Surgery

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2012

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Pre-Operative Assessment and Planning

Aims
- Informed consent
- Assess risk vs. benefits
- Optimise fitness of patient
- Check anaesthesia / analgesia type‐c anaesthetist

Pre-op Checks: OP CHECS
- Operative fitness: cardiorespiratory comorbidities
- Pills
- Consent
- History
  - MI, asthma, HTN, jaundice
  - Complications of anaesthesia: DVT, anaphylaxis
- Ease of intubation: neck arthritis, dentures, loose teeth
- Clexane: DVT prophylaxis
- Site: correct and marked

Drugs
Anti-coagulants
- Balance risk of haemorrhage ¯ risk of thrombosis
- Avoid epidural, spinal and regional blocks

AED
- Give as usual
- Post-op give IV or via NGT if unable to tolerate orally

OCP / HRT
- Stop 4wks before major / leg surgery
- Restart 2wks post-op if mobile

β-Blockers
- Continue as usual

Pre-op Investigations

Bloods
- Routine: FBC, U+E, G+S, clotting, glucose
- Specific
  - LFTs: liver disease, EIOH, jaundice
  - TFT: thyroid disease
  - Se electrophoresis: Africa, West Indies, Med
- Cross-match
  - Gastrectomy: 4u
  - AAA: 6u

Cardiopulmonary Function
- CXR: cardiorespiratory disease/symptoms, >65yrs
- Echo: poor LV function, lx murmurs
- ECG: HTN, Hx of cardiac disease, >55yrs
- Cardiopulmonary Exercise Testing
- PFT: known pulmonary disease or obesity

Other
- Lat C-spine flexion and extension views: RA, AS
- MRSA swabs

Preparation

NBM
- ≥2h for clear fluids, ≥6h for solids

Bowel Prep
- May be needed in left-sided ops
  - Picolax: picosulfate and Mg citrate
  - Klean-Prep: macroglob
- Not usually needed in right-sided procedures
- Necessity is controversial as benefit of minimising post-op infection might not outweigh risks
  - Liquid bowel contents spilled during surgery
  - Electrolyte disturbance
  - Dehydration
  - ↑ rate of post-op anastomotic leak

Prophylactic Abx
- Use
  - GI surgery (20% post-op infection if elective)
  - Joint replacement
  - Give 15-60min before surgery
  - Regimens: (see local guidelines)
    - Biliary: Cef 1.5g + Met 500mg IV
    - CR or appendicetomy: Cef+Met TDS
    - Vascular: co-amoxiclav 1.2g IV TDS
    - MRSA+ve: vancomycin

DVT Prophylaxis
- Stratify pts according to patient factors and type of surgery.
- Low risk: early mobilisation
- Med: early mobilisation + TEDS + 20mg enoxaparin
- High: early mobilisation + TEDS + 40mg enoxaparin + intermittent compression boots perioperatively.
- Prophylaxis started @ 1800 post-op
- May continue medical prophylaxis at home (up to 1mo)

ASA Grades
1. Normally healthy
2. Mild systemic disease
3. Severe systemic disease that limits activity
4. Systemic disease which is a constant threat to life
5. Moribund: not expected to survive 24h even t op

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Specific Pre-operative Complications

Diabetes

↑ Risk of post-operative complications
- Surgery → stress hormones → antagonise insulin
- Pts. are NBM
- ↑ risk of infection
- IHD and PVD

Pre-op
- Dipstick: proteinuria
- Venous glucose
- U+E: K+

IDDM

Practical Points
- Put pt. first on list and inform surgeon and anaesthetist
- Some centres prefer to use GKI infusions
- Sliding scale may not be necessary for minor ops
  - If in doubt, liaise c diabetes specialist nurse

Insulin
- ± stop long-acting insulin the night before
- Omit AM insulin if surgery is in the morning

Start sliding scale
- 5% Dex 20mmol KCl 125ml/hr
- Infusion pump 50u actrapid
- Check CPG hrly and adjust insulin rate
- Check glucose hrly: aim for 7-11mM

Post-op
- Continue sliding-scale until tolerating food
- Switch to SC regimen around a meal

NIDDM

- If glucose control poor (fasting >10mM): treat as IDDM
- Omit oral hypoglycaemins on the AM of surgery
- Eating post-op: resume oral hypoglycaemins c meal
- No eating post-op
  - Check fasting glucose on AM of surgery
  - Start insulin sliding scale
  - Consult specialist team ore. restarting PO Rx

Diet Controlled
- Usually no problem
- Pt. may be briefly insulin-dependent post-op
  - Monitor CPG

Steroids

Risks
- Poor wound healing
- Infection
- Adrenal crisis

Mx
- Need to ↑ steroid to cope c stress
- Consider cover if high-dose steroids w/i last yr
- Major surgery: hydrocortisone 50-100mg IV c pre-med then 6-8hrly for 3d.
- Minor: as for major but hydrocortisone only for 24h

Jaundice

- Best to avoid operating in jaundiced pts.
- Use ERCP instead

Risks
- Pts. c obstructive jaundice have ↑ risk of post-op renal failure . need to maintain good UO.
- Coagulopathy
- ↑ infection risk: may → cholangitis

Pre-op
- Avoid morphine in pre-med
- Check clotting and consider pre-op vitamin K
- Give 1L NS pre-op (unless CCF) → moderate diuresis
- Urinary catheter to monitor UPO
- Abx prophylaxis: e.g. cef+met

Intra-op
- Hrly UO monitoring
- NS titrated to output

Post-op
- Intensive monitoring of fluid status
- Consider CVP + frusemide if poor output despite NS

Anticoagulated Patients

- Balance risk of haemorrhage c risk of thrombosis
- Consult surgeon, anaesthetist and haematologist
- Very minor surgery may be undertaken w/o stopping warfarin if INR <3.5.
- Avoid epidural, spinal and regional blocks if anticoagulated,
  - In general, continue aspirin/clopidogrel unless risk of bleeding is high – then stop 7d before surgery

Low thromboembolic risk: e.g. AF
- Stop warfarin 5d pre-op: need INR <1.5
- Restart next day

High thromboembolic risk: valves, recurrent VTE
- Need bridging c LMWH
  - Stop warfarin 5d pre-op and start LMWH
  - Stop LMWH 12-18h pre-op
  - Restart LMWH 6h post-op
  - Restart warfarin next day
  - Stop LMWH when INR >2

Emergency Surgery
- Discontinue warfarin
- Vit K .5mg slow IV
- Request FFP or PCC to cover surgery

COPD and Smoking

Risks
- Basal atelectasis
- Aspiration
- Chest infection

Pre-op
- CXR
- PFTs
- Physio for breathing exercises
- Quit smoking (at least 4wks prior to surgery)
Anaesthesia

Principals and Practical Conduct
- Aims: hypnosis, analgesia, muscle relaxation
- Induction: e.g. IV propofol
- Muscle Relaxation
  - Depolarising: suxamethonium
  - Non-depolarising: vecuronium, atracurium
- Airway Control: ET tube, LMA
- Maintenance
  - Usually volatile agent added to N₂O/O₂ mix
  - E.g. halothane, enflurane
- End of Anaesthesia
  - Change inspired gas to 100% O₂
  - Reverse paralysis: neostigmine + atropine (prevent muscarinic side effects)

Pre-medication: 7As
- Anxiolytics and Amnesia: e.g. temazepam
- Analgesics: e.g. opioids, paracetamol, NSAIDs
- Anti-emetics: e.g. ondansetron 4mg / metoclopramide 10mg
- Antacids: e.g. lansoprazole
- Anti-sialogue e.g. glycopyrolate (↓secretions)
- Antibiotics

Regional Anaesthesia
- May be used for minor procedures or if unsuitable for GA
  - Nerve or spinal blocks
    - Cf: local infection, clotting abnormality
  - Use long-acting agents: e.g. bupivacaine

Complications of Anaesthesia

Propofol Induction
- Cardiorespiratory depression

Intubation
- Oro-pharyngeal injury zlib laryngoscope
- Oesophageal intubation

Loss of pain sensation
- Urinary retention
- Pressure necrosis
- Nerve palsies

Loss of muscle power
- Corneal abrasion
- No cough → atelectasis + pneumonia

Malignant Hyperpyrexia
- Rare complication ppted by halothane or suxamethonium
- AD inheritance
- Rapid rise in temperature + masseter spasm
- Rx: dantrolene + cooling

Anaphylaxis
- Rare
- Possible triggers
  - Antibiotics
  - Colloid
  - NM blockers: e.g. vecuronium

Analgesia

Necessity
- Pain → autonomic activation → arteriolar constriction → ↓wound perfusion → impaired wound healing
- Pain → ↓mobilisation → ↑VTE and ↓function
- Pain → ↓respiratory excursion and ↓cough → atelectasis and pneumonia
- Humanitarian considerations

General Guidance
- Give regular doses at fixed intervals
- Consider best route: oral when possible
- PCA should be considered: morphine, fentanyl
- Follow stepwise approach
- Liaise zlib Acute Pain Service

Pre-Op
- Epidural anaesthesia: e.g. zlib bupivacaine

End-Op
- Infiltrate wound edge zlib LA
- Infiltrate major regional nerves zlib LA

Post-Op: stepwise approach
1. Non-opioid ± adjuvants
   - Paracetamol
   - NSAIDs
     - Ibuprofen: 400mg/6h PO max
     - Diclofenac: 50mg PO / 75mg IM

2. Weak opioid + non-opioid ± adjuvants
   - Codeine
   - Dihydrocodeine
   - Tramadol

3. Strong opioid + non-opioid ± adjuvants
   - Morphine: 5-10mg/2h max
   - Oxycodone
   - Fentanyl

Spinal or Epidural Anaesthesia
- ↓SE as drugs more localised
- 1st line for major bowel resection
- Caution
  - Respiratory depression
  - Neurogenic shock → ↓BP

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Enhanced Recovery After Surgery

ERAS
- Commonly employed in colorectal and orthopaedic surgery

Aims
- Optimise pre-op preparation for surgery
- Avoid iatrogenic problems (e.g. ileus)
- Minimise adverse physiological / immunological responses to surgery
  - ↑ cortisol and ↓ insulin (absolute or relative)
  - Hypercoagulability
  - Immunosuppression
- ↑ speeded of recovery and return to function
- Recognise abnormal recovery and allow early intervention

Pre-op: optimisation
- Aggressive physiological optimisation
  - Hydration
  - BP (↑ / ↓)
  - Anaemia
  - DM
  - Co-morbidities
- Smoking cessation: ≥4wks before surgery
- Admission on day of surgery, avoidance of prolonged fast
- Carb loading prior to surgery: e.g. carb drinks
- Fully informed pt., encouraged to participate in recovery

Intra-op: ↓ physical stress
- Short-acting anaesthetic agents
- Epidural use
- Minimally invasive techniques
- Avoid drains and NGTs where possible

Post-op: early return to function and mobilisation
- Aggressive Rx of pain and nausea
- Early mobilisation and physiotherapy
- Early resumption of oral intake (inc. carb drinks)
- Early discontinuation of IV fluids
- Remove drains and urinary catheters ASAP

Surgical Complications

Immediate (<24h)
- Intubation → oropharyngeal trauma
- Surgical trauma to local structures
- Primary or reactive haemorrhage

Early (1d-1mo)
- Secondary haemorrhage
- VTE
- Urinary retention
- Atelectasis and pneumonia
- Wound infection and dehiscence
- Antibiotic association colitis (AAC)

Late (>1mo)
- Scarring
- Neuropathy
- Failure or recurrence
Post-op Complications: General

Haemorrhage Classification
- **Primary**: continuous bleeding starting during surgery
- **Reactive**
  - Bleeding at the end of surgery or early post-op
  - $2^\text{nd}$ to $1^\text{st}$ CO and BP
- **Secondary**
  - Bleeding $>24h$ post-op
  - Usually due to infection

Post-op Urinary Retention

**Causes**
- **Drugs**: opioids, epidural/spinal, anti-AChM
- **Pain**: sympathetic activation $\rightarrow$ sphincter contraction
- **Psychogenic**: hospital environment

**Risk Factors**
- Male
- $\uparrow$ age
- Neuropathy: e.g. DM, EtOH
- BPH
- Surgery type: hernia and anorectal

**Mx**
- **Conservative**
  - Privacy
  - Ambulation
  - Void to running taps or in hot bath
  - Analgesia
- **Catheterise** $\pm$ gent $2.5mg/kg$ IV stat
- **TWOC** = Trial w/o Catheter
  - If failed, may be sent home $\exists$ silicone catheter and urology outpt. f/up.

Pulmonary Atelectasis

- Occurs after every nearly every GA
- Mucus plugging + absorption of distal air $\rightarrow$ collapse

**Causes**
- Pre-op smoking
- Anaesthetics $\uparrow$ mucus production $\downarrow$ mucociliary clearance
- Pain inhibits respiratory excursion and cough

**Presentation**
- $w/i$ first 48hrs
- Mild pyrexia
- Dyspnoea
- Dull bases $\exists\downarrow$AE

**Mx**
- Good analgesia to aid coughing
- Chest physiotherapy

Wound Infection
- 5-7d post-op
- Organisms: S. aureus and Coliforms

Operative Classification
- **Clean**: incise uninfected skin w/o opening viscus
- **Clean/Cont**: intra-op breach of viscus (not colon)
- **Contaminated**: breach of viscus + spillage or opening of colon
- **Dirty**: site already contaminated – faeces, pus, trauma

**Risk Factors**
- **Pre-operative**
  - $\uparrow$ Age
  - Comorbidities: e.g. DM
  - Pre-existing infection: e.g. appendix perforation
  - Pt. colonisation: e.g. nasal MRSA
- **Operative**
  - Op classification and wound infection risk
  - Duration
  - Technical: pre-op Abx, asepsis
- **Post-operative**
  - Contamination of wound from staff

**Mx**
- Regular wound dressing
- Abx
- Abscess drainage

Wound Dehiscence

**Presentation**
- Occurs $\sim$10d post-op
- Preceded by serosanguinous discharge from wound

**Risk Factors**
- **Pre-Operative Factors**
  - $\uparrow$ age
  - Smoking
  - Obesity, malnutrition, cachexia
  - Comorbs: e.g. BM, uraemia, chronic cough, Ca
  - Drugs: steroids, chemo, radio
- **Operative Factors**
  - Length and orientation of incision
  - Closure technique: follow Jenkin’s Rule
  - Suture material
- **Post-operative Factors**
  - $\uparrow$ IAP: e.g. prolonged ileus $\rightarrow$ distension
  - Infection
  - Haematoma / seroma formation

**Mx**
- Replace abdo contents and cover $\exists$ sterile soaked gauze
- IV Abx: cef+met
- Opioid analgesia
- Call senior and arrange theatre
- Repair in theatre
  - Wash bowel
  - Debride wound edges
  - Close $\exists$ deep non-absorbable sutures (e.g. nylon)
- May require VAC dressing or grafting
Post-op Complications: Specific

**General Surgery**

**Cholecystectomy**
- Conversion to open: 5%
- CBD injury: 0.3%
- Bile leak
- Retained stones (needing ERCP)
- Fat intolerance / loose stools

**Inguinal Hernia Repair**
- **Early**
  - Haematoma / seroma formation: 10%
  - Intra-abdominal injury (lap)
  - Infection: 1%
  - Urinary retention
- **Late**
  - Recurrence (<2%)
  - Ischaemic orchitis: 0.5%
  - Chronic groin pain / paraesthesia: 5%

**Appendicectomy**
- Abscess formation
- Fallopian tube trauma
- Right hemicolectomy (e.g. for carcinoid, caecal necrosis)

**Colonic Surgery**
- **Early**
  - Ileus
  - AAC
  - Anastomotic leak
  - Enterocutaneous fistulae
  - Abdominal or pelvic abscess
- **Late**
  - Adhesions → obstruction
  - Incisinal hernia

**Post-op Ileus**
- **Causes**
  - Bowel handling
  - Anaesthesia
  - Electrolyte imbalance
- **Presentation**
  - Distension
  - Constipation ± vomiting
  - Absent bowel sounds
- **Rx**
  - IV fluids + NGT
  - TPN if prolonged

**Anorectal Surgery**
- Anal incontinence
- Stenosis
- Anal fissure

**Small Bowel Surgery**
- Short gut syndrome (≤250cm)

**Splenectomy**
- Gastric dilatation (≥250 gastric ileus)
  - Prevent NGT
- Thrombocytosis → VTE
- Infection: encapsulated organisms

**Vascular**

**Arterial Surgery**
- Thrombosis and embolization
- Anastomotic leak
- Graft infection

**Aortic Surgery**
- Gut ischaemia
- Renal failure
- Aorto-enteric fistula
- Anterior spinal syndrome (paraplegia)
- Emboli → distal ischaemia (trash foot)

**Breast**
- Arm lymphoedema
- Skin necrosis
- Seroma

**Urological**
- Sepsis (instrumentation → infected urine)
- Uroma: extravasation of urine

**Prostatectomy**
- Urinary incontinence
- Erectile dysfunction
- Retrograde ejaculation
- Prostatitis

**ENT**

**Thyroidectomy**
- Wound haematoma → tracheal obstruction
- Recurrent laryngeal N. trauma → hoarse voice
  - Transient in 1.5%
  - Permanent in 0.5%
  - R commonest (more medial)
- Hypoparathyroidism → hypocalcaemia
- Thyroid storm
- Hypothyroidism

**Tracheostomy**
- Stenosis
- Mediastinitis
- Surgical emphysema

**Orthopaedic Surgery**

**Fracture Repair**
- Mal-/non-union
- Osteomyelitis
- AVN
- Compartment syndrome

**Hip Replacement**
- Deep infection
- VTE
- Dislocation
- Nerve injury: sciatic, SGN
- Leg length discrepancy

**Cardiothoracic Surgery**
- Pneumo-/haemo-thorax
- Infection: mediastinitis, empyema
Post-op Pyrexia

Causes

Early: 0-5d post-op
- Blood transfusion
- Physiological: SIRS from trauma: 0-1d
- Pulmonary atelectasis: 24-48hr
- Infection: UTI, superficial thrombophlebitis, cellulitis
- Drug reaction

Delayed: >5d post-op
- Pneumonia
- VTE: 5-10d
- Wound infection: 5-7d
- Anastomotic leak: 7d
- Collection: 5-20d

Examination of Post-Op Febrile Pt.
- Observation chart, notes and drug chart
- Wound
- Abdo + DRE
- Legs
- Chest
- Lines
- Urine
- Stool

Ix
- Urine: dip + MCS
- Blood: FBC, CRP, cultures ± LFTs
- Cultures: wound swabs, CVP tip for culture
- CXR

Pneumonia

Cause
- Anaesthesia → atelectasis
- Pain → ↓ cough
- Surgery → immunosuppression

Rx
- Chest physio: encouraging coughing
- Good analgesia
- Abx

Collection

Presentation
- Malaise
- Swinging fever, rigors
- Localised peritonitis
- Shoulder tip pain (if subphrenic)

Locations
- Pelvic: present @ 4-10d post-op
- Subphrenic: present @ 7-21d post-op
- Paracolic gutters
- Lesser sac
- Hepatorenal recess (Morrison's space)
- Small bowel (interloop spaces)

Ix
- FBC, CRP, cultures
- US, CT
- Diagnostic lap

Rx
- Abx
- Drainage / washout

Cellulitis
- Acute infection of the subcutaneous connective tissue

Cause: β-haemolytic Streps + staph. aureus

Presentation
- Pain, swelling, erythema and warmth
- Systemic upset
- ± lymphadenopathy

Rx
- Benpen IV
- Pen V and fluclox PO
Epidemiology
- DVTs occur in 25-50% of surgical patients

Risk Factors: Virchow's Triad
- Blood Contents
  - Surgery → ↑ plats and ↑ fibrinogen
  - Dehydration
  - Malignancy
  - Age: ↑
- Blood Flow
  - Surgery
  - Immobility
  - Obesity
- Vessel Wall
  - Damage to veins: esp. pelvic veins
  - Previous VTE

Signs
- Peak incidence @ 5-10d post-op
- 65% of below knee DVTs are asymptomatic
- Calf warmth, tenderness, erythema, swelling
- Mild pyrexia
- Pitting oedema

Differential
- Cellulitis
- Ruptured Baker's cyst

Ix
- D-Dimers: sensitive but not specific
- Compression US (clot will be incompressible)
- Thrombophilia screen if:
  - No precipitating factors
  - Recurrent DVT
  - Family Hx

Dx
1. Assess probability using Wells' Score
2. Low-probability → perform D-dimers
   - Negative → excludes DVT
   - Positive → Compression US
3. Med / High probability → Compression US

Rx
Anticoagulate
- Therapeutic LMWH: enoxaparin 1.5mg/kg/24h SC
- Start warfarin using Tait model: 5mg OD for first 4d
- Stop LMWH when INR 2.5
- Duration
  - Below knee: 6-12wks
  - Above knee: 3-6mo
  - On-going cause: indefinite

Graduated Compression Stockings
- Consider for prevention of post-phlebitic syndrome

Preventing DVT

Pre-op
- Pre-op VTE risk assessment
- TED stockings
- Aggressive optimisation: esp. hydration
- Stop OCP 4wks pre-op

Intra-op
- Minimise length of surgery
- Use minimal access surgery where possible
- Intermittent pneumatic compression boots

Post-op
- LMWH
- Early mobilisation
- Good analgesia
- Physio
- Adequate hydration

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Other Common Post-Operative Presentations

Dyspnoea / Hypoxia

Causes
- Previous lung disease
- Atelectasis, aspiration, pneumonia
- LVF
- PE
- Pneumothorax (e.g. due to CVP line insertion)
- Pain → hypoventilation

Ix
- FBC, ABG
- CXR
- ECG

Rx
- Sit up, give O₂, monitor SpO₂
- Rx cause

Reduced Urine Output

Causes
- Post-renal
  - Commonest cause
  - Blocked / malsited catheter
  - Acute urinary retention
- Pre-renal: hypovolaemia
- Renal: NSAIDs, gentamicin
- Anuria usually = blocked or malsited catheter
- Oliguria usually = inadequate fluid replacement

Mx
- Information
  - Op Hx
  - Obs chart: UO
  - Drug chart: nephrotoxins
- Examination
  - Assess fluid status
  - Examine for palpable bladder
  - Inspect drips, drains, stomas, CVP
- Action
  - Flush 50ml NS and aspirate back
  - Fluid challenge

Nausea and Vomiting

Causes
- Obstruction
- Ileus
- Emetic drugs: e.g. opioids
- Consider NGT, AXR and ondansetron 4mg IV TDS

↓ Na
- What was pre-op level?

Common Causes:
- S(I)ADH: pain, nausea, opioids, stress
- Over administration of IV fluids

Correct slowly
- Acute: 1mM/h
- Chronic: 15mM/d

Hypotension

Immediate Mx
- Tilt bed head down, give O₂
- Assess fluid status

Causes: CHOD
- Cardiogenic
  - MI
  - Fluid overload
- Hypovolaemia
  - Inadequate replacement of fluid losses
  - Haemorrhage
- Obstructive
  - PE
- Distributive
  - Sepsis
  - Neurogenic shock

Mx
- Hypovolaemia → fluid challenge
  - 250-500ml colloid over 15-30min
- Haemorrhage → return to theatre
- Sepsis → fluid challenge, start Abx
- Overload → frusemide
- Neurogenic → NA infusion

Hypertension

- Continue anti-hypertensives during peri-operative period

Causes
- Pain
- Urinary retention
- Previous HTN

Rx
- Rx cause
- May use labetalol 50mg IV every 5min (200mg max)

Acute Confusional State

- Agitation, disorientation, attempts to leave hospital

Common Causes: DELIRIUM
- Drugs: opiates, sedatives, L-DOPA
- Eyes, ears and other sensory deficits
- Low O₂ states: MI, stroke, PE
- Infection
- Retention: stool or urine
- Ictal
- Under- hydration / -nutrition
- Metabolic: Na, AKI, glucose, EtOH withdrawal

Mx
- May need sedation: midazolam / haldol
- Nurse in well-lit environment
- Rx cause
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Fluid Homeostasis

Body Composition
- Total water: 60% of 70kg = 42L
  - 2/3 intracellular = 28L
  - 1/3 extracellular = 14L
    - Plasma = 3L (21% of ECF)
    - Interstitial = 10L
    - Transcellular = 1L

Starling’s Forces

Osmotic Pressure
- Pressure which needs to be applied to prevent the inflow of water across a semipermeable membrane.
- i.e. the ability of a solute to attract water.
- Oncotic pressure: form of osmotic pressure exerted by proteins.

Hydrostatic Pressure
- Pressure exerted by a fluid at equilibrium due to the force of gravity.

Distribution
- Distribution between the ECF and ICF is driven by differences in osmotic pressure only.
- Distribution w/i the ECF is determined by Starling’s forces.
  - Capillary and interstitial oncotic pressure.
  - Capillary and interstitial hydrostatic pressure.
  - Filtration coefficient (capillary permeability)

3rd Space Losses → ↓ ECF
- Bowel obstruction → ↓ fluid reabsorption → 3rd space loss
- Sudden diuresis on day 2-3 post op = recovery of ileus
- Peritonitis → ascites → 3rd space loss

Fluid Balance

<table>
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<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>1500</td>
</tr>
<tr>
<td>Food</td>
<td>1000</td>
</tr>
<tr>
<td>Metabolism</td>
<td>300</td>
</tr>
<tr>
<td>- lungs</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2800ml</td>
</tr>
</tbody>
</table>

Other Values
- Minimum UO = 0.5ml/kg/h = ~30ml/h
- Na requirement = 1.5-2mmol/kg/d = 100mmol/d
- K requirement = 1mmol/kg/d = 60mM/d

Fluid Regimens

Daily Requirements
- 3L dex-saline c 20mM K⁺ in each bag
- 1L NS + 2L dex c 20mM K⁺ in each bag
  - Each bag over 8h = 125ml/h

Replace other losses
- Vomiting and Diarrhoea
- NGT
- Drains
- Fever (+500ml for each °C)
- Tachypnoea
- High-output stomas

CVP Monitoring
- Indicates RV preload and depends on
  - Venous return
  - Cardiac output
- ↑ CVP
  - ↑ circulating volume
  - ↓ CO: i.e. pump failure
- ↓ CVP
  - ↓ circulating volume
- Normal value: ~5-10cmH₂O
- Single reading is not as useful as serial measurements before and after fluid challenge.
  - Unchanged: hypovolaemic
  - ↑ that reverses after 30min: euvolaemic
  - Sustained ↑ >5cmH₂O: overload / failure
- Passive leg raising may be more useful than fluid challenge in determining response to fluids.
  - Sustained ↑ in CVP suggests heart failure.
**Crystalloid**

**NS**

Contents
- 0.9% NaCl = 9g/L
- 154mM NaCl

pH: 5-6

Use
- Normal daily fluid requirements + replace losses

---

**5% Dextrose**

Contents
- 50g dextrose/L

Use
- Normal daily fluid requirements

---

**Dextrose-Saline**

Contents
- 4% dextrose = 40g/L
- 0.18% NaCl = 31mM NaCl

Use
- Normal daily fluid requirements

---

**Hartmann’s / Ringer’s Lactate**

Contents
- Na: 131mM
- Cl: 111mM
- K: 5mM
- Ca: 2.2mM
- Lactate / HCO₃: 29mM

Use
- Resuscitation in trauma pts.
  - **Parkland’s formula**: 4 x wt x %burn = mL in 1st 24hrs

pH
- pH = 6.5 but Hartmann’s is an alkalinising solution
- Lactate is not an acid in itself: it’s a conjugate base
- Given exogenously as sodium lactate
- Lactate metabolised in liver → HCO₃ production
  - The Cori Cycle

**Daily Requirements**
- 3L dex-saline + 20mM K⁺ in each bag
- 1L NS + 2L dex + 20mM K⁺ in each bag
  - Each bag over 8h = 125ml/h

**Problems**
- Anaphylaxis
- Volume overload
- Can interfere with cross-matching therefore take blood for x-match before using.

---

**Colloid**

**Physiology**
- Contain large molecular wt. molecules
  - Gelatin
  - Dextran
- Preserves oncotic pressure → preferential ↑ in intravascular volume

**Synthetic**
- Gelofusin
- Volpxel
- Haemaccel
- Voluven

**Natural**
- Albumin
- Blood

**Use**
- Fluid challenge: 250-500ml over 15-30min
- Hypovolaemic shock
- Mount Vernon Formula
  - (wt. x %burn)/2 = mL colloid per unit time

**Problems**
- Anaphylaxis
- Volume overload
- Can interfere with cross-matching therefore take blood for x-match before using.

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Assessing Fluid Status
- **Hx:** balance chart, surgery, other losses, thirsty
- **Impression:** drowsy, alert
- **Inspection:** drips, drains, stomas, catheters, CVP

Examination
- **IV volume**
  - CRT
  - HR
  - BP lying and standing
  - JVP
- **Tissue perfusion**
  - Skin turgor
  - Oedema: ankle, pulmonary, ascites
  - Mucus membranes
- **End-organ**
  - UO, ↑U+Cr
  - Consciousness
  - Lactate

Other Tests
- **PCWP:** indirect measure of left atrial pressure
- **CVP**

Post-operative Fluids

Problems
- ↑ADH, ↑aldosterone, ↑cortisol → Na +H₂O conservation
- ↑K⁺: tissue damage, transfusion, stress hormones

Solutions
- Use UO (aim>30ml/h) to guide fluid replacement but may need to ↓ maintenance fluids to 2L first 24h post-op
- Avoid K⁺ supplementation for first 24h post-op

Cardiac or Renal Failure

Problem
- RAS activation → Na and H₂O retention

Solution
- Avoid fluids c Na → give 5% dextrose

Bowel Obstruction
- Pts. have significant third space losses c loss of both water and electrolytes.
- Likely to need significantly more than standard daily requirements.
- **Regimen**
  - 0.9% NS c 20-40mm KCl added to each bag
  - Titrate rate of fluid therapy to clinical findings on serial examination.
  - Serial U+Es guide electrolyte replacement

Pancreatitis
- Inflammation → significant fluid shift into the abdomen.
- Pts require aggressive fluid resuscitation and maintenance
  - Insert urinary catheter and consider CVP monitoring
  - 0.9% NS c 20-40mm KCl added to each bag
  - Keep UO >30ml/h
  - Serial U+Es guide electrolyte replacement

Ileostomy
- **Ileal fluid composition**
  - Na: 130mM
  - Cl: 110mM
  - K: 10mM
  - HCO₃: 30mM
- Normal output: 10-15mL/Kg/d = ~700ml/d
- High output = >1000ml/d
- Ileum will adapt to limit fluid and electrolyte losses
- **Fluids**
  - 0.9% NS +KCl
  - Daily requirements + replaces losses, titrated to UO
  - Serial U+Es guide electrolyte replacement
- **High Output**
  - Loperamide
  - Codeine

Reduced Urine Output Post-op

Causes
- **Post-rerenal**
  - Commonest cause
  - Blocked / malsited catheter
  - Acute urinary retention
- **Pre-renal:** hypovolaemia
- **Renal:** NSAIDs, gentamicin
- Anuria usually = blocked or malsited catheter
- Oliguria usually = inadequate fluid replacement

Mx
- **Information**
  - Op Hx
  - Obs chart: UO
  - Drug chart: nephrotoxins
- **Examination**
  - Assess fluid status
  - Examine for palpable bladder
  - Inspect drips, drains, stomas, CVP
- **Action**
  - Flush c 50ml NS and aspirate back
  - Fluid challenge

Suspect Catheter Problem
- Flush c 50ml NS and aspirate back

Suspect Pre-renal Problem
- **Fluid challenge**
  - 250-500ml colloid bolus over 15-30min
  - Look for CVP or UO response w/i minutes
Nutrition

Assessment

Clinical
- Hx
  - Wt. loss
  - Diet
- Examination
  - Skin fat
  - Dry hair
  - Pressure sores
  - Cheilitis
  - Wt. and BMI (<20kg/m²)

Anthropometric
- Skin-fold thickness
- Arm circumference

Ix
- Albumin
- Transthyretin (prealbumin)
- Phosphate

Requirements (/kg/24h)
- Calories: 20-40 Kcal
- Carb: 2g
- Fat: 3g
- Protein: 0.5-1
- Nitrogen: 0.2-0.4g

Enteral Nutrition

Delivery
- PO is best
  - Consider semi-solid diet if risk of aspiration
- Fine bore NGT (9 Fr)
- Percutaneous Endoscopic Gastrostomy
- Jejunostomy
- Build up feeds gradually to prevent diarrhoea

Feeds
- Oral supplements
- Polymeric: e.g. osmolite, jevity
  - Intact proteins, starches and long-chain FAs
- Disease Specific
  - e.g. ↓ branched chain AAs in hepatic encephalopathy
- Elemental
  - Simple AAs and oligo/monosaccharides
  - Require minimal digestion and used if abnormal GIT: e.g. in Crohn’s

Indications
- Catabolic: sepsis, burns, major surgery
- Coma/ITU
- Malnutrition
- Dysphagia: stricture, stroke

Complications
- NGT
  - Nasal trauma
  - Malposition or tube blockage
- Feeding
  - Feed intolerance → diarrhoea
  - Electrolyte imbalance
  - Aspiration
  - Refeeding syndrome

Parenteral Nutrition

- May be “Total” or used to supplement enteral feeding
- Combined c H₂O to deliver total daily requirements

Indications
- Prolonged obstruction or ileus (>7d)
- High output fistula
- Short bowel syndrome
- Severe Crohn’s
- Severe malnutrition
- Severe pancreatitis
- Unable to swallow: e.g. oesophageal Ca

Delivery
- Delivered centrally as high osmolality is toxic to veins
  - Short-term: CV catheter
  - Long-term: Hickman or PICC line
- Sterility is essential: use line only for PN

Monitoring
- Standard
  - Wt., fluid balance and urine glucose daily
  - Zn, Mg weekly
- Initially
  - Blood glucose, FBC, U+E + PO₄ 3x /wk
  - LFTs 3x /wk
- Once stable
  - Blood glucose, FBC, U+E + PO₄ daily
  - LFTs weekly

Contents
- 2000Kcal: 50% fat, 50% carb
- 10-14g nitrogen
- Vitamins, minerals and trace elements

Complications
- Line-related
  - Pneumothorax / haemothorax
  - Cardiac arrhythmia
  - Line sepsis
  - Central venous thrombosis → PE or SVCO
- Feed-related
  - Villous atrophy of GIT
  - Electrolyte disturbances
    - Refeeding syndrome
    - Hypercapnoea from excessive CO₂ production
  - Hyperglycaemia and reactive hypoglycaemia
  - Line sepsis: ↑ risk c TPN
  - Vitamin and mineral deficiencies
Refeeding Syndrome

Definition
- Life-threatening metabolic complication of refeeding via any route after a prolonged period of starvation.

Pathophysiology
- ↓ carbs → catabolic state c¯ ↓ insulin, fat and protein catabolism and depletion of intracellular PO₄
- Refeeding → ↑ insulin in response to carbs and ↑ cellular PO₄ uptake.
- → hypophosphataemia
  - Rhabdomyolysis
  - Respiratory insufficiency
  - Arrhythmias
  - Shock
  - Seizures

Chemistry
- ↓K, ↓Mg, ↓PO₄

At-Risk Patients
- Malignancy
- Anorexia nervosa
- Alcoholism
- GI surgery
- Starvation

Prevention
- Identify and monitor at-risk patients
- Liaise c¯ dietician

Rx
- Identify at-risk pts in advance and liaise c¯ dietician
- Parenteral and oral PO₄ supplementation
- Rx complications
# Trauma

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Primary Survey

ADDRESS PROBLEMS IN 1O SURVEY IN THE ABCDE ORDER.

Airway and C-Spine

Airway
- Check for airway compromise
  - Ask pt. a question
  - Stridor
  - Orofacial injury or burns
  - Visualise airway and use suction if necessary
- Manoeuvres to open airway
  - Jaw thrust
- Adjuncts if compromise / potential compromised
  - NPA: gag reflex present
  - OPA: no gag reflex (stop tongue swallowing)
- Emergency Airways
- Definitive Airways (no risk of aspiration)
  - Endotracheal tube
  - Tracheostomy

C-Spine
- Maintain in-line cervical support to keep neck stable
- Place pt. in hard-collar and sandbags c tape

Breathing
- Start 15L O₂ via non-rebreathe mask (Hudson)

Assessment
- SpO₂
- Inspection of chest
- Position of trachea
- RR and chest expansion
- Breath sounds, vocal resonance
- Percussion
- ABG

Tension Pneumothorax
- Signs
  - Respiratory distress
  - ↑JVP and ↓BP
  - Tracheal deviation + displaced apex
  - ↓ air entry and ↓ VR
  - Hyperresonant percussion
- Rx: immediate decompression
  - Insert large-bore venflon into 2nd ICS, mid-clavicular line.
  - Insert ICD later

Open Sucking Chest Wounds
- Convert to closed wounds by covering with damp occlusive dressing stuck down on 3 sides.

Circulation
- Two-large bore cannulae (14/16G) in each ACF
- FBC, U+E, x-match (6U), clotting, VBG

Assessment
- Inspection: pale, sweaty, active bleeding
- Vascular status: BP, HR, JVP, heart sounds, cardiac mon
- End-organ: consciousness, UO

Sites of Haemorrhage
- Chest
- Abdomen
- Pelvis: use pelvic binder
- Floor

Mx
- If haemodynamic compromise give 2L warmed Hartmann’s stat.
- Consider further colloid / blood
- Insert CVP and catheter (after PR) to guide resus

Response
- Assess response to fluids using UO, lactate, BP

Rapid
- Usually <20% loss
- Slow fluid to maintenance if haemodynamically stable

Transient
- 20-40% loss
- On-going losses or inadequate resuscitation

None
- Exsanguinating haemorrhage → theatre
- Consider non-haemorrhagic shock
  - Tamponade
  - Pneumothorax

Disability

Assessment
- Assess consciousness using AVPU or GCS
- Pupil responses

Exposure

Assessment
- Completely undress pt.
- Perform log-role and PR
  - Feel for high riding prostate (urethral rupture)
  - Look for bleeding
- Prevent hypothermia

REPEAT 1O SURVEY AGAIN!
Secondary Survey

History
- Allergies
- Medication
- PMH
- Last ate / drunk
- Events

Examination
- Head-to-toe examination
- Examine every system

Ix
- Trauma series
  - C-spine: lat + peg
  - CXR
  - Pelvis
- FAST scan (Focused Assessment Sonography in Trauma)
- CT: when pt. is stable.

Assessing C-spine Radiographs
- Views
  - Lateral
  - AP
  - Open-mouth Peg view
- Adequacy
  - Must see C7-T1 junction
  - May need swimmer’s view or abducted arm
- Alignment: 4 lines
  - Ant. vertebral bodies
  - Ant. vertebral canal
  - Post. vertebral canal
  - Tips of spinous processes
- Bones: shapes of bodies, laminae, processes
- Cartilage: IV discs should be equal height
- Soft tissue
  - Width of soft tissue shadow anterior to upper vertebrae should be 50% of vertebral width.

Clearing the C-Spine

Clinical Clearance
- Indication: NEXUS Criteria
  - Fully alert and orientated
  - No head injury
  - No drugs or alcohol
  - No neck pain
  - No abnormal neurology
  - No distracting injury
- Method
  - Examine for bruising or deformity
  - Palpate for deformity and tenderness
  - Ensure pain-free active movement

Radiological Clearance
- Indications
  - Pt. doesn’t meet criteria for clinical clearance
- Modalities
  - Radiograph initially
    - Clear if normal radiograph and clinical exam
  - CT C-spine if abnormal radiograph or clinical exam

Shock

Haemorrhagic Shock
- Circulating blood volume = 7% body mass

<table>
<thead>
<tr>
<th>%</th>
<th>ml</th>
<th>RR</th>
<th>HR</th>
<th>BP</th>
<th>UO</th>
<th>Mental</th>
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<tr>
<td>1</td>
<td>0-15</td>
<td>750</td>
<td>↔</td>
<td>↔</td>
<td>↔</td>
<td>Normal</td>
</tr>
<tr>
<td>2</td>
<td>15-30</td>
<td>750-1500</td>
<td>&gt;20</td>
<td>&gt;100</td>
<td>↔</td>
<td>&lt;30 Anxious++</td>
</tr>
<tr>
<td>3</td>
<td>30-40</td>
<td>1500-2000</td>
<td>&gt;30</td>
<td>&gt;120</td>
<td>↓</td>
<td>5-20 Confused</td>
</tr>
<tr>
<td>4</td>
<td>&gt;40</td>
<td>&gt;2000</td>
<td>&gt;35</td>
<td>&gt;140</td>
<td>↓↓</td>
<td>&lt;5 Lethargic</td>
</tr>
</tbody>
</table>

Neurogenic Shock
- Disruption of sympathetic nervous system

Causes
- Spinal anaesthesia
- Hypoglycaemia
- Cord injury above T5
- Closed head injuries

Presentation
- Hypotension
- Bradycardia
- Warm extremities

Mx
- Vasopressors: vasopressin and norad
- Atropine: reverse the bradycardia

Spinal Shock
- Acute spinal cord transection
- Loss of all voluntary and reflex activity below the level of injury

Presentation
- Hypotonic paralysis
- Areflexia
- Loss of sensation
- Bladder retention
Life-Threatening Chest Injuries

Differential: ATOMIC
- Airway obstruction
- Tension Pneumothorax
- Open pneumothorax (sucking)
- Massive haemothorax
- Intercostal disruption and pulmonary contusion
- Cardiac Tamponade

Massive Haemothorax
- Accumulation of >1.5L of blood in chest cavity
- Usually caused by disruption of hilar vessels

Presentation
- Signs of chest wall trauma
- ↓BP
- ↓ expansion
- ↓ breath sounds and ↓VR
- Stony dull percussion

Mx
- X-match 6u
- Large-bore chest drain c hep saline for autotransfusion
- Thoracotomy if >1.5L or >200ml/h

Flail Chest
- Ant. or lat. # of ≥2 adjacent ribs in ≥2 places
- Flail segment moves paradoxically c respiration
- ↓ Oxygenation
  - Underlying pulmonary contusion
  - ↓ Ventilation of affected segment

Ix
- CXR / CT chest: pulmonary contusion (white)
- Serial ABGs: ↓PaO2:FiO2 ratio

Rx
- O2
- Good analgesia: PCA, epidural
- Persistent respiratory failure: PPV

Cardiac Tamponade
- Disruption of myocardium or great vessels → blood in the pericardium → ↓ filling and contraction → shock
- Usually results from penetrating trauma

Presentation
- Beck’s Triad
  - ↑ JVP / distended neck veins
  - ↓BP
  - Muffled heart sounds
- Pulsus paradoxus: SBP fall of >10mmHg on inspiration
- Kussmaul’s sign: ↑ JVP on inspiration
- Intensely restless pt.

Ix
- US: FAST or transthoracic echo
- CXR: enlarged pericardium
- ↑CVP >12mmHg
- ECG: low voltage QRS ± electrical alternans

Mx
- Pericardiocentesis: spinal needle in R subxiphoid space aiming at 45° towards the R tip of left scapula
- Thoracotomy may be needed

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2º Survey Chest Injuries

Rib #
- Usually 5th-9th ribs
- # of upper 4 ribs = high energy trauma

Complications
- Pneumothorax
- Lacerate thoracic or abdominal viscera

Rx: good analgesia
- NSAIDs + opioids
- Intrapleural analgesia
- Intercostal block

Sternal #
- Usually MVA driver vs. steering wheel
- Risk of mediastinal injury
- Rx
  - Analgesia, admit, observe
  - Cardiac monitor
  - Troponin: rule out myocardial contusion

Pulmonary Contusion
- Usually due to rapid deceleration injury or shock waves
- May → ARDS
- Pres: dyspnoea, haemoptysis, respiratory failure
- Ix
  - CXR: opacification
  - Serial ABGs: ↓PaO2:FiO2 ratio
  - Rx: O2, ventilate if necessary

Myocardial Contusion
- Direct blunt trauma over precordium
- Ix
  - ECG: abnormal, arrhythmias
  - ↑ troponin
  - Rx: bed rest, cardiac monitoring, Rx arrhythmias

Contained Aortic Disruption
- Rapid deceleration injury (80% immediately fatal)
- Pres: initially stable but → hypotensive
- Ix
  - CXR: wide mediastinum, deviation of NGT
  - CT
  - Rx: cardiothoracic consult

Diaphragmatic Injury
- Consider in penetrating injuries below 5th rib or high energy compression.
- Ix: CXR (visceral herniation), CT

Oesophageal Disruption
- Usually penetrating trauma
- → mediastinitis
- Ix
  - CXR: pneumomediastinum, surgical emphysema
  - CT

Tracheobronchial Disruption
- Presentation
  - Persistent pneumothorax
  - Pneumomediastinum
- Rx: thoracotomy

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Abdominal Trauma

Mechanisms

- Penetrating
  - All require exploration as tract may be deeper than it appears.
- Blunt
  - Have a high index of suspicion for taking to theatre.

