosis.
- May cause spontaneous abortion, haemorrhage & peritonitis.

**SIGNS & SYMPTOMS:**
- Initially causing no symptoms but amenorrhoea.
- Unilateral pelvic pain and vaginal bleeding.
- If ruptures: Sudden acute abdominal pain.
- Generally 6-8 weeks after ovulation.

*ectopic* = abnormal location
Infertility

• Failure to conceive after 1 year of unprotected intercourse

CAUSES:
• Male 40%: Low sperm count, poor sperm viability or motility, blocked sperm ducts, undescended testes, metal toxicity, smoking.
• Female 40%: PCOS, endometriosis *(blocked fallopian tubes)*, fibroids, PID, menopause, amenorrhea, hypothyroid, pH, irregular ovulation, STIs.
• Both 20%: Toxicity, radiation, malnutrition, body weight, smoking/alcohol, stress.

ALLOPATHIC TREATMENT:
• Clomiphene: induces ovulation by blocking hypothalamic oestrogen receptors inhibiting negative feedback = ↑FSH + LH *(risk of multiple pregnancies)*
• IVF

ALTERNATIVE TREATMENT:
• Treat cause. Weight management can normalise hormone levels. Both male & female to be treated: detoxification & healthy diet. Acupuncture & homeopathy.
In-Vitro Fertilisation (IVF)

• Artificial fertilisation of the ovum by sperm outside the body – ‘in vitro’.
• When other methods of assisted reproductive technology have failed.
• Success rates: 32.3% women under 35; 27.7% aged 35-37; 20.8% aged 38-39; 13.6% aged 40-42.

The process involves:
1. The drug Clomiphene stimulates multiple oocytes to develop.

2. Eggs retrieved from ovaries, examined and incubated with sperm on a petri dish to allow fertilisation to occur (or sperm injected into egg).

3. The zygote is then transferred to the woman’s uterus with the intent to establish a successful pregnancy.
Breast Cancer

- Most common female cancer.
- Either ductal or lobular epithelial cells.

SIGNS & SYMPTOMS:
- Asymptomatic usually
- Painless, unilateral fixed lump
- Overlying skin changes i.e. dimpling, ‘orange peel’ appearance.
- Asymmetry of breasts, inverted & discharging nipple
- Enlarged axillary lymph nodes.

RISK FACTORS:
- Family history (breast, ovarian cancer) & age
- Genetic mutations in BRCA1 or BRCA2
- Poor diet and sedentary lifestyle, regular alcohol intake and smoking.

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Breast Cancer

DIAGNOSIS:
• Mammography *(increases risk of breast cancer!)*
• Thermography *(safer & more effective method of detecting earlier cell changes)*

COMPLICATIONS:
• Metastatic spread via lymphatics.

ALLOPATHIC TREATMENT:
• Radiotherapy, Surgery, Tamoxifen *(blocks oestrogen receptors)*

SUPPORT:

Research:
Inflammation of the glans penis

CAUSES:
- **Infectious:** Candida albicans, bacterial growth.
- **Non-infectious:** Eczema, psoriasis, inadequate cleaning under foreskin.
- **Phimosis** (foreskin narrowing, preventing retraction).

SYMPTOMS & COMPLICATIONS:
- Pain, irritation, *dyspareunia*.
- Chronic infections can result in foreskin fibrosis.

TREATMENT:
- **Allopathic:** Antibiotics, surgery, hygiene.
- **Alternative:** Antimicrobial herbs, support immunity with herbs & supplements, homeopathy.
Epididymitis

- Inflammation of the epididymis
- In younger men usually retrograde bacterial infection, often related to STIs (commonly gonorrhoea).
- Often associated with orchitis (can be caused by the mumps virus).
- Can lead to sterility.

SYMPTOMS:
- Swollen (especially in orchitis) and tender on palpation.
- Dull ache (testis/groin/abdomen). Often unilateral.
- In severe cases there may be blood in ejaculate.

TREATMENT:
- Antibiotics. Antimicrobial herbs, supplements, homeopathy
Undescended Testes

- One testicle fails to descend in late foetal development and remains in the abdomen.

CAUSES:
- Unclear: may be hormonal or structural.
- Premature birth (affects 30% premature boys)

COMPLICATIONS:
- Seminiferous tubules degenerate
- Impaired spermatogenesis → infertility.
- Testicular cancer.

ALLOPATHIC TREATMENT:
- May descend independently a few months after birth
- hCG injection (acts like LH, increases testosterone)
- Surgery (6-18 months)
Torsion (Rotation) of the spermatic cord, causing occlusion of its contents – medical emergency.