Specific Ix

Urine Dip
- Haematuria suggests injury to renal tract

FAST Scan
- Replacing DPL in most centres
- Check for fluid in the abdomen, pelvis and pericardium.
  - 90% sensitive for free fluid
- Can be extended to look for pneumothoraces

Diagnostic Peritoneal Lavage

- Advantages and Disadvantages
  - 98% sensitive for intra-abdominal haemorrhage
  - Useful if FAST unavailable
  - May be better for identifying injury to hollow viscus
  - Unable to identify retroperitoneal injury
- Insert urinary catheter and NGT
  - Decompression to minimise risk of injury
- Midline incision through skin and fascia @ 1/3 distance form umbilicus to pubic symphysis (arcuate line).
- Carefully dissect to the peritoneum and insert a urinary catheter.
- Instil 10ml/kg warmed Hartmann’s
- Drain fluid back into bag and send sample to lab.
  - +ve = >100,000 RBCs/mm³, bile/intestinal contents

Indications for Laparatomy

- Unexplained shock
- Peritonism: rigid silent abdomen
- Evisceration: bowel or omentum
- Radiological evidence of intraperitoneal gas
- Radiological evidence of ruptured diaphragm
- Gunshot wounds
- +ve DPL or CT

Damage Control Surgery

Aim
- Early Mx of abdominal trauma should focus on “damage control” to limit physiological stress.
  - Control haemorrhage: ligation and packing
  - Control contamination
  - Stabilise in ITU

Spleen
- Kehr’s Sign
  - Shoulder tip pain 2° to blood in the peritoneal cavity.
  - Left Kehr sign is classic symptom of ruptured spleen
- Classification
  - 1: capsular tear
  - 2: Tear + parenchymal injury
  - 3: Tear up to the hilum
  - 4: Complete fracture
- Mx
  - Haemodynamically unstable: laparotomy
  - Stable 1-3: observation in HDU
  - Stable 4: consider laparotomy
    - Suture lac or partial / complete splenectomy

Liver
- Conservative if capsule is intact
- Suture laceration
- Partial hepatectomy
- Packing

Bowel
- Resection may be required

Bladder (often assoc. ñ pelvic injury)
- Intraperitoneal rupture requires laparoscopic repair ñ urethral and suprapubic drainage
- Extraperitoneal rupture can be treated conservatively ñ urethral drainage.
- Give prophylactic Abx

Urethra
- Classification
  - Anterior
    - Spongy urethra (penile + bulbar)
    - Occur following straddling injuries or instrumentation
  - Posterior
    - Membranous urethra
    - Occur following pelvic ñs
- Presentation
  - Often assoc. ñ pelvic fracture
  - Blood in the urethral meatus or scrotum
  - Perineal bruising
  - High-riding prostate
  - Inability to micturate + palpable bladder
- Ix
  - Retrograde urethrogram
- Mx
  - Suprapubic catheter
  - Surgical repair

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Head Injury

Epidemiology
- Head injury, alone or in combination with other injuries, is the commonest cause of trauma death (50%)

Primary Brain Injury
- Occurs at time of injury and is a result of direct or indirect injury to brain tissue.

Diffuse
- Concussion / Mild Traumatic Brain Injury
  - Temporary ↓ in brain function
  - Headache, confusion, visual symptoms, amnesia, nausea
- Diffuse Axonal Injury
  - Shearing forces disrupt axons
  - May → coma and persistent vegetative state
  - Autonomic dysfunction → fever, HTN, sweating

Focal
- Contusion
  - E.g. coup and contra-coup
  - May have focal neurological deficit
- Intracranial Haemorrhage
  - Extradural
  - Subdural
  - Subarachnoid
  - Parenchymal haemorrhage and laceration

Secondary Brain Injury
- Occurs after primary injury.

Causes
- Hypoxia
- Hypercapnoea
- Hypotension
- ↑ ICP
- Infection

Monroe-Kelly Doctrine
- Cranium is rigid box → total volume of intracranial contents must remain constant if ICP is not to change.
- ↑ in volume of one constituent → compensatory ↓ in another:
  - CSF
  - Blood (esp. venous)
- These mechanisms can compensate for a volume change of ~100ml before ICP ↑.
  - As autoregulation fails, ICP ↑ rapidly → herniation.

Cerebral Blood Flow
- CBF \( \propto \) CPP \( \times \) radius of vessels
- CPP = MABP – ICP
- ↑ ICP → ↓ CPP → ↓ CBF
  - Autoreg → vasodilatation → ↑ volume → ↑ ICP...
- Prevent or attenuate this vicious circle by
  - Ventilate to normocapnoea: 4.5KPa
  - IV fluid to normovolaemia
  - Mannitol bolus acutely

Cushing Reflex: imminent herniation
- Hypertension
- Bradycardia
- Irregular breathing

History
- LOC
- Amnesia: anterograde worse
- Nausea / vomiting
- Fits
- Focal neurology
- Mechanism
- Drugs: e.g. antiplats, warfarin

Examination
- GCS: E4, V5, M6
  - 3-8 = coma
  - 9-12 = moderate head injury
  - 13-15 = mild head injury
- Scalp lacerations

Basal Skull #
- CSF rhinorrhoea or otorrhoea (Test: halo sign)
- Battle sign: bruised mastoid
- Pando sign: bilateral orbital bruising
- Haemotypmanum

Ix
- C-spine
- CT Head
  - Basal or other skull #
  - Amnesia: > 30min retrograde (before event)
  - Neurological deficit: e.g. seizures
  - GCS: <13 @ scene, <15 2h later
  - Sick: vomiting > 1
- Bloods: FBC, U+E, glucose, clotting, EtOH level, ABG

Mx
- Neurosurgical consult if +ve CT
- Admit if
  - LOC >5min
  - Abnormalities on imaging
  - Difficult to assess: EtOH, post-ictal
  - Not returned to GCS 15 after imaging
  - CNS signs: persistent vomiting, severe headache
- Neuro obs: half hrly until GCS 15/15
- GCS, pupils, TPR, BP
- Analgesia: codeine phosphate 30-60mg PO/IM QDS
- Suture scalp lacs
- Abx: if open / base of skull #

Intubate if
- GCS ≤ 8
- PaO₂ <9KPa on air / <13KPa on O₂ or PCO₂ >6KPa
- Spontaneous hyperventilation: PCO₂ <4KPa
- Respiratory irregularity

Rx ↑ ICP
- Elevate bed
- Good sedation, analgesia ± NM block
- Neuroprotective ventilation
- Mannitol or hypertonic saline

Discharge Advice
- Stay with someone for first 48hrs
- Give advice card advising return on:
  - Confusion, drowsiness, unconsciousness, fits
  - Visual problems
  - V. painful headache that won’t go away
  - Vomiting
Risk Factors
- Age: children and elderly
- Co-morbidities: epilepsy, CVA, dementia, mental illness
- Occupation

Classification

Superficial
- Erythema
- Painful
- E.g. sunburn

Partial Thickness
- Heal w/i 2-3wks if not complicated
  - **Superficial**
    - No loss of dermis
    - Painful
    - Blister
  - **Deep**
    - Loss of dermis but adnexae remain
    - Healing from adnexae: e.g. follicles
    - V. painful

Full Thickness
- Complete loss of dermis
- Charred, waxy, white, skin
- Anaesthetic
- Heal from the edges → scar

Complications

Early
- **Infection**: loss of barrier function, necrotic tissue, SIRS
- **Hypovolaemia**: loss of fluid in skin + ↑ cap permeability
- **Metabolic disturbance**: ↑K, ↑myoglobin, ↑Hb → AKI
- **Compartment syndrome**: circumferential burns
- **Peptic ulcers**: Curling’s ulcers
- **Pulmonary**: laryngeal oedema, CO poisoning, ARDS
- Renal and hepatic impairment

Intermediate
- VTE
- Pressure sores

Late
- Scarring
- Contractures
- Psychological problems

Assessment

Wallace Rule of 9s: % BSA burnt
- Head and neck: 9%
- Arms: 9% each
- Torso: 18% front and back
- Legs: 18% each
- Perineum: 1%
- (Palm: 1%)

Mx
- Based on ATLS principals
- Specific concerns ± burns
  - Secure airway
  - Manage fluid loss
  - Prevent infection

Airway
- Examine for respiratory burns
  - Soot in oral or nasal cavity
  - Burnt nasal hairs
  - Hoarse voice, stridor
- Flexible laryngoscopy can be helpful
- Consider early intubation + dexamethasone (↓ inflam)

Breathing
- 100% O₂
- Exclude constricting burns
- Signs of CO poisoning
  - Headache
  - n/v
  - Confusion
  - Cherry red appearance
- ABG
  - COHb level
  - SpO₂ unreliable if CO poisoning

Circulation
- Fluid losses may be huge
- 2x large-bore cannulae in each ACF
- Bloods: FBC, U+E, G+S/XM
- Start 2L warmed Hartmann’s immediately
- Formula guide additional fluid requirements in burns pts.

Parkland Formula to guide replacement in 1st 24hrs
- 4 x wt. (kg) x % burn = mL of Hartmann’s in 24h
- Replace fluid from time of burn
- Give half in 1st 8h
- Best guide is UO: 30-50mL/h

Muir and Barclay Formula to guide fluid replacement
- (wt. x % burn)/2 = mL of Colloid per unit time
- Time units: 4, 4, 4, 6, 6, 12 = 36hrs total
- May need to use blood

Burn Treatments
- Analgesia: morphine
- Dress partial thickness burns
  - Biological: e.g. cadaveric skin
  - Synthetic
  - Cream: e.g. Flamazine (silver sulfadiazine) + sterile film
- Full thickness burns
  - Tangential excision debridement
  - Split-thickness skin grafts
  - Circumferential burns may require escharotomy to prevent compartment syndrome.
  - Anti-tetanus toxoid (0.5ml ATT)
  - Consider prophylactic Abx: esp. anti-pseudomonal

NB. may also use Lund and Browder charts
Hypothermia

Definition
- Core (rectal) temperature <35°C

Pathophysiology
- Body heat is lost via 4 mechanisms

1. Radiation: 60%
   - Infra-red emissions

2. Conduction: 15%
   - Direct contact
   - 1°C means in cold water immersion

3. Convection: 15%
   - Removes warmed air from around the body
   - ↑ in windy environments

4. Evaporation: 10%
   - Removal of warmed water
   - ↑ in dry, windy environments

Aetiological Classification
- Primary: environmental exposure
- Secondary: change in temperature set-point
  - E.g.: age-related, hypothyroidism, autonomic neuropathy

Presentation
Mild: 32 – 35°C
- Shivering
- Tachycardia
- Vasoconstriction
- Apathy

Moderate: 28 – 32°C
- Dysrhythmia, bradycardia, hypotension
- J waves
- ↓ reflexes, dilated pupils, ↓ GCS

Severe: <28°C
- VT → VF → Cardiogenic shock
- Apnoea
- Non-reactive pupils
- Coagulopathy
- Oliguria
- Pulmonary oedema

Ix
- Rectal / ear temperature
- FBC, U+E, glucose
- TFTs, blood gas
- ECG
  - J waves: between QRS and T wave
  - Arrhythmias

Mx
- Cardiac monitor
- Warm IVI 0.9% NS
- Urinary catheter
- Consider Abx for prevention of pneumonia
  - Routine if temp <32 and >65yrs

Slowly Rewarm
- Reheating too quickly → peripheral vasodilatation and shock.
- Aim for 0.5°C/hr
- Passive external: blankets, warm drinks
- Active external: warm water or warmed air
- Active internal: mediastinal lavage and CPB
  - Severe hypothermia only

Complications
- Arrhythmias
- Pneumonia
- Coagulopathy
- Acute renal failure

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Upper GI Surgery

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Oesophageal Anatomy
- 25cm long muscular tube (40cm from GOJ → lips)
- Starts at level of cricoid cartilage (C6)
- In the neck lies in the visceral column
- Runs in posterior mediastinum and passes through right crus of diaphragm @ T10.
- Continues for 2-3cm before entering the cardia
- 3 locations of narrowing
  - Level of cricoid
  - Posterior to left main bronchus and aortic arch
  - LOS
- Divided into 3 rds: reflects change in musculature from striated → mixed → smooth.
- Lined by non-keratinising squamous epithelium.
- Z-line: transition from squamous → gastric columnar

Causes

Inflammatory
- Tonsillitis, pharyngitis
- Oesophagitis: GORD, candida
- Oral candidiasis
- Aphthous ulcers

Neurological / Motility Disorders
- Local
  - Achalasia
  - Diffuse oesophageal spasm
  - Nutcracker oesophagus
  - Bulbar / pseudobulbar palsy (CVA, MND)
- Systemic
  - Systemic sclerosis / CREST
  - MG

Mechanical Obstruction
- Luminal
  - FB
  - Large food bolus
- Mural
  - Benign stricture
    - Web (e.g. Plummer-Vinson)
    - Oesophagitis
    - Trauma (e.g. OGD)
  - Malignant stricture
    - Pharynx, oesophagus, gastric
    - Pharyngeal pouch
- Extra-Mural
  - Retrosternal goitre
  - Rolling hiatus hernia
  - Lung Ca
  - Mediastinal LNs (e.g. lymphoma)
  - Thoracic aortic aneurysm

Ix
- Upper GI endoscopy
- Ba swallow
- Manometry

Achalasia
- Pathophysiology
  - Degeneration of myenteric plexus (Auerbach’s)
  - ↓ peristalsis
  - LOS fails to relax
- Cause
  - 1<sup>o</sup> / idiopathic: commonest
  - 2<sup>o</sup>: Chagas’ disease (T. cruzii)
- Presentation
  - Dysphagia: liquids then solids
  - Regurgitation (esp. @ night)
  - Substernal cramps
  - Wt. loss
- Comp: Chronic → oesophageal SCC in 3-5%
- Rx:
  - Ba swallow: dilated tapering oesophagus
    - Bird’s beak
  - Manometry: failure of relaxation + ↓ peristalsis
  - CXR: widened mediastinum, double RH border
  - OGD: exclude malignancy

Pharyngeal Pouch: Zenker’s Diverticulum
- Outpouching between crico- and thyro-pharyngeal components of the inf. pharyngeal constrictor.
  - Area of weakness = Killian’s dehiscence.
- Defect usually occurs posteriorly but swelling usually bulges to left side of neck.
- Food debris → pouch expansion → oesophageal compression → dysphagia.
- Pres: Regurgitation, halitosis, gurgling sounds
- Rx: excision, endoscopic stapling

Diffuse Oesophageal Spasm
- Intermittent severe chest pain ± dysphagia
- Ba swallow shows corkscrew oesophagus

Nutcracker Oesophagus
- Intermittent dysphagia ± chest pain
  - ↑ contraction pressure c¯ normal peristalsis

Plummer-Vinson Syndrome
- Severe IDA → hyperkeratinisation of upper 3<sup>rd</sup> of oesophagus → web formation
- Pre-malignant: 20% risk of SCC

Oesophageal Rupture
- Iatrogenic (85-90%): endoscopy, biopsy, dilatation
- Violent emesis: Boerhaave’s syndrome
- Carcinoma
- Caustic ingestion
- Trauma: surgical emphysema ± pneumothorax

Features
- Odonophagia
- Mediastinitis: tachypnoea, dyspnoea, fever, shock
- Surgical emphysema

Mx
- Iatrogenic: PPI, NGT, Abx
- Other: resus, PPI, Abx, antifungals, debridement + formation of oesophageo-cutaneous fistula c¯ T-tube
Oesophageal Cancer

Epidemiology
- Incidence: 12/100,000, increasing (↑ Barrett’s)
- Age: 50-70 yrs
- Sex: M>F = 5:1
- Geo: ↑ Iran, Transkei, China

Risk Factors
- EtOH
- Smoking
- Achalasia
- GORD → Barrett’s
- Plummer-Vinson
- Fatty diet
- ↓ vit A+C
- Nitrosamine exposure

Pathophysiology
- 65% adenocarcinoma
  - Lower 3rd
  - GORD → Barrett’s → dysplasia → Ca
- 35% SCC
  - Upper and middle 3rd
  - Assoc. ć EtOH and smoking
  - Commonest type worldwide

Presentation
- Progressive dysphagia: solids → liquids (esp. bread)
  - Often alter dietary habit → soft food → exacerbation of wt. loss.
- Wt. loss
- Retrosternal chest pain
- Lymphadenopathy
- Upper 3rd:
  - Hoarseness: recurrent laryngeal N. invasion
  - Cough ± aspiration pneumonia

Spread
- Direct extension, lymphatics and blood
- 75% of pts have mets @ Dx

Ix
- Bloods
  - FBC: anaemia
  - LFTs: hepatic mets, albumin
- Diagnosis
  - Upper GI endoscopy: allows biopsy
  - Ba swallow: not often used, apple-core stricture
- Staging: TNM
  - CT
  - EUS
  - Laparoscopy / mediastinoscopy: mets

Staging: TNM
- Tis: carcinoma in situ
- T1: submucosa
- T2: muscularis propria (circ / long)
- T3 adventicia
- T4: adjacent structures
- N1: regional nodes
- M1: distant mets

Rx
- Discuss in an MDT
  - Upper GI surgeon + gastroenterologist
  - Radiologist
  - Pathologist
  - Oncologist
  - Specialist nurses
  - Macmillan nurses
  - Palliative care

Surgical: oesophagectomy
- Only 25-30% have resectable tumours
- May be offered neo-adjuvant chemo before surgery to downstage tumour: e.g. cisplatin + 5FU
- Approaches
  - Ivor-Lewis (2 stage): abdominal + R thoracotomy
  - McKeown (3 stage): abdominal + R thoracotomy + left neck incision
  - Trans-hiatal: abdominal incision
- Prognosis
  - Stage dependent
  - ~15% 5ys

Palliative
- Majority of pts.
- Laser coagulation
- Alcohol injection + ↓ Ascites (spiro)
- Stenting and Secretion reduction (e.g. hyoscine patch)
- Analgesia: e.g. fentanyl patches
- Radiotherapy: external or brachytherapy
- Referral
  - Palliative care team
  - Macmillan nurses
- Prognosis
  - 5ys <5%
  - Median: 4mo

Benign Tumours
- Leiomyoma
- Lipomas
- Haemangiomas
- Benign polyps
GORD

Pathophysiology
- LOS dysfunction → reflux of gastric contents → oesophagitis.

Risk Factors
- Hiatus hernia
- Smoking
- EtOH
- Obesity
- Pregnancy
- Drugs: anti-AChM, nitrates, CCB, TCAs
- Iatrogenic: Heller’s myotomy

Symptoms
Oesophageal
- Retrosternal pain: heartburn
  - Related to meals
  - Worse lying down (e.g. @ night) / stooping
  - Relieved by antacids
- Belching
- Regurgitation
- Acid brash, water brash
- Odonophagia

Extra-oesophageal
- Nocturnal asthma
- Chronic cough
- Laryngitis, sinusits

Complications
- Oesophagitis
- Ulceration: rarely → haematemesis, melaena, ↓Fe
- Benign stricture: dysphagia
- Barrett’s oesophagus
  - Intestinal metaplasia of squamous epithelium
  - Metaplasia → dysplasia → adenocarcinoma
- Oesophageal adenocarcinoma

Differential Dx
- Oesophagitis
  - Infection: CMV, candida
  - IBD
  - Caustic substances / burns
- PUD
- Oesophageal Ca

Ix
- Isolated symptoms don’t need Ix
- Bloods: FBC
- CXR: hiatus hernia may be seen
- OGD if:
  - >55yrs
  - Persistent symptoms despite Rx
  - Anaemia
  - Loss of wt.
  - Anorexia
  - Recent onset progressive symptoms
  - Melaena
  - Swallowing difficulty
  - OGD allows grading by Los Angeles Classification
- Ba swallow: hiatus hernia, dysmotility
- 24h pH testing ± manometry
  - pH <4 for >4hrs

Rx
Conservative
- Lose wt.
- Raise head of bed
- Small regular meals ≥ 3h before bed
- Stop smoking and ↓ EtOH
- Avoid hot drinks and spicy food
- Stop drugs: NSAIDs, anti-AChM, nitrates, CCB, TCAs

Medical
- OTC antacids: Gaviscon, Mg trisilicate
  - 1: Full-dose PPI for 1-2mo
    - Lansoprazole 30mg OD
  - 2: No response → double dose PPI BD
  - 3: No response: add an H2RA
    - Ranitidine 300mg nocte
- Control: low-dose acid suppression PRN

Surgical: Nissen Fundoplication
- Indications: all 3 of:
  - Severe symptoms
  - Refractory to medical therapy
  - Confirmed reflux (pH monitoring)

Nissen Fundoplication
- Aim: prevent reflux, repair diaphragm
- Usually laparoscopic approach
- Mobilise gastric fundus and wrap around lower oesophagus
- Close any diaphragmatic hiatus
- Complications
  - Gas-bloat syn.: inability to belch / vomit
  - Dysphagia if wrap too tight

Hiatus Hernia

Classification
Sliding (80%)
- Gastro-oesophageal junction slides up into chest
- Often assoc. c GORD

Rolling (15%)
- Gastro-oesophageal junction remains in abdomen but a bulge of stomach rolls into chest alongside the oesophagus
- LOS remains intact so GORD uncommon
- Can → strangulation

Mixed (5%)

Ix
- CXR: gas bubble and fluid level in chest
- Ba swallow: diagnostic
- OGD: assess for oesophagitis
- 24h pH + manometry: exclude dysmotility or achalasia

Rx
- Lose wt.
- Rx reflux
- Surgery if intractable symptoms despite medical Rx.
  - Should repair rolling hernia (even if asympto) as it may strangulate.
Peptic Ulcer Disease

Presentation
- **Epigastric pain**
  - DU
    - Before meals and at night
    - Relieved by eating
  - GU
    - Worse on eating (→ ↓ wt.)
    - Relieved by antacids

Risk Factors
- H. pylori
- NSAIDs, steroids
- Smoking, EtOH
- Stress (GU)
  - Cushing’s ulcers: head injury
  - Curling's: ulcers: burns

Pathology
- Punched out ulcers
- Usually background of chronic inflammation
- DU
  - 4x commoner cf. GU
  - 1st part of duodenum (cap)
- GU
  - Lesser curvature of gastric antrum

Complications
- **Haemorrhage**
  - Haematemesis or melaena
  - Fe deficiency anaemia
- **Perforation**: peritonitis
- **Gastric Outflow Obstruction**
  - Vomiting
  - Colic
  - Distension
- **Malignancy**
  - ↑ risk of H. pylori infection
  - Actual malignant transformation probably doesn’t occur

Ix
- **Bloods**: FBC, urea (↑ in haemorrhage)
- C13 breath test
- **OGD** (stop PPIs >2wks before)
  - CLO / urease test for H. pylori
  - Biopsy all ulcers to check for malignancy
  - Gastrin levels if Zollinger-Ellison suspected

Mx

Conservative
- Lose wt.
- Stop smoking and ↓ EtOH
- Avoid hot drinks and spicy food
- Stop drugs: NSAIDs, steroids
- OTC antacids

Medical
- OTC antacids: Gaviscon, Mg trisilicate
- H. pylori eradication: PAC 500 / PMC 250
- Acid suppression
  - **PPIs**: lansoprazole 30mg/d
  - H2RAs: ranitidine 300mg nocte

Surgery for PUD

Concepts
- No acid → no ulcer
- Acid secretion stimulated by gastrin (from antral G cells) and vagus N.

Vagotomy
- **Truncal**
  - ↓ acid secretion directly and via ↓ gastrin
  - Prevents pyloric sphincter relaxation
  - ... must be combined with pyloroplasty (widening of pylorus) or gastroenterostomy
- **Selective**
  - Vagus nerve only denervated where it supplies lower oesophagus and stomach
  - Nerves of Laterjet (supply pylorus) left intact

Antrectomy & Vagotomy
- Distal half of stomach removed.
- Anastomosis:
  - Billroth 1: directly to duodenum
  - Billroth 2 / Polya: to small bowel loop to duodenal stump oversewn

Subtotal Gastrectomy & Roux-en-Y
- Occasionally performed for Zollinger-Ellison

Physical Complications
- Ca: ↑ risk of gastric Ca
- Reflux or bilious vomiting (improves time)
- Abdominal fullness
- Stricture
- Stump leakage

Metabolic Complications
- **Dumping syndrome**
  - Abdo distension, flushing, n/v, fainting, sweating
- **Early**: osmotic hypovolaemia
- **Late**: reactive hypoglycaemia
- **Blind loop syndrome** → malabsorption, diarrhoea
  - Overgrowth of bacteria in duodenal stump
- **Vitamin deficiency**
  - ↓ parietal cells → B12 deficiency
  - Bypassing proximal SB → Fe + folate deficiency
  - Osteoporosis
- **Wt. loss**: malabsorption of ↓ calories intake
Upper GI Bleeding

Hx
- Previous bleeds
- Dyspepsia, known ulcers
- Liver disease or oesophageal varices
- Dysphagia, wt. loss
- Drugs and EtOH
- Co-morbidities

o/e
- Signs of CLD
- PR: melaena
- Shock?
  - Cool, clammy, CRT>2s
  - ↓BP (<100) or postural hypotension (>20 drop)
  - ↓urine output (<30ml/h)
  - Tachycardia
  - ↓GCS

Common Causes
- PUD: 40% (DU commonly)
- Acute erosions / gastritis:20%
- Mallory-Weiss tear: 10%
- Varices: 5%
- Oesophagitis: 5%
- Ca stomach / oesophagus:<3%

Rockall Score: (Prof T Rockall, St. Mary’s)
- Prediction of re-bleeding and mortality
- 40% of re-bleeders die
- Initial score pre-endoscopy
  - Age
  - Shock: BP, pulse
  - Comorbidities
- Final score post-endoscopy
  - Final Dx + evidence of recent haemorrhage
    - Active bleeding
    - Visible vessel
    - Adherent clot
- Initial score ≥3 or final >6 are indications for surgery

Oesophageal Varices
- Portal HTN → dilated veins @ sites of porto-systemic anastomosis: L. gastric and inferior oesophageal veins
- 30-50% of portal HTN will bleed from varices
- Overall mortality 25%: ↑ severity of liver disease.

Causes of portal HTN
- Pre-hepatic: portal vein thrombosis
- Hepatic: cirrhosis (80% in UK), schisto (commonest worldwide), sarcoidosis.
- Post-hepatic: Budd-Chiari, RHF, constrict pericarditis

Bleed Prevention
- 10: β-B, repeat endoscopic banding
- 20: β-B, repeat banding, TIPSS

Transjugular Intrahepatic Porto-Systemic Shunt (TIPSS)
- IR creates artificial channel between hepatic vein and portal vein → ↓ portal pressure.
- Colapinto needle creates tract through liver parenchyma which is expand using a balloon and maintained by placement of a stent.
- Used prophylactically or acutely if endoscopic therapy fails to control variceal bleeding.

Management

Resuscitate
- Head-down.
- 100% O₂, protect airway
- 2 x 14G cannulae + IV crystalloid infusion up to 1L.
- Bloods: FBC, U+E (↑ urea), LFTs, clotting, x-match 6u, ABG, glucose

Blood if remains shocked
- Group specific or O- until x-matched

Variceal Bleed
- Terlipressin IV (splanchnic vasopressor)
- Prophylactic Abx: e.g. ciprofloxacin 1g/24h

Maintenance
- Crystalloid IVI, transfuse if necessary (keep Hb≥10)
- Catheter + consider CVP (aim for >5cm H₂O)
- Correct coagulopathy: vit K, FFP, platelets
- Thiamine if EtOH
- Notify surgeons of severe bleeds

Urgent Endoscopy

Haemostasis of vessel or ulcer
- Adrenaline injection
- Thermal / laser coagulation
- Fibrin glue
- Endoclips

Variceal bleeding:
- 2 of: banding, sclerotherapy, adrenaline, coagulation
- Balloon tamponade c Sengstaken-Blakemore tube
  - Only used if exsanguinating haemorrhage or failure of endoscopic therapy
- TIPSS if bleeding can’t be stopped endoscopically

After endoscopy
- Omeprazole IV + continuation PO (↓ re-bleeding)
- Keep NBM for 24h → clear fluids → light diet @ 48h
- Daily bloods: FBC, U+E, LFT, clotting
- H. pylori testing and eradication
- Stop NSAIDs, steroids et.c.

Indications for Surgery
- Re-bleeding
- Bleeding despite transfusing 6u
- Uncontrollable bleeding at endoscopy
- Initial Rockall score ≥3, or final >6.
- Open stomach, find bleeder and underrun vessel.

NB. Avoid 0.9% NS in uncompensated liver disease (worsens ascites). Use blood or albumin for resus and 5% dex for maintenance.
Perforated Peptic Ulcer

Pathophysiology
- Perforated duodenal ulcer is commonest
  - 1st part of the duodenum: highest acid conc
  - Ant. perforation → air under diaphragm
  - Post. perforation can erode into GDA → bleed
  - ¾ of duodenum retroperitoneal ↓ no air under diaphragm if perforated.
- Perforated GU
- Perforated gastric Ca

Presentation
- Sudden onset severe pain, beginning in the epigastrium and then becoming generalised.
- Vomiting
- Peritonitis

Differential
- Pancreatitis
- Acute cholecystitis
- AAA
- MI

Ix
- Bloods
  - FBC, U+E, amylase, CRP, G+S, clotting
  - ABG: ↑ mesenteric ischaemia
- Urine dipstick
- Imaging
  - Erect CXR
    - Must be erect for ~15min first
    - Air under the diaphragm seen in 70%
    - False +ve in Chailaditi’s sign
  - AXR
    - Rigler’s: air on both sides of bowel wall

Mx
- Resuscitation
  - NBM
  - Aggressive fluid resuscitation
    - Urinary Catheter ± CVP line
  - Analgesia: morphine 5-10mg/2h max
    - ± cyclizine
  - Abx: cef and met
  - NGT

Conservative
- May be considered if pt. isn’t peritonitic
- Careful monitoring, fluids + Abx
- Omentum may seal perforation spontaneously preventing operation in ~50%

Surgical: Laparotomy
- DU: abdominal washout + omental patch repair
- GU: excise ulcer and repair defect
- Partial / gastrectomy may rarely be required
  - Send specimen for histo: exclude Ca

Test and Treat
- 90% of perforated PU assoc. Ĉ H. pylori

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Gastric Outlet Obstruction

Cause
- Late complication of PUD → fibrotic stricturing
- Gastric Ca

Presentation
- Hx of bloating, early satiety and nausea
- Outlet obstruction
  - Copious projectile, non-bilious vomiting a few hrs after meals.
  - Contains stale food.
  - Epigastric distension + succussion splash

Ix
- ABG: Hypochloraemic hypokalaemic met alkalosis
- AXR
  - Dilated gastric air bubble, air fluid level
  - Collapsed distal bowel
- OGD
- Contrast meal

Rx
- Correct metabolic abnormality: 0.9% NS + KCl
- Benign
  - Endoscopic balloon dilatation
  - Pyloroplasty or gastroenterostomy
- Malignant
  - Stenting
  - Resection

Hypertrophic Pyloric Stenosis

Epidemiology
- Sex: M>F=4:1
- Race: ↑ in Caucasians

Presentation
- 6-8wks
- Projectile vomiting minutes after feeding
- RUQ mass: olive
- Visible peristalsis

Dx
- Test feed: palpate mass + see peristalsis
- Hypochloraemic hypokalaemic metabolic alkalosis
- US

Mx
- Resuscitate and correct metabolic abnormality
- NGT
- Ramstedt pyloromyotomy: divide muscularis propria

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Gastric Cancer

Epidemiology
- Incidence: 23/100,000
- Age: 50s
- Sex: M>F=2:1
- Geo: ↑ in Japan, Eastern Europe, China, S. America

Risk Factors
- Atrophic gastritis (→ intestinal metaplasia)
  - Pernicious anaemia / AI gastritis
  - H. pylori
- Diet: ↑ nitrites – smoked, pickled, salted (↑ Japan)
  - Nitrites → carcinogenic nitrosamines in GIT
- Smoking
- Blood group A
- Low SEC
- Familial: E. cadherin abnormality
- Partial gastrectomy

Pathology
- Mainly adenocarcinomas
- Usually located on gastric antrum
- H. pylori may → MALToma

Classification

Depth of Invasion
- Early gastric Ca: mucosa or submucosa
- Late gastric Ca: muscularis propria breached

Microscopic Appearance
- Intestinal: bulky, glandular tumours, heaped ulceration
- Diffuse: infiltrative c signet ring cell morphology

Borrmann Classification
1. Polypoid / fungating
2. Excavating
3. Ulcerating and raised
4. Linitis plastica: leather-bottle like thickening c flat rugae

Symptoms
- Usually present late
- Wt. loss + anorexia
- Dyspepsia: epigastric or retrosternal pain/discomfort
- Dysphagia
- n/v

Signs
- Anaemia
- Epigastric mass
- Jaundice
- Ascites
- Hepatomegaly
- Virchow’s node (= Troisier’s sign)
- Acanthosis nigricans

Complications
- Perforation
- Upper Gl bleed: haematemesis, melaena
- Gastric outlet obstruction → succession splash

Spread
- w/i stomach: linitis plastica
- Direct invasion: pancreas
- Lymphatic: Virchow’s node
- Blood: liver and lung
- Transcoelomic
  - Ovaries: Krukenberg tumour (Signet ring morph)
  - Sister Mary Joseph nodule: umbilical mets

Ix
- Bloods
  - FBC: anaemia
  - LFTs and clotting
- Imaging
  - CXR: mets
  - USS: liver mets
  - Gastroscopy + biopsy
  - Ba meal

Staging
- Endoluminal US
- CT/MRI
- Diagnostic laparoscopy

Mx

Medical Palliation
- Analgesia: e.g. fentanyl patch
- PPI
- Secretion control
- Chemo: epirubicin, 5FU, cisplatin
- Palliative care team package

Surgical Palliation
- Pyloric stenting
- Bypass procedures

Curative Surgery
- EGC may be resected endoscopically
- Partial or total gastrectomy c roux-en-Y to prevent bile reflux.
  - Spleen and part of pancreas may be removed

Prognosis
- Overall: 5ys <10%
- Surgery: 20-50% 5ys
Other Gastric Neoplasms

Benign
- Benign polyps: adenomas
- Leiomyoma
- Lipomas
- Haemangiomas
- Schwannomas

Malignant
- Lymphoma
- Carcinoid
- GIST

Gastrointestinal Stromal Tumour
- Commonest mesenchymal tumour of the GIT
- >50% occur in the stomach.

Epidemiology
- M=F
- ~60yrs
- ↑ c¯ NF1

Pathology
- Arise from intestinal cells of Cajal
  - Located in muscularis propria
  - Pacemaker cells
- OGD: well-demarcated spherical mass c ¯ central punctum

Presentation
- Mass effects: abdo pain, obstruction
- Ulceration: → bleeding

Poor Prognosticators
- ↑ size
- Extra-gastric location
- ↑ mitotic index

Mx
- Medical
  - Unresectable, recurrent or metastatic disease
  - Imatinib: kit selective tyrosine kinase inhibitor
- Surgical
  - Resection

Zollinger-Ellison Syndrome

Pathophysiology
- Gastrin-secreting tumour (gastrinoma) most commonly found in the small intestine or pancreas.
- ↑ Gastrin → ↑HCL→ PUD + chronic diarrhoea
  - Diarrhoea due to inactivation of panc enzymes
- ECL proliferation can → carcinoid tumours
- 60-90% of gastrinomas are malignant
- 25% assoc. c MEN1

Presentation
- Abdominal pain and dyspepsia
- Chronic diarrhoea / Steatorrhoea
- Refractory PUD

Ix
- ↑ gastrin c¯ ↑↑ HCl (pH<2)
- MRI/CT
- Somatostatin receptor scintigraphy

Rx
- High dose PPI
- Surgery
  - Tumour resection
  - May do subtotal gastrectomy c¯ Roux en Y

Carcinoid Tumours
- Diverse group of neuroendocrine tumours of enterochromaffin cell origin
- May secrete multiple hormones
- 10% occur in the stomach

Gastric Carcinoids
- Atrophic gastritis → ↓ acid production → ↑ gastrin →
  ECL hyperplasia → carcinoid tumour
- Gastrinomas may also → carcinoid

Gastric Lymphoma
- Commonest site for extranodal lymphoma
- Most commonly MALToma due to chronic H. pylori gastritis
- H. pylori eradication can be curative
Bariatric Surgery

Benefits
- Sustained wt. ↓
- Symptom improvement
  - Sleep apnoea
  - Mobility
  - HTN
  - DM

Indications
- All the criteria must be met
  - BMI ≥40 or ≥35 & significant co-morbidities that could improve ↓ wt.
  - Failure of non-surgical Mx to achieve and maintain clinically beneficial wt. loss for 6mo.
  - Fit for surgery and anaesthesia
  - Integrated program providing guidance on diet, physical activity, psychosocial concerns and lifelong medical monitoring
  - Well-informed and motivated pt.
- If BMI >50, surgery is 1st-line Rx

Laparoscopic Gastric Banding
- Inflatable silicone band around proximal stomach → small pre-stomach pouch.
  - Limits food intake
  - Slows digestion
- At 1yr 46% mean excess wt. loss

Roux-en-Y Gastric Bypass
- Oesophagojejunostomy allows bypass of stomach, duodenum and proximal jejunum.
- Alters secretion of hormones influencing glucose regulation and perception of hunger / satiety.
- Greater wt. loss and lower reoperation rates.
- Complications
  - Dumping syndrome
  - Wound infection
  - Hernias
  - Malabsorption
  - Diarrhoea
  - Mortality 0.5%
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Gallstones

Epidemiology
- ~8% of the population >40yrs
- Incidence ↑ over last 20yrs: western diet
- Slightly ↑ incidence in females
- 90% of gallstones remain asymptomatic

Formation

General Composition
- Phospholipids: lecithin
- Bile pigments (broken down Hb)
- Cholesterol

Aetiology
- Lithogenic bile: Admirand’s Triangle
- Biliary sepsis
- GB hypomotility → stasis
  - Pregnancy, OCP
  - TPN, fasting

Cholesterol Stones: 20%
- Large
- Often solitary
- Formation ↑ according to Admirand’s Triangle
  - ↓ bile salts
  - ↓ lecithin
  - ↑ cholesterol
- Risk factors
  - Female
  - OCP, pregnancy
  - ↑ age
  - High fat diet and obesity
  - Racial: e.g. American Indian tribes
  - Loss of terminal ileum (↓ bile salts)

Pigment Stones: 5%
- Small, black, gritty, fragile
- Calcium bilirubinate
- Associated Ë haemolysis

Mixed Stones: 75%
- Often multiple
- Cholesterol is the major component

Complications

In the Gallbladder
1. Biliary Colic
2. Acute cholecystitis ± empyema
3. Chronic cholecystitis
4. Mucocele
5. Carcinoma
6. Mirizzi’s syndrome

In the CBD
1. Obstructive jaundice
2. Pancreatitis
3. Cholangitis

In the Gut
1. Gallstone ileus

Biliary Colic

Pathogenesis
- Gallbladder spasm against a stone impacted in the neck of the gallbladder – Hartmann’s Pouch.
- Less commonly, the stone may be in the CBD

Presentation
- Biliary colic
  - RUQ pain radiating → back (scapular region)
  - Assoc. Ë sweating, pallor, n/v
  - Attacks may be ppted. by fatty food and last <6h
- o/e may be tenderness in right hypochondrium
- ± jaundice if stones passes in to CBD

Differential
- Cholecystitis / other gallstone disease
- Pancreatitis
- Bowel perforation

Ix
- Same work up as cholecystitis as may be difficult to differentiate clinically.
- Urine: bilirubin, urobilinogen, Hb
- Bloods: FBC, U+E, amylase, LFTs, G+S, clotting, CRP
- Imaging
  - AXR: 10% of gallstones are radio-opaque
  - Erect CXR: look for perforation
  - US:
    - Stones: acoustic shadow
    - Dilated ducts: >6mm
    - Inflamed GB: wall oedema
- If Dx uncertain after US
  - HIDA cholescintigraphy: shows failure of GB filling (requires functioning liver)
- If dilated ducts seen on US → MRCP

Rx
- Conservative
  - Rehydrate and NBM
  - Opioid analgesia: morphine 5-10mg/2h max
  - High recurrence rate : surgical Rx favoured
- Surgical
  - As for conservative + either:
    - Urgent lap chole (same admission)
    - Elective lap chole @ 6-12wks
Acute Cholecystitis

Pathogenesis
- Stone or sludge impaction in Hartmann’s pouch
- → chemical and / or bacterial inflammation
- 5% are acalculous: sepsis, burns, DM

Sequelae
1. Resolution ± recurrence
2. Gangrene and rarely perforation
3. Chronic cholecystitis
4. Empyema

Presentation
- Severe RUQ pain
  - Continuous
  - Radiates to right scapula and epigastrium
- Fever
- Vomiting

Examination
- Local peritonism in RUQ
- Tachycardia ℅ shallow breathing
- ± jaundice
- Murphy’s sign
  - 2 fingers over the GB and ask pt. to breathe in
  - → pain and breath catch. Must be –ve on the L
- Phlegmon
  - Mass of adherent omentum and bowel
- Boas’ sign
  - Hyperaesthesia below the right scapula

Ix
- Urine: bilirubin, urobilinogen
- Bloods
  - FBC: ↑ WCC
  - U+E: dehydration from vomiting
  - Amylase, LFTs, G+S, clotting, CRP
- Imaging
  - AXR: gallstone, porcelain gallbladder
  - Erect CXR: look for perforation
  - US
    - Stones: acoustic shadow
    - Dilated ducts (>6mm)
    - Inflamed GB: wall oedema
- If Dx uncertain after US
  - HIDA cholecintigraphy: shows failure of GB filling (requires functioning liver)
- MRCP if dilated ducts seen on US

Mx
- Conservative
  - NBM
  - Fluid resuscitation
  - Analgesia: paracetamol, diclofenac, codeine
  - Abx: cefuroxime and metronidazole
  - 80-90% settle over 24-48h
  - Deterioration: perforation, empyema
- Surgical
  - May be elective surgery @ 6-12wks (↓ inflam)
  - If <72h, may perform lap chole in acute phase
- Empyema
  - High fever
  - RUQ mass
  - Percutaneous drainage: cholecystostomy

Chronic Cholecystitis

Symptoms: Flatulent Dyspepsia
- Vague upper abdominal discomfort
- Distension, bloating
- Nausea
- Flatulence, burping
- Symptoms exacerbated by fatty foods
  - CCK release stimulates gallbladder

Differential
- PUD
- IBS
- Hiatus hernia
- Chronic pancreatitis

Ix
- AXR: porcelain gallbladder
- US: stones, fibrotic, shrunken gallbladder
- MRCP

Mx
- Medical
  - Bile salts (not very effective)
- Surgical
  - Elective cholecystectomy
  - ERCP first if US shows dilated ducts and stones

Rarer Gallstone Disease

Mucocele
- Neck of gallbladder blocked by stone but contents remains sterile
- Can be very large → palpable mass
- May become infected → empyema

Gallbladder Carcinoma
- Rare
- Associated ℅ gallstones and gallbladder polyps.
- Calcification of gallbladder → porcelain GB
- Incidental Ca found in 0.5-1% of lap choles.

Mirizzi’s Syndrome
- Rare
- Large stone in GB presses on the common hepatic duct → obstructive jaundice.
- Stone may erode through into the ducts

Gallstone Ileus
- Large stone (>2.5cm) erodes from GB → duodenum through a cholecysto-duodenal fistula 2O to chonic inflam.
- May impact in distal ileum → obstruction
- Rigler’s Triad:
  - Pneumobilia
  - Small bowel obstruction
  - Gallstone in RLQ
- Rx: stone removal via enterotomy
- NB. Bouveret’s syn. = duodenal obstruction
Obstructive Jaundice

Causes
- 30% stones
- 30% Ca head of the pancreas
- 30% Other
  - LNs @ porta hepatitis: TB, Ca
  - Inflammatory: PBC, PSC
  - Drugs: OCP, sulfonylureas, flucloxac
  - Neoplastic: Cholangiocarcinoma
  - Mirizzi’s syndrome

Clinical Features
- Jaundice
  - Noticeable @ ~50mM
  - Seen @ tongue frenulum first
- Dark urine, pale stools
- Itch (bile salts)

Ix
- Urine
  - Dark
  - ↑ bilirubin
  - ↓ urobilinogen
- Bloods
  - FBC: ↑ WCC in cholangitis
  - U+E: hepatorenal syndrome
  - LFT: ↑BR, ↑ ALP, ↑AST/ALT
  - Clotting: ↓ vit K → ↑ INR
  - G+S: may need ERCP
  - Immune: AMA, ANCA, ANA

Imaging
- AXR
  - May visualise stone
  - Pneumobilia suggests gas forming infection
- US
  - Dilated ducts >6mm
  - Stones (95% accurate)
  - Tumour
- MRCP or ERCP
- Percutaneous Transhepatic Cholangiography

Mx of Stones
- Conservative
  - Monitor LFTs: passage of stone may → resolution
  - Vitamins ADEK
  - Analgesia
  - Cholestyramine
- Interventional
  - If: no resolution, worsening LFTs or cholangitis
  - ERCP & sphincterotomy and stone extraction
- Surgical
  - Open / lap stone removal & T tube placement
  - T tube cholangiogram 8d later to confirm stone removal.
  - Delayed cholecystectomy to prevent recurrence

Ascending Cholangitis
- May complicate CBD obstruction
- Charcot’s triad: fever/rigors, RUQ pain, jaundice
- Reynolds pentad: Charcot’s triad + shock + confusion

Mx
- Cef and met
- 1st: ERCP
- 2nd: Open or lap stone removal & T tube drain

Pancreatic Carcinoma

Risk Factors: SINED
- Smoking
- Inflammation: chronic pancreatitis
- Nutrition: ↑ fat diet
- EtOH
- DM

Pathology
- 90% ductal adenocarcinomas
- Present late, metastasise early
  - Direct extension to local structures
  - Lymphatics
  - Blood → liver and lungs
- 60% located in head, 25% body, 15% tail

Presentation
- Typically male >60yrs
- Painless obstructive jaundice: dark urine, pale stools
- Epigastric pain: radiates to back, relieved sitting forward
- Anorexia, wt. loss and malabsorption
- Acute pancreatitis
- Sudden onset DM in the elderly

Signs
- Palpable gallbladder
- Jaundice
- Epigastric mass
- Thrombophlebitis migrans (Trousseau Sign)
- Splenomegaly: PV thrombosis → portal HTN
- Ascites

Courvoisier’s Law
- In the presence of painless obstructive jaundice, a palpable gallbladder is unlikely to be due to stones.

Ix
- Bloods: cholestatic LFTs, ↑Ca19-9 (90% sens), ↑Ca
- Imaging
  - US: pancreatic mass, dilated ducts, hepatic mets, guide biopsy
  - EUS: better than CT/MRI for staging
  - CXR: mets
  - Laparoscopy: mets, staging
- ERCP
  - Shows anatomy
  - Allows stenting
  - Biopsy of peri-ampullary lesions

Rx
- Surgery
  - Fit, no mets, tumour ≤3cm (≤10% of pts)
  - Whipple’s pancreaticoduodenectomy
  - Distal pancreatectomy
  - Post-op chemo delays progression
  - 5ys = 5-14%
- Palliation
  - Endoscopic / percutaneous stenting of CBD
  - Palliative bypass surgery:
    - cholecystojejunostomy + gastrojejunostomy
  - Pain relief – may need coeliac plexus block

Prognosis
- Mean survival <6mo
- 5ys = <2%

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Acute Pancreatitis

Pathophysiology
- Pancreatic enzymes released and activated in vicious circle → multi-stage process.
  1. Oedema + fluid shift + vomiting → hypovolaemic shock while enzymes → autodigestion and fat necrosis
  2. Vessel autodigestion → retroperitoneal haemorrhage
  3. Inflammation → pancreatic necrosis
  4. Super-added infection: 50% of pts. necrosis

Epidemiology
- 1% of surgical admissions
- 4th and 5th decades
- 10% mortality

Aetiology
- Gallstones (45%)
- Ethanol (25%)
- Idiopathic (20%): microstomes
- Trauma
- Steroids
- Mumps + other infections: Coxsackie B
- Autoimmune: e.g. PAN
- Scorpion (Trinidadian)
- Hyperlipidaemia (I and V), ↑Ca, Hypothermia
- ERCP: 5% risk
- Drugs: e.g. thiazides, azathioprine

Symptoms
- Severe epigastric pain → back
  - May be relieved by sitting forward
- Vomiting

Signs
- ↑HR, ↑RR
- Fever
- Hypovolaemia → shock
- Epigastric tenderness
- Jaundice
- Ileus → absent bowel sounds
- Ecchymoses
  - Grey Turners: flank
  - Cullens: periumbilical (tracks up Falciform)

Differential
- Perforated DU
- Mesenteric infarction
- MI

Modified Glasgow Criteria
- Valid for EtOH and Gallstones
- Assess severity and predict mortality
- Ranson’s criteria are only applicable to EtOH and can only be fully applied after 48hrs.

Ix

- Bloods
  - FBC: ↑WCC
  - ↑amylase (>1000 / 3x ULN) and ↑lipase
    - ↑ in 80%
    - Returns to normal by 5-7d
  - U+E: dehydration and renal failure
  - LFTs: cholestatic picture, ↑AST, ↑LDH
  - Ca²⁺: ↓
  - Glucose: ↑
  - CRP: monitor progress, >150 after 48hrs = severe
  - ABG: ↓O₂ suggests ARDS

- Urine: glucose, ↑cBR, ↓urobilinogen

- Imaging
  - CXR: ARDS, exclude perfored DU
  - AXR: sentinel loop, pancreatic calcification
  - US: Gallstones and dilated ducts, inflammation
  - Contrast CT: Balthazar Severity Score

Conservative Mx
- Manage @ appropriate level: e.g. ITU if severe
- Constant reassessment is key
  - Hrly TPR, UO
  - Daily FBC, U+E, Ca²⁺, glucose, amylase ABG

Fluid Resuscitation
- Aggressive fluid resus: keep UO >30ml/h
- Catheter ± CVP

Pancreatic Rest
- NBM
- NGT if vomiting
- TPN may be required if severe to prevent catabolism

Analgesia
- Pethidine via PCA
- Or morphine 5-10mg/2h max

Antibiotics
- Not routinely given if mild
- Used if suspicion of infection or before ERCP
- Penems often used: e.g. meropenem, imipenem

Mx Complications
- ARDS: O₂ therapy or ventilation
- ↑ glucose: insulin sliding scale
- ↓/↑Ca
- EtOH withdrawal: chlordiazepoxide

Interventional Mx: ERCP
- If pancreatitis dilated ducts 2º to gallstones
- ERCP + sphincterotomy → ↓ complications

Surgical Mx

Indications
- Infected pancreatic necrosis
- Pseudocyst or abscess
- Unsure Dx

Operations
- Laparotomy + necrosectomy (pancreatic debridement)
- Laparotomy + peritoneal lavage
- Laparostomy: abdomen left open sterile packs in ITU

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Complications of Acute Pancreatitis

Early: Systemic
- Respiratory: ARDS, pleural effusion
- Shock: hypovolaemic or septic
- Renal failure
- DIC
- Metabolic
  - ↓ Ca²⁺
  - ↑ glucose
  - Metabolic acidosis

Late (>1wk): Local
- Pancreatic necrosis
- Pancreatic infection
- Pancreatic abscess
  - May form in pseudocyst or in pancreas
  - Open or percutaneous drainage
- Bleeding: e.g. from splenic artery
  - May require embolisation
- Thrombosis
  - Splenic A., GDA or colic branches of SMA
    - May → bowel necrosis
  - Portal vein → portal HTN
- Fistula formation
  - Pancreato-cutaneous → skin breakdown

Pancreatic Pseudocyst
- Collection of pancreatic fluid in the lesser sac surrounded by granulation tissue
- Occur in 20% (esp. in EtOH pancreatitis)
- Presentation
  - 4-6wks after acute attack
  - Persisting abdominal pain
  - Epigastric mass → early satiety
- Complications
  - Infection → abscess
  - Obstruction of duodenum or CBD
- Ix
  - Persistently ↑ amylase ± LFTs
  - US / CT
- Rx
  - <6cm: spontaneous resolution
  - >6cm
    - Endoscopic cyst-gastrostomy
    - Percutaneous drainage under US/CT

Chronic Pancreatitis

Causes: AGITS
- Alcohol (70%)
- Genetic
  - CF
  - HH
- Immune
  - Lymphoplasmacytic sclerosing pancreatitis (IgG4)
- Triglycerides ↑
- Structural
  - Obstruction by tumour
  - Pancreas divisum

Presentation
- Epigastric pain
  - Bores through to back
  - Relieved by sitting back or hot water bottle → erythema ab igne
  - Exacerbated by fatty food or EtOH
- Steatorrhea and wt. loss
- DM: polyuria, polydipsia
- Epigastric mass: pseudocyst

Ix
- ↑ glucose
- ↓ faecal elastase: ↓ exocrine function
- US: pseudocyst
- AXR: speckled pancreatic calcifications
- CT: pancreatic calcifications

Rx
- Diet
  - No EtOH
  - ↓ fat, ↑ carb
- Drugs
  - Analgesia: may need coeliac plexus block
  - Enzyme supplements: pancreatin (Creon)
  - ADEK vitamins
  - DM Rx
- Surgery
  - Indications
    - Unremitting pain
    - Wt. loss
    - Duct blockage
  - Procedures
    - Distal pancreatectomy, Whipple’s
    - Pancreaticojejunostomy: drainage
    - Endoscopic stenting

Complications
- Pseudocyst
- DM
- Pancreatic Ca
- Pancreatic swelling → biliary obstruction
- Splenic vein thrombosis → splenomegaly
Pancreatic Endocrine Neoplasia

Epidemiology
- 30-60yrs
- ~15% assoc. ☑ MEN1

Insulinoma
- Fasting / exercise-induced hypoglycaemia
- Confusion, stupor, LOC
- ↑ insulin + ↑ c-peptide + ↓ glucose

Gastrinoma → Zollinger-Ellison
- Hypergastrinaemia → hyperchlorhydria → PUD and chronic diarrhoea (inactivation of pancreatic enzymes)

Glucagonoma
- ↑ se glucagon → mild DM
- Characteristic blistering rash
  - Necrolytic migratory erythema

VIPoma / Verner-Morrison / WDHA Syn.
- Watery Diarrhoea
- Hypokalaemia
- Achlorhydria
- Acidosis

Somatostatinoma
- Somatostatin
  - Inhibits glucagon and insulin release
  - Inhibits pancreatic enzyme secretion
- Features
  - DM
  - Steatorrhoea
  - Gall stones
- Usually v. malignant tumour ☑ poor prognosis

Pancreatic Malformations

Ectopic Pancreas
- Meckel's diverticulum
- Small bowel

Pancreas Divisium
- Failure of fusion of dorsal and ventral buds
- → bulk of pancreas drains through smaller accessory duct.
- Usually asymptomatic
- May → chronic pancreatitis

Annular Pancreas
- Fusion of dorsal and ventral buds around duodenum
- May present ☑ infantile duodenal obstruction.
Cholangiocarcinoma

Pathology
- Rare bile duct tumour
- Adenocarcinoma
- Typically occur at confluence of right and left hepatic ducts: called “Klatskin” tumours

Risk Factors
- PSC
- Ulcerative colitis
- Choledocholithiasis
- Hep B/C
- Choledochal cysts
- Lynch 2
- Flukes

Presentation
- Progressive painless obstructive jaundice
  - Gallbladder not palpable
- Steatorrhoea
- Wt. loss

Ix
- Cholestatic LFTs
- CA 19-9

Rx
- Poor prognosis: no curative Rx
- Palliative stenting by ERCP

Hydatid Cyst

Pathophysiology
- Zoonotic infection by Echinococcus granulosus
- Occurs in sheep-rearing communities
- Parasite penetrates the portal system and infects the liver → calcified cyst

Presentation
- Mostly asymptomatic
- Pressure effects
  - Non-specific pain
  - Abdominal fullness
  - Obstructive jaundice
- Rupture
  - Biliary colic
  - Jaundice
  - Urticaria
  - Anaphylaxis
- 2nd infection

Ix
- Eosinophilia
- CT

Rx
- Medical: albendazole
- Surgical cystectomy
  - Indicated for large cysts
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Paediatric Conditions

Meckel’s Diverticulum
- Ileal remnant of vitellointestinal duct
  - Joins yoke sac to midgut lumen

Features
- A true diverticulum
- 2 inches long
- 2 ft from ileocaecal valve on antimesenteric border
- 2% of population
- 2% symptomatic
- Contain ectopic gastric or pancreatic tissue

Presentation of Symptomatic Meckel’s
- Rectal bleeding: from gastric mucosa
- Diverticulitis mimicking appendicitis
- Intussusception
- Volvulus
- Malignant change: adenocarcinoma
- Raspberry tumour: mucosa protruding at umbilicus
  - A vitello-intestinal fistula
- Littre’s Hernia: herniation of Meckel’s

Dx
- Tc pertechnecate scan +ve in 70% (detects gastric mucosa)

Rx
- Surgical resection

Intussusception
- Portion of intestine (the intussusception) is invaginated into its own lumen (the intussuscipiens)

Cause
- Hypertrophied Peyer’s patch
- Meckel’s
- HSP
- Peutz-Jeghers
- Lymphoma

Presentation
- 6-12mo
- Colicky abdo pain:
  - Episodic inconsolable crying, drawing up legs
  - ± bilious vomiting
- Redcurrent jelly stools
- Sausage-shaped abdominal mass

Mx
- Resuscitate, x-match, NGT
- US + reduction by air enema
- Surgery if not reducible by enema

NB. Intussusception rarely occurs in an adult
- If it does, consider neoplasm as lead-point

Mesenteric Adenitis
- Viral infection / URTI → enlargement of mesenteric LNs
- → pain, tenderness and fever
- Differentiating features
  - Post URTI
  - Headache + photophobia
  - Higher temperature
  - Tenderness is more generalised
  - Lymphocytosis

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Small Bowel Neoplasms

Benign: 35%
- Lipoma
- Leiomyoma
- Neurofibroma
- Haemangioma
- Adenomatous polyps (FAP, Peutz-Jeghers)

Malignant: 65% (only 2% of GI malignancies)
- Adenocarcinoma (40% of malignant tumours)
- Carcinoid (40% of malignant tumours)
- Lymphoma (esp. in Coeliac disease: EATL)
- GIST

Presentation
- Often non-specific symptoms so present late
  - N/V, obstruction
  - Wt. loss and abdominal pain
  - Bleeding
  - Jaundice from biliary obstruction or liver mets.

Imaging
- AXR: SBO
- Ba follow through
- CT

Endoscopy
- Push enteroscopy
- Capsule endoscopy

Carcinoid Tumours

Pathology
- Diverse group of neuroendocrine tumours of enterochromaffin cell origin capable of producing 5HT
  - May be derived from
    - Foregut: respiratory tract
    - Midgut: stomach, ileum, appendix
    - Hindgut: colorectum
  - May secrete: 5-HT, VIP, gastrin, glucagon, insulin, ACTH
  - Hind gut tumours rarely secrete 5-HT
  - Carcinoid syndrome suggest bypass of first-pass metabolism and is strongly assoc. with metastatic disease.
  - 10% part of MEN1
  - Sites
    - Appendix: 45%
    - Ileum: 30%
    - Colorectum: 20%
    - Stomach: 10%
    - Elsewhere in GIT
    - Bronchus: 10%
  - Consider all as malignant

Presentation

Local
- Appendicitis
- Intussusception or obstruction
- Abdominal pain

Carcinoid Syndrome: FIVE HT
- Flushing: paroxysmal, upper body ± wheals
- Intestinal: diarrhoea
- Valve fibrosis: tricuspid regurg and pulmonary stenosis
- whEEze: bronchoconstriction
- Hepatic involvement: bypassed 1st pass metabolism
- Tryptophan deficiency → pellagra (3Ds)

Ix
- ↑ urine 5-hydroxyindoleacetic acid
- ↑ plasma chromogranin A
- CT/MRI: find primary

Rx
- Symptoms: octreotide or loperamide
- Curative
  - Resection: tumours are v. yellow
  - Give octreotide to avoid carcinoid crisis

Carcinoid Crisis
- Tumour outgrows blood supply or is handled too much → massive mediator release
- Vasodilatation, hypotension, bronchoconstriction, hyperglycaemia
- Rx: high-dose octreotide

Prognosis
- Median survival is 5-8yrs (~3yrs if mets present)
Acute Appendicitis

Definition
- Inflammation of the vermiform appendix ranging from oedema to ischaemic necrosis and perforation.

Epidemiology
- Incidence: 6% lifetime incidence, commonest surgical emergency
- Age: rare <2yrs, maximal peak during child, ↓ thereafter

Pathogenesis
- Obstruction of the appendix
  - Faecolith most commonly
  - Lymphoid hyperplasia post-infection
  - Tumour (e.g. caecal Ca, carcinoid)
  - Worms (e.g. Ascaris lumbicoides, Schisto)
- Gut organisms → infection behind obstruction
- → oedema → ischaemia → necrosis → perforation
- Peritonitis
- Abscess
- Appendix mass

Pattern of Abdominal Pain
Early inflammation → appendiceal irritation
- Visceral pain is not well localised cf. somatic pain.
- Nociceptive info travels in the sympathetic afferent fibres that supply the viscus
- Pain referred to the dermatome corresponding to the spinal cord entry level of these sympathetic fibres.
- Append = midgut = lesser splanch (T10/11) = umb

Late inflammation → parietal peritoneum irritation
- Pain localised in RIF

Symptoms
- Colicky abdo pain
  - Central → localised in RIF
  - Worse c movement
- Anorexia
- Nausea (vomiting is rarely prominent)
- Constipation / diarrhoea

Signs
- Low-grade pyrexia: 37.5 – 38.5
- ↑HR, shallow breathing
- Foetor oris
- Guarding and tenderness: @ McBurney’s point
  - +ve cough / percussion tenderness
- Appendix mass may be palpable in RIF
- Pain PR suggests pelvic appendix.

Special Signs
Rovsing’s Sign
- Pressure in LIF → more pain in RIF

Psoas Sign
- Pain on extending the hip: retrocaecal appendix

Cope Sign
- Flexion + internal rotation of R hip → pain
  - Appendix lying close to obturator internus

Differential
- Surgical
  - Cholecystitis
  - Diverticulitis
  - Meckel’s diverticulitis
- Gynae
  - Cyst accident: torsion, rupture, haemorrhage
  - Salpingitis / PID
  - Ruptured ectopic
- Medical
  - Mesenteric adenitis
  - UTI
  - Crohn’s

Ix
- Dx is principally clinical
- Bloods: FBC, CRP, amylase, G+S, clotting
- Urine
  - Sterile pyuria: may indicate bladder irritation
  - Ketones: anorexia
  - Exclude UTI
  - β-HCG
- Imaging
  - US: exclude gynae path, visualise inflamed appendix
  - CT: can be used
- Diagnostic lap

Mx
- Fluids
- Abx: cef 1.5g + met 500g IV TDS
- Analgesia: paracetamol, NSAIDs, codeine phosphate
- Certain Dx → appendicectomy (open or lap)
- Uncertain Dx → active observation

Complications
Appendix Mass
- Inflamed appendix c adherent covering of omentum and small bowel
- Dx: US or CT
- Mx
  - Initially: Abx + NBM
  - Resolution of mass → interval appendicectomy
  - Exclude a colonic tumour: colonoscopy

Appendix Abscess
- Results if appendix mass doesn’t resolve
- Mass enlarges, pt. deteriorates
- Mx
  - Abx + NBM
  - CT-guided percutaneous drainage
  - If no resolution, surgery may involve right hemicolectomy.

Perforation
- Commoner if faecolith present and in young children (as Dx is often delayed)
- Deteriorating pt. c peritonitis.
Inflammatory Bowel Disease: Pathology and Presentation

**Epidemiology**

<table>
<thead>
<tr>
<th></th>
<th>UC</th>
<th>Crohn’s</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prev</strong></td>
<td>100-200 /100,000</td>
<td>50-100 /100,000</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>30s</td>
<td>20s</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td>F&gt;M (just)</td>
<td></td>
</tr>
<tr>
<td><strong>Aet</strong></td>
<td>Concordance = 10% Smoking protective TH2-mediated</td>
<td>Concordance = 70% Smoking ↑ risk TH1/TH17-mediated</td>
</tr>
</tbody>
</table>

**Pathology**

<table>
<thead>
<tr>
<th></th>
<th>UC</th>
<th>Crohn’s</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Macroscopic</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td>Rectum + colon ± backwash ileitis</td>
<td>Mouth to anus esp. terminal ileum</td>
</tr>
<tr>
<td><strong>Distribution</strong></td>
<td>Contiguous</td>
<td>Skip lesions</td>
</tr>
<tr>
<td><strong>Strictures</strong></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Microscopic</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Inflammation</strong></td>
<td>Mucosal</td>
<td>Transmural</td>
</tr>
<tr>
<td><strong>Ulceration</strong></td>
<td>Shallow, broad → cobbled mucosa</td>
<td>Deep, thin, serpiginous</td>
</tr>
<tr>
<td><strong>Fibrosis</strong></td>
<td>None</td>
<td>Marked</td>
</tr>
<tr>
<td><strong>Granulomas</strong></td>
<td>None</td>
<td>Present</td>
</tr>
<tr>
<td><strong>Pseudoplyps</strong></td>
<td>Marked</td>
<td>Minimal</td>
</tr>
<tr>
<td><strong>Fistulae</strong></td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Presentation**

<table>
<thead>
<tr>
<th></th>
<th>UC</th>
<th>Crohn’s</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Symptoms</strong></td>
<td></td>
<td>Fever, malaise, anorexia, wt. loss in active disease</td>
</tr>
<tr>
<td><strong>Systemic</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Abdominal</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Diarrhoea</td>
<td>• Diarrhoea (not usually bloody)</td>
<td></td>
</tr>
<tr>
<td>• Blood ± mucus PR</td>
<td>• Abdominal pain</td>
<td></td>
</tr>
<tr>
<td>• Abdominal discomfort</td>
<td>• Wt. loss</td>
<td></td>
</tr>
<tr>
<td>• Tenesmus, faecal urgency</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Signs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Abdominal</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Fever</td>
<td>• Aphthous ulcers, glossitis</td>
<td></td>
</tr>
<tr>
<td>• Tender, distended abdomen</td>
<td>• Abdominal tenderness</td>
<td></td>
</tr>
<tr>
<td><strong>Extra-abdominal</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Skin</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Clubbing</td>
<td>• Arthritis (non-deforming, asymmetrical)</td>
<td></td>
</tr>
<tr>
<td>• Erythema nodosum</td>
<td>• Sacroiliitis</td>
<td></td>
</tr>
<tr>
<td>• Pyoderma gang (esp. UC)</td>
<td>• Ank spond</td>
<td></td>
</tr>
<tr>
<td><strong>Eyes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Iritis</td>
<td>• HPB</td>
<td></td>
</tr>
<tr>
<td>• Conjunctivitis</td>
<td>• PSC + cholangiocarcinoma (esp. UC)</td>
<td></td>
</tr>
<tr>
<td>• Episcleritis</td>
<td>• Gallstones (esp. Crohn’s)</td>
<td></td>
</tr>
<tr>
<td>• Scleritis</td>
<td>• Fatty liver</td>
<td></td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Amyloidosis</td>
<td>• Other</td>
<td></td>
</tr>
<tr>
<td>• Oxalate renal stones (esp. Crohns)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Complications</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Toxic megacolon</td>
<td>• Fistulae</td>
<td></td>
</tr>
<tr>
<td>• Diameter &gt;6cm</td>
<td>• Entero-enteric/colonic → diarrhoea</td>
<td></td>
</tr>
<tr>
<td>• Risk of perforation</td>
<td>• Enterovesical → frequency, UTI</td>
<td></td>
</tr>
<tr>
<td>• Bleeding</td>
<td>• Enterovaginal</td>
<td></td>
</tr>
<tr>
<td>• Malignancy</td>
<td>• Perianal “pepperpot” anus</td>
<td></td>
</tr>
<tr>
<td>• CRC in 15% c pancolitis for 20yrs</td>
<td>• Strictures → obstruction</td>
<td></td>
</tr>
<tr>
<td>• Cholangiocarcinoma</td>
<td>• Abscesses</td>
<td></td>
</tr>
<tr>
<td>• Strictures → obstruction</td>
<td>• Abdominal</td>
<td></td>
</tr>
<tr>
<td>• Venous thrombosis</td>
<td>• Anorectal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Malabsorption</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Fat → Steatorrhoea, gallstones</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• B12 → megaloblastic anaemia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Vit D → osteomalacia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Protein → oedema</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Toxic megacolon and Ca may occur (&lt; cf. UC)</td>
<td></td>
</tr>
</tbody>
</table>
Ulcerative Colitis: Management

Ix
- **Bloods:**
  - FBC: ↓Hb, ↑WCC
  - LFT: ↓albumin
  - ↑CRP/ESR
  - Blood cultures
- **Stool**
  - MCS: exclude Campy, Shigella, Salmonella...
  - CDT: C. diff may complicate or mimic
- **Imaging**
  - AXR: megacolon (>6cm), wall thickening
  - CXR: perforation
  - CT
  - Ba / gastrograffin enema
    - Lead-pipe: no haustra
    - Thumbprinting: mucosal thickening
    - Pseudopolyps: regenerating mucosal island
- Ileocolonoscopy + regional biopsy: Baron Score

Severity

<table>
<thead>
<tr>
<th></th>
<th>Mild</th>
<th>Mod</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motions</td>
<td>&lt;4</td>
<td>4-6</td>
<td>&gt;6</td>
</tr>
<tr>
<td>PR bleed</td>
<td>small</td>
<td>moderate</td>
<td>large</td>
</tr>
<tr>
<td>Temp</td>
<td>Apyrexic</td>
<td>37.1-37.8</td>
<td>&gt;37.8</td>
</tr>
<tr>
<td>HR</td>
<td>&lt;70</td>
<td>70-90</td>
<td>&gt;90</td>
</tr>
<tr>
<td>Hb</td>
<td>&gt;11</td>
<td>10.5-11</td>
<td>&lt;10.5</td>
</tr>
<tr>
<td>ESR</td>
<td>&lt;30</td>
<td>&gt;30</td>
<td></td>
</tr>
</tbody>
</table>

Acute Severe UC
- **Resus:** Admit, IV hydration, NBM
- **Hydrocortisone:** IV 100mg QDS + PR
- Transfuse if required
- **Thromboprophylaxis:** LMWH
- **Monitoring**
  - Bloods: FBC, ESR, CRP, U+E
  - Vitals + stool chart
  - Twice daily examination
  - ± AXR

NB. RCTs show no benefit of Abx: not routinely recommended
- May use: megacolon, perforation, uncertain Dx

Acute Complications
- Perforation
- Bleeding
- Toxic megacolon (>6cm)
- VTE

Improvement → oral therapy
- Switch to oral pred + a 5-ASA
- Taper pred after full remission

No Improvement → rescue therapy
- On day 3: stool freq >8 or CRP >45
  - Predicts 85% chance of needing a colectomy during the admission
- Discussion between pt, physician and surgeon
- **Medical:** ciclosporin, infliximab or visilizumab (anti-T cell)
- **Surgical**

Inducing Remission in Mild / Mod Disease
- **OPD-based**

Oral Therapy
- **1st line:** 5-ASAs
- **2nd line:** prednisolone

Topical Therapy: mainly left-sided disease
- **Proctitis:** suppositories
- **More proximal disease:** enemas or foams
- 5-ASAs ± steroids (prednisolone or budesonide)

Additional Therapy: steroid sparing
- Azathioprine or mercaptopurine
- Infliximab: steroid-dependent pts

Maintaining Remission
- **1st line:** 5-ASAs PO – sulfasalazine or mesalazine
  - Topical Rx may be used in proctitis
- **2nd line:** Azathioprine or mercaptopurine
  - Relapsed on ASA or are steroid-dependent
  - Give 6-mercaptopurine if azathioprine intolerant
- **3rd line:** Infliximab / adalimumab

Emergency Surgery
- 20% require surgery at some stage
- 30% UC colitis require surgery w/ 5yrs

Indications
- Toxic megacolon
- Perforation
- Massive haemorrhage
- Failure to respond to medical Rx

Procedures
- Total / subtotal colectomy & end ileostomy ± mucus fistula
- Followed after ~3mo by either
  - Completion proctectomy + ileal-pouch anal anastomosis (IPAA) or end ileostomy
  - Ileorectal anastomosis (IRA)
- Panproctocolectomy + permanent end ileostomy
- Acute colitis op mortality: 7% (30% if perforated)

Elective Surgery

Indications
- Chronic symptoms despite medical therapy
- Carcinoma or high-grade dysplasia

Procedures
- Panproctocolectomy & end ileostomy or IPAA
- Total colectomy & IRA

Surgical Complications
- **Abdominal**
  - SBO
  - Anastomotic stricture
  - Pelvic abscess
- **Stoma:** retraction, stenosis, prolapse, dermatitis
- **Pouch**
  - Pouchitis (50%): metronidazole + cipro
  - ↓ female fertility
  - Faecal leakage
Crohn’s Disease: Management

Ix
- **Bloods:** (top 3 are severity markers)
  - FBC: ↓Hb, ↑WCC
  - LFT: ↓albumin
  - ↑CRP/ESR
  - Haematinics: Fe, B12, Folate
- Blood cultures
- **Stool**
  - MCS: exclude Campy, Shigella, Salmonella…
  - CDT: C. diff may complicate or mimic
- **Imaging**
  - AXR: obstruction, sacroileitis
  - CXR: perforation
  - MRI
    - Assess pelvic disease and fistula
    - Assess disease severity
  - **Small bowel follow-through or enteroclysis**
    - Skip lesions
    - Rose-thorn ulcers
    - Cobblestoning: ulceration + mural oedema
    - **String sign of Kantor:** narrow terminal ileum
- **Endoscopy**
  - ileocolonoscopy + regional biopsy: Ix of choice
  - Wireless capsule endoscopy
  - Small bowel enteroscopy

Severe Attack

Assessment
- ↑temp, ↑HR, ↑ESR, ↑CRP, ↑WCC, ↓albumin

Management
- **Resus:** Admit, NBM, IV hydration
- Hydrocortisone: IV + PR if rectal disease
- Abx: metronidazole PO or IV
- Thromboprophylaxis: LMWH
- Dietician Review
  - Elemental diet
    - Liquid prep of amino acids, glucose and fatty acids
  - Consider parenteral nutrition
- **Monitoring**
  - Vitals + stool chart
  - Daily examination

Improvement → oral therapy
- Switch to oral pred (40mg/d)

No Improvement → rescue therapy
- Discussion between pt, physician and surgeon
- Medical: methotrexate ± infliximab
- Surgical

Inducing Remission in Mild / Mod Disease
- OPD treatment

Supportive
- High fibre diet
- Vitamin supplements

Oral Therapy
- 1st line
  - ileocaecal: budesonide
  - Colitis: sulfasalazine
- 2nd line: prednisolone (tapering)
- 3rd line: methotrexate
- 4th line: infliximab or adalimumab

Perianal Disease
- Occurs in ~50%
- Ix: MRI + EUA
- Rx
  - Oral Abx: metronidazole
  - Immunosuppression ± infliximab
  - Local surgery ± seton insertion

Maintaining Remission
- 1st line: azathioprine or mercaptopurine
- 2nd line: methotrexate
- 3rd line: Infliximab / adalimumab

Surgery
- 50-80% need ≥1 operation in their life
- Never curative
- Should be as conservative as possible

Indications
- **Emergency**
  - Failure to respond to medical Rx
  - Intestinal obstruction or perforation
  - Massive haemorrhage
- **Elective**
  - Abscess or fistula
  - Perianal disease
  - Chronic ill health
  - Carcinoma

Procedures
- Limited resection: e.g. ileocaecal
- Strictureplasty
- Defunction distal disease ⊃ temporary loop ileostomy

Complications
- Stoma complications
- Enterocutaneous fistulae
- Anastomotic leak or stricture

Short gut
- <1-2m small bowel

- **Features**
  - Steatorrhoea
  - ADEK and B12 malabsorption
  - Bile acid depletion → gallstones
  - Hyperoxaluria → renal stones
- **Rx**
  - Dietician
  - Supplements or TPN
  - Loperamide

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Definitions
- Diverticulum = out-pouching of tubular structure
- True = composed of complete wall (e.g. Meckel's)
- False = composed of mucosa only (pharyngeal, colonic)
- Diverticular disease: symptomatic diverticulosis
- Diverticulitis: inflammation of diverticula

Epidemiology
- 30% of Westerner's have diverticulosis by 60yrs
- F>M

Pathophysiology
- Associated with ↑ intraluminal pressure
  - Low fibre diet: no osmotic effect to keep stool wet
- Mucosa herniates through muscularis propria at points of weakness where perforating arteries enter.
- Most commonly located in sigmoid colon
- Commoner in obese pts.
  - Uniting factor in Saint's Triad?
    - Hiatus Hernia
    - Cholelithiasis
    - Diverticular disease

Symptoms of Diverticular Disease
- Altered bowel habit ± left-sided colic
  - Relieved by defecation
- Nausea
- Flatulence
- Rx
  - High fibre diet, mebeverine may help
  - Elective resection for chronic pain

Diverticulitis
- Inspissated faeces → obstruction of diverticulum
- Elderly pt. c prev Hx of constipation

Presentation
- Abdominal pain and tenderness
  - Typically LIF
  - Localised peritonitis
- Pyrexia

Ix
- Bloods
  - FBC: ↑WCC
  - ↑CRP/ESR
  - Amylase
  - G+S/x-match
- Imaging
  - Erect CXR: look for perforation
  - AXR: fluid level / air in bowel wall
  - Contrast CT
  - Gastrografin enema
- Endoscopy
  - Flexi Sig
  - Colonoscopy: not in acute attack

Hinchey Grading

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Small confined pericolic abscesses</td>
<td>Surgery rarely needed</td>
</tr>
<tr>
<td>2</td>
<td>Large abscess extending into pelvis</td>
<td>May resolve w/o surgery</td>
</tr>
<tr>
<td>3</td>
<td>Generalised purulent peritonitis</td>
<td>Surgery needed</td>
</tr>
<tr>
<td>4</td>
<td>Generalised faecal peritonitis</td>
<td>Surgery needed</td>
</tr>
</tbody>
</table>

Mx of Acute Diverticulitis
- Mild Attacks
  - Can be treated at home c bowel rest (fluids only) and augmentin ± metronidazole
- Admit if
  - Unwell
  - Fluids can't be tolerated
  - Pain can't be controlled
- Medical
  - NBM
  - IV fluids
  - Analgesia
  - Antibiotics: cefuroxime + metronidazole
  - Most cases settle
- Surgical
  - Indications
    - Perforation
    - Large haemorrhage
    - Stricture → obstruction
  - Procedure
    - Hartmann's to resect diseased bowel

Other Complications

Perforation
- Sudden onset pain (± preceding diverticulitis)
- Generalised peritonitis and shock
- CXR: free air under diaphragm
- Rx: Hartmann's

Haemorrhage
- Sudden, painless bright red PR bleed
- Ix: mesenteric angiography or colonoscopy
- Rx
  - Usually stops spontaneously
  - May need transfusion
  - Colonoscopy ± diathermy / adrenaline
  - Embolisation
  - Resection

Abscess
- Walled-off perforation
- Swinging fever
- Localising signs: e.g. boggy rectal mass
- Leukocytosis
- Rx: Abx + CT/US-guided drainage

Fistulae
- Enterocolic
- Colovaginal
- Colovesicular: pneumaturia + intractable UTIs
- Rx: resection

Strictures
- After diverticulitis, colon may heal c fibrous strictures
- Rx
  - Resection (usually c 1° anastomosis)
  - Stenting
Bowel Obstruction: Causes and Investigation

Classification
- **Simple**
  - 1 obstructing point + no vascular compromise
  - May be partial or complete
- **Closed Loop**
  - Bowel obstructed @ two points
    - Left CRC c¯ competent ileocaecal valve
    - Volvulus
  - Gross distension → perforation
- **Strangulated**
  - Compromised blood supply
  - Localised, constant pain + peritonism
  - Fever + ↑WCC

Commonest Causes

**SBO**
- Adhesions: 60%
- Hernia

**LBO**
- Colorectal Neoplasia: 60%
- Diverticular stricture: 20%
- Volvulus: 5%

Other Causes

Non-Mechanical = Paralytic Ileus (usually SB)
- Post-op
- Peritonitis
- Pancreatitis or any localised inflammation
- Poisons / Drugs: anti-AChM (e.g. TCAs)
- Pseudo-obstruction
- Metabolic: ↓K, ↓Na, ↓Mg, uraemia
- Mesenteric ischaemia

Mechanical
- **Intraluminal**
  - Impacted matter: faeces, worms, bezoars
  - Intussusception
  - Gallstones
- **Intramural**
  - Benign stricture
    - IBD
    - Surgery
    - Ischaemic colitis
    - Diverticulitis
    - Radiotherapy
  - Neoplasia
  - Congenital atresia
- **Extramural**
  - Hernia
  - Adhesions
  - Volvulus (sigmoid, caecal, gastric)
  - Extrinsic Compression
    - Pseudocyst
    - Abscess
    - Haematoma
    - Tumour: e.g. ovarian
    - Congenital bands (e.g. Ladd’s)

Presentation
- **Abdominal Pain**
  - Colicky
  - Central but level depends on gut region
  - Constant / localised pain suggests strangulation or impending perforation
- **Distension**
  - ↑ c¯ lower obstructions
- **Vomiting**
  - Early in high obstruction
  - Late or absent in low obstructions
- **Absolute Constipation**: flatus and faeces

Examination
- ↑HR: hypovolaemia, strangulation
- Dehydration, hypovolaemia
- Fever: suggests inflammatory disease or strangulation
- **Surgical scars**
- **Hernias**
- Mass: neoplastic or inflammatory
- **Bowel sounds**
  - ↑: mechanical obstruction
  - ↓: ileus
- **PR**
  - Empty rectum
  - Rectal mass
  - Hard impacted stool
  - Blood from higher pathology

Ix
- **Bloods**
  - FBC: ↑WCC
  - U+E: dehydration, electrolyte abnormalities
  - Amylase: ↑↑ if strangulation/perforation
  - VBG: ↑ lactate in strangulation
  - G+S, clotting: may need surgery
- **Imaging**
  - Erect CXR
  - AXR: ± erect film for fluid levels
  - CT: can show transition point
- **Gastrograffin studies**
  - Look for mechanical obstruction: no free flow
  - Follow through or enema
  - Follow through may relieve mild mechanical obstruction: usually adhesional
- **Colonoscopy**
  - Can be used in some cases
  - Risk of perforation
  - May be used therapeutically to stent

AXR Findings

<table>
<thead>
<tr>
<th></th>
<th>SBO</th>
<th>LBO</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Diameter</strong></td>
<td>≥3</td>
<td>≥6 cm (caecum ≥9)</td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td>Central</td>
<td>Peripheral</td>
</tr>
<tr>
<td><strong>Markings</strong></td>
<td>Valvulae coniventes - completely across</td>
<td>Haustra - partially across</td>
</tr>
<tr>
<td><strong>LB Gas</strong></td>
<td>Absent</td>
<td>Present</td>
</tr>
<tr>
<td><strong>No. of loops</strong></td>
<td>Many</td>
<td>Few</td>
</tr>
<tr>
<td><strong>Fluid levels</strong></td>
<td>Many, short</td>
<td>Few, long</td>
</tr>
</tbody>
</table>

**Ileus**
- Both small and large bowel may be visible
- No clear transition point
**Medical**

**Resuscitate: “Drip and Suck”**
- NBM
- IV fluids: aggressive as pt. may be v. dehydrated
- NGT: decompress upper GIT, stops vomiting, prevents aspiration
- Catheterise: monitor UO

**Therapy**
- Analgesia: may require strong opioid
- Antibiotics: cef+met if strangulation or perforation
- Gastrograffin study: oral or via NGT
- Consider need for parenteral nutrition

**Monitoring**
- Regular clinical examination is necessary to ensure that the pt. is not deteriorating.
  - ↑ distension
  - ↑ pain or tenderness
  - ↑ HR/ ↑RR
- Repeat imaging and bloods
- Non-operative Mx successful in ~80% of pts. ⚠ SBO w/o peritonitis
- Pts. ⚠ LBO are more likely to need surgery.

**Surgical**

**Indications**
- Closed loop obstruction
- Obstructing neoplasm
- Strangulation / perforation → sepsis, peritonitis
- Failure of conservative Mx (up to 72h)

**Principals**
- Aim to treat the cause
- Typically involves resection of the obstructing lesion
- Colon has not been cleansed therefore most surgeons utilise a proximal ostomy post-resection.
- Pts. ⚠ substantial comorbidity or unresectable tumours may be offered bypass procedures.
- Endoscopically placed expanding metal stents offer palliation or a bridge to surgery allowing optimisation.

**Procedures**
- Must consent pt. for possible resection ± stoma
- SBO: adhesiolysis
- LBO
  - Hartmann’s
  - Colectomy + $^0$ anastomosis + on table lavage
  - Palliative bypass procedure
  - Transverse loop colostomy or loop ileostomy
  - Caecostomy
Bowel Obstruction: Specific Management

Sigmoid Volvulus (80% of volvulus)

Pathophysiology
- Long mesentery → narrow base predisposes to torsion
- Usually due to sigmoid elongation → chronic constipation
- ↑ risk in neuropsych pts.: MS, PD, psychiatric
  - Disease or Rx interferes with intestinal motility
- → closed loop obstruction

Presentation
- Commoner in males
- Often elderly, constipated, co-morbid pts.
- Massive distension → tympanic abdomen

AXR
- Characteristic inverted U / coffee bean sign

Mx
- Often relieved by sigmoidoscopy and flatus tube insertion
  - Monitor for signs of bowel ischaemia following decompression.
- Sigmoid colectomy occasionally required
  - Failed endoscopic decompression
  - Bowel necrosis
- Often recurs → elective sigmoidectomy may be needed

Caecal Volvulus
- Assoc. c congenital malformation where caecum is not fixed in the RIF.
- Only ~10% of pts can be detorsed c colonoscopy
  - Typically requires surgery
- Right hemi c ileocolic anastomosis
- Caecostomy

Gastric Volvulus

Triad of gastro-oesophageal obstruction
- Vomiting → retching c regurgitation of saliva
- Pain
- Failed attempts to pass an NGT

Risk Factors
- Congenital
  - Bands
  - Rolling / Paraoesophageal hernia
  - Pyloric stenosis
- Acquired
  - Gastric / oesophageal surgery
  - Adhesions

Ix
- Gastric dilatation
- Double fluid level on erect films

Mx
- Endoscopic manipulation
- Emergency laparotomy

Paralytic Ileus

Presentation
- Adynamic bowel 2O to the absence of normal peristalsis
- Usually SBO
- Reduced or absent bowel sounds
- Mild abdominal pain: not colicky

Cause
- Post-op
- Peritonitis
- Pancreatitis or any localised inflammation
- Poisons / Drugs: anti-AChM (e.g. TCAs)
- Pseudo-obstruction
- Metabolic: ↓ K, ↓ Na, ↓ Mg, uraemia
- Mesenteric ischaemia

Prevention
- ↓ bowel handling
- Laparoscopic approach
- Peritoneal lavage after peritonitis
- Unstarched gloves

Mx
- Conservative “drip and suck” Mx
- Correct any underlying causes
  - Drugs
  - Metabolic abnormalities
- Consider need for parenteral nutrition
- Exclude mechanical cause if protracted

Colonic Pseudo-obstruction / Ogilvie’s Syn.