- Occurs in children/adolescents. Peak age: 10 years.
- Presents as acute/severe unilateral testicular pain
- Reddening of scrotal skin

COMPLICATIONS:
- Ischaemia (strangulation of blood supply)

ALLOPATHIC TREATMENT (Rx):
- Manual reduction
- Immediate surgery (within 6 hours – 90% salvage rate 12 hours 50%)
Hydrocoele

• Abnormal accumulation of fluid within the scrotum

CAUSES:
• In neonates due to congenital defect. Often disappears.
• In adulthood due to epididymo-orchitis, testicular torsion, tumour, Varicocele*: abnormal valves in spermatic cord veins. *(can cause infertility*)

DIAGNOSIS:
• Transillumination test

ALLOPATHIC TREATMENT:
• Treat the cause & drainage.
Testicular Cancer

- Most common cancer in young men (15-35yrs).
- Higher risk if **undescended testis & family history**.
- Excellent prognosis if caught early: orchidectomy

**SIGN & SYMPTOMS:**
- **Hard, painless, unilateral mass.**
- Dragging sensation & dull ache
- Metastasises to bone, brain, lungs & liver.

**SUPPORT:**
- Regular, monthly self-examination,
- Herbs, nutritional supplements – antioxidants, diet is essential for all forms of cancer (primarily plant based diet rich in nutrients & antioxidants). Homeopathy & Acupuncture.

95% present with lump on testis
Benign Prostatic Hyperplasia (BPH)

- Enlargement of prostate tissue leading to compression of the urethra
- Very common in older men (60 years+)

CAUSES:
- Thought to be related to Dihydrotestosterone (DHT) produced from testosterone (in the prostate).
- Failure of apoptosis.

SIGNS & SYMPTOMS:
- Obstructed/poor urinary flow
- Intermittent urine flow
- Dribbling
- Nocturia
- Cystitis

apoptosis = programmed cell death
Benign Prostatic Hyperplasia (BPH)

DIAGNOSIS:
• Elevated PSA levels
• Digital Rectal Examination (DRE)
• Ultrasound

ALLOPATHIC TREATMENT:
• 5α-Reductase Inhibitors (Finasteride)
• Surgery when obstruction is severe.

ALTERNATIVE TREATMENT:
• Saw Palmetto (as effective as finasteride in urine output, peak flow, nocturia). Cernilton (pollen extract).
• Nutrition – zinc & soy/phytosterols inhibit 5α-Reductase, avoid alcohol, regular exercise and managing caloric intake.
• Herbs, acupuncture & homeopathy.
Prostate Cancer

- Increasing incidence
- 90% of prostate cancer never grow out of the capsule.
- Many tumours are androgen dependent
- Metastases early to bone, liver and brain

SIGNS & SYMPTOMS:
- Same urinary symptoms as BPH
- Key symptoms include nocturia and haematuria.
- Back pain can indicate bone metastases.

INVESTIGATIONS:
- Elevated PSA
- Digital rectal examination
- Biopsy
Prostate Cancer

ALLOPATHIC TREATMENT:
• PSA every 3 months.
• Radiotherapy (localised, non invasive)
• Androgen deprivation therapy (cancerous cells usually need androgens to grow)
• Chemotherapy (metastatic, resistant to hormone therapy)
• Surgery (removal) – 50% never recover urinary/erectile function

ALTERNATIVE APPROACHES:
• Diet has been shown to be an important factor
• Obesity is a significant risk factor
• High meat consumption (esp. chargrilled), dairy & saturated fats, processed sugars have an increased risk.
• Fish, fruit, vegetables, soy and a plant based diet show to have protective factors.
• Herbs – Boswelia, Pygeum, carotenoids, green tea.
Summary Quiz!

1. Define the term ‘Dysmenorrhoea’
2. Define the pathology endometriosis. A common symptom of endometriosis if pelvic pain. When does this pain tend to occur?
3. What is meant by uterine fibroids? List TWO symptoms.
4. Give a definition for the condition Polycystic Ovarian Syndrome. List as many symptoms as possible of PCOS.
5. Briefly explain the process of IVF.
6. What is meant by an ectopic pregnancy?
7. List TWO symptoms of breast cancer. Explain why a patient with breast cancer might have their axillary lymph nodes removed.
8. What is meant by a ‘hydrocoele’. Explain one test used to help diagnose this.
9. List THREE symptoms of prostate cancer.
10. Name a substance found on a blood test that is a useful marker of prostate function.