Presentation
- Clinical signs of mechanical obstruction but no obstructing lesion found
- Usually distension only: no colic

Cause
- Aetiology unknown
- Assoc. c
  - Elderly
  - Cardiorespiratory disorders
  - Pelvic surgery: e.g. hip arthroplasty
  - Trauma

Ix
- Gastrograffin enema: exclude mechanical cause

Mx
- Neostigmine: anti-cholinesterase
- Colonoscopic decompression: 80% successful
Epidemiology
- 3rd commonest cancer
- 2nd commonest cause of cancer deaths (16,000/yr)
- Age: peak in 60s
- Sex: rectal Ca commoner in men
- Geo: Western disease

Pathophysiology

Colonic Adenomas
- Benign precursors to CRC
- Characterised by dysplastic epithelium

Classification
- Tubular: small, pedunculated, tubular glands
- Villous: large, sessile, covered by villi
- Tubulovillous: mixture

Presentation
- Typically asymptomatic
- Large polyps can bleed → IDA
- Villous adenomas can → ↓K + hypoproteinaemia

Malignant potential
- ↑ size
- ↑ dysplasia
- ↑ villous component

APC et al.
- -ve regulator of β-catenin (component of WNT pathway)
- APC binds to and promotes degradation of β-catenin.
- APC mutation → ↑ β-catenin → ↑ transcription of genes which promote cell proliferation.
- Proliferation → mutation of other genes which promote growth and prevent apoptosis
  - KRAS (proto-oncogene)
  - p53 (TSG)

Adenoma → Carcinoma Sequence
1. First hit: mutation of one APC copy
2. Second hit: mutation of second APC copy
   → adenoma formation
3. Additional mutations in adenoma → malignant transformation: e.g KRAS, p53

Other Aetiological Factors
- Diet: ↓ fibre + ↑ refined carbohydrate
- IBD: CRC in 15% of pancolitis for 20yrs
- Familial: FAP, HNPCC, Peutz-Jeghers
- Smoking
- Genetics
  - No relative: 1/50 CRC risk
  - One 1st degree: 1/10
- NSAIDs / Aspirin (300mg/d): protective

Pathology
- 95% adenocarcinoma
  - Others: lymphoma, GIST, carcinoid

Location
- Rectum: 35%
- Sigmoid: 25%
- Caecum and ascending colon: 20%
- Transverse: 10%
- Descending: 5%
- Proximal tumours: sessile or polypoid
- Distal tumours: annular stenosing

Spread
- Local
- Lymphatic
- Blood (liver, lungs)
- Transcoelomic

Presentation

Left
- Altered bowel habit
- PR mass (60%)
- Obstruction (25%)
- Bleeding / mucus PR
- Tenesmus

Right
- Anaemia
- Wt. loss
- Abdominal pain

Either
- Abdominal mass
- Perforation
- Haemorrhage
- Fistula

Examination
- Palpable mass: per abdomen or PR
- Perianal fistulae
- Hepatomegaly
- Anaemia
- Signs of obstruction
Colorectal Carcinoma: Ix, Mx and Prevention

Ix
- **Bloods**
  - FBC: Hb
  - LFTs: mets
  - Tumour Marker: CEA (carcinoembryonic Ag)
- **Imaging**
  - CXR: lung mets
  - US liver: mets
  - CT and MRI
    - Staging
    - MRI best for rectal Ca and liver mets
  - Endoanal US: staging rectal tumours
  - Ba / gastrograffin enema: apple-core lesion
- **Endoscopy + Biopsy**
  - Flexi sig: 65% of tumours accessible
  - Colonoscopy

Staging

**Dukes** (Sir Cuthbert Dukes: St. Mary’s Pathologist)

<table>
<thead>
<tr>
<th>Spread</th>
<th>% 5ys</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confined to bowel wall</td>
<td>90</td>
</tr>
<tr>
<td>Through bowel wall but no LNs</td>
<td>60</td>
</tr>
<tr>
<td>Regional LN s</td>
<td>30</td>
</tr>
<tr>
<td>Distant mets</td>
<td>&lt;10</td>
</tr>
</tbody>
</table>

**TNM**
- Tis: carcinoma in situ
- T1: submucosa
- T2: muscularis propria
- T3: subserosa
- T4: through the serosa to adjacent organs
- N1: 1-3 nodes
- N2: >4 nodes

**Grading**
- Grading from low to high
- Based on cell morphology
- Dysplasia, mitotic index, hyperchromatism

Mx
- Manage in an MDT
- Confirmation of Dx
- Stage c CT or MRI
- 60% amenable to radical surgery

Surgery
- Use ERAS pathway
- Pre-operative bowel prep (except R sided lesions)
  - E.g. Kleen Prep (Macrogol: osmotic laxative) the day before and phosphate enema in the AM.
- Consent: discuss stomas
- Stoma nurse consult for siting

**Principals**
- Excision depends on lymphatic drainage which follows arterial supply.
- Mobility of bowel and blood supply at cut ends is also important.
- Hartmann’s often used if obstruction.
- Laparoscopic approach is the standard of care

Rectal Ca
- Neo-adjuvant radiotherapy may be used to ↓ local recurrence and ↑ 5ys
- **Anterior resection:** tumour 4-5cm from anal verge
  - Defunction c loop ileostomy
- **AP resection:** <4cm from anal verge
- + **Total mesorectal excision** for tumours of the middle and lower third.
  - Aims to ↓ recurrence
  - ↑ anastomotic leak and faecal incontinence

**Other Tumours**
- **Sigmoid:** high anterior resection or sigmoid colectomy
- **Left:** left hemicolectomy
- **Transverse:** extended right hemicolectomy
- **Caecal / right:** right hemicolectomy

**Other Rx**
- **Local excision:** e.g. Transanal Endoscopic Microsurg
- **Bypass surgery:** palliation
- **Hepatic resection:** if single lobe mets only
- **Stenting:** palliation or bridge to surgery in obstruction
- **Chemo**
  - Adjuvant 5-FU for Dukes’ C ↓ mortality by 25%
    - i.e. LN +ve pts.
  - High grade tumour
  - Palliation of metastatic disease

NHS Screening for CRC

**FOB Testing**
- Introduced in 2006
- 60-75yrs
- Home FOB testing every 2yrs: ~1/50 have +ve FOB
- Colonoscopy if +ve: ~1/10 have Ca
- Lindholm et al. BJS 2008
  - Screening ↓ risk of dying from CRC by 25%

**Flexi Sig**
- Introduced in 2011/12
- 55-60yrs
- Once only flexi Sig
- Atkin et al. Lancet 2010
  - ↓ CRC incidence by 33%
  - ↓ CRC mortality by 43%
**Familial CRC Syndromes**

**Familial Adenomatous Polyposis**
- Autosomal dominant
- APC gene on 5q21

**Presentation**
- 100-1000s of adenomas by ~16yrs
  - Mainly in large bowel
  - Also stomach and duodenum (near ampulla)
- 100% develop CRC, often by ~40yrs
- May be assoc. with congenital hypertrophy of the retinal pigment epithelium (CHPRE)

**Variants**
- Attenuated FAP: <100 adenomas, later CRC (>50yrs)
- Gardener’s (TODE)
  - Thyroid tumours
  - Osteomas of the mandible, skull and long bones
  - Dental abnormalities: supernumerary teeth
  - Epidermal cysts
- Turcot’s: CNS tumours: medullo- and glioblastomas

**Mx**
- Prophylactic colectomy before 20yrs
- Total colectomy + IRA
  - Requires life-long stump surveillance
- Proctocolectomy + IPAA
  - Requires life-long stump surveillance
  - Remains at risk of Ca in stomach and duodenum
  - Regular endoscopic screening

**Hereditary Non-Polyposis Colorectal Cancer**
- Autosomal dominant
- Mutation of mismatch repair enzymes
  - E.g. MSH2 on Chr 2p
- Commonest cause of hereditary CRC: 3% of all CRC

**Presentation**
- Lynch 1: right sided CRC
- Lynch 2: CRC + gastric, endometrial, prostate, breast

**Dx: “3, 2, 1, rule”**
- ≥3 family members over 2 generations at <50yrs

**Peutz-Jeghers Syndrome**
- Autosomal dominant
- STK11 mutation

**Presentation**
- ~10-15yrs
- Mucocutaneous hyperpigmentation
  - Macules on palms, buccal mucosa
- Multiple GI hamartomatous polyps
  - Intussusception
  - Haemorrhage
- ↑ Ca risk
  - CRC, pancreas, breast, lung, ovaries, uterus

**GI Polyps**

**Inflammatory Pseudopolyps**
- Regenerating islands of mucosa in UC

**Hyperplastic Polyps**
- Piling up of goblet cells and absorptive cells
- Serrated surface architecture
- No malignant potential

**Hamartomatous**
- Tumour-like growths composed of tissues present at site where they develop.
- Sporadic or part of familial syndromes
- Juvenile polyyp: solitary hamartoma in children
  - “Cherry on a stalk”

**Neoplastic**
- Tubular or Villous adenomas
- Usually asymptomatic
- May have blood/mucus PR, tenesmus

**Other Hamartomatous Polyposis Syndromes**

**Juvenile Polyposis**
- Autosomal dominant
- >10 hamartomatous polyps
- ↑ CRC risk: need surveillance and polypectomy

**Cowden Syndrome**
- Autosomal dominant
- Macrocephaly + skin stigmata
- Intestinal hamartomas
- ↑ risk of extra-intestinal Ca
Mesenteric Ischaemia

Acute

**Causes**
- **Arterial:** thrombotic (35%), embolic (35%)
- **Non-occlusive (20%)**
  - Splanchnic vasoconstriction: e.g. 2G to shock
- **Venous thrombosis (5%)**
- **Other:** trauma, vasculitis, strangulation

**Presentation**
- Nearly always small bowel
- Triad
  - Acute severe abdominal pain ± PR bleed
  - Rapid hypovolaemia → shock
  - No abdominal signs
- **Degree of illness >> clinical signs**
- May be in AF

**Ix**
- **Bloods**
  - ↑Hb: plasma loss
  - ↑WCC
  - ↑ amylase
  - Persistent metabolic acidosis: ↑lactate
- **Imaging**
  - AXR: gasless abdomen
  - Arteriography / CT/MRI angio

**Complications**
- Septic peritonitis
- SIRS → MODS

**Mx**
- Fluids
- Abx: gent + met
- LMWH
- Laparotomy: resect necrotic bowel

Chronic Small Bowel Ischaemia

**Cause:** atheroma + low flow state (e.g. LVF)

**Presentation:**
- Severe, colicky post-prandial abdo pain
  - “gut claudication”
- PR bleeding
- Malabsorption
- Wt. loss

**Mx:** angioaplasty

Chronic Large Bowel Ischaemia

**Cause:** follows low flow in IMA territory

**Presentation**
- Lower, left-sided abdominal pain
- Bloody diarrhoea
- Pyrexia
- Tachycardia

**Ix**
- ↑WCC
- Ba enema: thumb-printing
- MR angiography

**Complications**
- May → peritonitis and septic shock
- Strictures in the long-term

**Mx**
- Usually conservative: fluids and Abx
- Angioplasty and endovascular stenting

Lower GI Bleed

**Causes**

**Common / Important**
- Rectal: haemorrhoids, fissure
- Diverticulitis
- Neoplasm

**Other**
- Inflammation: IBD
- Infection: shigella, campylobacter, C. diff
- Polyps
- Large upper GI bleed (15% of lower GI bleeds)
- Angio: dysplasia, ischaemic colitis, HHT

**Ix**
- **Bloods:** FBC, U+E, LFT, x-match, clotting, amylase
- **Stool:** MCS
- **Imaging**
  - AXR, erect CXR
  - Angiography: necessary if no source on endoscopy
  - Red cell scan
- **Endoscopy**
  - 1st: Rigid proctoscopy / sigmoidoscopy
  - 2nd: OGD
  - 3rd: Colonoscopy: difficult in major bleeding

**Mx**
- Resuscitate
- Urinary catheter
- Abx: if evidence of sepsis or perf
- PPI: if upper GI bleed possible
- **Keep bed bound:** need to pass stool may be large bleed → collapse
- **Stool chart**
- **Diet:** keep on clear fluids (allows colonoscopy)
- Surgery: only if unremitting, massive bleed

Angiodysplasia

**Submucosal AV malformations**
- 70-90% occur in right colon
- Can affect anywhere in GIT

**Presentation**
- Elderly
- Fresh PR bleeding

**Ix**
- Exclude other Dx
  - PR exam
  - Ba enema
  - Colonoscopy
  - Mesenteric angiography or CT angiography
  - Tc-labelled RBC scan: identify active bleeding

**Rx**
- Embolisation
- Endoscopic laser electrocoagulation
- Resection
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Key Anatomy

Rectum
- 12cm
- Sacral promontory to levator ani muscle
- The 3 tenia coli fuse around the rectum to form a continuous muscle layer.

Anal Canal
- 4cm
- Levator ani muscle to anal verge
- **Upper 2/3 of canal**
  - Lined by columnar epithelium
  - Insensate
  - Sup. rectal artery and vein
  - Internal iliac nodes
- **Lower 1/3 of canal**
  - Lined by squamous epithelium
  - Sensate
  - Middle and inf. rectal arteries and veins
  - Superficial inguinal nodes
- Dentate line = squamomucosal junction
- White line = where anal canal becomes true skin

Anal Sphincters

Internal
- Thickening of rectal smooth muscle
- Involuntary control

External
- Three rings of skeletal muscle
  - Deep
  - Superficial
  - Subcutaneous
- Voluntary control

Anorectal Ring
- Deep segment of external sphincter which is continuous c puborectalis muscle (part of levator ani)
- Palpable on PR ~5cm from the anus
- Demarcates junction between anal canal and rectum.
- Must be preserved to maintain continence

Minor Anal Conditions

Perianal Haematoma

Definition
- Subcutaneous bleeding from a burst venule caused by straining or the passage of hard stool.
- Also called an external pile: a misnomer

Presentation
- Tender blue lump at the anal margin
- Pain worsened by defecation or movement

Rx
- Analgesia + spontaneous resolution
- Evacuation under LA

Proctalgia Fugax
- Young, anxious men
- Crampy anorectal pain, worse @ night
- Unrelated to defecation
- Assoc. c trigeminal neuralgia

Rx
- Reassurance
- GTN cream

Perineal Warts
- Commonly seen in MSM
- Condylomata accuminata
  - HPV
  - **Rx**: podophyllin paint, cryo, surgical excision
- Condylomata lata
  - Syphilis
  - **Rx**: penicillin

Pruritis Ani
- 50% idiopathic
- Poor hygiene
- Haemorrhoids
- Anal fissure
- Anal fistula
- Fungi, worms
- Crohn’s
- Neoplasia
Haemorrhoids

**Definition**
- Disrupted and dilated anal cushions

**Pathophysiology**
- Anal cushion: mass of spongy vascular tissue
- Positioned @ 3, 7 and 11 O’clock
  - Where the three major arteries that feed the vascular plexuses enter the anal canal
- Gravity, straining → engorgement and enlargement of anal cushions
- Hard stool disrupts connective tissue around cushions.
- Cushions protrude and can be damaged by hard stool
  - → bright red (capillary) bleeding.
- Haemorrhoids arise above dentate line ⇒ not painful
- May be gripped by anal sphincter → thrombosis
  - Strangulated piles are acutely painful
  - May ulcerate or infarct

**Causes**
- Constipation ⇒ prolonged straining
- Venous congestion may contribute
  - Pregnancy
  - Abdominal tumour
  - Portal HTN

**Classification**
- 1\(^{st}\) degree: never prolapse
- 2\(^{nd}\): prolapse on defecation but spontaneously reduce
- 3\(^{rd}\): prolapse on defecation but require digital reduction
- 4\(^{th}\): remain permanently prolapsed

**Symptoms**
- Fresh painless PR bleeding
  - Bright red
  - On paper, on stool, may drip into pan
- Pruritis ani
- Lump in perianal area
- Severe pain = thrombosis

**Examination**
- Full abdo exam, palpating for masses
- Inspect perianal area: masses, recent bleeding
- DRE: can’t palpate piles unless thrombosed
- Rigid sig to identify higher rectal pathology
- Proctoscopy (also allows Rx)

**Differential**
- Perianal haematoma
- Fissure
- Abscess
- Tumour (must exclude in all cases)

**Mx**

**Conservative**
- ↑ fibre and fluid intake
- Stop straining @ stool

**Medical**
- Topical preparations
  - Anusol: hydrocortisone
  - Topical analgesics
- Laxatives: lactulose, Fybogel

**Interventional**
- Injection c sclerosant (5% phenol in Almond oil)
  - Injection above dentate line
  - SE: impotence, prostatitis
- Barron’s banding → thrombosis and separation
  - SE: bleeding, infection
- Cryotherapy
  - SE: watery discharge post-procedure
- Infra-red coagulation

**Surgical: Haemorrhoidectomy**
- Excision of piles + ligation of vascular pedicles
- Lactulose + metronidazole 1wk pre-op
- Discharge c laxatives post-op
- SE: bleeding, stenosis

**Mx of Thrombosed Piles**
- Analgesia
- Ice-packs
- Stool softeners
- Bed rest c elevated foot of bed
- Pain usually resolves in 2-3wks
- Haemorrhoidectomy is not usually necessary
**Anal Fissure**

**Definition**
- Tear of squamous epithelial lining in lower anal canal

**Causes**
- Mostly trauma due to the passage of hard stool
  - Assoc. constipation
  - Spasm of internal anal sphincter contributes to pain and ischaemia + poor healing
  - Commoner in women
- Rarer causes, often multiple ± lateral fissures
  - Crohn’s
  - Herpes
  - Anal Ca

**Presentation**
- Intense anal pain
  - Especially on defecation
  - May prevent pt. from passing stools
- Fresh rectal bleeding
  - On paper mostly

**Examination**
- PR often impossible
- Midline ulcer is seen
  - Usually posterior @ 6 O’clock
  - May be anterior
- May be a mucosal tag – sentinel pile
  - Usually posterior @ 6 O’clock
- Groin LNs suggest complicating factor: e.g. HIV

**Mx**
- If fissure recurrent, chronic or difficult to Rx the patient requires EUA.

**Conservative**
- Soaks in warm bath
- Toileting advice
- Dietary advice: ↑ fibre and fluids

**Medical**
- Laxatives: lactulose + fybogel
- Topical → resolution in 75%
  - Lignocaine
  - GTN
  - Diltiazem
- Botulinum injection

**Surgical: Lateral partial sphincterotomy**
- Division of internal anal sphincter @ 3 O’clock
- Pre-op anorectal US and manometry
  - Complications
    - Minor faecal/flatus incontinence (= GTN)
    - Perianal abscess

**NB.** Lord’s operation (anal dilatation under anaesthesia) is no longer used due to high rates of incontinence.

**Fistula in Ano**

**Definition**
- Abnormal connection between ano-rectal canal and the skin.

**Pathogenesis**
- Usually occur due to perianal sepsis
  - Blockage of intramuscular glands → abscess
  - Abscess discharges to form a fistula
- Associations
  - Crohn’s
  - Diverticular disease
  - Rectal Ca
  - Immunosuppression

**Classification**
- High: cross sphincter muscles above dentate line
- Low: don’t cross sphincter muscles above dentate line

**Goodsall’s Rule**
- Determines path of fistula tract
- Fistula anterior to anus track in a straight line (radial)
- Fistula posterior to anus always have internal opening at the 6 o’clock position → curved track

**Presentation**
- Persistent anal discharge
- Perianal pain or discomfort

**Examination**
- May visualise external opening: may be pus
- Induration around the fistula on DRE
- Proctoscopy may reveal internal opening

**Ix**
- MRI
- Endoanal US

**Rx**
- Extent of fistula must first be delineated by probing the fistula @ EUA

**Low Fistula**
- Fistulotomy and excision
  - Laid open to heal by 2 O’ intention

**High Fistula**
- Fistulotomy could damage the anorectal ring
- Suture – a seton – passed through fistula and gradually tightened over months
  - Stimulates fibrosis of tract
  - Scar tissue holds sphincter together
Peri-anal Sepsis / Abscess

Pathogenesis
- Anal gland blockage → infection → abscess
  - E.g. coli, bacteroides
- May develop from skin infections
  - E.g. sebaceous gland or hair follicle
  - Staphs

Associations
- Crohn’s
- DM
- Malignancy

Classification
- Perianal: 45%
  - Discrete local red swelling close to the anal verge
- Ischiorectal: ≤30%
  - Systemic upset
  - Extremely painful on DRE
- Interphincteric / intermuscular: >20%
- Pelvirectal / supraleveror: ~5%
  - Systemic upset
  - Bladder irritation

Presentation
- Throbbing perianal pain
- Worse on sitting
- Occasionally a purulent anal discharge

Examination
- Perianal mass or cellulitic area
- Fluctuant mass on PR
- Septic signs: fever, tachycardia

Rx
- Abx may suffice if Rx instigated v. early in course
- Most cases require EUA c ¯ I&D
  - Wound packed
  - Heals by 2º intention
  - Daily dressing for 7-10d
- Look for an anal fistula which complicates ~30% of abscesses.

Pilonidal Sinus

Definition
- Pilonidal: lat “nest of hair”
- Sinus: blind ending tract, lined by epithelial or granulation tissue, which opens onto an epithelial surface.

Pathophysiology
- Hair works its way beneath skin → foreign body reaction → formation of abscess
- Usually occur in the natal cleft.

Risk Factors
- M>F=4:1
- Geo: Mediterranean, Middle east, Asians
- Often overweight c ¯ poor personal hygiene
- Occupations c ¯ lots of sitting: e.g. truck drivers

Presentation
- Persistent discharge of purulent or clear fluid
- Recurrent pain
- Abscesses

Rx
Conservative
- Hygiene advice
- Shave / remove hair from affected area

Surgical
- Incision and drainage of abscesses
- Elective sinus excision
  - Methylene blue to outline tract
  - Recurrence in 4-15%
Anal Carcinoma

Epidemiology
- Relatively uncommon: 250-300 cases/yr in the UK

Pathology
- 80% SCCs
  - Others: melanomas, adenocarcinomas
- Anal Margin tumours
  - Well differentiated keratinising lesions
  - Commoner in men
  - Good prognosis
- Anal Canal tumours
  - Arise above dentate line
  - Poorly differentiated, non-keratinising
  - Commoner in women
  - Worse prognosis
- Spread
  - Above dentate line → internal iliac nodes
  - Below dentate line → inguinal nodes

Aetiology
- HPV (16, 18, 31, 33) is important factor
  - ↑ incidence in MSM
  - ↑ incidence if perianal warts

Presentation
- Perianal pain and bleeding
- Pruritis ani
- Faecal incontinence
  - 70% have sphincter involvement @ presentation
  - May → rectovaginal fistula

Examination
- Palpable lesion in only 25%
- ± palpable inguinal nodes

Ix
- ↓ Hb (ACD)
- Endoanl US
- Rectal EUA + biopsy
- CT / MRI: assess pelvic spread

Rx
- Chemoradiotherapy: most pts
  - 50% 5ys
- Surgery: reserved for
  - Tumours that fail to respond to radiotherapy
  - GI obstruction
  - Small anal margin tumours w/o sphincter involvement

Rectal Prolapse

Definition
- Protrusion of rectal tissue through the anal canal.

Classification
Type 1: Mucosal Prolapse
- Partial prolapse of redundant mucosa
- Common in children: esp. ♂ CF
- Essentially large piles ↓: same Rx

Type 2: Full Thickness Prolapse
- Commoner cf. type 1
- Usually elderly females ♂ poor O&G Hx

Presentation
- Mass extrudes from rectum on defecation
  - May reduce spontaneously or require manual reduction
- May become oedematous and ulcerated
  - → pain and bleeding
- Faecal soiling
- Assoc. ♂ vaginal prolapse and urinary incontinence

Examination
- Visible prolapse: brought out on straining
- ± excoriation and ulceration
- ↓ sphincter tone on PR
- Assoc. uterovaginal prolapse

Ix
- Sigmoidoscopy to exclude proximal lesions
- Anal manometry
- Endoanal US
- MRI

Rx
Partial Prolapse
- Phenol injection
- Rubber band ligation
- Surgery: Delorme’s Procedure

Complete Prolapse
- Conservative
  - Pelvic floor exercises
  - Stool softeners
- Surgery
  - Abdominal Approach: Rectopexy
    - Lap or open
    - Mobilised rectum fixed to sacrum ♂ mesh
  - Perineal Approach: Delorme’s Procedure
    - Resect mucosa and suture the two mucosal boundaries.
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**Hernia Definitions**

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<th>Definition</th>
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<tr>
<td>Hernia</td>
<td>Protrusion of a viscus or part of a viscus through the walls of its containing cavity into an abnormal position.</td>
</tr>
<tr>
<td>Reducible</td>
<td>Sac can return to the abdominal cavity either spontaneously or by manipulation.</td>
</tr>
<tr>
<td>Irreducible</td>
<td>Sac cannot be reduced despite pressure or manipulation.</td>
</tr>
<tr>
<td>Strangulated</td>
<td>Blood supply of contents is compromised due to pressure at the neck of the hernia.</td>
</tr>
<tr>
<td>Sliding hernia</td>
<td>Part of the sac is formed by bowel (e.g. caecum or sigmoid): take care when excising the sac.</td>
</tr>
<tr>
<td>Maydl’s hernia</td>
<td>Herniating double loop of bowel. Strangulated portion may reside as a single loop inside the abdomen.</td>
</tr>
<tr>
<td>Littre’s hernia</td>
<td>Hernial sac containing strangulated Meckel’s diverticulum.</td>
</tr>
<tr>
<td>Amyand’s</td>
<td>Inguinal hernia containing strangulated Appendix</td>
</tr>
</tbody>
</table>
| Richter’s          | Only part of circumference of bowel is within sac  
Most commonly seen with femoral hernias.  
Can strangulate w/o obstructing.                                                   |
| Pantaloon          | Simultaneous direct and indirect hernia.                                                                                                    |
| Herniotomy         | Excision of hernial sac                                                                                                                    |
| Herniorrhaphy      | Suture repair of hernial defect                                                                                                              |
| Hernioplasty       | Mesh repair of hernial defect                                                                                                                |
Inguinal Hernia

Epidemiology
- 3% of adults will require hernioplasty
- ~4% of male neonates have hernia (↑ prem)
- M>>F = 9:1 (descent of testes)
- Majority present in 50s.

Pathology
- Commoner on R (?damage to ilioinguinal N. @ appendicectomy → muscle weakness)
- 5% bilateral
- 8-15% present as emergency c ¯ strangulation/obstruction

Aetiology

Congenital: patent processus vaginalis
- Processus vaginalis should obliterate following descent of the testes.
- If it stays patent it may fill with
  - Fluid → hydrocele
  - Bowel/omentum → indirect hernia

Acquired: mainly things which ↑IAP
- Chronic cough: COPD, asthma
- Prostatism
- Constipation
- Severe muscular effort: e.g. heavy lifting
- Previous incision/repair
- Ascites / obesity
- Appendicectomy

Classification

Indirect
- 80%: commoner in young
- Congenital patent processus vaginalis
- Emerge through deep ring
- Same 3 coverings as cord and descend into the scrotum
- Can strangulate

Direct
- 20%: commoner in elderly
- Acquired
- Emerge through Hesselbach’s triangle
- Can acquire internal and external spermatic fascia
- Rarely descend into scrotum
- Rarely strangulate

Mx

Non-surgical
- Rx RFs: cough, constipation
- Lose weight
- Truss

Surgical
- Tension-free mesh (e.g. Lichtenstein repair) better cf. suture repair (e.g. Shouldice repair)
  - Recurrence < 2% vs. 10%
- Open approach can be done under LA or GA
- Lap approach allows bilateral repair and improved cosmesis. Also preferred for recurrent hernias.
- 1º unilateral repairs should be open (NICE)
- Children only require sac excision (herniotomy)

Complications

Early
- Haematoma / seroma formation: 10%
- Intra-abdominal injury (lap)
- Infection: 1%
- Urinary retention

Late
- Recurrence (<2%)
- Ischaemic orchitis: 0.5%
- Chronic groin pain / paraesthesia: 5%

Clinical Features

Children
- Lump in groin which may descend into scrotum
- Exacerbated by crying
- Commonly obstruct

Adults
- Lump in groin, exacerbated by straining/cough
- May be clear pp'ting event: e.g. heavy lifting
- Dragging pain radiating to groin
- May present c ¯ obstruction/strangulation

Questions
- Reducible?
- Ever episodes of obstruction / strangulation?
- Predisposing factors: cough, straining, lifting?
- Occupation and social circumstances?

Ix
- US if Dx in doubt
Femoral Hernia

Definition
- Protrusion of viscus through the femoral canal

Epidemiology
- F>M
  - Inguinal hernias still more common in F
  - Middle aged and elderly

Aetiology
- Acquired: ↑ intra-abdominal pressure
- Femoral canal larger in females due to shape of pelvis and changes in its configuration due to childbirth

Clinical features
- Painless groin lump
  - Neck inferior (and lateral) to the pubic tubercle.
  - Cough impulse.
  - Often irreducible (tight boarders)

Commonly present c° obstruction or strangulation
- Tender, red and hot
- Abdo pain, distension, vomiting, constipation

Mx
- 50% risk of strangulation w/i 1mo
- Urgent surgery

Elective: Lockwood Approach
- Low incision over hernia c° herniotomy and herniorrhaphy (suture ing. ligt. to pectineal ligt.)

Emergency: McEvedy Approach
- High approach in inguinal region to allow inspection and resection of non-viable bowel.
- Then herniotomy and herniorrhaphy

Incisional Hernia

Definition
- Hernia arises through a previously acquired defect

Epidemiology
- 6% of surgical incisions

Risk Factors

Pre-operative
- ↑ age
- Obesity or malnutrition
- Comorbidities: DM, renal failure, malignancy
- Drugs: steroids, chemo, radio

Intra-operative
- Surgical technique/skill (major factor)
  - Too small suture bites
  - Inappropriate suture material
- Incision type (e.g. midline)
- Placing drains through wounds

Post-operative
- ↑ IAP: chronic cough, straining, post-op ileus
- Infection
- Haematoma

Mx
- Surgery is not appropriate for all patients.
- Must balance risk of operation and recurrence c° risk of obstruction / strangulation and pt. choice.
- Usually broad-necked c° low risk of strangulation

Conservative
- Manage RFs: e.g. constipation, cough
- Weight loss
- Elasticated corset or truss

Surgical
- Pre-Op
  - Optimise cardiorespiratory function
  - Encourage wt. loss
- Nylon mesh repair: open or lap
### Umbilical

**Features**
- Congenital
- 3% of LBs
- Defect in the umbilical scar

**Management**
- Usually resolves by 2-3yrs
- Mesh repair if no closure.
- Can recur in adults: pregnancy or gross ascites

**Risk Factors**
- Afro-Caribbean
- Trisomy 21
- Congenital hypothyroidism

### Paraumbilical

**Features**
- Acquired: middle aged obese men
- Defect through linea alba just above or below umbilicus
- Small defect → strangulation (often omentum)

**Management**
- Mayo (double-breast linea alba σ sutures) / mesh repair

**Risk Factors**
- Chronic cough
- Straining

### Epigastric

**Features**
- Young M >F
- Pea-sized swelling caused by defect in linea alba above the umbilicus.
- Usually contains omentum: can strangulate

**Management**
- Mesh repair

### Spigelian

**Features**
- Hernia through linea semilunaris
- Hernia lies between layers of abdo wall
- Palpable mass more likely to be colon Ca

### Obturator

**Features**
- Old aged F>M
- Sac protrudes through obturator foramen
- Pain on inner aspect of thigh or knee
- Frequently present obstructed / strangulated

### Lumbar

**Features**
- Middle-aged M>F
- Typically follow loin incisions
- Hernias through sup./inf. lumbar triangles

### Sciatic

**Features**
- Hernia through lesser sciatic foramen
- Usually presents as SBO + gluteal mass

### Gluteal

**Features**
- Hernia through greater sciatic foramen
- Usually presents as SBO + gluteal mass
Superficial Lesions

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<th>Pathology</th>
<th>Features</th>
<th>Viva</th>
<th>Mx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lipoma</td>
<td>Benign tumour of mature adipocytes</td>
<td>Inspection: Occur anywhere fat can expand - i.e. NOT scalp or palms - inc. spermatic cord, submucosa</td>
<td>Dercum’s Disease / Adiposid dolorosa - Multiple, painful lipomas - Assoc. peripheral neuropathy - Obese postmen women</td>
<td>Non-surgical</td>
</tr>
<tr>
<td></td>
<td>Sarcomatous change probably doesn’t occur.</td>
<td>Palpation: Soft Subcutaneous Imprecise margin Fluctuant</td>
<td>Familial Multiple Lipomatosis</td>
<td>Surgical Excision</td>
</tr>
<tr>
<td></td>
<td>Liposarcomas arise de novo</td>
<td></td>
<td>Madelung’s Disease</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Older pts.</td>
<td></td>
<td>Bannayan-Zonana Syndrome - Multiple lipomas - Macrocephaly - Haemangiomas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Deeper tissues of the lower limbs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sebaceous cyst</td>
<td>Epithelial-lined cyst containing keratin</td>
<td>Inspection: Occur @ sites of hair growth - Scalp, face, neck, chest and back - NOT soles or palms Central Punctum</td>
<td>Complications - Infection: pus discharge - Ulceration - Calcification</td>
<td>Non-surgical</td>
</tr>
<tr>
<td></td>
<td>Two histological subtypes</td>
<td>Palpation: Firm Smooth Intradermal</td>
<td>Cock's Peculiar Tumour - Large ulcerating trichilemmal cyst on the scalp - Resemble an SCC</td>
<td>Surgical Excision</td>
</tr>
<tr>
<td></td>
<td>1) Epidermal Cyst - Arise from hair follicle infundibulum</td>
<td></td>
<td>Gardener’s Syndrome: FAP + - Thyroid tumours - Osteomas - Dental abnormalities - Epidermal cysts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2) Trichilemmal Cyst / Wen - Arise from hair follicle epithelium</td>
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<tr>
<td></td>
<td>- Often multiple</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>- May be autosomal dominant</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Ganglion</td>
<td>Cystic swelling related to a synovial lined structures: joint, tendon</td>
<td>Inspection: Can be found anywhere 90% on dorsum of hand or wrist Dorsum of ankle May be scar from recurrence Weakly transilluminable</td>
<td>Differential - Bursae - Cystic protrusion from synovial cavity of arthritic joint.</td>
<td>Non-Surgical</td>
</tr>
<tr>
<td></td>
<td>Myxoid degeneration of fibrous tissue</td>
<td>Palpation: Soft Subcutaneous May be tethered to tendon</td>
<td>- Aspiration followed by 3wks of immobilisation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Contain thick, gelatinous material</td>
<td></td>
<td>Surgical Excision - Recurrence can be 50% - Neurovascular damage</td>
<td></td>
</tr>
<tr>
<td>Seborrheic keratosis</td>
<td>Benign hyperplasia of basal epithelial layer</td>
<td>Stuck on appearance Dark brown Greasy</td>
<td>Non-surgical</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Hyperkeratosis: keratin layer thickening</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Acanthosis: prickle layer thickening</td>
<td></td>
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</tbody>
</table>

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<table>
<thead>
<tr>
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<th>Pathology</th>
<th>Features</th>
<th>Viva</th>
<th>Mx</th>
</tr>
</thead>
</table>
| Neurofibroma         | Benign nerve sheath tumour arising from schwann cells.                     | **Inspection**  
Solitary or multiple Pedunculated nodules | **NF 1: von Recklinghausen’s**  
- AD, Chr 17  
- Cafe-au-lait spots (>6)  
- Freckling  
- Neurofibromas  
- Lisch nodules (iris) | Surgical excision only indicated if malignant growth suspected.  
Local regrowth is common |
|                      |                                                                           | **Palpation**  
Fleshy consistency  
Pressure can → paraesthesia |                                                           |                                             |
|                      |                                                                           | **Extras**  
Examine the eyes  
Examine the axilla  
Examine the cranial nerves (esp. 8)  
BP |                                                             |                                             |
| Papilloma             | Overgrowth of all layers of the skin ☏ a central vascular core.          | **Inspection**  
Skin tag / fibroepithelial polyp Pedunculated Flesh coloured |                                                           | Excision + diathermy to control bleeding. |
|                      |                                                                           | **Palpation**  
Fleshy consistency  
Pressure can → paraesthesia |                                                           |                                             |
|                      |                                                                           | **Extras**  
Examine the eyes  
Examine the axilla  
Examine the cranial nerves (esp. 8)  
BP |                                                           |                                             |
| Pyogenic granuloma    | Rapidly growing capillary haemangioma.  
Neither pyogenic, nor a granuloma | **Inspection**  
Most commonly on hands, face, gums and lips.  
Bright red hemispherical nodule  
May have serous / purulent discharge | Possible assoc. ☏ prev trauma  
More common in pregnancy | Non-surgical  
- regression is uncommon  
Surgical  
- curettage ☏ diathermy of the bases |
|                      |                                                                           | **Palpation**  
Soft  
Bleed very easily |                                                             |                                             |
| Dermoid Cyst          | Epidermal-lined cyst deep to the skin                                      | **Inspection**  
Smooth spherical swelling  
Sites of embryological fusion  
Scar from recurrence | Child / young adult: congenital  
Adult: congenital  
- Ask re. trauma | Congenital  
- CT to establish extent  
- Surgical excision  
Acquired  
- Surgical excision |
| Congenital / Inclusion Cysts | - Developmental inclusion of  
edepidermis along lines of skin fusion  
- Midline of neck and nose  
- Medial and lateral ends of eyebrows | **Inspection**  
Smooth spherical swelling  
Sites of embryological fusion  
Scar from recurrence |                                                             |                                             |
|                      |                                                                           | **Palpation**  
Soft  
Non-tender  
Subcutaneous |                                                             |                                             |
| Dermato-fibroma       | Benign neoplasm of dermal fibroblasts                                      | **Inspection**  
Can occur anywhere  
Mostly on the lower limbs of young to middle-aged women  
Small, brown pigmented nodule | **Differential**  
- Malignancy: melanoma, BCC | Excision + histology |
|                      |                                                                           | **Palpation**  
Firm, woody feel: characteristic  
Intradermal: mobile over deep tissue |                                                            |                                             |
| Kerato-acanthoma      | Benign overgrowth of hair follicle cells  
Cytologically similar to well-differentiated SCCs | **Inspection**  
Fast-growing  
Dome-shaped ☏ a keratin plug  
Intradermal |                                                            | Regress w/i 6wks  
Excise to reduce scarring and obtain histology |
|                      |                                                                           | **Palpation**  
Firm, woody feel: characteristic  
Intradermal: mobile over deep tissue |                                                            |                                             |
Malignant and Pre-malignant Skin Lesions

Malignant Melanoma

Epidemiology
- F>M = 1.5:1
- UK incidence = 10,000/yr and 2000 deaths/yr
  - ↑80% in 20yrs

Features
- Asymmetry
- Boarder: irregular
- Colour: non-uniform
- Diameter >6mm
- Evolving / Elevation

Risk Factors
- Sunlight: esp. intense exposure in early years.
- Fair skinned (low Fitzpatrick skin type)
- ↑ no. of common moles
- +ve FH
- ↑ age
- Immunosuppression

Classification
- Superficial Spreading: 80%
  - Irregular boarders, colour variation
  - Commonest in Caucasians
  - Grow slowly, metastasise late = better prognosis
- Lentigo Maligna Melanoma
  - Often elderly pts.
  - Face or scalp
- Acral Lentiginous
  - Asians/blacks
  - Palms, soles, subungual (CF Hutchinson’s sign)
- Nodular Melanoma
  - All sites
  - Younger age, new lesion
  - Invade deeply and metastasise early = poor prog
- Amelanotic
  - Atypical appearance → delayed Dx

Staging and Prognosis
- Breslow Depth
  - Thickness of tumour to deepest point of dermal invasion
  - <1mm = >75% 5ys
  - >4mm = 50% 5ys
- Clark’s Staging
  - Stratifies depth by 5 anatomical levels
  - Stage 1: Epidermis
  - Stage 5: subcutaneous fat

Metastasis
- Liver
- Eye

Mx
- Excision + 2 cm margin excision depending on Bres depth
- ± lymphadenectomy
- ± adjuvant chemo (may use isolated limb perfusion)

Poor prognostic indicators
- Male sex (more tumours on trunk cf. females)
- ↑ mitoses
- Satellite lesions (lymphatic spread)

Squamous Cell Carcinoma
- Ulcerated lesion ≥ hard, raised everted edges
- Sun exposed areas

Causes
- Sun exposure: scalp, face, ears, lower leg
- May arise in chronic ulcers: Marjolin’s Ulcer
- Xeroderma pigmentosa

Evolution
- Solar/actinic keratosis → Bowen’s → SCC
- Lymph node spread is rare

Rx
- Excision + radiotherapy to affected nodes

Actinic Keratoses
- Irregular, crusty warty lesions.
- Pre-malignant (~1%/yr)

Rx
- Cautery
- Cryo
- 5-FU
- Imiquimod
- Photodynamic phototherapy

Bowen’s Disease
- Red/brown scaly plaques
- Typically on the legs of older women
- SCC in situ

Rx
- As for AKs

Basal Cell Carcinoma
- Commonest cancer
- Pearly nodule ≥ rolled telangiectactic edge
- May ulcerate
- Typically on face in sun-exposed area
  - Above line from tragus → angle of mouth

Behaviour
- Low-grade malignancy → very rarely metastasise
- Locally invasive

Rx
- Excision
  - Mohs: complete circumferential margin assessment using frozen section histology
  - Cryo/radio may be used.
Neck Lumps: General Approach

Diagnosis
- 85% of neck lumps are LNs: esp. if present < 3wks
  - Infection: EBV, tonsillitis, HIV
  - Ca: lymphoma or mets
- 8% are goitres
- 7% other: e.g. sebaceous cyst or lipoma

Ix: Triple Assessment
- Clinical assessment
- Imaging: US
- Cyto/Histo: aspiration or biopsy

Anterior triangle
- Ant. margin of SCM
- Midline
- Ramus of the mandible
- Roof: investing fascia
- Floor: pre-vertebral fascia

Causes
- Pulsatile
  - Carotid artery aneurysm
  - Tortuous carotid artery
  - Carotid body tumour (chemodectoma)
- Non-pulsatile
  - Branchial cysts
  - Laryngocele
  - Goitre
  - Parotid tumour (lump in postero-superior area)

Submandibular Triangle
- Mental process
- Ramus of the mandible
- Line between two angles of the mandible

Causes
- Salivary stone
- Sialadenitis
- Salivary tumour

Posterior Triangle
- Post. margin of SCM
- Ant. margin of trapezius
- Mid 1/3 of clavicle.

Causes
- LNs
- Cervical ribs
- Pharyngeal pouch
- Cystic hygromas
- Pancoast’s tumour

Midline Lumps
- <20yrs
  - Thyroglossal cyst
  - Dermoid cyst
- >20yrs
  - Thyroid isthmus mass
  - Ectopic thyroid tissue

Anterior Triangle Lumps

Branchial Cysts
- Embryological remnant 2nd branchial cleft

Presentation
- Age <20yrs
- Ant. margin of SCM at junction of upper and middle 3rd
- May become infected → abscess
- May be assoc. c branchial fistula

Pathology
- Lined by squamous epithelium
- Contain “glary” fluid c cholesterol crystals

Rx
- Med
  - Abx for infection
  - Sclerotherapy c OK-432 can be used
- Surgical excision
  - Definitive Rx
  - May be difficult due to proximity of carotids

Branchial sinus or fistula
- Small opening in lower 3rd of neck on ant. margin of SCM
- Between tonsillar fossa and ant. border of SCM
- May discharge mucus

Carotid Body Tumour: Chemodectoma
- Very rare
- Carotid bodies
  - Located @ carotid bifurcation
  - Detect pO₂, pCO₂ and H+

Presentation
- Just anterior to upper 3rd of SCM.
- Pulsatile
- Move laterally but not vertically
- May be bilateral
- Pressure may → dizziness and syncope
- Mostly benign (5% malignant)

Ix: Doppler or angio: splaying of bifurcation

Rx: extirpation by a vascular surgeon

Laryngocele
- Cystic dilatation of the laryngeal saccule
- Congenital or acquired
- Exacerbated by blowing
Midline Neck Lumps

**Dermoid Cyst**
- Developmental inclusion of epidermis along lines of skin fusion.

**Presentation**
- Common <20yrs
- Found at junctions of embryological fusion
  - Neck midline
  - Lateral angles of eyebrow
  - Under tongue
- Contains ectodermal elements
  - Hair follicles, sebaceous glands

Rx: excision

**Thyroglossal Cyst**
- Cyst formed from persistent thyroglossal duct
  - Path of thyroid descent from base of tongue

**Presentation**
- Can be located anywhere between foramen caecum and the thyroid
  - Usually just inferior to the hyoid: subhyoid
  - Or, just above the hyoid: suprathyroid
- Fluctuant lump that moves up with tongue protrusion
- Can become infected → thyroglossal fistula

Rx
- Sistrunk’s Op: excision of cyst and thyroglossal duct

Posterio Arctic Triangle Lumps

**Cervical ribs**
- Overdevelopment of transverse process of C7
- Occur in 1:150

**Presentation**
- Mostly asymptomatic
- Hard swelling
  - ↓ radial pulse on abduction and external rotation of arm
- Can → vascular symptoms
  - Compresses subclavian A
  - Raynaud’s
  - Subclavian steal
  - ↓ venous outflow → oedema
- Can → neurological symptoms
  - Compresses lower trunk of brachial plexus, T1 nerve root or stellate ganglion.
  - Wasting of intrinsic hand muscles
  - Paraesthesia along medial border of arm

**Pharyngeal Pouch: Zenker’s Diverticulum**
- Herniation of pharyngeal mucosa through its muscular coat at its weakest point.
  - Pulsion diverticulum
- Killian’s dehiscence
  - Between thyro- and crico-pharyngeal muscles that form the inferior constrictor

**Presentation**
- Swelling on left side of neck
- Regurgitation and aspiration
- Halitosis
- Gurgling sounds
- Food debris → pouch expansion → oesophageal compression → dysphagia.

Ix: barium swallow

Rx
- Excision and cricopharyngeal myotomy
- Endoscopic stapling

**Cystic Hygroma**
- Congenital multiloculated lymphangioma arising from the jugular lymph sac

**Presentation**
- Infants
- Lower part of post. triangle but may extend to axilla.
  - ↑ in size when child coughs/cries
  - Transilluminates brilliantly

Rx: excision or hypertonic saline sclerosant
- May recur
Cervical Lymphadenopathy

Key Features
- Consistency
- Number
- Fixation
- Symmetry
- Tenderness

Additional Examination
- Face and scalp for infection or neoplasm
- Chest exam: infection or neoplasm
- Breast examination
- Formal full ENT examination
- Rest of reticuloendothelial system

History
- Symptoms from the lumps
  - E.g. EtOH-induced pain
- General symptoms
  - Fever, malaise, wt. loss
- Systemic disease
  - PMH
  - Previous operations
- Social history
  - Ethnic origin
  - HIV risk factors

Causes: LIST
- Lymphoma and Leukaemia
- Infection
- Sarcoïdosis
- Tumours

Infection
- Bacterial
  - Tonsillitis, dental abscess
  - TB
  - Bartonella henselae (Cat scratch disease)
- Viral
  - EBV
  - HIV
- Protozoal
  - Toxoplasmosis

Ix

Blood
- FBC, ESR, film (atypical lymphocytes)
- TFTs, serum ACE
- Monospot test, HIV test

Radiological
- US
- CT scan

Pathology
- FNAC
- Excision biopsy

Hypertrophic and Keloid Scars

Features
- Scar more prominent than surrounding skin

Hypertrophic
- Scar confined to wound margins
- Across flexor surfaces and skin creases
- Appear soon after injury and regress spontaneously
- Any age: commonly 8-20yrs
- M=F
- All races

Keloid
- Scar extends beyond wound margins
- Earlobes, chin, neck, shoulder, chest
- Appear months after injury and continue to grow
- Puberty to 30yrs
- F>M
- Black and Hispanic

Wound Associations
- Infection
- Trauma
- Burns
- Tension
- Certain body areas

Mx

Non-surgical
- Mechanical-pressure therapy
- Topical silicone gel sheets
- Intrallesional steroid and LA injections

Surgical
- Revision of scar closure by direct suturing
Thyroid Lumps

Congenital Thyroid Disease
- Lingual thyroid
- Ectopic thyroid tissue
- Thyroglossal cyst

Embryology
- Thyroid migrates from its origin at the foramen caecum at the base of the tongue:
  - Passes behind the hyoid bone
  - Lies anterior to 3rd-4th tracheal rings in the pretracheal fascia
- Leaves behind the thyroglossal cyst which atrophies
  - Persistence $\rightarrow$ thyroglossal cyst
- Ectopic thyroid tissue can be found anywhere along this descent

Goitre Differential

Diffuse
- Simple colloid goitre
  - Endemic: iodine deficiency
  - Sporadic: autoimmune, hereditary, goitrogens (e.g. sulphonylureas)
- Graves’
- Thyroiditis
  - Hashimoto’s
  - De Quervain’s
  - Subacute lymphocytic (e.g. post-partum)
  - (multinodular goitre $\checkmark$ nodules too small to palpate)

Multinodular
- Multinodular colloid goitre (commonest)
- Multiple cysts
- Multiple adenomas

Solitary nodule
- Dominant nodule in multinodular goitre
- Adenoma (hot or cold)
- Cyst
- Malignancy

Ix

Bloods
- TFTs: TSH, fT3, fT4
- Other: FBC, Ca$^{2+}$, LFTs, ESR
- Antibodies: anti-TPO, TSH

Imaging
- CXR: goitres and mets
- High resolution US
- CT
- Radionucleotide (Tc or I) scan (hot vs. cold)

Histology or cytology
- FNAC (can’t distinguish adenoma vs. follicular Ca)
- Biopsy

Laryngoscopy
- Important pre-op to assess vocal cords
# Benign Thyroid Disease

<table>
<thead>
<tr>
<th>Disease</th>
<th>Clinical Features</th>
<th>Cause</th>
<th>Management</th>
</tr>
</thead>
</table>
| Simple goitre               | Diffuse painless goitre Mass effects:  
- dysphagia  
- stridor  
- SVC obstruction  
Usually euthyroid, may → hypothyroid | Endemic  
- iodine deficiency  
Sporadic  
- autoimmune  
- goitrogens (e.g. sulphonylureas)  
- hereditary (dyshormogenic) | Thyroxine  
Total or subtotal thyroidectomy if pressure symptoms. |
| Multinodular goitre         | Evolves from long-standing simple goitre. Mass effects. Euthyroid (or subclinical hyperthyroid) | As for simple goitre                       | Thyroxine  
Total or subtotal thyroidectomy if pressure symptoms. |
| Plummer’s Toxic multinodular goitre | Multinodular goitre Thyrotoxicosis Uneven iodine uptake with hot nodule | Autonomous nodule develops on background multinodular goitre | Carbimazole  
Radioiodide  
Total or subtotal thyroidectomy. |
| Graves’                     | Diffuse goitre  
bruit  
Ophthalmopathy  
Dermopathy  
Thyrotoxicosis  
Assoc.  
other AI disease (T1DM, PA)  
↑ uptake on radionucleotide scan | Autoimmune (T2 hypersensitivity)  
- anti-TSH | Propanolol  
Carbimazole  
Radioiodide  
Thyroidectomy |
| Hashimoto’s thyroiditis     | Diffuse painless goitre  
May have transient thyrotoxicosis, then hypothyroidism  
Assoc.  
other AI disease (T1DM, PA) | Autoimmune (T2 and T4)  
- anti-TPO, -Tg | Levothyroxine |
| de Quervain’s               | Diffuse painful goitre  
Preceding viral URTI common  
Thyrotoxicosis → hypo→eu  
↓ iodine uptake | Viral: Coxsackie common  
Autoimmune | Self-limiting |
| Subacute lymphocytic        | Diffuse painless goitre  
May occur post-partum  
Thyrotoxicosis → hypo→eu | Autoimmune | Self-limiting |
| Riedel’s thyroiditis        | Firm, fixed, irregular thyroid mass  
Mass effects  
Assoc.  
retroperitoneal fibrosis | Autoimmune fibrosis | Conservative |
| Follicular adenoma          | Single thyroid nodule  
± thyrotoxicosis (majority are cold)  
May get pressure symptoms | | Hemithyroidectomy |
| Thyroid cysts               | Solitary thyroid nodule  
Asympto or pressure symptoms  
Can → localised pain due to cyst bleed | | Aspiration or excision |
Malignant Thyroid Disease

### Presentation
- Non-functional (cold)
- Painless neck mass
- Cervical mets
- Compression symptoms
  - Dysphagia
  - Stridor
  - SVC obstruction

### Risk factors for malignancy in thyroid nodules
- Solitary
- Solid
- Younger
- Male
- Cold
- Radiation exposure

### Thyroid Surgery
**Indications: 5 Ms**
- Mechanical obstruction
- Malignancy
- Marred beauty: cosmetic reasons
- Medical Rx failure: thyrotoxicosis
- Mediastinal extension: can't monitor changes

**Practicalities**
- Render euthyroid pre-op c̄ antithyroid drugs
  - Stop 10 days prior to surgery (they ↑ vascularity)
  - Alternatively just give propranolol
- Check for phaeo pre-op in medullary carcinoma
- Laryngoscopy: check vocal cords pre- and post-op

**Procedure**
- Collar incision

### Complications of Thyroid Surgery
**Early**
- Reactionary haemorrhage → haematoma (<1%)
  - Can → airway obstruction.
  - Call anaesthetist and remove wound clips
  - Evacuate haematoma and re-explore wound
- Laryngeal oedema
  - Damage during intubation or surgical manipulation
  - Can → airway obstruction
- Recurrent laryngeal nerve palsy (0.5%) 
  - Right RLN more common (oblique ascent)
  - Damage to one → hoarse voice
  - Damage to both → obstruction needing tracheostomy
- Hypocalcaemia (3-5%)
  - Usually parathyroid dysfunction but may be permanent if parathyroids removed.
  - Presents @ 24-48hrs
    - Tingling in fingers and lips
    - Wheeze / stridor → airway obstruction
    - Chvostek’s and Trousseau’s
  - Rx: 10ml 10% Ca gluconate IV
- Thyroid storm
  - Severe hyperthyroidism
  - Rx: propranolol, antithyroid drugs, Lugol’s iodine and hydrocortisone sodium succinate

**Late**
- Hypothyroidism
- Recurrent hyperthyroidism
- Keloid scar

### Disease Frequency Age Cell Origin Spread Mx

<table>
<thead>
<tr>
<th>Disease</th>
<th>Frequency</th>
<th>Cell Origin</th>
<th>Spread</th>
<th>Mx</th>
</tr>
</thead>
<tbody>
<tr>
<td>Papillary</td>
<td>80%</td>
<td>Follicular cells</td>
<td>Nodes and lung - JDG node = lateral aberrant thyroid</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Assoc. ċ irradiation</td>
<td>Tg tumour marker</td>
<td>Often multifocal</td>
<td>Total thyroidectomy ± node excision ± radioiodine T4 to suppress TSH &gt;95% 10ys</td>
</tr>
<tr>
<td>Follicular</td>
<td>10%</td>
<td>Follicular cells</td>
<td>Blood → bone and lungs</td>
<td>Total thyroidectomy + T4 suppression + Radioiodine &gt;95% 10ys</td>
</tr>
<tr>
<td></td>
<td>F&gt;M = 3:1</td>
<td>Tg tumour marker</td>
<td>Blood → bone and lungs</td>
<td>Total thyroidectomy + T4 suppression + Radioiodine &gt;95% 10ys</td>
</tr>
<tr>
<td>Medullary</td>
<td>5%</td>
<td>Parafollicular C-cells</td>
<td>Do phaeo screen pre-op</td>
<td>Thyroidectomy + Node clearance Consider radiotherapy</td>
</tr>
<tr>
<td></td>
<td>30% are familial - e.g. MEN2</td>
<td>CEA and calcitonin markers</td>
<td>Rapid growth</td>
<td>Usually palliative</td>
</tr>
<tr>
<td>Anaplastic</td>
<td>Rare</td>
<td>Undifferentiated follicular cells</td>
<td>Aggressive: local, LN and blood.</td>
<td>Usually palliative</td>
</tr>
<tr>
<td></td>
<td>F&gt;M = 3:1</td>
<td>Lymphocytes</td>
<td>Rapid growth</td>
<td>Usually palliative</td>
</tr>
<tr>
<td>Lymphoma</td>
<td>5%</td>
<td>Lymphocytes - MALToma in Hashi’s</td>
<td>Rapid growth</td>
<td>Usually palliative</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Aggressive: local, LN and blood.</td>
<td>Usually palliative</td>
</tr>
</tbody>
</table>

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Salivary Glands

History
- Swelling/pain related to food: calculi
- Malaise, fever, mumps
- Dry eyes/mouth: Sjogren's (Sicca, Mickulicz)

Causes of Salivary Gland Enlargement
- Whole gland
  - Parotitis
  - Sjogren's / Sicca Syndrome
  - Sarcoid
  - Amyloid
  - ALL
  - Chronic liver disease
  - Anorexia or bulimia
- Localised
  - Tumours
  - Stones

Acute Parotitis
- Viral: mumps, coxsackie A, HIV
- Bacterial: S. aureus
  - Assoc. calculi and poor oral hygiene

Calculi
- Recurrent unilateral swelling and pain
- Worse on eating
- Red, tender, swollen gland (80% submandibular)
- Ix: plain x-ray or sialography
- Rx: gland excision

Salivary Gland Neoplasms
- 80% are in the parotid (80% are superficial)
- 80% are pleomorphic adenomas
- Deflection of ear outwards is classic sign
- CN VII palsy = malignancy

Classification
- Benign
  - 1st: Pleomorphic adenoma
  - 2nd: Adenolymphoma (Warthin’s)
- Malignant (CN7 palsy + fast growing)
  - 1st: Mucoepidermoid
  - 2nd: Adenoid cystic

Ix
- ENT examination
- US ± CT
- FNAC

Pleomorphic Adenoma
- Commonest salivary gland neoplasm (80%)
- Presentation
  - 90% occur in parotid
  - Occur in middle age
  - F>M
  - Benign and slow growing
- Histo: different tissue types (hence name)
- Rx: superficial parotidectomy

Adenolymphoma (Warthin’s tumour)
- Benign soft cystic tumour
- Older men
- Rx: enucleation

Adenoid-cystic carcinoma
- One of the commonest malignant salivary tumours
- Highly malignant and often incurable
- Rapid growth
- Hard fixed mass
- Pain
- Facial palsy

Surgery
- Superficial or radical parotidectomy
- Facia lata face lift for facial palsy

Complications
- Facial palsy
- Salivary fistula
- Frey’s Syndrome (gustatory sweating)
  - Redness and sweating skin over parotid area
  - Occurs in relation to food (inc. thinking)
  - Auriculotemporal branch of CN V₃ carries sympathetic fibres to sweat glands over parotid area and parasympathetic fibres to the parotid
  - Reinervation of divided sympathetic nerves by fibres from the secretomotor branch of auriculotemporal branch of CN V₃
Breast Cancer: Pathology, Presentation and Assessment

Epidemiology
- Affects 1/10 women
- 20 000 cases/yr in UK
- Commonest cause of cancer death in females 15-54
- Second commonest cause of cancer deaths overall

Aetiology / Risk Factors

Family Hx
- 10% Ca breast is familial
  - One 1st degree relative = 2x risk
- 5% assoc. c BRCA mutations
  - BRCA1 (17q) → 80% breast Ca, 40% + ov Ca
  - BRCA2 (13q) → 80% breast Ca

Oestrogen Exposure
- Early menarche, late menopause
- HRT, OCP (Million Women Study)
- First child >35yrs
- Obesity

Other Factors
- Proliferative breast disease c atypia
- Previous Ca breast
  - ↑ age (v. rare <30)
- Breast feeding is protective

Pathology

DCIS/LCIS
- Non-invasive pre-malignant condition
- Microcalcification on mammography
- 10x ↑ risk of invasive Ca

Invasive Ductal Carcinoma, NST/NOS
- Commonest: ~70% of cancers
- Feels hard (scirrhous)

Other subtypes
- Invasive lobular: ~20% of cancers
- Medullary: affects younger pts, feels soft
- Colloid/mucinous: occur in elderly
- Inflammatory: pain, erythema, swelling, peau d’orange
- Papillary

Phyllodes Tumour
- Stromal tumour
- Large, non-tender mobile lump

Spread
- Direct extension → muscle and/or skin
- Lymph → p’eau d’orange + arm oedema
- Blood →
  - Bones: bone pain, #, ↑Ca
  - Lungs: dyspnoea, pleural effusion
  - Liver: abdo pain, hepatic impairment
  - Brain: headache, seizures

Screening
- Every 3yrs from 47-73
- Craniocaudal and oblique views
- ↓ breast Ca deaths by 25%
- 10% false negative rate.

Presentation

Lump: commonest presentation of Ca breast
- Usually painless
- 50% in upper outer quadrant
- ± axillary nodes

Skin changes
- Paget’s: persistent eczema
- Peau d’orange

Nipple
- Discharge
- Inversion

Mets
- Pathological #
- SOB
- Abdominal pain
- Seizures
- May present through screening

Differential
- Cysts
- Fibroadenomas
- DCIS
- Duct ectasia

Triple Assessment: any breast lump
- Hx and Clinical Examination
- Radiology
  - <35yrs: US
  - >35ys: US + mammography
- Pathology
  - Solid lump:tru-cut core biopsy
  - Cystic lump: FNAC (green / 18G needle)
    - Reassure if clear fluid
    - Send cytology if bloody fluid
    - Core biopsy residual mass
    - Core biopsy if +ve cytology

Other Ix
- Bloods
  - FBC, LFTs, ESR, bone profile
- Imaging: help staging
  - CXR
  - Liver US
  - CT scan
  - Breast MRI: multifocal disease or c implants
  - Bone scan and PET-CT
- May need wire-guided excision biopsy

Clinical Staging
- Stage 1: confined to breast, mobile, no LNs
- Stage 2: Stage 1 + nodes in ipsilateral axilla
- Stage 3: Stage 2 + fixation to muscle (not chest wall) LNs matted and fixed, large skin involvement
- Stage 4: Complete fixation to chest wall + mets

TNM Staging
- Tis (no palpable tumour): CIS
- T1: <2cm, no skin fixation
- T2: 2-5cm, skin fixation
- T3: 5-10cm, ulceration + pectoral fixation
- T4: >10cm, chest wall extension, skin involved
- N1: mobile nodes
- N2: fixed nodes
Breast Cancer: Management

Principals
- Manage in an MDT c an individual approach
  - Oncologist
  - Breast surgeon
  - Breastcare nurse
  - Radiologist
  - Histopathologist
- Try to enrol pts. in a trial
- Factors: age, fitness, wishes, clinical stage
  - 1-2: surgical
  - 3-4: chemo and palliation

Surgery
- Aim = gain local control
- Two options
  - WLE + radiotherapy (80% treated like this)
  - Mastectomy
    - Typically large tumours >4cm
    - Multifocal or central tumours
    - Nipple involvement
    - Pt. choice
    - Not radical: no longer used
- Same survival, but WLE has ↑ recurrence rates

Sentinel Node Biopsy: gold standard

Rational
- SN = first node that a section of breast drains to.
- If clinically -ve axillary LNs, no need for further dissection if SN is clear.

Procedure
- Blue dye / radiocolloid injected into tumour
- Visual inspection / gamma probe @ surgery to ID SN
- SN removed and sent for frozen section
- If node +ve → axillary clearance or radiotherapy

Evidence
- 2 RCTs compared SNB vs. SNB + axillary clearance
- No differences in overall or disease-free survival
  - ↓ morbidity if SNB alone
    - Lymphoedema
    - Pain
    - Numbness

Other Axillary Options
- For clinically -ve axilla options included
  - Axillary sampling
    - Removal of lower nodes
  - Clearance or DXT if +ve
  - Axillary clearance
    - Can be done to various levels

Surgical Complications
- Haematoma, seroma
- Frozen shoulder
- Long-thoracic nerve palsy
- Lymphoedema

Nottingham Prognostic Index
- Predicts survival and risk of relapse
- Guides appropriate adjuvant systemic therapy
  - (0.2 x tumour size) + histo grade + nodal status
    - Histo grade: Bloom-Richardson system (1-3)

Systemic Rx

Radiotherapy
- Post-WLE: ↓ local recurrence
- Post-mastectomy: only if high risk of local recurrence
  - Large, poorly differentiated, node +ve
- Axillary: node +ve disease
- Palliation: bone pain

Chemotherapy
- Pre-menopausal, node +ve, high grade or recurrent tumours.
- Neo-adjuvant chemo improves survival in large tumours
  - 6 x FEC: 5-FU, Epirubicin, Cyclophosphamide
  - Trastuzumab (anti-Her2) is used if Her2+ve
    - SE: cardiac toxicity

Endocrine Therapy
- Used in ER or PR +ve disease: ↓ recurrence, ↑ survival
- 5yrs of adjuvant therapy
  - Tamoxifen
    - SERM: antagonist @ breast, agonist @ uterus
    - SE: menopausal symptoms, endometrial Ca
  - Anastrozole
    - Aromatase inhibitor → ↓ oestrogen
    - Better cf. tamoxifen if post-men (ATAC trial)
    - SE: menopausal symptoms
- If pre-menopausal and ER+ve may consider ovarian ablation or GnRH analogues (e.g. goserelin)

Treating Advanced Disease (Stage 3-4)
- Tamoxifen if ER+ve
- Chemo for relapse
- Her2+ve tumours may respond to trastuzumab

Supportive
- Bone pain: DXT, bisphosphonates, analgesia
- Brain: occasional surgery, DXT, steroids, AEDs
- Lymphoedema: decongestion, compression

Reconstruction
- Offered either at 1O surgery or as delayed procedure.
- Implants: silastic or saline inflatable

Lat dorsi myocutaneous flap
- Pedicled flap: skin, fat, muscle and blood supply
- Supplied by thoracodorsal A. via subscapular A.
- Usually used if implant, CI if poor circulation: smokers, obese, PVD, DM
- Risk of abdominal hernia

Nipple Tattoo

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**Other Breast Disease**

### Congenital
- Amastia: complete absence of breast and nipple
- Hypoplasia more common: some asymmetry normal
- Accessory nipples
  - Can occur anywhere along the milk line
  - Present in 1%

### Gynaecomastia
- Occurs in 30% of boys at puberty
- Hormone secreting tumours: e.g. sex-cord testicular
- Chronic liver disease: hypogonadism + ↓E2 metabolism
- Drugs: spironolactone, digoxin, cimetidine

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- Hormone secreting tumours: e.g. sex-cord testicular
- Chronic liver disease: hypogonadism + ↓E2 metabolism
- Drugs: spironolactone, digoxin, cimetidine

### Inflammatory

<table>
<thead>
<tr>
<th>Disease</th>
<th>Patient</th>
<th>Presentation</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Mastitis</td>
<td>Usually lactating</td>
<td>Painful, red breast</td>
<td>Fluclox alone in early stages</td>
</tr>
<tr>
<td></td>
<td></td>
<td>May → <strong>Abscess</strong> (lump near nipple)</td>
<td>Fluclox + I&amp;D if fluctuant abscess</td>
</tr>
<tr>
<td>Fat Necrosis</td>
<td></td>
<td>Associated with previous trauma</td>
<td>Analgesia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Painless, palpable, non-mobile mass</td>
<td>No f/up necessary</td>
</tr>
<tr>
<td>Duct Ectasia</td>
<td>Post-menopausal</td>
<td>Slit-like nipple</td>
<td>Need to distinguish from Ca</td>
</tr>
<tr>
<td>Duct dilatation</td>
<td>- 50-60yrs</td>
<td>Often bilateral</td>
<td>Surgical duct excision if mass present or discharge troublesome</td>
</tr>
<tr>
<td></td>
<td></td>
<td>± peri-areolar mass</td>
<td>Close f/up</td>
</tr>
<tr>
<td>Periductal Mastitis</td>
<td>Smokers 30yrs</td>
<td>Painful, erythematous sub-areolar mass</td>
<td>Broad-spectrum Abx</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Assoc. with inverted nipple ± purulent discharge</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>May → abscess or discharging fistula</td>
<td></td>
</tr>
</tbody>
</table>

### Benign Epithelial Lesions

<table>
<thead>
<tr>
<th>Disease</th>
<th>Patient</th>
<th>Presentation</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benign Mammary Dysplasia</td>
<td>30-50yrs</td>
<td>Pre-menstrual breast nodularity and pain</td>
<td>Triple assessment.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Often in upper outer quadrant</td>
<td>Reassurance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Tender “lumpy-bumpy” breasts</td>
<td>Analgesia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aberration of Normal Development and</td>
<td>Good Bra</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Involution (ANDI)</td>
<td>± evening primrose oil</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Fibroadenosis</td>
<td>Danazol may occasionally be used</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Cyst formation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Epitheliosis (hyperplasia)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Papillomatosis</td>
<td></td>
</tr>
<tr>
<td>Cystic Disease</td>
<td>Peri-menopausal</td>
<td>Distinct, fluctuant round mass</td>
<td>Aspiration: green-brown fluid</td>
</tr>
<tr>
<td></td>
<td>&gt;40</td>
<td>Often painful</td>
<td>Persistence or blood → triple assessment.</td>
</tr>
<tr>
<td>Duct Papilloma</td>
<td>40-50yrs</td>
<td>Common cause of bloody discharge</td>
<td>Triple assessment.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not usually palpable</td>
<td>Excise due to ↑ risk of Ca</td>
</tr>
</tbody>
</table>
## Stromal Tumours

<table>
<thead>
<tr>
<th>Disease</th>
<th>Patient</th>
<th>Presentation</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fibroadenoma</td>
<td>&lt;35yrs Rare post-menopause ↑ in Blacks</td>
<td>Commonest benign tumour Painless, mobile, rubbery mass Often multiple and bilateral Popcorn calcification</td>
<td>Reassurance + f/up if &lt;2.5cm Shell-out surgically - &gt;2.5cm - FH of breast Ca - Pt. choice</td>
</tr>
<tr>
<td>Phyllodes tumour</td>
<td>50s+</td>
<td>Large, fast growing mass Mobile, non-tender Epithelial and connective tissue elements</td>
<td>WLE</td>
</tr>
</tbody>
</table>

## Malignant Conditions

<table>
<thead>
<tr>
<th>Disease</th>
<th>Clinical</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCIS</td>
<td>Presents as Microcalcification on mammogram Rarely assoc. with symptoms: - lump - discharge - eczematous change = Paget's disease → Ca @ 1%/yr (10x ↑ risk) in ipsilateral breast</td>
<td>WLE + radiotherapy Extensive or multifocal → mastectomy + reconstruction + SNB</td>
</tr>
<tr>
<td>Paget's</td>
<td>Unilat, scaly, erythematous, itchy +/- palpable mass (invasive carcinoma)</td>
<td>Usually underlying invasive or DCIS breast cancer. Mastectomy + radio ± chemo/endo</td>
</tr>
<tr>
<td>LCIS</td>
<td>Incidental biopsy finding (no calcification) Often bilat (20-40%) Young women ↑ risk Ca risk (x10) in both breasts</td>
<td>Bilateral prophylactic mastectomy or close watching ± mammographic screening</td>
</tr>
</tbody>
</table>
Chronic Limb Ischaemia: Presentation and Classification

Incidence
- 5% of males >50yrs have intermittent claudication

Definition
- European Working Group Definition (1991)
- Ankle artery pressure <50mmHg (toe <30mmHg)
- And either:
  - Persistent rest pain requiring analgesia for ≥2wks
  - Ulceration or gangrene

Cause
- Atherosclerosis
  - Typically asymptomatic until 50% stenosis
  - (vasculitis and fibromuscular dysplasia are v. rare causes)

Atherosclerosis Summary
1. Endothelial injury: haemodynamic, HTN, ↑ lipids
2. Chronic inflammation
   - Lipid-laden foam cells produce GFs, cytokines, ROS and MMPs
   - → lymphocyte and SMC recruitment
3. SM proliferation: conversion of fatty streak to atherosclerotic plaque

NB. Arteriosclerosis = general arterial hardening
Atherosclerosis = arterial hardening specifically due to atheroma

Atheroma Pathology
- Fibrous cap: SM cells, lymphocytes, collagen
- Necrotic centre: cell debris, cholesterol, Ca, foam cells

Risk Factors

<table>
<thead>
<tr>
<th>Modifiable</th>
<th>Non-modifiable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking</td>
<td>FH and PMH</td>
</tr>
<tr>
<td>BP</td>
<td>Male</td>
</tr>
<tr>
<td>DM control</td>
<td>↑ age</td>
</tr>
<tr>
<td>Hyperlipidaemia</td>
<td>Genetic</td>
</tr>
<tr>
<td>↓ exercise</td>
<td></td>
</tr>
</tbody>
</table>

Associated Vascular Disease
- IHD: 90%
- Carotid stenosis: 15%
- AAA
- Renovascular disease
- DM microvascular disease

Presentation

Intermittent Claudication
- Cramping pain after walking a fixed distance
- Pain rapidly relieved by rest
- Calf pain = superficial femoral disease (commonest)
- Buttock pain = iliac disease (internal or common)

Critical Limb Ischaemia: Fontaine 3 or 4
- Rest pain
  - Especially @ night
  - Usually felt in the foot
  - Pt. hangs foot out of bed
  - Due to ↓ CO and loss of gravity help
  - Ulceration
  - Gangrene

Leriche's Syndrome: Aortoiliac Occlusive Disease
- Atherosclerotic occlusion of abdominal aorta and iliacs
- Triad
  - Buttock claudication and wasting
  - Erectile dysfunction
  - Absent femoral pulses

Buerger’s Disease: Thromboangiitis Obliterans
- Young, male, heavy smoker
- Acute inflammation and thrombosis of arteries and veins in the hands and feet → ulceration and gangrene

Signs
- Pulses: pulses and ↑ CRT (norm ≤2sec)
- Ulcers: painful, punched-out, on pressure points
- Nail dystrophy / Onycholysis
- Skin: cold, white, atrophy, absent hair
- Venous guttering
- Muscle atrophy
- ↓ Buerger’s Angle
  - ≥90: normal
  - 20-30: ischaemia
  - <20: severe ischaemia
- +ve Buerger’s Sign
  - Reactive hyperaemia due to accumulation of deoxygenated blood in dilated capillaries

Clinical Classification

Fontaine
1. Asympto (subclinical)
2. Intermittent claudication
   a. >200m
   b. <200m
3. Ischaemic rest pain
4. Ulceration / gangrene

Rutherford
1. Mild claudication
2. Moderate claudication
3. Severe claudication
4. Ischaemic rest pain
5. Minor tissue loss
6. Major tissue loss
Chronic Limb Ischaemia: Investigation and Management

Ix

Doppler Waveforms
- Normal: triphasic
- Mild stenosis: biphasic
- Severe stenosis: monophasic

ABPI

<table>
<thead>
<tr>
<th>Clinical</th>
<th>Fontaine</th>
<th>ABPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcification: CRF, DM</td>
<td></td>
<td>&gt;1.4</td>
</tr>
<tr>
<td>Normal</td>
<td></td>
<td>≥1</td>
</tr>
<tr>
<td>Asymptomatic</td>
<td>Fontaine 1</td>
<td>0.8-0.9</td>
</tr>
<tr>
<td>Claudication</td>
<td>Fontaine 2</td>
<td>0.6-0.8</td>
</tr>
<tr>
<td>Rest pain</td>
<td>Fontaine 3</td>
<td>0.3-0.6</td>
</tr>
<tr>
<td>Ulceration and gangrene</td>
<td>Fontaine 4</td>
<td>&lt;0.3</td>
</tr>
</tbody>
</table>

NB. Falsely high results may be obtained in DM / CRF due to calcification of vessels: mediasclerosis
- Use toe pressure with small cuff: <30mmHg

Walk test
- Walk on treadmill @ certain speed and incline to establish maximum claudication distance.
- ABPI measured before and after: 20% ↓ is sig

Bloods
- FBC + U+E: anaemia, renovascular disease
- Lipids + glucose
- ESR: arteritis
- G+S: possible procedure

Imaging: assess site, extent and distal run-off
- Colour duplex US
- CT / MR angiogram: gadolinium contrast
- Digital subtraction angiography
  - Invasive: ∴ not commonly used for Dx only.
  - Used when performing therapeutic angioplasty or stenting

Other
- ECG: ischaemia

Conservative Mx
- Most pts. c̄ claudication can be managed conservatively
- ↑ exercise and employ exercise programs
- Stop smoking
- Wt. loss
- Foot care
- Prog: 1/3 improve, 1/3 stay the same, 1/3 deteriorate

Medical Mx
- Risk factors: BP, lipids, DM
  - β-B don’t worsen intermittent claudication but use c caution in CLI
- Antiplatelets: aspirin / clopidogrel
- Analgesia: may need opiates
- (Parenteral prostanoids ↓ pain in pts. unfit for surgery)

Endovascular Mx
- Percutaneous Transluminal Angioplasty ± stenting
- Good for short stenosis in big vessels: e.g. iliacs, SFA
- Lower risk for pt.: performed under LA as day case
- Improved inflow → ↓ pain but restoration of foot pulses is required for Rx of ulceration / gangrene.

Surgical Reconstruction

Indications
- V. short claudication distance (e.g. <100m)
- Symptoms greatly affecting pts. QoL
- Development of rest pain

Pre-op assessment
- Need good optimisation as likely to have cardiorespiratory co-morbidities.

Practicalities
- Need good proximal supply and distal run-off
- Saphenous vein grafts preferred below the IL
- More distal grafts have ↑ rates of thrombosis

Classification
- Anatomical: fem-pop, fem-distal, aortobifemoral
- Extra-anatomical: axillo-fem / -bifem, fem-fem crossover

Other
- Endarterectomy: core-out atheromatous plaque
- Sympathectomy: chemical (EtOH injection) or surgical
  - Caution in DM c neuropathy
- Amputation

Prognosis

1yr after onset of CLI
- 50% alive w/o amputation
- 25% will have had major amputation
- 25% dead (usually MI or stroke)

Following amputation
- Perioperative mortality
  - BK: 5-10%
  - AK: 15-20%
- 1/3 → complete autonomy
- 1/3 → partial autonomy
- 1/3 → dead
Acute Limb Ischaemia

Definitions
- Acute: ischaemia <14d
- Acute on chronic: worsening symptoms and signs <14d
- Chronic: ischaemia stable for >14d

Severity
- Incomplete: limb not threatened
- Complete: limb threatened
  - Loss of limb unless intervention w/i 6hrs
- Irreversible: requires amputation

Causes
- Thrombosis in situ (60%)
  - A previously stenosed vessel c plaque rupture
  - Usually incomplete ischaemia
- Embolism (30%)
  - 80% from LA in AF
  - Valve disease
  - Iatrogenic from angioplasty / surgery
  - Cholesterol in long bone #
  - Paradoxical (venous via PFO)
  - Typically lodge at femoral bifurcation
  - Often complete ischaemia
- Graft / stent occlusion
- Trauma
- Aortic dissection

Presentation: 6Ps
- Pale
- Pulseless
- Perishingly cold
- Painful
- Paraesthesia
- Paralysis

Thrombosis vs. Embolus

<table>
<thead>
<tr>
<th></th>
<th>Thrombosis</th>
<th>Embolus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onset</td>
<td>Hrs-days</td>
<td>Sudden</td>
</tr>
<tr>
<td>Severity</td>
<td>Less severe - collaterals</td>
<td>Profound ischaemia</td>
</tr>
<tr>
<td>Embolic source</td>
<td>Present - often AF</td>
<td></td>
</tr>
<tr>
<td>Claudication Hx</td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>Contralat pulses</td>
<td>Absent</td>
<td>Present</td>
</tr>
<tr>
<td>Dx</td>
<td>Angiography</td>
<td>Clinical</td>
</tr>
<tr>
<td>Rx</td>
<td>Thrombolysis</td>
<td>Embolectomy + Warfarin</td>
</tr>
</tbody>
</table>

I x
- Blood
  - FBC, U+E, INR, G+S
  - CK
- ECG
- Imaging
  - CXR
  - Duplex doppler

General Mx
- In an acutely ischaemic limb discuss immediately c a senior as time is crucial.
- NBM
- Rehydration: IV fluids
- Analgesia: morphine + metoclopramide
- Abx: e.g augmentin if signs of infection
- Unfractionated heparin IVI: prevent extension
- Complete occlusion?
  - Yes: urgent surgery: embolectomy or bypass
  - No: angiogram + observe for deterioration

Angiography
- Not performed if there is complete occlusion as it introduces delay: take straight to theatre.
- If incomplete occlusion, pre-op angio will guide any distal bypass.

Embolus Mx
1. Embolectomy
- Under LA or GA
- Wire fed through embolus
- Fogarty catheter fed over the top
- Balloon inflated and catheter withdrawn, removing the embolism.
- Send embolism for histo (exclude atrial myxoma)
- Adequacy confirmed by on-table angiography
2. Thrombolysis
- Consider if embolectomy unsuccessful
- E.g. local injection of TPA
3. Other options
- Emergency reconstruction
- Amputation

Post-embolectomy
- Anticoagulate: heparin IVI → warfarin
- ID embolic source: ECG, echo, US aorta, fem and pop
- Complications
  - Reperfusion injury
    - Local swelling → compartment syndrome
    - Acidosis and arrhythmia 2° to ↑K
    - ARDS
    - Gl oedema → endotoxic shock
  - Chronic pain syndromes

Thrombosis Mx
- Emergency reconstruction if complete occlusion
- Angiography + angioplasty
- Thrombolysis
- Amputation

Manage Cardiovascular Risk Factors
Carotid Artery Disease

Definitions
- **Stroke**: sudden neurological deficit of vascular origin lasting >24h
- **TIA**: sudden neurological deficit of vascular origin lasting <24h (usually lasts <1h) followed by complete recovery

Pathogenesis
- **Turbulent flow → ↓ shear stress @ carotid bifurcation** promoting atherosclerosis and plaque formation.
- **Plaque rupture → complete occlusion or distal emboli**
- **Cause 15-25% of CVA/TIA**

Presentation
- **Bruit**
- **CVA/TIA**

Ix
- **Duplex carotid Doppler**
- **MRA**

Mx

Conservative
- Aspirin or clopidogrel
- Control risk factors

Surgical: Endarterectomy
- **Symptomatic (ECST, NASCET)**
  - ≥70% (5% stroke risk per yr)
  - ≥50% if low risk (<3%, typically <75yrs)
  - Perform within 2wks of presentation
- **Asymptomatic (ACAS, ACST)**
  - ≥60% benefit if low risk

Complications of Endarterectomy
- Stroke or death: 3%
- HTN: 60%
- Haematoma
- MI
- Nerve injury
  - Hypoglossal: ipsilateral tongue deviation
  - Great auricular: numb ear lobe
  - Recurrent laryngeal: hoarse voice, bovine cough

Stenting
- Less invasive: ↓ hospital stay, ↓ infection, ↓ CN injury
- There is concern over ↑ stroke risk, esp. pts. >70yrs
- Meta-analysis shows no sig difference in mortality vs. CEA @ 120d
- Younger pts. have best risk / benefit ratio

Aneurysms

Definition
- Abnormal dilatation of a blood vessel > 50% of its normal diameter.

Classification
- **True Aneurysm**
  - Dilatation of a blood vessel involving all layers of the wall and is >50% of its normal diameter
  - Two different morphologies
    - Fusiform: e.g AAA
    - Saccular: e.g Berry aneurysm
- **False Aneurysm**
  - Collection of blood around a vessel wall that communicates with the vessel lumen.
  - Usually iatrogenic: puncture, cannulation
- **Dissection**
  - Vessel dilatation caused by blood splaying apart the media to form a channel within the vessel wall.

Causes
- **Congenital**
  - ADPKD → Berry aneurysms
  - Marfan’s, Ehlers-Danlos
- **Acquired**
  - Atherosclerosis
  - Trauma: e.g. penetrating trauma
  - Inflammatory: Takayasu’s aortitis, HSP
  - Infection
    - Mycotic: SBE
    - Tertiary syphilis (esp. thoracic)

Complications
- Rupture
- Thrombosis
- Distal embolization
- Pressure: DVT, oesophagus, nutcracker syndrome
- Fistula (IVC, intestine)

Popliteal Aneurysm
- Less common cf. AAA
- 50% of pts. with popliteal aneurysm also have AAA

Presentation
- Very easily palpable popliteal pulse
- 50% bilateral
- Rupture is relatively rare
- Thrombosis and distal embolism is main complication
  - → acute limb ischaemia

Mx
- Acute: embolectomy or fem-distal bypass
- Stable: elective grafting + tie off vessel
Abdominal Aortic Aneurysms

Epidemiology

- **Prevalence**: ~5% >50yrs
- **Mortality**: 10,000 deaths/yr
- **Sex**: M>F=3:1

Pathology

- Dilatation of the abdominal aorta ≥3cm
- 90% infrarenal
- 30% involve the iliac arteries

Presentation

- Usually asympto: discovered incidentally
- May → back pain or umbilical pain radiating to groin
- Acute limb ischaemia
- Blue toe syndrome: distal embolisation
- Acute rupture

Examination

- Expansile mass just above the umbilicus
- Bruits may be heard
- Tenderness + shock suggests rupture

Ix

- AXR: calcification may be seen
- Abdo US: screening and monitoring
- CT / MRI: gold-standard
- Angiography
  - Won’t show true extent of aneurysm due to endoluminal thrombus.
  - Useful to delineate relationship of renal arteries

Mx

Conservative

- Manage cardiovascular risk factors: esp. BP
- UK Small Aneurysm Trial suggested that AAA <5.5cm in maximum diameter can be monitored by US (/CT)
  - <4cm: yearly monitoring
  - 4-5.5cm: 6 monthly monitoring

Surgical

- Aim to treat aneurysm before it ruptures.
  - Elective mortality: 5%
  - Emergency mortality: 50%
- Operate when risk of rupture > risk of surgery

Indications

- Symptomatic (back pain = imminent rupture)
- Diameter >5.5cm
- Rapidly expanding: >1cm/yr
- Causing complications: e.g. emboli

Open or EVAR

- EVAR has ↓ perioperative mortality
- No ↓ mortality by 5yrs due to fatal endograft failures.
- EVAR not better than medical Rx in unfit pts.

Screening

MASS trial revealed 50% ↓ aneurysm-related mortality in males aged 65-74 screened c US.
UK men offered one-time US screen @ 65yrs

AAA Rupture

Rupture Rates

- <5.5cm = 1% / yr
- >6cm = 25% / yr
- ↑ risk if:
  - ↑BP
  - Smoker
  - Female
  - Strong FH

Rupture Presentation

- Sudden onset severe abdominal pain
  - Intermittent or continuous
  - Radiates to back or flanks (don’t dismiss as colic)
- Collapse → shock
- Expansile abdominal mass

Mx: a surgical emergency

- High flow O₂
- 2 x large bore cannulae in each ACF
  - Give fluid if shocked but keep SBP <100mmHg
  - Give O- blood if desperate
  - Blood: FBC, U+E, clotting, amylase, xmatch 10u
- Instigate the major haemorrhage protocol
- Call vascular surgeon, anaesthetist and warn theatre
- Analgesia
- Abx prophylaxis: cef + met
- Urinary catheter + CVP line
- If stable + Dx uncertain: US or CT may be feasible
- Take to theatre: clamp neck, insert dacron graft

Mortality

- 100% w/o surgery
- 50% c surgery
Thoracic Aortic Dissection

Definition

- Blood splays apart the laminar planes of the media to form a channel within the aortic wall.

Aetiology

- Atherosclerosis and HTN cause 90%
- Minority caused by connective tissue disorder
  - Marfan’s, Ehlers Danlos
  - Vitamin C deficiency

Presentation

- Sudden onset, tearing chest pain
  - Radiates through to the back
  - Tachycardia and hypertension (1st sympathetic)
- Distal propagation → sequential occlusion of branches
  - Left hemiplegia
  - Unequal arm pulses and BP
  - Paraplegia (anterior spinal A.)
  - Anuria
- Proximal propagation
  - Aortic regurgitation
  - Tamponade
- Rupture into pericardial, pleural or peritoneal cavities
  - Commonest cause of death

Stanford Classification

Type A: Proximal
- 70%
- Involves ascending aorta ± descending
- Higher mortality due to probable cardiac involvement
- Usually require surgery

Type B: Distal
- 30%
- Involves descending aorta only: distal to L SC artery
- Usually best managed conservatively

Ix

- ECG: exclude MI
- TTE / TOE: can be used in haemodynamically unstable pts
- CT/MRI: not suitable for unstable pts.

Mx

Resuscitate

Investigate

- Bloods: x-match 10u, FBC, U+E, clotting, amylase
- ECG: 20% show ischaemia due to involvement of the coronary ostia
- Imaging
  - CXR
  - CT/MRI: not if haemodynamically unstable
  - TOE: can be used if haemodynamically unstable

Treat

- Analgesia
- ↓SBP
  - Labetalol or esmolol (short t½)
  - Keep SBP 100-110mmHg
- Type A: open repair
  - Acute operative mortality: <25%
- Type B: conservative initially
  - Surgery if persistent pain or complications
  - Consider TEVAR if uncomplicated

Gangrene

Definition

- Death of tissue from poor vascular supply.

Classification

- Wet: tissue death + infection
- Dry: tissue death only
- Pregangrene: tissue on the brink of gangrene

Presentation

- Black tissues ± slough
- May be suppuration ± sepsis

Gas Gangrene

- Clostridium perfringens myositis
- RFs: DM, trauma, malignancy

- Presentation
  - Toxaemia
  - Haemolytic jaundice
  - Oedema
  - Crepitus from surgical emphysema
  - Bubbly brown pus

- Rx
  - Debridement (may need amputation)
  - Benzylpenicillin + metronidazole
  - Hyperbaric O₂

Synergistic Gangrene

- Involves aerobes + anaerobes
- Fournier’s: perineum
- Meleney’s: post-op ulceration
- Both progress rapidly to necrotising fasciitis + myositis

Mx

- Take cultures
- Debridement (including amputation)
- Benzylpenicillin ± clindamycin
Varicose Veins

**Definition**
- Tortuous, dilated veins of the superficial venous system

**Pathophysiology**
- One-way flow from sup → deep maintained by valves
- Valve failure → ↑ pressure in sup veins → varicosity
- 3 main sites where valve incompetence occurs:
  - SFJ: 3cm below and 3cm lateral to pubic tubercle
  - SPJ: popliteal fossa
  - **Perforators**: draining GSV
    - 3 medial calf perforators (Cockett’s)
    - 1 medial thigh perforator (Hunter’s)

**Causes**

**Primary**
- Idiopathic (congenitally weak valves)
  - Prolonged standing
  - Pregnancy
  - Obesity
  - OCP
  - FH
- Congenital valve absence (v. rare)

**Secondary**
- Valve destruction → reflux: DVT, thrombophlebitis
- Obstruction: DVT, foetus, pelvic mass
- Constipation
- AVM
- Overactive pumps (e.g. cyclists)
- Klippel-Trenaunay
  - PWS, varicose veins, limb hypertrophy

**Symptoms**
- Cosmetic defect
- Pain, cramping, heaviness
- Tingling
- Bleeding: may be severe
- Swelling

**Signs**
- Skin changes
  - Venous stars
  - Haemosiderin deposition
  - Venous eczema
  - Lipodermatosclerosis (panniculitis)
  - Atrophie blanche
- Ulcers: medial malleolus / gaiter area
- Oedema
- Thrombophlebitis

**Ix**
- **Duplex ultrasonography**
  - Anatomy
  - Presence of incompetence
  - Caused by obstruction or reflux
- Surgery: FBC, U+E, clotting, G+S, CXR, ECG

**Conservative Mx**
- Treat any contributing factors
  - Lose weight
  - Relieve constipation
- **Education**
  - Avoid prolonged standing
  - Regular walks
- **Class II Graduated Compression Stockings**
  - 18-24mmHg
  - Symptomatic relief and slows progression
- **Skin Care**
  - Maintain hydration c emollients
  - Treat ulcers rapidly

**Minimally Invasive Therapies**

**Indications**
- Small below knee varicosities not involving GSV or SSV

**Techniques**
- Local or GA
- Injection sclerotherapy: 1% Na tetradecyl sulphate
- Endovenous laser or radiofrequency ablation

**Post-Operatively**
- Compression bandage for 24hrs
- Compression stockings for 1mo

**Surgical Mx**

**Indications**
- SFJ incompetence
- Major perforator incompetence
- Symptomatic: ulceration, skin changes, pain

**Procedures**
- **Trendelenberg**: saphenofemoral ligation
- **SSV ligation**: in the popliteal fossa
- **LSV stripping**: no longer performed due to potential for saphenous nerve damage.
- **Multiple avulsions**
- **Perforator ligation**: Cockett’s operation
- **Subfascial endoscopic perforator surgery (SEPS)**

**Post-op**
- Bandage tightly
- Elevate for 24h
- Discharged c compression stockings and instructed to walk daily.

**Complications**
- Haematoma (esp. groin)
- Wound sepsis
- Damage to cutaneous nerve (e.g. long saphenous)
- Superficial thrombophlebitis
- DVT
- Recurrence: may approach 50%
Leg Ulcers

Definition
- Interruption in the continuity of an epithelial surface

Causes
- Venous: commonest
- Arterial: large or small vessel
- Neuropathic: EtOH, DM
- Traumatic: e.g. pressure
- Systemic disease: e.g. pyoderma gangrenosum
- Neoplastic: SCC

Venous: 75%
- Painless, sloping, shallow ulcers
- Usually on medial malleolus: “gaiter area”
- Assoc. c ¯ haemosiderin deposition and lipodermatosclerosis
- RFs: venous insufficiency, varicosities, DVT, obesity

Arterial: 2%
- Hx of vasculopathy and risk factors
- Painful, deep, punched out lesions
- Occur @ pressure points
  - Heal
  - Tips of. and between, toes
  - Metatarsal heads (esp. 5’’)
- Other signs of chronic leg ischaemia

Neuropathic
- Painless c ¯ insensate surrounding skin
- Warm foot c ¯ good pulses

Complications
- Osteomyelitis
- Development of SCC in the ulcer (Marjolin’s ulcer)

Ix
- ABPI if possible
- Duplex ultrasonography
- Biopsy may be necessary
  - Look for malignant change: Marjolin’s ulcer

Mx of Venous Ulcers
- Refer to leg ulcer community clinic
- Focus on prevention
  - Graduated compression stockings
  - Venous surgery
- Optimise risk factors: nutrition, smoking

Specific Rx
- Analgesia
- Bed Rest + Elevate leg
- 4 layer graded compression bandage (if ABPI >0.8)
- Pentoxifylline PO
  - ↑ microcirculatory blood flow
  - Improves healing rates

Other Options (no proven benefit)
- Desloughing: e.g. larval therapy, hydrogel
- Topical antiseptics: iodine, Manuka honey
- Split-thickness skin grafting may be considered

Leg Swelling

Differential

Bilateral
- ↑ Venous Pressure
  - RHF
  - Venous insufficiency
  - Drugs: e.g. nifedipine
- ↓ Oncotic Pressure
  - Nephrotic syndrome
  - Hepatic failure
  - Protein losing enteropathy

Lymphoedema
- Myxoedema
  - Hyper- / hypo-thyroidism

Unilateral
- Venous insufficiency
- DVT
- Infection or inflammation
- Lymphoedema

Lymphoedema
- Collection of interstitial fluid due to blockage or absence of lymphatics

Primary
- Congenital absence of lymphatics
- May or may not be familial

Presentation
- Congenital: evident from birth
- Praecox: after birth but <35yrs
- Tarda: >35yrs

Milroy’s Syndrome
- Familial AD subtype of congenital lymphoedema
- F>M

Secondary: FIIT
- Fibrosis: e.g. post-radiotherapy
- Infiltration
  - Ca: prostate, lymphoma
  - Filariasis: Wuchereria bancrofti
- Infection: TB
- Trauma: block dissection of lymphatics

Ix
- Doppler US
- Lymphoscintigraphy
- CT / MRI

Mx
- Conservative
  - Skin care
  - Compression stocking
  - Physio
  - Treat or prevent comorbid infections
- Surgical: debulking operation
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Urinary Tract Obstruction

Causes

Luminal
- Stones
- Blood clots
- Sloughed papilla

Mural
- Congenital / acquired stricture
- Tumour: renal, ureteric, bladder
- Neuromuscular dysfunction

Extramural
- Prostatic enlargement
- Abdo / pelvic mass / tumour
- Retroperitoneal fibrosis

Presentation

Acute
- **Upper Urinary Tract**
  - Loin pain → groin
- **Lower Urinary Tract**
  - Bladder outflow obstruction precedes severe suprapubic pain ⇒ distended palpable bladder

Chronic
- **Upper Urinary Tract**
  - Flank pain
  - Renal failure (may be polyuric)
- **Lower Urinary Tract**
  - Frequency, hesitancy, poor stream, terminal dribbling, overflow incontinence
  - Distended, palpable bladder ± large prostate

Ix
- **Bloods**: FBC, U+E
- **Urine**: dip, MC+S
- **Imaging**
  - US: hydronephrosis or hydroureter
  - Anterograde / retrograde ureterograms
    - Allow therapeutic drainage
  - Radionucleotide imaging: renal function
  - CT / MRI

Mx

Upper Urinary Tract
- Nephrostomy
- Ureteric stent

Lower Urinary Tract
- Urethral or suprapubic catheter
  - May be a large post-obstructive diuresis

Complications of Ureteric Stents

Common
- Infection
- Haematuria
- Trigonal irritation
- Encrustation

Rare
- Obstruction
- Ureteric rupture
- Stent migration

Urethral Stricture

Aetiology
- Trauma
  - Instrumentation
  - Pelvic #s
- Infection: e.g. gonorrhoea
- Chemotherapy
- Balantitis xerotica obliterans

Presentation: voiding difficulty
- Hesitancy
- Strangury
- Poor stream
- Terminal dribbling
- Pis en deux

Examination
- PR: exclude prostatic cause
- Palpate urethra through penis
- Examine meatus

Ix
- Urodynamics
  - ↓ peak flow rate
  - ↑ micturition time
- Urethroscopy and cystoscopy
- Retrograde urethrogram

Mx
- Internal urethrotomy
- Dilatation
- Stent

Obstructive Uropathy

Pathogenesis
- Acute retention on a chronic background may go unnoticed for days due to lack of pain.
- Se Cr may be up to 1500uM
- Renal function should return to normal over days
- Some background impairment may remain.

Complications

Hyperkalaemia
Metabolic acidosis

Post-obstructive diuresis
- Kidneys produce a lot of urine in the acute phase after relief of obstruction.
- Must keep up c cân. losses to avoid dehydration.

Na and HCO₃ losing nephropathy
- Diuresis may → loss of Na and HCO₃
- May require replacement cân. 1.26% NaHCO₃

Infection
Urinary Retention

Causes

Obstructive
- Mechanical
  - BPH
  - Urethral stricture
  - Clots, stones
  - Constipation
- Dynamic: ↑ smooth muscle tone (α-adrenergic)
  - Post-operative pain
  - Drugs

Neurological
- Interruption of sensory or motor innervation
  - Pelvic surgery
  - MS
  - DM
  - Spinal injury / compression

Myogenic
- Over-distension of the bladder
  - Post-anaesthesia
  - High EtOH intake

Acute Urinary Retention (AUR)

Clinical Features
- Suprapubic tenderness
- Palpable bladder
  - Dull to percussion
  - Can’t get beneath it
- Large prostate on PR
- Check anal tone and sacral sensation
- <1L drained on catheterisation

Ix
- Blood: FBC, U+E, PSA (prior to PR)
- Urine: dip, MC+S
- Imaging
  - US: bladder volume, hydronephrosis
  - Pelvic XR

Mx

Conservative
- Analgesia
- Privacy
- Walking
- Running water or hot bath

Catheterise
- Use correct catheter: e.g. 3-way if clots
- ± STAT gent cover
- Hrly UO + replace: post-obstruction diuresis
- Tamsulosin: ↓ risk of recatheterisation after retention
- TWOC after 24-72h
  - May d/c and f/up in OPD
  - More likely to be successful if predisposing factor and lower residual volume (<1L)

TURP
- Failed TWOC
- Impaired renal function
- Elective

Chronic Urinary Retention (CUR)

Classification
- High Pressure
  - High detrusor pressure @ end of micturition
  - Typically bladder outflow obstruction
  - → bilateral hydronephrosis and ↓ renal function
- Low Pressure
  - Low detrusor pressure @ end of micturition
  - Large volume retention & very compliant bladder
  - Kidney able to excrete urine
  - No hydronephrosis & normal renal function

Presentation
- Insidious as bladder capacity ↑↑ (>1.5L)
- Typically painless
- Overflow incontinence / nocturnal enuresis
- Acute on chronic retention
- Lower abdo mass
- UTI
- Renal failure

Mx

High-Pressure
- Catheterise if
  - Renal impairment
  - Pain
  - Infection
- Hrly UO + replace: post-obstruction diuresis
- Consider TURP before TWOC

Low-Pressure
- Avoid catheterisation if possible
  - Risk of introducing infection
- Early TURP
  - Often do poorly due to poor detrusor function
  - Need CISC or permanent catheter

Suprapubic Catheterisation

Advantages
- ↓ UTIs
- ↓ stricture formation
- TWOC w/o catheter removal
- Pt. preference: ↑ comfort
- Maintain sexual function

Disadvantages
- More complex: need skills
- Serious complications can occur

CI
- Known or suspected bladder carcinoma
- Undiagnosed haematuria
- Previous lower abdominal surgery
  - → adhesion of small bowel to abdo wall

Clean Intermittent Self-Catheterisation
- Alternative to indwelling catheter in AUR and CUR
- Also useful in pts. who fail to void after TURP
Haematuria

False
- Beetroot
- Rifampicin
- Porphyria
- PV bleed

True

General
- HSP
- Bleeding diathesis

Renal
- Infarct
- Trauma: inc. stones
- Infection
- Neoplasm
- GN
- Polycystic kidneys

Ureter
- Stone
- Tumour

Bladder
- Infection
- Stones
- Tumour
- Exercise

Prostate
- BPH
- Prostatitis
- Tumour

Urethra
- Infection
- Stones
- Trauma
- Tumour

Clinical Features
- Timing?
  - Beginning of stream: urethral
  - Throughout stream: renal / systemic, bladder
  - End of stream: bladder stone, schisto
- Painful or painless?
- Obstructive symptoms?
- Systemic symptoms: wt. loss, appetite

Ix
- Bloods: FBC, U+E, clotting
- Urine: dip, MC+S, cytology
- Imaging
  - Renal US
  - IVU
  - Flexible cystoscopy + biopsy
  - CT/MRI
  - Renal angio

Peri-Aortitis

Aetiology
- Idiopathic retroperitoneal fibrosis
- Inflammatory AAAs
- Perianeurysmal RPF
- RPF 2° to malignancy: e.g. lymphoma

Idiopathic Retroperitoneal Fibrosis
- Autoimmune vasculitis
- Fibrinoid necrosis of vasa vasorum
- Affects aorta and small/medium sized retroperitoneal vessels.
- Ureters are embedded in dense, fibrous tissue → bilateral obstruction

Associations
- Drugs: β-B, bromocriptine, methysergide, methyldopa
- AI disease: thyroiditis, SLE, ANCA+ vasculitis
- Smoking
- Asbestos

Presentation
- Middle-aged male
- Vague loin, back or abdo pain
- ↑ BP
- Chronic urinary tract obstruction

Ix
- Blood: ↑U and Cr, ↑ESR/CRP, ↓Hb
- US: bilateral hydronephrosis + medial ureteric deviation
- CT/MRI: peri-aortic mass
  - Biopsy: exclude Ca

Rx
- Relieve obstruction: retrograde stent placement
- Ureterolysis: dissection of ureters from retroperitoneal tissue.
- ± immunosuppression

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Urolithiasis: Pathophysiology and Presentation

Epidemiology
- Lifetime incidence: 15%
- Young men
  - Peak age: 20-40yrs
  - Sex: M>F=3:1

Pathophysiology
- ↑ concentration of urinary solute
- ↓ urine volume
- Urinary stasis

Common Anatomical Sites
- Pelviureteric junction
- Crossing the iliac vessels at the pelvic brim
- Under the vas or uterine artery
- Vesicoureteric junction

Stone Types
- Calcium oxalate: 75%
  - ↑ risk in Crohn’s
- Triple phosphate (struvite): 15%
  - Ca Mg NH₄ – phosphate
  - May form staghorn calculi
  - Assoc. c̅ proteus infection
- Urate: 5% (radiolucent)
  - Double if confirmed gout
- Cystine: 1% (faint)
  - Assoc. c̅ Fanconi Syn.

Associated Factors
- Dehydration
- Hypercalcaemia: 1⁰ HPT, immobilisation
- ↑ oxalate excretion: tea, strawberries
- UTIs
- Hyperuricaemia: e.g. gout
- Urinary tract abnormalities: e.g. bladder diverticulae
- Drugs: frusemide, thiazides

Presentation

Ureteric Colic
- Severe loin pain radiating to the groin
- Assoc. c̅ n/v
- Pt. cannot lie still

Bladder or Urethral Obstruction
- Bladder irritability: frequency, dysuria, haematuria
- Strangury: painful urinary tenesmus
- Suprapubic pain radiating → tip of penis or in labia
- Pain and haematuria worse at the end of micturition

Other Possible Features
- UTI
- Haematuria
- Sterile pyuria
- Anuria

Examination
- Usually no loin tenderness
- Haematuria
Urolithiasis: Ix and Mx

Urine
- Dip: haematuria
- MC+S

Blood
- FBC, U+E, Ca, PO₄, urate

Imaging
KUB XR
- 90% of stones radio-opaque
- Urate stones are radiolucent, cysteine stones are faint

USS: hydronephrosis

Spiral non-contrast CT-KUB
- 99% of stones visible
- Gold standard

IVU
- 600x radiation dose of KUB
- IV contrast injected and control, immediate and serial films taken until contrast @ level of obstruction

Abnormal findings
- Failure of flow to the bladder
- Standing column of contrast
- Clubbing of the calyces: back pressure
- Delayed, dense nephrogram: no flow from kidney

CI
- Contrast allergy
- Severe asthma
- Metformin
- Pregnancy

Functional Scans
- DMSA: dimercaptosuccinic acid
- DTPA: diethylenetriamine penta-acetic acid
- MAG-3

Prevention
- Drink plenty
- Treat UTIs rapidly
- ↓ oxalate intake: chocolate, tea, strawberries

Initial Rx
- Analgesia
  - Diclofenac 75mg PO/IM or 100mg PR
  - Opioids if NSAIDs CI: e.g. pethidine
- Fluids: IV if unable to tolerate PO
- Abx if infection: e.g. cefuroxime 1.5mg IV TDS

Conservative: <5mm in lower 1/3 of ureter
- 90-95% pass spontaneously
- Can discharge pt. c analgesia
- Sieve urine to collect stone for OPD analysis

Medical Expulsive Therapy (MET)

Indications
- Stone 5-10mm
- Stone expected to pass

Drugs
- Nifedipine or tamsulosin
- ± prednisolone
- Most pass w/i 48h, 80% w/i 30d

Active Stone Removal

Indications
- Low likelihood of spontaneous passage: e.g. >10mm
- Persistent obstruction
- Renal insufficiency
- Infection

Extracorporeal Shockwave Lithotripsy (SWL)
- Stones <20mm in kidney or proximal ureter
- SE: renal injury may → ↑BP
- CI: pregnancy, AAA, bleeding diathesis

Ureterorenoscopy (URS) + Dormier Basket Removal
- Stone >10mm in distal ureter or if SWL failed
- Stone >20mm in renal pelvis

Percutaneous Nephrolithotomy (PNL)
- Stone >20mm in renal pelvis
- E.g. staghorn calculi: do DMSA first

Lap or Open Surgery: rare

Febrile Renal Obstruction
- Surgical emergency
- Percutaneous nephrostomy or ureteric stent
- IV Abx: e.g. cefuroxime 1.5g IV TDS

Rx Summary

Conservative: stone <5mm in distal ureter
MET: stone 5-10mm and expected to pass

Active: stones >10mm, persistent pain, renal insufficiency

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Renal Tumours

Renal Cell Carcinoma / Hypernephroma

Epidemiology
- 90% of renal cancers
- Age: 55yrs
- Sex: M>F=2:1

Risk Factors
- Obesity
- Smoking
- HTN
- Dialysis (15% of pts. develop RCC)
- 4% heritable: e.g. VHL syndrome

Pathology
- Adenocarcinoma from proximal renal tubular epithelium
- Subtypes
  - Clear Cell (glycogen): 70-80%
  - Papillary: 15%
  - Chromophobe: 5%
  - Collecting duct: 1%

Presentation
- 50% incidental finding
- Triad: Haematuria, loin pain, loin mass
- Systemic: anorexia, malaise, wt. loss, PUO
- Clot retention
- Invasion of L renal vein → varicocele (1%)
- Cannonball mets → SOB

Paraneoplastic Features
- EPO → polycythaemia
- PTHrP → ↑ Ca
- Renin → HTN
- ACTH → Cushing’s syn.
- Amyloidosis

Spread
- Direct: renal vein
- Lymph
- Haematogenous: bone, liver and lung

Ix
- Blood: polycythaemia, ESR, U+E, ALP, Ca
- Urine: dip, cytology

Imaging
- CXR: cannonball mets
- US: mass
- IVU: filling defect
- CT/MRI

Robson Staging
1. Confined to kidney
2. Involves perinephric fat, but not Garota’s fascia
3. Spread into renal vein
4. Spread to adjacent / distant organs

Mx
- Medical
  - Reserved for pts. c poor prognosis
  - Temsirolimus (mTOR inhibitor)
- Surgical
  - Radical nephrectomy
  - Consider partial if small tumour or 1 kidney

Prognosis: 45%, 5yrs

Transitional Cell Carcinoma

Epidemiology
- 2nd commonest renal cancer
- Age: 50-80yrs
- Sex: M>F=4:1

Risk Factors
- Smoking
- Amine exposure (rubber industry)
- Cyclophosphamide

Pathology
- Highly malignant
- Locations
  - Bladder: 50%
  - Ureter
  - Renal pelvis

Presentation
- Painless haematuria
- Frequency, urgency, dysuria
- Urinary tract obstruction

Ix
- Urine cytology
- CT/MRI
- IVU: pelviceal filling defect

Mx
- Nephrouretectomy
- Regular f/up: 50% develop bladder tumours

Nephroblastoma: Wilm’s Tumour
- Childhood tumour of primitive renal tubules and mesenchymal cells
- May be assoc. c Chr 11 mutation
- May be assoc. c WAGR syndrome
  - Wilms, Aniridia, GU abnormalities, Retardation

Presentation
- 2-5yrs
- 5-10% bilat
- Abdo mass (doesn’t cross the midline)
- Haematuria
- Abdo pain
- HTN

Other Neoplasms

Benign
- Cysts: very common
- Renal papillary adenomas
- Oncocytoma: eosinophilic cells c numerous mitochondria
- Angiomyolipoma: seen in tuberous sclerosis

Malignant
- SCC: assoc. c chronic infected staghorn calculi

NB. Benign tumours commonly require nephrectomy to exclude malignancy.
Bladder Tumours

Epidemiology
- Incidence: 1:5000/yr
- Sex: M>F=4:1

Pathology
- Transitional cell carcinomas account for 90%
- SCCs: assoc. c schistosomiasis
- Adenocarcinoma

Natural Hx
- Low-Grade Tumours
  - 80%
  - Non-invasive, generally not life-threatening
  - High rate of recurrence
- High-Grade Tumours
  - 20%
  - Invasive and life-threatening
  - High recurrence rates

Risk Factors
- Smoking
- Amine exposure (rubber industry)
- Previous renal TCC
- Chronic cystitis
- Schistosomiasis (SCC)
- Urechal remnants (adenocarcinomas)
  - Embryological remnant of communication between umbilicus and bladder
  - Pelvic irradiation

Presentation
- Painless haematuria
- Voiding irritability: dysuria, frequency, urgency
- Recurrent UTIs
- Retention and obstructive renal failure

Examination
- Anaemia
- Palpable bladder mass
- Palpable liver

TNM Staging
- 80% confined to mucosa
- 20% penetrate muscle (↑ mortality)

<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Tis</td>
<td>Carcinoma in situ</td>
</tr>
<tr>
<td>T1</td>
<td>Tumour in lamina propria</td>
</tr>
<tr>
<td>T2</td>
<td>Superficial muscle involved</td>
</tr>
<tr>
<td>T3</td>
<td>Deep muscle involved</td>
</tr>
<tr>
<td>T4</td>
<td>Invasion of prostate, uterus or vag</td>
</tr>
</tbody>
</table>

Ix
- Urine: dip (sterile pyuria), cytology
- IVU: filling defects
- Cystoscopy & biopsy: diagnostic
- Bimanual EUA: helps to assess spread
- CT/MRI: helps stage

Mx
- Depends on histological grade and the presence of dissemination.

Tis, Ta and T1 (Superficial)
- 80% of all pts.
- Diathermy via transurethral cystoscopy / Transurethral Resection of Bladder Tumour (TURBT)
- Intravesicular chemo: mitomycin C
- Intravesicular immunotherapy: Bacille Calmette-Guérin

T2, T3 (Invasive)
- Radical cystectomy & ileal conduit is gold standard
- Radiotherapy: worse 5ys but preserves bladder
  - Salvage cystectomy can be performed
- Adjuvant chemo: e.g. M-VAC
- Neoadjuvant chemo may have a role

T4
- Palliative chemo / radiotherapy
- Long-term catheterisation
- Urinary diversions

Complications
- Massive bladder haemorrhage
- Cystectomy → Sexual and urinary malfunction

Follow-Up
- Up to 70% of bladder tumours recur therefore intensive flup is required.
- History, examination and regular cystoscopy
- High-risk tumours: every 3mo for 2yrs, then every 6mo
- Low-risk tumours: @ 9mo, then yrly

Prognosis
- Depends on age and stage
  - Tis, Ta and T1: 95% 5ys
  - T2: 40-50% 5ys
  - T3: 25% 5ys
  - T4: <1yr median survival

Spread
- Local → pelvic structures
- Lymph → iliac and para-aortic nodes
- Haem → bones, liver and lungs

Histological Classification
- Grade 1: well differentiated
- Grade 2: intermediate
- Grade 3: poorly differentiated
Benign Prostatic Hypertrophy

Epidemiology
- 70% @ 60yrs
- 90% @ 80yrs

Pathophysiology
- Benign nodular or diffuse hyperplasia of stromal and epithelial cells
- Affects inner (transitional) layer of prostate (cf. Ca)
  - → urethral compression
- DHT produced from testosterone in stromal cells by 5α-reductase enzyme.
- DHT-induced GFs → ↑ stromal cells and ↓ epithelial cell death.

Presentation
- Storage Symptoms
  - Nocturia
  - Frequency
  - Urgency
  - Overflow incontinence
- Voiding Symptoms
  - Hesitancy
  - Straining
  - Poor stream/flow + terminal dribbling
  - Strangury (urinary tenesmus)
  - Incomplete emptying: pis en deux
- Bladder stones (2° to stasis)
- UTI (2° to stasis)

Examination
- PR
  - Smoothly enlarged prostate
  - Definable median sulcus
  - Bladder not usually palpable unless acute-on-chronic obstruction

Ix
- Blood: U+E, PSA (after PR)
- Urine: dip, MC+S
- Imaging
  - Transrectal US ± biopsy
- Urodynamics: pressure / flow cystometry
- Voiding diary

Mx
Conservative
- ↓ caffeine, EtOH
- Double voiding
- Bladder training: hold on → ↑ time between voiding

Medical
- Useful in mild disease and while awaiting TURP
- 1st: α-blockers
  - Tamsulosin, doxazosin
  - Relax prostate smooth muscle
  - SE: drowsiness, ↓ BP, depression, EF, wt. ↑, extra-pyramidal signs
- 2nd: 5α-reductase inhibitors
  - Finasteride
  - Inhibit conversion of testosterone → DHT
  - Preferred if significantly enlarged prostate.
  - SE: excreted in semen (use condoms), ED

Surgical Mx
- Indications
  - Symptoms affect QoL
  - Complications of BPH
- TURP
  - Cystoscopic resection of lateral and middle lobes
  - ≤14% become impotent
- Transurethral incision of prostate (TUIP)
  - < destruction → ↓ risk to sexual function
  - Similar benefits to TURP if small prostate (<30g)
- Tranurethral ElectroVaporisation of Prostate
  - Electric current → tissue vaporisation
- Laser prostatectomy
  - ↓ ED and retrograde ejaculation
  - Similar efficacy as TURP
- Open retropubic prostatectomy
  - Used for very large prostates (>100g)

TURP Complications
Immediate
- TUR syndrome
  - Absorption of large quantity of fluids → ↓ Na
- Haemorrhage
Early
- Haemorrhage
- Infection
- Clot retention: requires bladder irrigation
Late
- Retrograde ejaculation: common
- ED: ~10%
- Incontinence: ≤10%
- Urethral stricture
- Recurrence
Prostate Cancer

Epidemiology
- Commonest male Ca
- 3rd commonest cause of male Ca death
- Prevalence: 80% of men >80yrs
- Race: ↑ in Blacks

Pathology
- Adenocarcinoma
- Peripheral zone of prostate

Presentation
- Usually asymptomatic
- Urinary: nocturia, frequency, hesitancy, poor stream, terminal dribbling, obstruction
- Systemic: wt. loss, fatigue
- Mets: bone pain

Examination
- Hard irregular prostate on PR
- Loss of midline sulcus

Spread
- Local: seminal vesicles, bladder, rectum
- Lymph: para-aortic nodes
- Haem: sclerotic bony lesions

Ix
- Bloods: PSA, U+E, acid and alk phos, Ca
- Imaging
  - XR chest and spine
  - Transrectal US + biopsy
  - Bone scan
  - Staging MRI
    - Contrast enhancing magnetic nanoparticles ↑s detection of affected nodes.

PSA
- Proteolytic enzyme used in liquefaction of ejaculate
- Not specific for prostate Ca
  - ↑ c age, PR, TURP, and prostatitis
  - >4ng/ml: 40-90% sensitivity, 60-90% specificity
  - Only 1-in-3 will have Ca
- Normal in 30% of small cancers

Gleason Grade
- Score two worst affected areas
- Sum is inversely proportional to prognosis

TNM Stage

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<tr>
<th>Grade</th>
<th>Description</th>
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<td>Tis</td>
<td>Carcinoma in situ</td>
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<td>T1</td>
<td>Incidental finding on TURP or ↑ PSA</td>
</tr>
<tr>
<td>T2</td>
<td>Intracapsular tumour c deformation of prostate</td>
</tr>
<tr>
<td>T3</td>
<td>Extra-prostatic extension</td>
</tr>
<tr>
<td>T4</td>
<td>Fixed to pelvis + invading neighbouring structures</td>
</tr>
<tr>
<td>N1-4</td>
<td>1 or more lymph nodes involved</td>
</tr>
<tr>
<td>M1</td>
<td>Distant mets, e.g. spine</td>
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</tbody>
</table>

Prognostic Factors
- Help determine whether to pursue radical Rx
- Age
- Pre-Rx PSA
- Tumour stage
- Tumour grade

Mx
- Difficult to know which tumours are indolent and will not → mortality before something else.
- Radical therapy assoc. c significant morbidity.

Conservative: Active Monitoring
- Close monitoring c DRE and PSA

Radical Therapy
- Radical prostatectomy (+ goserelin if node +ve)
  - Performed laparoscopically c robot
  - Only improves survival c P<75yrs
- Brachytherapy: implantation of palladium seeds
- SEs: ED, urinary incontinence, death (0.2-0.5%)

Medical
- Used for metastatic or node +ve disease
- LHRH analogues
  - E.g. goserelin
  - Inhibit pituitary gonadotrophins → ↓ testosterone
- Anti-androgens
  - E.g. cyproterone acetate, flutamide

Symptomatic
- TURP for obstruction
- Analgesia
- Radiotherapy for bone mets / cord compression

Screening c PSA
- Population based screening not recommended in UK
- PSA not an accurate tumour marker
- ERSPC trial showed small mortality benefit, PLCO trial showed no benefit.
- Must balance mortality benefit c harm caused by over diagnosis and over treatment of indolent cancers.
Prostatitis

Aetiology
- S. faecalis
- E. coli
- Chlamydia

Presentation
- Usually >35yrs
- UTI / dysuria
- Pain
  - Low backache
  - Pain on ejaculation
- Haematospermia
- Fever and rigors
- Retention
- Malaise

Examination
- Pyrexia
- Swollen / boggy / tender prostate on PR
- Examine testes to exclude epididymo-orchitis

Ix
- Blood: FBC, U+E, CRP
- Urine: dip, MC+S

Rx
- Analgesia
- Levofloxacin 500mg/d for 28d

Urinary Incontinence

Male
- Usually caused by prostatic enlargement
  - Urge incontinence or dribbling may result from partial retention.
  - Retention may → overflow (palpable bladder after voiding)
- TURP and pelvic surgery may weaken external urethral sphincter.

Women
- Stress Incontinence
  - Leakage from incompetent sphincter when IAP ↑
  - Loss of small amounts of urine when coughing
  - Pelvic floor weakness
- Urge Incontinence / Overactive Bladder
  - Can’t hold urine for any length of time
  - May have precipitant: arriving home, running water, coffee
  - Dx: urodynamic studies

Mx
- Check
  - PR: faecal impaction
  - Palpable bladder after voiding: retention → overflow
  - UTI
  - DM
  - CNS: MS, Parkinson’s stroke, spinal trauma
  - Diuretics
- Stress Incontinence
  - Pelvic floor exercises
  - Ring pessary
  - Duloxetine
  - Surgery: tension-free vaginal tape
- Urge Incontinence
  - Bladder training
  - Wt. loss
  - Anti-AChM: tolterodine, imipramine
Undescended Testes

Epidemiology
- 3% @ birth
- 1% @ 1yr
- Unilateral 4x commoner cf. bilateral
  - Should have genetic testing if bilateral
    - Noonan's Prader-Willi
- Commoner in prems: incidence up to 30%

Normal Descent
- Testes remain in abdomen (retroperitoneal) until 7mo
- Gubernaculum connects inferior pole of testis to scrotum.
- Testis descends through inguinal canal to scrotum: processus vaginalis.

Classification

Cryptorchidism
- Complete absence of testis from scrotum
- Anorchism = absence of both testes

Retractile Testis
- Normal development but excessive cremasteric reflex
- Testicle often found at external inguinal ring
- Will descend: no Rx required

Maldescended Testis
- Found anywhere along normal path of descent
- Testis and scrotum are usually under-developed
- Often assoc. c patent processus vaginalis

Ectopic Testis
- Found outside line of descent
- Usually in sup. inguinal pouch (ant. to external oblique aponeurosis)
- Abdominal, perineal, penile, femoral triangle

Complications
- Infertility
- 10x ↑ risk of malignancy (remains after surgery)
- ↑ risk of trauma
- ↑ risk of torsion
- Assoc. c hernias (90%) or urinary tract abnormalities

Mx
- Restores potential for spermatogenesis
- Makes Ca easier to Dx

Surgical: Orchidopexy by Dartos Pouch Procedure
- Perform before 2yrs
- Mobilisation of testis and cord
- Removal of patent processus
- Testicle brought through a hole made in the dartos muscle to lie in a subcutaneous pouch.
- Dartos prevents retraction.

Hormonal
- β-HCG may be tried if testis is in inguinal canal.

Testicular Torsion

Aetiology
- Usually 2° to some exertion or minor trauma
- Occurs because testicle doesn’t have a large “bare area” to attach to scrotal wall.
  - Tunica vaginalis invests whole of testicle
  - Free-hanging “clapper bell” testicle can twist on its mesentery.

Presentation
- Usually 10-25yrs
- Sudden onset severe pain in one testis
- May have lower abdominal pain (testis supplied by T10)
- Assoc. c n/v
- May be Hx of previous testicular pain or torsion

Examination
- Inflam of one testis: hot, swollen, extremely tender
- Testis rides high and lies transversely

Differential
- Epididymo-orchitis
  - Older pt.
  - UTI symptoms
  - More gradual onset
- Torted Hydatid of Morgagni
  - Remnant of Mullerian duct
  - Younger pt.
  - Less pain
  - Tiny blue dot visible on scrotum
- Tumour
- Trauma
- Strangulated hernia
- Appendicitis

Ix
- Doppler US may demonstrate absence of flow
  - Must not delay surgical exploration

Mx
- Surgical emergency
  - 4-6h window from onset of pain to salvage testis
- Inform senior
- NBM
- IV access
  - Analgesia
  - Bloods: FBC, U+E, G+S, clotting
- Surgery
  - Consent for possible orchidectomy
  - Bilateral orchidopexy: suture testes to scrotum
- If no torsion found and epididymo-orchitis Dx, take fluid sample from scrotum for bacteriology and Rx c Abx.
Lumps in the Groin and Scrotum

Differential
- Can’t get above: inguinoscrotal hernia
- Separate, cystic: epididymal cyst
- Separate, solid: varicocele, sperm granuloma, epididymitis
- Testicular, cystic: hydrocele
- Testicular, solid: tumour, orchitis, haematocele

Epididymal Cyst
- Develop in adulthood
- Contain clear or milky (spermatocele) fluid
- Lie above and behind testis
- Remove if symptomatic

Varicocele
- Dilated veins of pampiniform plexus
- Presentation
  - Feel like bag of worms in the scrotum
  - May be visible dilated veins
  - ↓ size on lying down
  - Pt. may c/o dull ache
  - May → oligospermia (↓ fertility)
- Pathology
  - 1º: Left side commoner: drain into left renal vein
  - 2º: left renal tumour has tracked down renal vein → testicular vein obstruction.
- Mx
  - Conservative: scrotal support
  - Surgical: clipping the testicular vein (open or lap)

Sperm Granuloma
- Painful lump of extravasated sperm after vasectomy

Hydrocele
- Collection of serous fluid w/i tunica vaginalis
- Primary
  - assoc. ♂ patent processus vaginalis
  - Commoner, larger, tense, younger men
- Secondary
  - Tumour, trauma, infection
  - Smaller, less tense
- Ix
  - US testicle to exclude tumour
- Mx
  - May resolve spontaneously
  - Surgery
    - Lord’s Repair: plication of the sac
    - Jaboulay’s Repair: eversion of the sac
  - Aspiration
    - Usually recur so not 1st line.
    - Send fluid for cytology and MC+S

Haematocele
- Blood in the tunica vaginalis
- Hx of trauma
- May need drainage or excision

Epididymo-Orchitis

Aetiology
- STI: Chlamydia, gonorrhoea
- Ascending UTI: e. coli
- Mumps

Features
- Sudden onset tender swelling
- Dysuria
- Sweats, fever

Examination
- Tender, red, warm, swollen testis and epididymis
  - Elevating testicle may relieve pain
- Secondary hydrocele
- Urethral discharge

Ix
- Blood: FBC, CRP
- Urine: dip, MC+S (fist catch may be best)
- Urethral swab and STI screen
- US: may be needed to exclude abscess

Complications
- May → infertility

Mx
- Bed rest
- Analgesia
- Scrotal support
- Abx: doxycycline or cipro
- Drain abscess if present
**Testicular Tumours**

**Epidemiology**
- Commonest male malignancies from 15-44yrs
- Whites > Blacks = 5:1

**Presentation**
- Painless testicular lump
  - Often noticed after trauma
- Haematospermia
- 2\(^{0}\) hydrocele
- Mets: SOB from lung mets
- Abdo mass: para-aortic lymphadenopathy
- Hormones: gynaecomastia, virilisation
- Contralateral tumour in 5%

**Risk Factors**
- Undescended testis
  - 10% occur in undescended testes
- Infant hernia
- Infertility

**Pathology**

**Germ Cell: 95% of tumours**
- **Pure Seminomas: 40%**
  - Commonest single subtype
  - 30-40yrs
  - ↑ βhCG in 15%
  - ↑ placental ALP in some
  - Very radiosensitive
- **Non-seminomas (inc.mixed): 60%**
  - **Mixed:** commonest NSGCT
  - **Teratoma**
    - Arise from all 3 germ layers
    - Common and benign in children
    - Rare and malignant in adults: 15-30yrs
    - Secrete βhCG and/or AFP
    - Chemosensitive
  - **Yolk Sac**
    - Commonest testicular tumour in children
  - **Choriocarcinoma**
    - ↑↑ βhCG

**Sex-cord Stromal**
- **Leydig Cell**
  - Mostly benign
  - May secrete androgens or oestrogens
- **Sertoli Cell**
  - Mostly benign
  - May secrete oestrogens

**Lymphoma / Leukaemia**
- **NHL:** commonest malignant testicular mass >60yrs
- **ALL:** commonest malignant testicular mass <5yrs

**Staging: Royal Marsden Classification**
1. Disease only in testis
2. Para-aortic nodes involved (below diaphragm)
3. Supra- and infra-diaphragmatic LNs involved
4. Extra-lymphatic spread: lungs, liver

**Ix**
- **Tumour markers**
  - Useful for monitoring
    - ↑AFP and ↑hCG in 90% of teratomas
    - ↑hCG in 15% of seminomas
    - Normal AFP in pure seminomas
- **Scrotum US**
- **Staging**
  - CXR
  - CT

*NB.* Percutaneous biopsy should not be performed as it may → seeding along needle tract

**Mx**
- If both testes are abnormal, semen can be cryopreserved

**Seminomas**
- **Stage 1-2:** inguinal orchidectomy + radiotherapy
  - Groin incision allows cord clamping to prevent seeding
- **Stage 3-4:** as above + chemo (BEP)
  - Bleomycin, Etoposide, cisPlatin

**Non-seminomas / Teratomas**
- **Stage 1:** inguinal orchidectomy + surveillance
- **Stage 2:** orchidectomy + chemo + para-aortic LN dissection
- **Stage 3:** orchidectomy + chemo

**Close f/up to detect relapse**
- Typically w/i 18-24mo
- Repeat CT scanning and tumour markers

**Prognosis**
- **Stage 1:** 98% 5ys
- **Stage 2:** 85% 5ys
- **Stage 4:** 60% 5ys
The Penis

Balanitis
- Acute inflammation of the foreskin and glans
- **Cause:** Strep, staph infection, Candida (DM)
- **RFs:** DM, young children ≥ tight foreskin
- **Rx:** hygiene advice, Abx, circumcision

Phimosis
- Foreskin occludes the meatus
- **Children**
  - **Pres:** recurrent balanitis and ballooning
  - **Mx:** Gentle retraction, steroid creams, circumcision
- **Adults**
  - **Pres:** dyspareunia, infection
  - **Mx:** circumcision
  - **Assoc. c-balaniitis xerotica obliterans:** thickening of foreskin and glans → phimosis + meatal narrowing

Paraphimosis
- Tight foreskin is retracted and becomes irreplaceable.
- ↓ venous return → oedema and swelling of the glans
  - Can rarely → glans ischaemia
- **Causes:** catheterisation, masturbation, intercourse
- **Mx:**
  - Manual reduction: use ice and lignocaine jelly
  - May require glans aspiration or dorsal slit

Hypo- / epi-spadias
- Developmental abnormality of the position of the urethral opening
- **Hypospadias:** opens on ventral surface of penis
- **Epispadias:** opens on dorsal surface

Penile Cancer

Epidemiology
- **Incidence:** 1:100,000/yr in UK
- **Geo:** commoner in Far East and Africa

Aetiology
- Very rare if circumcised
- **Risk factors**
  - HPV (16, 18, 31) infection
  - Chronic irritation due to smegma

Pathology
- Erythroplasia of Queyrat: penile CIS
- SCC

Presentation
- Chronic fungating ulcer
- Bloody / purulent discharge
- 50% have inguinal nodes at presentation

Mx
- **Medical**
  - Early growths c no urethral involvement
  - DXT and iridium wires
- **Surgical**
  - Amputation required if urethral involvement
  - Lymph node dissection
Bone and Fracture Physiology

Composition

**Cells:** osteoblasts, osteoclasts, osteocytes, OPCs

**Matrix**
- **Organic = osteoid (40%)**
  - Collagen Type I
  - Resists tension, twisting and bending
- **Inorganic (60%)**
  - Calcium hydroxyapatite
  - Resists compressive forces

Classification

**Woven Bone**
- Disorganised bone that forms the embryonic skeleton and fracture callus.

**Lamellar Bone**
- Mature bone that can be of two types:
  - **Cortical/compact:** dense outer layer
  - **Cancellous/trabecular:** porous central layer

Formation

**Intramembranous Ossification**
- Direct ossification of mesenchymal bone models formed during embryonic development.
- Skull bones, mandible and clavicle.

**Endochondral Ossification**
- Mesenchyme → cartilage → bone
- Most bones ossify this way

Fracture Healing

**Reactive Phase** (injury – 48hrs)
1. **Bleeding into # site** → haematoma
2. **Inflammation** → cytokine, GF and vasoactive mediator release → recruitment of leukos and fibroblasts → granulation tissue

**Reparative Phase** (2 days – 2 wks)
3. **Proliferation** of osteoblasts and fibroblasts → cartilage and woven bone production → callus formation.
4. **Consolidation** (endochondral ossification) of woven bone → lamellar bone

**Remodelling Phase** (1wk – 7yrs)
5. **Remodelling** of lamellar bone to cope with mechanical forces applied to it (Wolff’s Law: “form follows function”)

Healing Time
- Closed, paediatric, metaphyseal, upper limb: 3wks
- “Complicating factor” doubles healing time
  - Adult
  - Lower limb
  - Diaphyseal
  - Open

Fracture Classification

**Classification**
- **Traumatic #**
  - Direct: e.g. assault → metal bar
  - Indirect: e.g. FOOSH → clavicle #
  - Avulsion
- **Stress #**
  - Bone fatigue due to repetitive strain
  - E.g. foot #s in marathon runners
- **Pathological #**
  - Normal forces but diseased bone
    - Local: tumours
    - General: osteoporosis, Cushing’s, Paget’s

Describing a fracture: **PAID**
- Radiographs must be orthogonal: request AP and lat. films.
- Need images of joint above and joint below #.

1. **Demographics**
   - Pt. details
   - Date radiograph taken
   - Orientation and content of image

2. **Pattern**
   - Transverse
   - Oblique
   - Spiral
   - Multifragmentary
   - Crush
   - Greenstick
   - Avulsion

3. **Anatomical Location**

4. **Intra- / extra-articular**
   - Dislocation or subluxation

5. **Deformity** (distal relative to proximal)
   - Translation
   - Angulation or tilt
   - Rotation
   - Impaction (→shortening)

6. **Soft Tissues**
   - Open or closed
   - Neurovascular status
   - Compartment syndrome

7. **Specific classification/type**
   - Salter-Harris
   - Garden
   - Colles’, Smith’s, Galeazzi, Monteggia
Fracture Management: 4Rs

1: Resuscitation

Principles
- Follow ATLS guidelines
- Trauma series in 1o survey: C-spine, chest and pelvis
- # usually assessed in 2o survey
- Assess neurovascular status and look for dislocations
- Consider reduction and splinting before imaging
  - ↓ pain
  - ↓ bleeding
  - ↓ risk of neurovascular injury
- X-ray once stable

Open fractures require urgent attention: 6As
- Analgesia: M+M
- Assess: NV status, soft tissues, photograph
- Antisepsis: wound swab, copious irrigation, cover with betadine-soaked dressing.
- Alignment: align # and splint
- Anti-tetanus: check status (booster lasts 10yrs)
- Abx
  - Fluclox 500mg IV/IM + benpen 600mg IV/IM
  - Or, augmentin 1.2g IV

Mx: debridement and fixation in theatre

Gustillo Classification of Open #s
1. Wound <1cm in length
2. Wound ≥1cm ə minimal soft tissue damage
3. Extensive soft tissue damage

Clostridium perfringes
- Most dangerous complication of open #
- Wound infections and gas gangrene
- ± shock and renal failure
- Rx: debride, benpen + clindamycin

2: Reduction

Principles
- Displaced #s should be reduced
  - Unless no effect on outcome, e.g. ribs
- Aim for anatomical reduction (esp. if articular surfaces involved)
- Alignment is more important than opposition

Methods
- Manipulation / Closed reduction
  - Under local, regional or general anaesthetic
  - Traction to disimpact
  - Manipulation to align

- Traction
  - Not typically used now.
  - Employed to overcome contraction of large muscles: e.g. femoral #s
  - Skeletal traction vs. skin traction

- Open reduction (and internal fixation)
  - Accurate reduction vs. risks of surgery
  - Intra-articular #s
  - Open #s
  - 2 #s in 1 limb
  - Failed conservative Rx
  - Bilat identical #s

3: Restriction

Principles
- Interfragmentary strain hypothesis dictates that tissue formed @ # site depends on strain it experiences.
- Fixation → ↓ strain → bone formation
- Fixation also → ↓ pain, ↑ stability, ↑ ability to function.

Methods
- Non-rigid
  - Slings
  - Elastic supports
- Plaster
  - POP
  - In first 24-48h use back-slab or split cast due to risk of compartment syndrome
- Functional bracing
  - Joints free to move but bone shafts supported in cast segments.
- Continuous traction
  - e.g. collar-and-cuff
- Ex-Fix
  - Fragments held in position by pins/wires which are then connected to an external frame.
  - Intervention is away from field of injury.
  - Useful in open #s, burns, tissue loss to allow wound access and ↓ infection risk.
  - Risk of pin-site infections
- Internal fixation
  - Pins, plates, screws, IM nails
  - Usually perfect anatomical alignment
  - ↑ stability
  - Aid early mobilisation

4: Rehabilitation

Principles
- Immobility → ↓ muscle and bone mass, joint stiffness
- Need to maximise mobility of uninjured limbs
- Quick return to function ↓s later morbidity

Methods
- Physiotherapy: exercises to improve mobility
- OT: splints, mobility aids, home modification
- Social services: meals on wheels, home help
Fracture Complications

General Complications
Tissue Damage
- Haemorrhage and shock
- Infection
- Muscle damage → rhabdomyolysis

Anaesthesia
- Anaphylaxis
- Damage to teeth
- Aspiration

Prolonged Bed Rest
- Chest infection, UTI
- Pressure sores and muscle wasting
- DVT, PE
- ↓ BMD

Specific Complications
Immediate
- Neurovascular damage
- Visceral damage

Early
- Compartment syn.
- Infection (worse if assoc. c metalwork)
- Fat embolism → ARDS

Late
- Problems c union
- AVN
- Growth disturbance
- Post-traumatic osteoarthritis
- Complex regional pain syndromes
- Myositis ossificans

Neurological Complications
- Severance is rare, stretching over bone edge commoner
- Seddon classification describes three types of injury

Neuropraxia
- Temporary interruption of conduction w/o loss of axonal continuity.

Axonotmesis
- Disruption of nerve axon → distal Wallerian degeneration.
- Connective tissue framework of nerve preserved.
- Regeneration occurs and recovery is possible.

Neurotmesis
- Disruption of entire nerve fibre
- Surgery required and recovery not usually complete.

Common Palsies

<table>
<thead>
<tr>
<th>Injury</th>
<th>Palsy</th>
<th>Test/Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ant. shoulder dislocation</td>
<td>Axillary N.</td>
<td>Numb chevron</td>
</tr>
<tr>
<td>Humeral surgical neck</td>
<td></td>
<td>Weak abduction</td>
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<tr>
<td># humeral shaft</td>
<td>Radial N.</td>
<td>Waiter’s tip</td>
</tr>
<tr>
<td>Elbow dislocation</td>
<td>Ulnar N.</td>
<td>Claw hand</td>
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<tr>
<td>Hip dislocation</td>
<td>Sciatic N.</td>
<td>Foot drop</td>
</tr>
<tr>
<td># neck of fibula</td>
<td>Fibular N.</td>
<td>Foot drop</td>
</tr>
</tbody>
</table>

Compartment Syndrome
- Osteofacial membranes divide limbs into separate compartments of muscles.
- Oedema following # → ↑ compartment pressure → ↓ venous drainage → ↑ compartment pressure
- If compartment pressure > capillary pressure → ischaemia
- Muscle infarction →
  - Rhabdomyolysis and ATN
  - Fibrosis → Volkmann’s ischaemic contracture

Presentation
- Pain > clinical findings
- Pain on passive muscle stretching
- Warm, erythematous, swollen limb
- ↑ CRT and weak/absent peripheral pulses

Rx
- Elevate limb
- Remove all bandages and split/remove cast
- Fasciotomy

Problems with union
Delayed Union: union takes longer than expected
Non-union: # fails to unite

Causative Factors: 5 Is
- Ischaemia: poor blood supply or AVN
- Infection
- ↑ Interfragmentary strain
- Interposition of tissue between fragments
- Intercurrent disease: e.g. malignancy or malnutrition

Non-union Classification
- Hypertrophic
  - Bone end is rounded, dense and sclerotic
- Atrophic
  - Bone looks osteopenic

Management
- Optimise biology: infection, blood supply, bone graft, BMPs
- Optimise mechanics: ORIF

Malunion: # healed in an imperfect position
- Poor appearance and/or function
- E.g. Gunstock deformity

Avascular Necrosis
- Death of bone due to deficient blood supply.
- Sites: femoral head, scaphoid, talus
- Consequence: bone becomes soft and deformed → pain, stiffness and OA.
- X-ray: sclerosis and deformity.

Myositis Ossificans
- Heterotopic ossification of muscle @ sites of haematoma formation
- → restricted, painful movement
- Commonly affects the elbow and quadriceps
- Can be excised surgically

Pellegrini-Stieda disease
- form of MO
- Calcification of the superior attachment of MCL @ the knee following traumatic injury.

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Complex Regional Pain Syndrome Type 1
= Reflex Sympathetic Dystrophy, Sudek’s Atrophy

Definition
- Complex disorder of pain, sensory abnormalities, abnormal blood flow, sweating and trophic changes in superficial or deep tissues.
- No evidence of nerve injury.

Causes
- Injury: #s, carpal tunnel release, ops for Dupuytren’s
- Zoster, MI, Idiopathic

Presentation
- Wks – months after injury
- NOT traumatised area that is affected: affects a NEIGHBOURING area.
- Lancing pain, hyperalgesia or allodynia
- Vasomotor: hot and sweaty or cold and cyanosed
- Skin: swollen or atrophic and shiny.
- NM: weakness, hyper-reflexia, dystonia, contractures

Growth Disturbance
- In children, damage to the physis (growth plate) can result in abnormal bone growth.
- The Salter-Harris classification (1963) categorises growth plate injuries:

1. Straight across
2. Above
3. Lower
4. Through
5. CRUSH

Salter Harris Classification

- ↑ing risk of growth plate injury
- SH 1: e.g. SUFE. Normal growth ☒ good reduction.
- SH 4: union across physis may interfere ☒ bone growth
- SH 5: crush ➔ physis injury ➔ growth arrest

Rx
- Usually self-limiting
- Refer to pain team
- Amitryptilline, gabapentin
- Sympathetic nerve blocks can be tried.

CRPS Type II (= Causalgia)
- Persistent pain following injury caused by nerve lesions.
Hip Fracture

Epidemiology
- 80/100,000
- 50% in >80yrs
- F>M = 3:1

Pathophysiology
- Old = **osteoporosis** c minor trauma (e.g. fall)
- Young = major trauma

Osteoporosis Risk Factors: Age + SHATTERED
- Steroids
- Hyper- para/thyroidism
- Alcohol and Cigarettes
- Thin (BMI<22)
- Testosterone low
- Early Menopause
- Renal / liver failure
- Erosive / inflame bone disease (e.g. RA, myeloma)
- Dietary Ca low / malabsorption, DM

Presentation
- O/E: shortened and externally rotated
- Key Qs:
  - Mechanism
  - RFs for osteoporosis / pathological #
  - Premorbid mobility
  - Premorbid independence
  - Comorbidities
  - MMSE

Initial Management
- Resuscitate: dehydration, hypothermia
- Analgesia: M+M
- Assess neurovascular status of limb
- Imaging: AP and lateral films
- Prep for theatre
  - Inform Anaesthetist and book theatre
  - Bloods: FBC, U+E, clotting, X-match (2u)
  - CXR
  - DVT prophylaxis: TEDS, LMWH
  - ECG
  - Films: orthogonal X-rays
  - Get consent

Imaging
- Ask for AP and lateral film
- Look @ Shenton’s lines
- Intra- or extra-capsular?
- Displaced or non-displaced
- Osteopaenic?

Key Anatomy
- Capsule attaches proximally to acetabular margin and distally to intertrochanteric line.
- Blood supply to fem head:
  1. Retinacular vessels, in capsule, distal → prox
  2. Intramedullary vessels
  3. Artery of ligamentum teres.
- If retinacular vessels damaged there is risk of AVN of the femoral head → pain, stiffness and OA

Classification
- **Intracapsular**: subcapital, transcervical, bascervical
- **Extracapsular**: Intertrochanteric, subtrochanteric

Garden Classification of Intracapsular Fractures
1. Incomplete #, undisplaced
2. Complete #, undisplaced
3. Complete #, partially displaced
4. Complete #, completely displaced

Surgical Management
Intracapsular
- 1,2: ORIF c cancellous screws
- 3,4:
  - <55: ORIF c screws.
  - f/up in OPD and do arthroplasty if AVN develops (in 30%)
  - 55-75: total hip replacement
  - >75: hemiarthroplasty
    - Mobilises: cemented Thompson’s
    - Non-mobiliser: uncemented Austin Moore

Extracapsular
- ORIF c DHS

Discharge
- Involve OT and physios
- Discharge when mobilisation and social circumstances permit.

Specific Complications
- AVN of fem head in displaced #s (30%)
- Non / mal-union (10-30%)
- Infection
- Osteoarthritis

Prognosis
- 30% mortality @ 1yr
- 50% never regain pre-morbid functioning
- >10% unable to return to premorbid residence
- Majority will have some residual pain or disability.
Distal Forearm Fractures

Colles' Fracture

Clinical Features
- Fall onto an outstretched hand
- Most common in elderly females with osteoporosis
- Dinner fork deformity

Radiographic Features
- Extra-articular # of dist. radius (w/ 1.5" of joint)
- Dorsal displacement of distal fragment
- Dorsal angulation of distal fragment
  - Normally 11 degrees volar tilt
  - ↓ radial height (norm =11mm)
  - ↓ radial inclination (norm=22°)
  - ± avulsion of ulna styloid
  - ± impaction

Specific Management
- Examine for neurovascular injuries as median nerve and radial artery lie close.
- If much displacement → reduction
  - Under haematoma block, IV regional anaesthesia (Bier’s block) or GA.
  - Disimpact and correct angulation.
  - Position: ulnar deviation + some wrist flexion
  - Apply dorsal backslab: provide 3-point pressure
- Re X-Ray – satisfactory position?
  - No: ortho review and consider MUA ± K wires
  - Yes: home ± # clinic f/up w/i 48hrs for completion of POP
  - 6 wks in POP + physio
  - If comminuted, intra-articular or re-displaces:
    - Surgical fixation ± ex-fix, Kirschner-wires or ORIF and plates.

Specific Complications
- Median N. injury
- Frozen shoulder / adhesive capsulitis
- Tendon rupture: esp. EPL
- Carpal tunnel syn.
- Mal- /non-union
- Sudek’s atrophy / CRPS

Other Distal Forearm Fractures

Smith’s / Reverse Colles’
- Fall onto back of flexed wrist
- Fracture of distal radius with volar displacement and angulation of distal fragment.
- Reduce to restore anatomy and POP for 6wks

Barton’s Fracture
- Oblique intra-articular # involving the dorsal aspect of distal radius and dislocation of radio-carpal joint
- Reverse Barton’s involves the volar aspect of the radius

Scaphoid Fractures

Clinical Features
- FOOSH
- Pain in anatomical snuffbox
- Pain on telescoping the thumb

Specific Management
- Request scaphoid x-ray view
- If clinical hx and exam suggest a scaphoid #, it should initially be treated even if the x-ray is normal.
  - # may become apparent after 10 days due to localised decalcification.
- Place wrist in scaphoid plaster (beer glass position)
- If initial x-ray is negative, pt. returns to # clinic after 10 days for re-xray.
  - # visible → plaster for 6 wks
  - No visible # but clinically tender → plaster for 2 wks
  - # not visible and not clinically tender → no plaster

Specific Complications
- Main risk is AVN of the scaphoid as blood supply runs distal to proximal.
  - → stiffness and pain at the wrist

Radial and Ulna Shaft Fractures

Classification
- Monteggia
  - # of proximal 3rd of ulna shaft
  - Anterior dislocation of radial head at capitellum
  - May → palsy of deep branch of radial nerve → weak finger extension but no sensory loss
- Galleazzi
  - # of radial shaft between mid and distal 3rds
  - Dislocation of distal radio-ulna joint

Specific Management
- Unstable fractures
  - Adults: ORIF
  - Children: MUA + above elbow plaster
- Fractures of forearm should be plastered in most stable position:
  - Proximal #: supination
  - Distal #: pronation
  - Mid-shaft #: neutral
The Shoulder

Shoulder Dislocation

Classification
- **Anterior**
  - 95% of shoulder dislocations.
  - Direct trauma or falling on hand
  - Humeral head dislocates antero-inferiorly
- **Posterior**
  - Caused by direct trauma or muscle contraction (seen in epileptics).

Associated Lesions

Bankart Lesion
- Damage to anteroinferior glenoid labrum.

Hill-Sachs Lesion
- Cortical depression in the posterolateral part of the humeral head following impaction against the glenoid rim during anterior dislocation.
- Occurs in 35-40% of anterior dislocations.

Presentation
- Shoulder contour lost: appears square
- Bulge in infracavicular fossa: humeral head
- Arm supported in opposite hand
- Severe pain

Specific Management
- **Assess for neurovascular deficit**: esp. axillary N.
  - Sensation over “chevron” area before and after reduction.
  - Occurs in 5%
- X-ray: AP and transcapular view
- Reduction under sedation (e.g. propofol)
  - Hippocratic: Longitudinal traction of arm in 30° abduction and counter traction @ the axilla
  - Kocher’s: external rotation of adducted arm, anterior movement, internal rotation
- Rest arm in a sling for 3-4wks
- Physio

Complications
- Recurrent dislocation
  - 90% of pts. <20yrs with traumatic dislocation
- Axillary N. injury

Recurrent Shoulder Instability

TUBS: Traumatic Unilateral dislocations with a Bankart lesion often require Surgery
- Mostly young patients: 15-30yrs
- Surgery involves a Bankart repair

AMBRI: Atraumatic Multidirectional Bilateral shoulder dislocation is treated with Rehabilitation, but may require Inferior capsular shift

Impingement Syndrome / Painful Arc

Pathology
- Entrapment of supraspinatus tendon and subacromial bursa between acromion and greater tuberosity of humerus.
- → subacromial bursitis and/or supraspinatus tendonitis

Presentation
- Painful arc: 60-120°
- Weakness and ↓ ROM
- +ve Hawkin’s test

Ix
- Plain radiographs: may see bony spurs
- US
- MRI arthrogram

Rx
- **Conservative**
  - Rest
  - Physiotherapy
- **Medical**
  - NSAIDs
  - Subacromial bursa steroid ± LA injection
- **Surgical**
  - Arthroscopic acromioplasty

Differential of Painful Arc

Frozen Shoulder: Adhesive Capsulitis

Presentation
- Progressive ↓ active and passive ROM
  - ↓ ext. rotation <30°
  - ↓ abduction <90°
- Shoulder pain, esp. @ night (can’t lie on affected side)

Cause
- Unknown, may follow trauma in elderly
- Commonly assoc. c ¯ DM

Rx
- **Conservative**: rest, physio
- **Medical**
  - NSAIDs
  - Subacromial bursa steroid ± LA injection

Rotator Cuff Tear

- 2° to degeneration or a sudden jolt or fall
- Partial tears → painful arc
- Complete tear
  - Shoulder tip pain
  - Full range of passive movement
  - Inability to abduct the arm
  - Active abduction possible following passive abduction to 90°
  - Lowering the arm beneath this → sudden drop → “drop arm” sign

Rx: open or arthroscopic repair
Supracondylar Fractures of the Humerus

Presentation
- Common in children after FOOSH
- Elbow very swollen and held semi-flexed.
- Sharp edge of proximal humerus may injure brachial artery which lies anterior to it.

Classification

Extension
- Commonest type
- Distal fragment displaces posteriorly
- Gartland further classified extension type:
  - Type 1: non-displaced
  - Type 2: angulated c intact posterior cortex
  - Type 3: displaced c no cortical contact

Flexion
- Less common
- Distal fragment displaces anteriorly

Specific Management
- Ensure there is no neurovascular damage
  - If radial pulse absent or damage to brachial artery suspected, take urgently to theatre for reduction ± on-table angiogram.
  - Median nerve is also vulnerable
- Restore the anatomy
  - No displacement → flex the arm as fully as possible and apply a collar and cuff for 3wks – triceps acts as sling to stabilise fragments.
  - Displacement → MUA + fixation with K-wires + collar and cuff with arm flexed for 3wks.

Specific Complications

Neurovascular Injury
- Brachial artery
- Radial nerve
- Median nerve: esp. anterior interosseous branch
  - Supplies deep forearm flexors (FPL, lateral half of FDP and pronator quadratus)

Compartment syndrome
- Monitor closely during the first 24h
- Pain on passive extension of the fingers (stretches flexor compartment) is early sign.
- Mx: try extension of the elbow, surgical Rx may be needed.
- Volkmann’s ischaemic contracture can result → fibrosis of flexors → claw hand.

Gunstock Deformity
- Valgus, varus and rotational deformities in the coronal plane do not remodel and → cubitus varus.
- Cubitus varus deformity is referred to as a “gunstock” deformity.

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Femoral and Tibial Fractures

Specific Management
- Resus and Mx life-threatening injuries first.
- **X-Match**
  - Tibial #: 2 units
  - Femoral #: 4 units
- **Assess neurovascular status: esp. distal pulses**
- If open
  - Abx and ATT
  - Take to theatre urgently for debridement, washout and stabilisation
- **Fixation methods**
  - Intramedullary nail
  - Ex-fix
  - Plates and screws
  - MUA c ¯ fixed traction for 3-4mo

Specific Complications
- **Hypovolaemic shock**
- **Neurovascular**
  - SFA: swelling and check pulses
  - Sciatic nerve
- **Compartment syndrome**
- **Respiratory complications**
  - Fat embolism
  - ARDS
  - Pneumonia

Ankle Injuries

Ligament Strains
- Typically twisting inversion injury
  - Strains anterior talofibular part of lateral collateral ligament
  - Medial deltoid ligament strains are rare.
  - May be assoc. c ¯ malleolar avulsion #s

Ankle Fracture

Ottowa Ankle Rules
- X-ray ankle if pain in malleolar zone + in any of:
  - Tenderness along distal 6cm of posterior tib / fib including posterior tip of the malleoli.
  - Inability to bear weight both immediately and in ED

Weber Classification
- Relation of fibula # to joint line
  - **A**: below joint line
  - **B**: at joint line
  - **C**: above joint line
- Weber’s B and C represent possible injury to the syndesmotic ligaments between tib and fib → instability

Mx
- **Weber A**
  - Boot or below-knee POP
- **Non-displaced Weber B/C**
  - Below-knee POP
- **Displaced Weber B/C**
  - Closed reduction and POP if anatomical reduction achieved
  - ORIF if closed reduction fails
Knee Injuries

History
- Mechanism
- Swelling
  - Immediate = haemarthrosis = # or torn cruciates
  - Overnight = effusion = meniscus or other lgt
- Pain / tenderness
  - Joint line = meniscal
  - Med/lateral margins = collateral lgt.
- Locking: meniscal tear → mechanical obstruction
- Giving way: instability following lgt. injury

Knee Haemarthrosis
- 1°: spontaneous bleeding
  - Coagulopathy: warfarin, haemophilia
- 2°: trauma
  - ACL injury: 80%
  - Patella dislocation: 10%
  - Meniscal injury: 10%
    - Outer third where its vascularised
  - Osteophyte #

Unhappy Triad of O'Donoghue
- ACL
- MCL
- Medial Meniscus

Mx of acutely injured knee
- Full examination of acutely swollen knee after injury is difficult.
- Take x-ray to ensure no #s
  - Fluid level indicates a lipohaemarthrosis and indicates either a # or torn cruciate.
- If no # → RICE + later re-examination for pathology
- If meniscal or cruciate injury suspected → MRI

Arthroscopy
- Direct vision of inside of knee joint by arthroscope
- Can examine knee under anaesthesia (↓ muscle tone)
- Meniscal tears can be trimmed or repaired.

Mx of Ruptured ACL

Conservative
- Rest
- Physio to strengthen quads and hamstrings
- Not enough stability for many sports

Surgical
- Gold-standard is autograft repair
- Usually semitendinosus ± gracilis (can use patella tendon)
- Tendon threaded through heads of tibia and femur and held using screws.
Osteoarthritis

Definition
- Degenerative joint disorder in which there is progressive loss of hyaline cartilage and new bone formation at the joint surface and its margin.

Aetiology / Risk Factors
- Age (80% > 75yrs)
- Obesity
- Joint abnormality

Classification
- Primary: no underlying cause
- Secondary: obesity, joint abnormality

Symptoms
- Affects: knees, hips, DIPs, PIPs, thumb CMC
- Pain: worse c¯ movement, background rest/night pain, worse @ end of day.
- Stiffness: especially after rest, lasts ~30min (e.g. AM)
- Deformity
- ↓ ROM

Signs
- Pouchards (prox), Heberdips (dist.)
- Thumb CMC squaring
- Fixed flexion deformity

History
- Pain severity, night pain
- Walking distance
- Analgesic requirements
- ADLs and social circumstances
- Co-morbidities
- Underlying causes: trauma, infection, congenital

Pathophysiology
- Softening of articular cartilage → fraying and fissuring of smooth surface → underlying bone exposure.
- Subchondral bone becomes sclerotic c¯ cysts.
- Proliferation and ossification of cartilage in unstressed areas → osteophytes.
- Capsular fibrosis → stiff joints.

Differential
- Septic
- Crystal
- Trauma

X-ray Changes
- Loss of joint space
- Osteophytes
- Subchondral cysts
- Subchondral sclerosis
- Deformity

Bloods
- CRP may be mildly elevated
- Ca, PO₄ and ALP all normal

Rx
MDT: GP, physio, OT, dietician, orthopod

Conservative
- Lifestyle: ↓ wt., ↑ exercise
- Physio: muscle strengthening
- OT: walking aids, supportive footwear, home mods

Medical
- Analgesia
  - Paracetamol
  - NSAIDs: e.g. arthrotec (diclofenac + misoprostol)
  - Tramol
- Joint injection: local anaesthetic and steroids

Surgical
- Arthroscopic Washout
  - Mainly knees
  - Trim cartilage
  - Remove loose bodies.
- Realignment Osteotomy
  - Small area of bone cut out
  - Useful in younger (<50yrs) pts. c¯ medial knee OA
  - High tibial valgus osteotomy redistributes wt. to lateral part of joint.
- Arthroplasty: replacement (or excision)
- Arthrodesis: last resort for pain management

Novel Techniques
- Microfracture: stem cell release → fibro-cartilage formation
- Autologous chondrocyte implantation
Back Pain

Mechanical Pain
- Soft tissue injury → dysfunction of whole spine → muscle spasm → pain.
- May have inciting event: e.g. lifting
- Younger pts. c ¯ no sinister features

Mx
- Conservative
  - Max 2d bed rest
  - Education: keep active, how to lift / stoop
  - Physiotherapy
  - Psychosocial issues re. chronic pain and disability
  - Warmth: e.g. swimming in a warm pool
- Medical
  - Analgesia: paracetamol ± NSAIDs ± codeine
  - Muscle relaxant: low-dose diazepam (short-term)

Disc Prolapse
- Herniation of nucleus pulposus through annulus fibrosus

Presentation
- L5 and S1 roots most commonly compressed by prolapse of L4/5 and L5/S1 discs.
- May present as severe pain on sneezing, coughing or twisting a few days after low back strain
- Lumbago: low back pain
- Sciatica: shooting radicular pain down buttock and thigh

Signs
- Limited spinal flexion and extension
- Free lateral flexion
- Pain on straight-leg raise: Lesage’s Sign
- Lateral herniation → radiculopathy
- Central herniation → corda equina syndrome

L4/5 → L5 Root Compression
- Weak hallux extension ± foot drop
  - In foot drop due to L5 radiculopathy, weak inversion (tib. post.) helps distinguish from peroneal N. palsy.
  - ↓ sensation on inner dorsum of foot

L5/S1 → S1 Root Compression
- Weak foot plantarflexion and evasion
- Loss of ankle-jerk
- Calf pain
- ↓ sensation over sole of foot and back of calf

Ix: MRI (emergency if cauda equina)

Rx
- Brief rest, analgesia and mobilisation effective in ≥90%
- Conservative: brief rest, mobilisation/physio
- Medical: analgesia, transforaminal steroid injection
- Surgical: discectomy or laminectomy may be needed in cauda-equina syndrome, continuing pain or muscle weakness.

Lumbar Microdiscectomy
- Commonest procedure for disc prolapse
- Microscopic resection of the protruding nucleus pulposus
- Posterior approach c pt. in prone position.
- May be performed endoscopically

Spondyloolisthesis
- Displacement of one lumbar vertebra on another
  - Usually forward
  - Usually L5 on S1
  - May be palpable

Causes
- Congenital malformation
- Spondylosis
- Osteoarthritis

Presentation
- Onset of pain usually in adolescence or early adulthood
  - Worse on standing
  - ± sciatica, hamstring tightness, abnormal gait

Dx
- Plain radiography

Rx
- Corset
- Nerve release
- Spinal fusion

Spinal Stenosis
- Developmental predisposition ± facet joint osteoarthritis → generalized narrowing of lumbar spinal canal.

Presentation
- Spinal claudication
  - Aching or heavy buttock and lower limb pain on walking
  - Rapid onset
  - May c/o paraesthesiae/numbness
  - Pain eased by leaning forward (e.g. on bike)
  - Pain on spine extension

Ix
- MRI

Rx
- Corsets
- NSAIDs
- Epidural steroid injection
- Canal decompression surgery

Neurosurgical Emergencies

Acute Cord Compression
- Bilateral pain: back and radicular
- LMN signs at compression level
- UMN signs and sensory level below compression
- Sphincter disturbance

Acute Cauda Equina Compression
- Alternating or bilateral radicular pain in the legs
- Saddle anaesthesia
- Loss of anal tone
- Bladder ± bowel incontinence

Rx
- Large prolapse: laminectomy / discectomy
- Tumours: radiotherapy and steroids
- Abscesses: decompression

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Osteochondritis
- Idiopathic condition in which bony centres of children/adolescents become temporarily softened due to osteonecrosis.
- Pressure → deformation
- Bone hardens in new, deformed position

Radiography
- Initially: ↑ density / sclerosis
- Then: patchy appearance

Scheuermann’s Disease
- Vertebral ring epiphyses
- Auto dom
- Vertebral tenderness and kyphosis
- X-ray: wedge-shaped thoracic vertebra

Kohler’s Disease
- Navicular bone
- Children 3-5yrs
- Pain in mid-tarsal region → limp

Kienbochs Disease
- Lunate bone
- Adults
- Pain over lunate, esp. on active movement
- Impaired grip

Friedberg’s Disease
- 2nd/3rd metatarsal heads
- Around puberty
- Forefoot pain worse c pressure

Panner’s Disease
- Capitulum of humerus

Perthes’ Disease
- Hip

Traction Apophysitis
Osgood-Shlatter’s
- Tibial tuberosity apophysitis + patellar tendonitis
- Children 10-14yrs, M>F=3:1
- Assoc. c physical activity
- Symptoms: pain below knee, esp c quads contraction
- X-ray: tuberosity enlargement ± fragmentation
- Rx: rest, consider POP

Sinding Larsen’s Disease
- Tranction tendinopathy with calcification of proximal attachment of patellar tendon
- Children 8-10yrs

Sever’s Disease
- Calcaneal apophysitis
- 8-13yrs
- Symptoms: pain behind heal + limping
- Rx: physio

Osteochondritis Dissecans
- Piece of bone and overlying cartilage dissects off into joint space.
- Commonly knee (med. fem. condyle), also elbow, hip and ankle.
- Young adult / adolescent
- Symptoms: pain, swelling, locking, ↓ ROM
- X-ray: loose bodies, lucent crater
- Mx: arthroscopic removal

Avascular Necrosis

Causes
- # or dislocation
- SCD, thalassaemia
- SLE
- Gaucher’s
- Drugs: steroids, NSAIDs
The Limping Child

Aetiology
- DDH
- Transient synovitis
- Septic arthritis
- Perthes’
- Slipped Capital Femoral Epiphyses
- JIA / Still’s Disease

DDH
- Congenital hip joint deformity in which the femoral head is or can be completely / partially displaced.

Epidemiology
- **Incidence:** 1/1000
- **Sex:** F>M

Predisposing Factors
- FH
- Breach presentation
- Oligohydramnios

Presentation
- Screening
- Asymmetric skin folds
- Limp / abnormal gait

Ix
- US is v. specific

Mx: maintain abduction
- Double nappies
- Pavlik harness
- Plaster hip spica
- Open reduction: derotation varus osteotomy

Transient Synovitis: Irritable Hip
- Commonest cause of acute hip pain in children

Presentation
- 2-12yrs
- Sudden onset hip pain / limp
- Often following or with viral infection
- Not systemically unwell

Ix
- PMN and ESR/CRP are normal
- -ve blood cultures
- May need joint aspiration and culture

Mx
- Rest and analgesia
- Settles over 2-3d

Perthes’ Disease
- Osteochondritis of the femoral head \(2^{\circ}\) to AVN.

Epidemiology
- 4-10yrs
- M>F=5:1

Presentation
- Insidious onset
- Hip pain initially, then painless
- 10-20% bilateral

Ix
- X-rays normal initially
- ↑ density of femoral head
  - Becomes fragmented and irregular
  - Flattening and sclerosis
  - Bone scan is useful

Mx
- Detected early and < half femoral head affected
  - Bed rest and traction
- More severe
  - Maintain hip in abduction c ¯ plaster
  - Femoral or pelvic osteotomy

Slipped Capital Femoral Epiphysis
- Postero-inferior displacement of femoral head epiphysis
- 10-15yrs
- Two main groups
  - Fat and sexually underdeveloped
  - Tall and thin

Presentation
- Slip may be acute, chronic or acute-on-chronic
- **Acute**
  - Groin pain
  - Shortened, externally rotated leg
  - All movements painful
  - 20% bilateral

Ix
- Confirm Dx by x-ray

Mx
- **Acute:** reduce and pin epiphysis
  - **Chronic:** in situ pinning
    - Epiphyseal reduction risks AVN

Complications
- **Chondrolysis:** breakdown of articular cartilage
  - ↑ risk c surgery

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Acute Osteomyelitis

Pathophysiology
- **Source:** local or haematogenous.
- **Organisms**
  - Staph
  - Strep
  - E. coli
  - Pseudomonas
  - Salmonella (in SCD)
- **RFs**
  - Vascular disease
  - Trauma
  - SCD
  - Immunosuppression (e.g. DM)
  - Children
    - Rich blood supply to growth plate
    - : usually affects metaphysis

Symptoms and Signs
- Pain, tenderness, erythema, warmth, ↓ROM
- Effusion in neighbouring joints
- Signs of systemic infection

Investigations
- ↑ESR/CRP, ↑WCC
- +ve blood cultures in 60%
- X-ray:
  - Changes take 10-14d
  - Haziness + ↓ bone density
  - Sub-periosteal reaction
  - Sequestrum and involucrum
- MRI is sensitive and specific

Management
- IV Abx: Vanc + cefotaxime until MCS known
- Drain abscess and remove sequestra
- Analgesia

Septic Arthritis

Pathophysiology
- **Source:** local or haematogenous.
- **Organisms**
  - Staph: 60%
  - Strep
  - Gonococcus
  - Gm-ve bacilli
- **RFs**
  - Joint disease (e.g. RA)
  - CRF
  - Immunosuppression (e.g. DM)
  - Prosthetic joints

Symptoms
- Acutely inflamed tender, swollen joint.
- ↓ROM
- Systemically unwell

Investigations
- Joint aspiration for MCS
  - ↑↑WCC (e.g. >50,000/mm³) : mostly PMN
- ↑ESR/CRP, ↑WCC, Blood cultures
- X-ray

Management
- IV Abx: vanc + cefotaxime
- Consider joint washout under GA
- Splint joint
- Physiotherapy after infection resolved

Complications
- Osteomyelitis
- Arthritis
- Ankylosis: fusion

Differential
- Crystal arthropathy
- Reactive arthritis
Bone Tumours

Bony Mets
- Commonest bone tumours
- Bronchus, thyroid, breast, kidney and prostate
- Usually radiolucent (except prostate which is sclerotic)
- Usually axial skeleton (contains red marrow)
- Present with pain or pathological #
  - Path # → internal fixation
  - Pain → radiotherapy

Tumour-like Non-neoplastic Conditions

<table>
<thead>
<tr>
<th>Lesion</th>
<th>Clinical Features</th>
<th>Location</th>
<th>X-ray</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fibrous Dysplasia</td>
<td>0-30</td>
<td>Long bones</td>
<td>“Ground Glass” lytic lesion</td>
</tr>
<tr>
<td></td>
<td>F&gt;M</td>
<td>Ribs</td>
<td>Shepherds crook deformity of prox. femur</td>
</tr>
<tr>
<td></td>
<td>↑ # risk</td>
<td>Skull</td>
<td></td>
</tr>
<tr>
<td>McCune Albright’s</td>
<td>- Polyostotic fibrous dysplasia</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Precocious puberty (females)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Café-au-lait spots</td>
<td>Usually mono-ostotic</td>
<td></td>
</tr>
<tr>
<td>Simple bone cyst</td>
<td>&lt;20</td>
<td>Prox metaphysis of</td>
<td>Well-defined lytic lesion</td>
</tr>
<tr>
<td></td>
<td>Lump migrates down shaft</td>
<td>humerus or femur</td>
<td>Cortex can fall into cyst → “fallen fragment”</td>
</tr>
<tr>
<td></td>
<td>from original growth plate site.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aneurysmal bone cyst</td>
<td>&lt;30yrs</td>
<td></td>
<td>MRI shows multiple fluid levels</td>
</tr>
<tr>
<td></td>
<td>Pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fibrous cortical defect and non-ossifying fibroma</td>
<td>Children</td>
<td>Dist femur</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-painful, benign</td>
<td>Prox tibia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spontaneously regress</td>
<td>Often multiple</td>
<td></td>
</tr>
</tbody>
</table>

Benign Cartilaginous Neoplasms

<table>
<thead>
<tr>
<th>Lesion</th>
<th>Clinical Features</th>
<th>Location</th>
<th>X-ray</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osteochondroma (exostosis)</td>
<td>10-20</td>
<td>Knee</td>
<td>Cartilage-capped bony outgrowth</td>
</tr>
<tr>
<td></td>
<td>M=F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commonest benign bone tumour</td>
<td>May be related to previous trauma</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enchondroma / Chondromas</td>
<td>10-40</td>
<td>Hands</td>
<td>O sign</td>
</tr>
<tr>
<td></td>
<td>M=F</td>
<td>Feet</td>
<td>- Oval lucencies c radiodense rim</td>
</tr>
<tr>
<td>Ollier Disease = multiple enchondromas</td>
<td></td>
<td></td>
<td>Endosteal scalloping</td>
</tr>
<tr>
<td>Maffucci Syn = Enchondromatosis + multiple soft-tissue haemangiomas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiple enchondromas have risk of malignant transformation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chondroblastoma</td>
<td>10-20</td>
<td>Epiphysis</td>
<td>Radiolucent with sclerotic border</td>
</tr>
<tr>
<td></td>
<td>M&gt;F = 2:1</td>
<td>Knee</td>
<td></td>
</tr>
</tbody>
</table>

Malignant Cartilaginous Neoplasms

<table>
<thead>
<tr>
<th>Lesion</th>
<th>Clinical Features</th>
<th>Location</th>
<th>X-ray</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chondrosarcoma</td>
<td>&gt;40</td>
<td>Pelvis</td>
<td>Lytic lesion</td>
</tr>
<tr>
<td></td>
<td>Pain + lump</td>
<td>Axial skeleton</td>
<td>Fluffy “popcorn calcification”</td>
</tr>
<tr>
<td></td>
<td>Arise de novo or from chondromas</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>70% 5ys</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Benign Bone-forming Neoplasms

<table>
<thead>
<tr>
<th>Lesion</th>
<th>Clinical Features</th>
<th>Location</th>
<th>X-ray</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osteoma</td>
<td>Lump</td>
<td>Skull</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Usually solitary</td>
<td>Facial bones</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Multiple in Gardner syn</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Osteoid osteoma</td>
<td>M&gt;F = 2:1</td>
<td>Lower limb</td>
<td>Lytic lesion &lt; central nidus and sclerotic rim</td>
</tr>
<tr>
<td></td>
<td>Teens and 20s</td>
<td>Diaphyseal cortex</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Severe nocturnal pain relieved by aspirin</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hot on bone scan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Osteoblastoma</td>
<td>Pain unresponsive to aspirin</td>
<td>Spine</td>
<td></td>
</tr>
<tr>
<td>Giant Cell Tumour /</td>
<td>20-40</td>
<td>Knee</td>
<td><strong>Soap bubble appearance</strong></td>
</tr>
<tr>
<td>Osteoclastoma</td>
<td><strong>(After fusion of growth plate)</strong></td>
<td><strong>Abut joint surface</strong></td>
<td>Solitary, expansile, lytic lesion</td>
</tr>
<tr>
<td></td>
<td>F&gt;M</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Malignant Bone-forming Neoplasms

<table>
<thead>
<tr>
<th>Lesion</th>
<th>Clinical Features</th>
<th>Location</th>
<th>X-ray</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osteosarcoma</td>
<td>Adolescents</td>
<td>Knee</td>
<td>Periosteal Elevation:</td>
</tr>
<tr>
<td></td>
<td>M&gt;F = 2:1</td>
<td>Metaphysis</td>
<td>- Sunburst appearance</td>
</tr>
<tr>
<td></td>
<td><strong>Commonest 1° bone tumour</strong></td>
<td></td>
<td>- Codman’s triangle</td>
</tr>
<tr>
<td></td>
<td>Pain, warm, bruit</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>May arise 2° to Paget’s or irradiation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ewing’s Sarcoma</td>
<td>&lt;20</td>
<td>Long bone diaphysis</td>
<td>Lytic tumour</td>
</tr>
<tr>
<td></td>
<td>Painful, warm, <strong>enlarging mass</strong></td>
<td></td>
<td><strong>Onion-skin periosteal reaction</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Systemic: fever, ↑ESR, anaemia, ↑WCC</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Brachial Plexus Injuries

Anatomy
- C5-T1
- Roots leave vertebral column between scalenus anterior and medius.
- Divisions occur under the clavicle, medial to coracoid process.
- Plexus has intimate relationship with subclavian and brachial arteries. Median N. is formed anterior to brachial artery.

Causes
- Direct: e.g. shoulder girdle #, penetrating or iatrogenic injury
- Indirect: e.g. avulsion or traction injuries

Leffert Classification
1. Open
2. Closed
   a. Supraclavicular
   b. Infraclavicular
3. Radiation-induced
4. Obstetric
   a. Upper
   b. Lower
   c. Mixed

High (C5/6): Erb’s Palsy
- Abductors and external rotators paralysed
- Waiter’s tip position
- Loss of sensation in C5/6 dermatomes

Low (C8/T1): Klumpke’s Paralysis
- Paralysis of small hand muscles
- Claw hand
- Loss of sensation in C8/T1 dermatomes

Other Nerve Injuries

Radial Nerve (C5-T1)

Low Lesions: posterior interosseous nerve
- Site: # around elbow or forearm
  - E.g. # head of radius
- Loss of extension of CMC joints (finger drop)
- No sensory loss

High Lesions
- Site: # shaft of humerus where N. is in radial groove.
- Wrist drop
- Loss of sensation to dorsum of thumb root (snuff box)
- Triceps functions normally

Very High Lesions
- Site: axilla – e.g. crutches or Sat night palsy
- Paralysis of triceps and wrist drop

Ulnar Nerve (C8-T1)

Site
- Elbow: cubital tunnel
- Wrist: in Guyon’s Canal

Effects
- Intrinsic hand muscle paralysis → claw hand
- Ulnar paradox: lesion at elbow has less clawing as FDP is paralysed, decreasing flexion of 4th/5th digits.
- Weakness of finger ad/abduction (interossei)
- Sensory loss over little finger

Tests
- Can’t cross fingers for luck
- Froment’s Sign: flexion of thumb IPJ when trying to hold onto paper held between thumb and finger.
  - Indicates weak adductor pollicis.

Median Nerve (C5-T1)

Injury Above the Antecubital Fossa
- Can’t flex index finger IPJs (e.g. on clasping hands)
- Can’t flex terminal thumb phalanx (FPL)
- Loss of sensation in median distribution

Injury at the Wrist
- Typically affects abductor pollicis brevis

Carpal Tunnel Syndrome
Carpal Tunnel Syndrome

Anatomy
- Carpal tunnel formed by flexor retinaculum and carpal bones.
- Contains
  - 4 tendons of FDS
  - 4 tendons of FDP
  - 1 tendon of FPL
  - Median N.
- Median N. supplies LLOAF (aBductor pollicis brevis)
- Palmer cutaneous branch travels superficial to flexor retinaculum → spares sensation over thenar area.

Causes
- F>M
- Primary / idiopathic
- Secondary
  - Water: pregnancy, hypothyroidism
  - Radial #
  - Inflammation: RA, gout
  - Soft tissue swelling: lipomas, acromegaly, amyloidosis
  - Toxic: DM, EtOH

Symptoms
- Tingling / pain in thumb, index and middle fingers
- Pain worse @ night or after repetitive actions
- Relieved by shaking / flicking
- Clumsiness

Signs
- ↓ sensation over lateral 3½ fingers
- ↓ 2-point touch discrimination
  - Early sign of irreversible damage
- Wasting of thenar eminence
  - Late sign of irreversible damage
- Phalen’s flexing and Tinel’s tapping

Ix
- Not usually performed
- Nerve conduction studies
- US

Non-surgical Mx
- Mx of underlying cause
- Wrist splints
  - Neutral position
  - Esp. @ night
- Local steroid injections

Surgical Mx
- Carpal tunnel decompression by division of the flexor retinaculum

Complications
- Scar formation: high risk for hypertrophic or keloid
- Scar tenderness: up to 40%
- Nerve injury
  - Palmar cutaneous branch of the median nerve
  - Motor branch to the thenar muscles
- Failure to relieve symptoms

Other Locations of Median Nerve Entrapment
- Pronator syndrome
  - Entrapment between two heads of pronator teres
- Anterior interosseous syndrome
  - Compression of the anterior interosseous branch by the deep head of pronator teres
  - Muscle weakness only
    - Pronator quadratus
    - FPL
    - Radial half of FDP

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Dupuytren’s Contracture
- Progressive, painless fibrotic thickening of palmar fascia.

The Patient
- M>F
- Middle age / elderly
- Skin puckering and tethering
- Fixed flexion contracture of ring and little fingers
- Often bilateral and symmetrical
- MCP and IP joint flexion

Associations: BAD FIBERS
- Bent penis: Peyronies (3%)
- AIDS
- DM
- FH: AD
- Idiopathic: commonest
- Booze: ALD
- Epilepsy and epilepsy meds (phenytoin)
- Reidel’s thyroiditis and other fibromatoses
  - Ledderhose disease
  - Fibrosis of plantar aponeurosis
  - 5% of Dupuytren’s
- Retroperitoneal fibrosis
- Smoking

Management
- Conservative: e.g. physio / exercises
- Fasciectomy
  - e.g. when hand can’t be placed flat on the table.
  - Z-shaped scars: prevent contracture
  - Can damage ulnar nerve
  - Usually recurs

Trigger Finger
- Tendon nodule which catches on proximal side of tendon sheath → triggering on forced extension.
- → Fixed flexion deformity
- Usually ring and middle fingers
- Assoc. of RA
- Rx: steroid injection (high recurrence) or surgery

Ganglion
- Smooth, multilocular cystic swellings
- Mucoid degeneration of joint capsule or tendon sheath
- May be in communication of joint capsules / tendons

Presentation
- 90% located on dorsum of wrist.
- Subdermal, fixed to deeper structures.
  - Limits planes of movement
- May cause pain or nerve pressure symptoms

Management
- 50% disappear spontaneously
- Aspiration ± steroid and hyaluronidase injection
- Surgical excision

Differential
- Lipoma
- Fibroma
- Sebaceous cyst

Differential
- Skin contracture: old laceration or burn
- Tendon fibrosis, trigger finger
- Ulnar N. palsy
Minor Leg and Foot Conditions

Meralgia Paraesthetica
- Entrapment of lat. cutaneous nerve of thigh
  - Between ASIS and inguinal ligament
- Pain ± paraesthesia on the lateral thigh
- No motor deficit
- ↑ risk c¯ obesity: compression by belts, underwear
  - Relieved by sitting down
- Can occasionally be damaged in lap hernia repair

Chondromalacia Patellae
- Predominantly young women
- Patellar aching after prolonged sitting or climbing stairs
- Pain on patellofemoral compression: Clarke’s test
- Ix: no abnormality on X-ray
- Rx: vastus medialis strengthening

Baker’s Cyst
- Popliteal swelling arising between the medial head of gastrocnemius and semimembranosus muscle
- Herniation from joint synovium
- Usually 2° to OA
- Rupture: acute calf pain and swelling
  - DVT differential

Hallux Valgus
- Great toe deviates laterally @ MTP joint
- Pressure of MTP against shoe → bunion
- ↑ wt. bearing @ 2nd metatarsal head
  - → pain: “Transfer metatarsalgia”
  - → hammer toe

Aetiology
- Pointed shoes
- Wearing high heels

Mx
- Conservative: bunion pads, plastic wedge between great and second toes.
- Surgical: metatarsal osteotomy

Lesser Toe Deformities

Morton’s Metatarsalgia / Neuroma
- Pain from pressure on an interdigital neuroma between the metatarsals.
- Pain radiates to medial side of one toe and lateral side of another.
- Rx: neuroma excision
Audiometry
- Quantify loss and determine its nature.

Pure tone audiometry (PTA)
- Headphones deliver tones at different frequencies and strengths in a sound-proofed room.
- Pt. indicates when sound appears and disappears.
- Mastoid vibrator → bone conduction threshold.
- Threshold at different frequencies are plotted to give an audiogram.

Tympanometry
- Measures stiffness of ear drum
  - Evaluates middle ear function
- Flat tympanogram: mid ear fluid or perforation
- Shifted tympanogram: +/- mid ear pressure

Evoked response audiometry
- Auditory stimulus → measurement of elicited brain response by surface electrode.
- Used for neonatal screening (if otoacoustic emission testing negative)

Otalgia

Otitis Externa

Presentation
- Watery discharge
- Itch
- Pain and tragal tenderness

Causes
- Moisture: e.g. swimming
- Trauma: e.g. fingernails
- Absence of wax
- Hearing aid

Organisms
- Mainly pseudomonas
- Staph aureus

Management
- Aural toilet → drops
  - Betamethasone for non-infected eczematous OE
  - Betamethasone + neomycin
  - Hydrocortisone + gentamicin
  - Acidifying drops

Malignant Otitis Externa
- Life-threatening infection which can → skull osteomyelitis
- 90% of pts. are diabetic (or other immune compromise)

Presentation
- Severe otalgia which is worse @ night
- Copious otorrhoea
- Granulation tissue in the canal

Rx
- Surgical debridement
- Systemic Abx

Bullous Myringitis
- Painful haemorrhagic blisters on deep meatal skin and TM.
- Assoc. influenza infection

TMJ Dysfunction

Symptoms
- Earache (referred pain from auriculotemporal N.)
- Facial pain
- Joint clicking/popping
- Teeth-grinding (bruxism)
- Stress (assoc. depression)

Signs
- Joint tenderness exacerbated by lateral movements of an open jaw.

Investigation
- MRI

Management
- NSAIDs
- Stabilising orthodontic occlusal prostheses
**Otitis Media**

**Classification**
- **Acute**: acute phase
- **Glue ear / OME**: effusion after symptom regression
- **Chronic**: effusion > 3mo if bilat or > 6mo if unilat
- **Chronic suppurative OM**: Ear discharge & hearing loss and evidence of central drum perforation.

**Organisms**
- Viral
- Pneumococcus
- Haemophilus
- Moraxella

**Acute OM**

**Presentation**
- Usually children post viral URTI
- Rapid onset ear pain, tugging @ ear.
- Irritability, anorexia, vomiting
- Purulent discharge if drum perforates

**o/e**
- Bulging, red TM
- Fever

**Rx**
- Paracetamol: 15mg/kg
- Amoxicillin: may use delayed prescription

**Complications**
- **Intratemporal**
  - OME
  - Perforation of TM
  - Mastoiditis
  - Facial N. palsy
- **Intracranial**
  - Meningitis / encephalitis
  - Brain abscess
  - Sub- / epi-dural abscess
- **Systemic**
  - Bacteraemia
  - Septic arthritis
  - IE

**OME**

**Presentation**
- Inattention at school
- Poor speech development
- Hearing impairment

**o/e**
- Retracted dull TM
- Fluid level

**Ix**
- Audiometry: flat tympanogram

**Rx**
- Usually resolves spontaneously,
- Consider grommets if persistent hearing loss
  - **SE**: infections and tympanosclerosis

**Chronic Suppurative OM**

**Presentation**
- **Painless** discharge and hearing loss

**o/e**
- TM perforation

**Rx**
- Aural toilet
- Abx / Steroid ear drops

**Complications**
- Cholesteatoma

**Mastoiditis**
- Middle-ear inflam → destruction of mastoid air cells and abscess formation.

**Presentation**
- Fever
- Mastoid tenderness
- Protruding auricle

**Imaging**: CT

**Rx**
- IV Abx
- Myringotomy ± mastoidectomy
Cholesteatoma

**Definition**
- Locally destructive expansion of stratified squamous epithelium within the middle ear.

**Classification**
- Congenital
- Acquired: 2° to attic perforation in chronic suppurative OM

**Presentation**
- Foul smelling white discharge
- Headache, pain
- CN Involvement
  - Vertigo
  - Deafness
  - Facial paralysis

**o/e**
- Appears pearly white c ⊕ surrounding inflammation

**Complications**
- Deafness (ossicle destruction)
- Meningitis
- Cerebral abscess

**Mx**
- Surgery

Tinnitus

**Definition**
- Sensation of sound w/o external sound stimulation

**Causes**
- **Specific**
  - Meniere’s
  - Acoustic neuroma
  - Otosclerosis
  - Noise-induced
  - Head injury
  - Hearing loss: e.g. presbyacusis
- **General**
  - ↑BP
  - ↓Hb
- **Drugs**
  - Aspirin
  - Aminoglycosides
  - Loop diuretics
  - EtOH

**Hx**
- **Character:** constant, pulsatile
- **Unilateral:** acoustic neuroma
- **FH:** otosclerosis
- Alleviating/exacerbating factors: worse @ night?
- Associations
  - **Vertigo:** Meniere’s, acoustic neuroma
  - **Deafness:** Meniere’s, acoustic neuroma
- Cause: head injury, noise, drugs, FH

**Examination**
- Otoscopy
- Tuning fork tests
- Pulse and BP

**Ix**
- Audiometry and tympanogram
- MRI if unilateral to exclude acoustic neuroma

**Mx**
- Treat any underlying causes
- Psych support: tinnitus retraining therapy
- Hypnotics @ night may help
Vertigo

Definition
- The illusion of movement

Causes

Peripheral / Vestibular
- Meniere’s
- BPV
- Labyrinthitis

Central
- Acoustic neuroma
- MS
- Vertebrobasilar insufficiency / stroke
- Head injury
- Inner ear syphilis

Drugs (central/ototoxic)
- Gentamicin
- Loop diuretics
- Metronidazole
- Co-trimoxazole

Hx
- Is it true vertigo or just light-headedness?
  - Which way are things moving?
- Timespan
- Assoc. symptoms: n/v, hearing loss, tinnitus, nystagmus

Examination and Tests
- Hearing
- Cranial nerves
- Cerebellum and gait
- Romberg’s +ve = vestibular or proprioception
- Hallpike manoeuvre
- Audiometry, calorimetry, LP, MRI

Ménière’s Disease

Pathology
- Dilatation of endolymph spaces of membranous labyrinth (endolymphatic oedema)

Presentation
- Attacks occur in clusters and last up to 12h.
- Progressive SNHL
- Vertigo and n/v
- Tinnitus
- Aural fullness

Ix
- Audiometry shows low-freq SNHL which fluctuates

Rx
- Medical
  - Vertigo: cyclizine, betahistine
- Surgical
  - Gentamicin instillation via grommets
  - Saccus decompression

Vestibular Neuronitis / Viral Labyrinthitis

Presentation
- Follows febrile illness (e.g. URTI)
- Sudden vomiting
- Severe vertigo exacerbated by head movement

Rx
- Cyclizine
- Improvement in days

Benign Positional Vertigo: BPV

Pathology
- Displacement of otoliths in semicircular canals
- Common after head injury.

Presentation
- Sudden rotational vertigo for <30s
  - Provoked by head turning
- Nystagmus

Causes
- Idiopathic
- Head injury
- Otosclerosis
- Post-viral

Dx
- Hallpike manoeuvre → upbeat-torsional nystagmus

Rx
- Self-limiting
- Epley manoeuvre
- Betahistine: histamine analogue
Adult Hearing Loss

Conductive
- Impaired conduction anywhere between auricle and round window.

External canal obstruction
- Wax
- Pus
- Foreign body

TM perforation
- Trauma
- Infection

Ossicle defects
- Otosclerosis
- Infection
- Trauma

Inadequate eustachian tube ventilation of middle ear

Sensorineural
- Defects of cochlea, cochlear N. or brain.

Drugs
- Aminoglycosides
- Vancomycin

Post-infective
- Meningitis
- Measles
- Mumps
- Herpes

Misc.
- Meniere’s
- Trauma
- MS
- CPA lesion (e.g. acoustic neuroma)
- ↓B12

Acoustic Neuroma / Vestibular Schwannoma

Pathology
- Benign, slow-growing tumour of superior vestibular N.
- Acts as SOL → CPA syndrome
  - 80% of CPA tumours
- Assoc. ⇔ NF2

Presentation
- Slow onset, unilat SNHL, tinnitus ± vertigo
- Headache (↑ICP)
- CN palsies: 5, 7 and 8
- Cerebellar signs

Ix
- MRI of cerebellopontine angle
  - MRI all pts. ⇔ unilateral tinnitus / deafness
  - PTA

Differential
- Meningioma
- Cerebellar astrocytoma
- Mets

Rx
- Gamma knife
- Surgery (risk of hearing loss)

Otosclerosis
- AD condition characterised by fixation of stapes at the oval window.
- F>M=2:1

Presentation
- Begins in early adult life
- Bilateral conductive deafness + tinnitus
- HL improved in noisy places: Willis’ paracousis
- Worsened by pregnancy/ menstruation/ menopause

Ix
- PTA shows dip (Caharts notch) @ 2kHz

Rx
- Hearing aid or stapes implant

Presbyacussis
- Age-related hearing loss

Presentation
- >65yrs
- Bilateral
- Slow onset
- ± tinnitus

Ix: PTA

Rx: hearing aid
Hearing Loss in Children

Congenital Causes

Conductive
- Anomalies of pinna, external auditory canal, TM or ossicles.
- Congenital cholesteatoma
- Pierre-Robin

SNHL
- **AD**
  - Waardenburgs: SNHL, heterochromia + telecanthus
- **AR**
  - Alport’s: SNHL + haematuria
  - Jewell-Lange-Nielson: SNHL + long QT
- X-linked
  - Alport’s
- Infections: CMV, rubella, HSV, toxo, GBS
- Ototoxic drugs

Perinatal
- Anoxia
- Cerebral palsy
- Kernicterus
- Infection: meningitis

Acquired Causes
- OM/OME
- Infection: meningitis, measels
- Head injury

Universal Neonatal Hearing Tests
- Detection and Mx of hearing loss before 6mo improves language.
- **Tests**
  - Otoacoustic emissions
  - Audiological brainstem responses.

Miscellaneous Ear Conditions

Congenital Anomalies
- 1st and 2nd branchial arches form auricle while 1st branchial groove forms external auditory canal.
- Malfusion → accessory tags/auricles and preauricular pits, fistulae or sinuses.
- Sinuses may get infected, mimicking a sebaceous cyst.

Pinna Haematoma
- Blunt trauma → subperichondrial haematoma.
- Can → ischaemic necrosis of cartilage and subsequent fibrosis to “cauliflower ears”.
- Mx: aspiration + firm packing to auricle contour.

Exostoses
- Smooth, symmetrical bony narrowing of external canals.

Path
- Bony hypertrophy due to cold exposure
  - e.g. from swimming / surfing

Symptoms
- Asympto unless narrowing occludes → conductive deafness.

Rx: conservative or surgical widening

Wax: Cerumen Auris
- Secreted in outer 3rd of canal to prevent maceration
- Wax accumulation can → conductive deafness.
- Mx
  - Suction under direct vision ⌀ microscope
  - Syringing after 1wk softening with olive oil

TM Perforation

Causes
- OM
- Foreign body
- Barotrauma
- Trauma
Allergic Rhinosinusitis

**Classification**
- **Seasonal**: hay-fever (prev = 2%)
- **Perennial**

**Pathology**
- T1HS IgE-mediated inflam from allergen exposure → mediator release from mast cells.
- Allergens: pollen, house dust mites (perennial)

**Symptoms**
- Sneezing
- Pruritus
- Rhinorrhoea

**Signs**
- Swollen, pale and boggy turbinates
- Nasal polyps

**Ix**
- Skin-prick testing to find allergens
  - Don't perform if prone to eczema
- RAST tests

**Mx**

**Allergen Avoidance**
- Regularly washing bedding (inc. toys) on high heat or use acaricides.
- Avoid going outside when pollen count high.

**1st Line**
- **Anti-histamines**: cetirazine, desloratidine
- Or, beclometasone nasal spray
- Or, chromoglycate nasal spray (children)

**2nd Line**: intranasal steroids + anti-histamines

**3rd Line**: Zafirlukast

**4th Line**: Immunotherapy
- Aim to induce desensitisation to allergen
- OD SL grass-pollen tablets → ↑ QOL in hay-fever
- Injection immunotherapy

**Adjuvants**
- **Nasal decongestants**: Pseudoephedrine, Otrivine

Sinusitis

**Pathophysiology**
- Viruses → mucosal oedema and ↓ mucosal ciliary actions → mucus retention ± 2O bacterial infection
- **Acute**: Pneumococcus, Haemophilus, Moraxella
- **Chronic**: S. aureus, anaerobes

**Causes**
- Majority are bacterial infection 2O to viral
- 5% 2O to dental root infections
- Diving / swimming in infected water
- Anatomical susceptibility: deviated septum, polyps
- Systemic Disease
  - PCD / Kartagener’s
  - Immunodeficiency

**Symptoms**
- Pain
  - Maxillary (cheek/teeth)
  - Ethmoidal (between eyes)
  - ↑ on bending / straining
- **Discharge**: from nose → post-nasal drip ↔ foul taste
- **Nasal obstruction / congestion**
- Anosmia or cacosmia (bad smell w/o external source)
- Systemic symptoms: e.g. fever

**Imaging**
- Nasendoscopy ± CT

**Mx**

**Acute / Single Episode**
- Bed-rest, decongestants, analgesia
- Nasal douching and topical steroids
- Abx (e.g. clarithro) of uncertain benefit

**Chronic / recurrent**
- Usually a structural or drainage problem.
- Stop smoking + fluticasone nasal spray
- Functional Endoscopic Sinus Surgery
  - If failed medical therapy

**Complications** (rare)
- Mucoceles → pyoceles
- Orbital cellulits / abscess
- Osteomyelits – e.g. Staph in frontal bone
- Intracranial infection
  - Meningitis, encephalitis
  - Abscess
  - Cavernous sinus thrombosis.
Nasal Polyps

The Patient
- Male, > 40yrs

Sites
- Middle turbinates
- Middle meatus
- Ethmoids

Symptoms
- Watery, anterior rhinorrhoea
- Purulent post-nasal drip
- Nasal obstruction
- Sinusitis
- Headaches
- Snoring

Signs
- Mobile, pale, insensitive

Associations
- Allergic / non-allergic rhinitis
- CF
- Aspirin hypersensitivity
- Asthma

Single Unilateral Polyp
- May be sign of rare but sinister pathology
  - Nasopharyngeal Ca
  - Glioma
  - Lymphoma
  - Neuroblastoma
  - Sarcoma
- Do CT and get histology

Nasal Polyps in Children
- Rare <10yrs old
- Must consider neoplasms and CF

Mx
- Drugs
  - Betamathasone drops for 2/7
  - Short course of oral steroids
- Endoscopic Polypectomy

Fractured Nose

Anatomy
- Upper 3rd of nose has bony support
- Lower 2/3 and septum are cartilaginous.

Hx
- Time of injury
- LOC
- CSF rhinorrhoea
- Epistaxis
- Previous nose injury
- Obstruction
- Consider facial #, check for
  - Teeth malocclusion
  - Piplopa (orbital floor #)

Ix
- Cartilaginous injury won’t show and radiographs don’t alter Mx.

Mx
- Exclude septal haematoma
- Re-examine after 1wk (↓ swelling)
- Reduction under GA c ¯ post-op splinting best w/i 2wks

Septal haematoma
- Septal necrosis + nasal collapse if untreated
  - Cartilage blood supply comes from mucosa
- Boggy swelling and nasal obstruction
- Needs evacuation under GA c ¯ packing ± suturing.
Epistaxis

Causes

- 80% unknown
- Trauma: nose-picking / #s
- Local infection: URTI
- Pyogenic granuloma
  - Overgrowth of tissue on Little’s area due to irritation or hormonal factors.
- Osler-Weber-Rendu / HHT
- Coagulopathy: Warfarin, NSAIDs, haemophilia, ↓ plats, vWD, ↑ EtOH
- Neoplasm

Classification

- Anterior
- Posterior

Initial Mx

- Wear PPE
- Assess for shock and manage accordingly
  - If not shocked
    - Sit up, head tilted down
    - Compress nasal cartilage for 15min.
  - If bleeding not controlled remove clots (suction or by blowing) and try to visualise bleed by rhinoscopy

Anterior Epistaxis

- Usually septal haemorrhage: Little’s area / Kisselbach’s plexus
  - Ant. Ethmoidal A.
  - Sphenopalatine A.
  - Facial A.
- Insert gauze soaked in vasoconstrictor + LA
  - Xyloketazoline + 2% lignocaine
  - 5min
- Bleeds can be cauterised (silver nitrate sticks)
- Persistent bleeds should be packed with Mericel pack
  - Refer to ENT if this fails or if you can’t visualise the bleeding point.
  - They may insert a posterior pack or take pt. to theatre for endoscopic control.

Posterior / Major Epistaxis

- Posterior packing (+ anterior pack)
  - Pass 18/18G Foley catheter through the nose into nasopharynx, inflate (c) 10ml water and pull forward until it lodges.
  - Admit pt. and leave pack for ~48hrs.
- Gold standard is endoscopic visualisation and direct control: e.g. by cauterity or ligation.

After the Bleed

- Don’t pick nose
- Sit upright, out of the sun
- Avoid bending, lifting or straining
- Sneezing through mouth
- No hot food or drink
- Avoid EtOH and tobacco

Osler-Weber-Rendu / HHT

- Autosomal dominant
- 5 genetic subtypes

Features

- Telangiectasias in mucosae
  - Recurrent spontaneous epistaxis
  - GI bleed (usually painless)
- Internal telangiectasias and AVMs
  - Lungs
  - Liver
  - Brain
- Rarely
  - Pulmonary HTN
  - Colon polyps: may → CRC
Tonsillitis

Symptoms
- Sore throat
- Fever, malaise

Signs
- Lymphadenopathy: esp. jugulodigastric node
- Inflamed tonsils and oropharynx
- Exudates

Organisms
- Viruses are most common (consider EBV)
- GAS: Pyogenes
- Staphs
- Moraxella

Mx
- Swabbing superficial bacteria is irrelevant and can → overdiagnosis.
- Analgesia: Ibuprofen / Paracetamol ± Difflam gargle
- Consider Abx only if ill: use Centor Criteria
  - Pen V 250mg PO QDS (125mg TDS in children) or erythromycin for 5/7
  - NOT AMOXICILLIN → MACPAP RASH IN EBV

Centor Criteria
- Guideline for admin of Abx in acute sore throat / tonsillitis / pharyngitis
  - 1 Point for Each of
    1. Hx of fever
    2. Tonsillar exudates
    3. Tender anterior cervical adenopathy
    4. No cough

Mx
- 0-1: no Abx (risk of strep infection <10%)
- 2: consider rapid Ag test + Rx if +ve
- ≥3: Abx

Tonsillectomy

Indications
- Recurrent tonsillitis if all the below criteria are met
  - Caused by tonsillitis
  - 5+ episodes/yr
  - Symptoms for >1yr
  - Episodes are disabling and prevent normal functioning
- Airway obstruction: e.g. OSA in children
- Quinsy
- Suspicion of Ca: unilateral enlargement or ulceration

Methods
- Cold steel
- Cautery

Complications
- Reactive haemorrhage
- Tonsillar gag may damage teeth, TMJ or posterior pharyngeal wall.
- Mortality is 1/30,000

Strep Throat Complications

Peritonsillar Abscess (Quinsy)
- Typically occurs in adults

Symptoms
- Trismus
- Odonophagia: unable to swallow saliva
- Halitosis

Signs
- Tonsillitis
- Unilateral tonsillar enlargement
- Contralateral uvula displacement
- Cervical lymphadenopathy

Rx
- Admit
- IV Abx
- I&D under LA or tonsillectomy under GA

Retropharyngeal Abscess
- Rare

Presentation
- Unwell child c ¯ stiff, extended neck who refuses to eat or drink
- Fails to improve c ¯ IV Abx
- Unilateral swelling of tonsil and neck

Ix
- Lat. neck x-rays show soft tissue swelling
- CT from skull-base to diaphragm.

Rx
- IV Abx
- I&D

Lemierre’s Syndrome
- IJV thrombophlebitis c ¯ septic embolization most commonly affecting the lungs.
- Organism: Fusobacterium necrophorum
- Rx
  - IV Abx: pen G, clinda, metro

Scarlet Fever
- “Sandpaper”-like rash on chest, axillae or behind ears 12-48h after pharyngotonsillitis.
- Circumoral pallor
- Strawberry tongue
- Rx
  - Start Pen V/G and notify HPA.

Rheumatic Fever
- Carditis
- Arthritis
- Subcutaneous nodules
- Erythema marginatum
- Sydenham’s chorea

Post-streptococcal Glomerulonephritis
- Malaise and smoky urine 1-2wks after a pharyngitis
The Larynx

Functions
- Phonation
- Positive thoracic pressure: inc. auto-PEEP
- Respiration
- Prevention of aspiration

Laryngitis
- Usually viral and self-limiting
- 2\textsuperscript{nd} bacterial infection may develop
- **Symptoms**: pain hoarseness and fever
- **o/e**: redness and swelling of the vocal cords
- **Rx**: Supportive, Pen V if necessary

Laryngeal Papilloma
- Pedunculated vocal cord swellings caused by HPV
- Present \(\rightarrow\) hoarseness
- Usually occur in children
- **Rx**: laser removal

Recurrent Laryngeal N. Palsy
- Supplies all intrinsic muscles of the larynx except for cricothyroideus.
  - Ext. branch of sup laryngeal N.
- Responsible for ab- and ad-uction of vocal folds

Symptoms
- Hoarseness
- "Breathy" voice \(\rightarrow\) bovine cough
- Repeated coughing from aspiration (↓ supraglottic sensation)
- Exertional dyspnoea (narrow glottis)

Causes
- 30\% are cancers: larynx, thyroid, oesophagus, hypopharynx, bronchus
- 25\% iatrogenic: para- / thyroidectomy, carotid endarterectomy
- Other: aortic aneurysm, bulbar / pseudobulbar palsy

Laryngeal SCC
- **Incidence**: 2000/yr in uk
- **Associations**: smoking, EtOH

Presentation
- Male smoker
- Progressive hoarseness \(\rightarrow\) stridor
- Dys-/odono-phagia
- **Wt. loss**

Lx
- Laryngoscopy + biopsy (inc. nodes)
- MRI staging

Mx
- Based on stage
- Radiotherapy
- Laryngectomy

After total laryngectomy
- Pts have permanent tracheostomy
  - Speech valve
  - Electrolarynx
  - Oesophageal speech (swallowed air)
- Regular f/up for recurrence

Paediatric Airway Issues

Laryngomalacia
- Immature and floppy aryepiglottic folds and glottis \(\rightarrow\) laryngeal collapse on inspiration

Presentation
- Stridor: commonest cause in children
- Presents w/i first wks of life.
- Noticeable \(\rightarrow\) certain times
  - Lying on back,
  - Feeding
  - Excited/upset
- Problems can occur \(\rightarrow\) concurrent laryngeal infections or \(\rightarrow\) feeding.

Mx
- Usually no Rx required but severe cases may warrant surgery.

Epiglottitis

Symptoms
- Sudden onset
- Continuous stridor
- Drooling
- Toxic

Pathogens: haemophilus, GAS

Rx
- Don’t examine throat
- Consult \(\rightarrow\) anaesthetists and ENT surgeons
- \(\text{O}_2\) + nebulised adrenaline
- IV dexamethasone
- Cefotaxime
- Take to theatre to secure airway by intubation

Foreign Body
- Sudden onset stridor in a previously normal child.
- Back slaps and abdominal thrusts.
- Needle cricothyro tomy in children
- Can only exclude foreign body in bronchus by bronchoscopy

Subglottic Stenosis
- Subglottis is narrowest part of respiratory tract in children.
- **Symptoms**: stridor, FTT
- **Causes**
  - Prolonged intubation
  - Congenital abnormalities
- **Rx**
  - Mild: conservative
  - Severe: Tracheostomy or partial tracheal resection

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Facial Nerve Palsy

Bell's Palsy
- Inflammatory oedema from entrapment of CNVII in narrow facial canal
- Probably of viral origin (HSV1).
- 75% of facial palsy

Features
- Sudden onset: e.g. overnight
- Complete, unilateral facial weakness in 24-72h
  - Failure of eye closure (Bell's Sign) → dryness and conjunctivitis
  - Drooling, speech difficulty
- Numbness or pain around ear
- ↓ taste (ageusia)
- Hyperacusis: stapedius palsy

Ix
- Serology: Borrelia or VZV Abs
- MRI: SOL, stroke, MS
- LP

Mx
- Protect eye
  - Dark glasses
  - Artificial tears
  - Tape closed @ night
- Give prednisolone w/i 72hrs
  - 60mg/d PO for 5/7 followed by tapering
- Valaciclovir if zoster suspected (otherwise antivirals don’t help).
- Plastic surgery may help if no recovery

Prognosis
- Incomplete paralysis usually recovers completely w/i wks.
- With complete lesions, 80% get full recovery but the remainder have delayed recovery or permanent neurological / cosmetic abnormalities.

Complications: Aberrant Neural Connections
- Synkinesis: e.g. blinking causes up-turning of mouth
- Crocodile tears: eating stimulates unilateral lacrimation, not salivation

Ramsay Hunt Syndrome
- American neurologist James Ramsay Hunt in 1907
- Reactivation of VZV in geniculate ganglion of CNVII

Features
- Preceding ear pain or stiff neck
- Vesicular rash in auditory canal ± TM, pinna, tongue, hard palate (no rash = zoster sine herpete)
- Ipsilateral facial weakness, ageusia, hyperacusis,
- May affect CN7 → vertigo, tinnitus, deafness

Mx
- If Dx suspected give valaciclovir and prednisolone w/i first 72h

Prognosis
- Rxed w/i 72h: 75% recovery
- Otherwise: 1/3 full recovery, 1/3 partial, 1/3 poor

Other Causes of Facial Palsy

May be suggested by
- Bilateral symptoms (Lyme, GBS, leukaemia, sarcoid)
- UMN signs: sparing of frontalis and orbicularis oculi
- Other CN palsies (but seen in 8% of Bell’s)
- Limb weakness
- Rashes

Intracranial Lesions
- Vascular, MS, SOL
  - Motor cortex → UMN signs
  - Brainstem nuclei → LMN signs
- Cerebello-pontine angle lesion
  - May be accompanied by 5th, 6th, and 8th CN palsies

Infratemporal Lesions
- Otitis media
- Cholesteatoma
- Ramsay Hunt

Systemic
- Peripheral neuropathy
  - Demyelinating: GBS
  - Axonal: DM, Lyme, HIV, Sarcoid
- Pseudopalsy: MG, botulism

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Pupils

Afferent Defect

Features
- No direct response but intact consensual response
- Cannot initiate consensual response in contralateral eye.
- Dilatation on moving light from normal to abnormal eye

Causes
- Total CN II lesion

Relative Afferent Pupillary Defect
- = Marcus-Gunn Pupil

Features
- Minor constriction to direct light
- Dilatation on moving light from normal to abnormal eye.
- RAPD = Marcus Gunn Pupil

Causes
- Optic neuritis
- Optic atrophy
- Retinal disease

Efferent Defect

Feature
- Dilated pupil does not react to light
- Initiates consensual response in contralateral pupil
- Ophthalmoplegia + ptosis

Cause
- 3rd nerve palsy
  - The pupil is often spared in a vascular lesion (e.g. DM) as pupillary fibres run in the periphery.

Differential of a fixed dilated pupil
- Mydriatics: e.g. tropicamide
- Iris trauma
- Acute glaucoma
- CN3 compression: tumour, coning

Argyll Robertson Pupil

Features
- Small, irregular pupils
- Accommodate but doesn’t react to light
- Atrophied and depigmented iris

Cause
- DM
- Quaternary syphilis

Holmes-Adie Pupil

Features
- Young woman c sudden blurring of near vision
- Initially unilateral and then bilateral pupil dilatation
- Dilated pupil has no response to light and sluggish response to accommodation.
  - A “tonic” pupil

Ix
- Iris shows spontaneous wormy movements on slit-lamp examination
  - Iris streaming

Cause
- Damage to postganglionic parasympathetic fibres
- Idiopathic: may have viral origin

Holmes-Adie Syndrome
- Tonic pupil + absent knee/ankle jerks + ↓ BP

Horner’s Syndrome

- Johann Horner (1831-1886), Swiss ophthalmologist

Features: PEAS
- Ptosis: partial (superior tarsal muscle)
- Enophthalmos
- Anhydrosis
- Small pupil

Causes
- Central
  - MS
- Wallenberg’s Lateral Medullary Syndrome
- Pre-ganglionic (neck)
  - Pancoast’s tumour: T1 nerve root lesion
  - Trauma: CVA insertion or CEA
- Post-ganglionic
  - cavernous sinus thrombosis
    - Usually 2nd to spreading facial infection via the ophthalmic veins
    - CN 3, 4, 5, 6 palsies

Holmes-Adie Syndrome
- Tonic pupil + absent knee/ankle jerks + ↓ BP

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Optic Atrophy / Optic Neuropathy

Features
- ↓ acuity
- ↓ colour vision (esp. red)
- Central scotoma
- Pale optic disc
- RAPD

Causes: CAC VISION
- Commonest: MS and glaucoma

Congenital
- Leber’s hereditary optic neuropathy
  - Epi: mitochondrial, onset 20-30s
  - PC: attacks of acute visual loss, sequential in each eye ± ataxia and cardiac defects
- HMSN / CMT
- Friedich’s ataxia
- DIDMOAD
- Retinitis pigmentosa

Alcohol and Other Toxins
- Ethambutol
- Lead
- B12 deficiency

Compression
- Neoplasia: optic glioma, pituitary adenoma
- Glaucoma
- Paget’s

Vascular: DM, GCA or thromboembolic
Inflammatory: optic neuritis – MS, Devic’s, DM
Sarcoid / other granulomatous
Infection: herpes zoster, TB, syphilis
Oedema: papilloedema
Neoplastic infiltration: lymphoma, leukaemia
Red Eye: History, Examination and Differential

**Visual History**

**Vision**
- Blurred
- Distorted
- Diplopia
- Field defect / Scotoma
- Floaters, Flashes

**Sensation**
- Irritation
- Pain
- Itching
- Photophobia
- FB

**Appearance**
- Red: ?distribution
- Lump
- Puffy lids

**Discharge**
- Watering
- Sticky
- Stringy

**Key Examination Questions**
- Inspect from anterior to posterior
- Is acuity affected?
- Is the globe painful?
- Pupil size and reactivity?
- Cornea: intact, cloudy? Use fluorescein

**Signs of Serious Disease**
- Photophobia
- Poor vision
- Corneal fluorescein staining
- Abnormal pupil

---

### Differential

<table>
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<tr>
<th>Site</th>
<th>Mechanical</th>
<th>Inflammation</th>
<th>Infection</th>
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<td>Preseptal cellulitis</td>
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<td>Chalazion</td>
<td>Orbital cellulitis</td>
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<td>Endophthalmitis</td>
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### Presentation Summary

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<th>Anterior Uveitis</th>
<th>Conjunctivitis</th>
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<td>+/-</td>
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<tr>
<td>Photophobia</td>
<td>+ +</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Acuity</td>
<td>↓</td>
<td>↓</td>
<td>normal</td>
</tr>
<tr>
<td>Cornea</td>
<td>hazy/cloudy</td>
<td>normal</td>
<td>normal</td>
</tr>
<tr>
<td>Pupil</td>
<td>large</td>
<td>small</td>
<td>normal</td>
</tr>
<tr>
<td>IOP</td>
<td>↑↑</td>
<td>normal</td>
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Red Eyes: Specific Diseases

Acute Closed Angle Glaucoma
- Blocked drainage of aqueous from anterior chamber via the canal of Schlemm.
- Pupil dilatation (e.g. @ night) worsens the blockage.
- Intraocular pressure rises from 15-20 → >60mmHg

Risk Factors
- Hypermetropia
- Shallow ant. chamber
- Female
- FH
- ↑ age
- Drugs
  - Anti-cholinergics
  - Sympathomimetics
  - TCAs
  - Anti-histamines

Symptoms
- Prodrome: rainbow haloes around lights at night-time.
- Severe pain c ¯ n/v
- ↓ acuity and blurred vision

Examination
- Cloudy cornea c¯ circumcorneal injection
- Fixed, dilated, irregular pupil
- ↑ IOP makes eye feel hard

Ix
- Tonometry: ↑↑ IOP (usually >40mmHg)

Acute Mx: Refer to Ophthalmologist
- Pilocarpine 2-4% drops stat: miosis opens blockage
- Topical β-B (e.g. timolol): ↓ aqueous formation
- Acetazolamide 500mg IV stat: ↓ aqueous formation
- Analgesia and antiemetics

Subsequent Mx
- Bilat YAG peripheral iridotomy once IOP ↓ medically

Anterior Uveitis / Acute Iritis

Pathophysiology
- Uvea is pigmented part of eye and included: iris, ciliary body and choroid.
- Iris + ciliary body = anterior uvea
- Iris inflammation involves ciliary body too.

Symptoms
- Acute pain and photophobia
- Blurred vision (aqueous precipitates)

Examination
- Small pupil initially, irregular later
- Circumcorneal injection
- Hypopyon: pus in anterior chamber
- White (keratic) precipitates on back of cornea
- Talbots test: ↑ pain on convergence

Associations (most have no systemic associations)
- Seronegative arthritis: AS, psoriatic, Reiter’s
- Still’s / JIA
- IBD
- Sarcoidosis
- Behcet’s
- Infections: TB, leprosy, syphilis, HSV, CMV, toxo

Mx
- Refer to ophthalmologist
- Prednisolone drops
- Cyclopentolate drops: dilates pupil and prevents adhesions between iris and lens (synechiae)

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Episcleritis
- Inflammation below conjunctiva in the episclera

Presentation
- Localised reddening: can be moved over sclera
- Painless / mild discomfort
- Acuity preserved

Causes
- Usually idiopathic
- May complicate RA or SLE

Rx: Topical or systemic NSAIDs

Scleritis
- Vasculitis of the sclera

Presentation
- Severe pain: worse on eye movement
- Generalised scleral inflammation
  - Vessels won’t move over sclera
- Conjunctival oedema (chemosis)

Causes
- Wegener’s
- RA
- SLE
- Vasculitis

Mx
- Refer to specialist
- most need or corticosteroids or immunosuppressants

Complications:
- Scleromalacia (thinning) → globe perforation

Conjunctivitis

Presentation
- Often bilateral ⚫ purulent discharge
  - Bacterial: sticky (staph, strep, Haemophilus)
  - Viral: watery
- Discomfort
- Conjunctival injection
  - Vessels may be moved over the sclera
- Acuity, pupil responses and cornea are unaffected.

Causes
- Viral: adenovirus
- Bacterial: staphs, chlamydia, gonococcus
- Allergic

Rx
- Bacterial: chloramphenicol 0.5% ointment
- Allergic: anti-histamine drops: e.g. emedastine

Conjunctival Ulcer + Keratitis (corneal inflammation)

Causes: bacterial, herpetic, fungal, protozoa, vasculitic (RA)
- Dendritic ulcer = Herpes simplex
- Acanthamoeba: protazoal infection affecting contact lens wearers swimming in pools.

Presentation
- Pain, photophobia
- Conjunctival hyperaemia
- ↓ acuity
- White corneal opacity

Risk factors: contact lens wearers

Ix: green ⚫ fluorescein on slit lamp

Rx: refer immediately to specialist who will
- Take smears and cultures
- Abx drops, oral/topical aciclovir
- Cycloplegics/mydriatics ease photophobia
- Steroids may worsen symptoms: professionals only

Complications
- Scarring and visual loss

Ophthamalic Shingles
- Zoster of CNV₁
- 20% of all Shingles (only commoner in thoracic dermatomes)

Presentation
- Pain in CNV₁ dermatome precedes blistering rash
- 40% → keratitis, iritis
- Hutchinson’s sign
  - Nose-tip zoster due to involvement of nasociliary branch.
  - ↑ chance of globe involvement as nasociliary nerve also supplies globe
- Ophthalmic involvement
  - Keratitis + corneal ulceration (fluorescein stains)
  - ± iritis

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Sudden Loss of Vision

Key Questions
- Headache associated: GCA
- Eye movements hurt: optic neuritis
- Lights / flashes preceding visual loss: detached retina
- Like curtain descending: TIA, GCA
- Poorly controlled DM: vitreous bleed from new vessels

Anterior Ischaemic Optic Neuropathy (AION)
- Optic nerve damaged if posterior ciliary arteries blocked by inflammation or atheroma.
- Pale / swollen optic disc

Causes
- Arteritic AION: Giant Cell Arteritis
- Non-arteritic AION: HTN, DM, ↑ lipids, smoking

Optic Neuritis

Symptoms
- Unilateral loss of acuity over hrs – days
- ↓ colour discrimination (dyschromatopsia)
- Eye movements may hurt

Signs
- ↓ acuity
- ↓ colour vision
- Enlarged blind-spot
- Optic disc may be: normal, swollen, blurred
- Afferent defect

Causes
- Multiple sclerosis (45-80% over 15yrs)
- DM
- Drugs: ethambutol, chloramphenicol
- Vitamin deficiency
- Infection: zoster, Lyme disease

Rx
- High-dose methyl-pred IV for 72h
- Then oral pred for 11/7

Vitreous Haemorrhage

Source
- New vessels: DM
- Retinal tears / detachment / trauma

Presentation
- Small bleeds → small black dots / ring floaters
- Large bleed can obscure vision → no red reflex, retina can’t be visualised

Ix
- May use B scan US to identify cause

Mx
- VH undergoes spontaneous absorption
- Vitrectomy may be performed in dense VH

Central Retinal Artery Occlusion

Presentation
- Dramatic unilateral visual loss in seconds
- Afferent pupil defect (may precede retinal changes)
- Pale retina → cherry-red macula

Causes
- GCA
- Thromboembolism: clot, infective, tumour

Rx
- If seen w/i 6h aim is to ↑ retinal blood flow by ↓ IOP
  - Ocular massage
  - Surgical removal of aqueous
  - Anti-hypertensives (local and systemic)

Retinal Vein Occlusion

Central
- Commoner than arterial occlusion
- Causes: arteriosclerosis, ↑BP, DM, polycythaemia
- Pres: sudden unilat visual loss → RAPD
- Fundus: Stormy Sunset Appearance
  - Tortuous dilated vessels
  - Haemorrhages
  - Cotton wool spots
- Complications
  - Glaucoma
  - Neovascularisation
- Prognosis: possible improvement for 6mo-1yr

Branch
- Presentation: unilateral visual loss
- Fundus: segmental fundal changes
- Comps: retinal ischaemia → VEGF release and neovascularisation (Rx: laser photocoagulation)

Retinal Detachment

- Holes/tears in retina allow fluid to separate sensory retina from retinal pigmented epithelium
- May be 2nd to cataract surgery, trauma, DM

Presentation: 4 F’s
- Floaters: numerous, acute onset, “spiders-web”
- Flashes
- Field loss
- Fall in acuity
- Painless

Fundus: grey, opalescent retina, ballooning forwards

Rx
- Urgent surgery
- Vitrectomy + gas tamponade + laser coagulation to secure the retina.

Causes of transient visual loss
- Vascular: TIA, migraine
- MS
- Subacute glaucoma
- Papilloedema
Gradual Visual Loss

Causes

Common
- Diabetic retinopathy
- ARMD
- Cataracts
- Open-angle Glaucoma

Rarer
- Genetic retinal disease: retinitis pigmentosa
- Hypertension
- Optic atrophy

Age-Related Macular Degeneration (ARMD)
- Commonest cause of blindness >60yrs
- 30% of >75yrs will have dry AMD

Risk Factors
- Smoking
- ↑ age
- Genetic factors

Presentation
- Elderly pts.
- Central visual loss

Dry ARMD: Geographic Atrophy
- Drusen: fluffy white spots around macula
- Degeneration of macula
- Slow visual decline over 1-2yrs

Wet ARMD: Subretinal Neovascularisation
- Aberrant vessels grow into retina from choroid and → haemorrhage
- Rapid visual decline (sudden / days / wks) → distortion
- Fundoscopy shows macular haemorrhage → scarring
- Amsler grid detects distortion

Ix
- OCT: optical coherence tomography
  - Gives high resolution images of the retina

Mx for Wet AMRD
- Photodynamic therapy
- Intravitreal VEGF inhibitors
  - Bevacizumab (Avastin)
  - Ranibizumab (Lucentis)
- Antioxidant vitamins (C,E) + zinc may help early ARMD

Tobacco-Alcohol Amblyopia
- Due to toxic effects of cyanide radicals when combined with thiamine deficiency.
- Pres: Optic atrophy, loss of red/green discrimination, scotomata
- Rx: vitamins may help

Chronic Simple (Open-Angle) Glaucoma

Pathogenesis
- Depends on susceptibility of pt’s. retina and optic nerve to ↑ IOP damage.
- IOP >21mmHg → ↓ blood flow and damage to optic nerve → optic disc atrophy (pale) + cupping

Presentation
- Peripheral visual field defect: superior nasal first
- Central field is intact : acuity maintained until late
  - Presentation delayed until optic N. damage is irreversible

Screen if High Risk
- >35yrs
- Afro-Caribbean
- FH
- Drugs: steroids
- Co-morbidities: DM, HTN, migraines
- Myopia

Ix
- Tonometry: IOP ≥21mmHg
- Fundoscopy: cupping of optic disc
- Visual field assessment: peripheral loss

Mx
- Life-long f/up

Eye-drops to ↓ IOP to baseline
- 1st line: β-blockers
  - Timolol, betaxolol
  - ↓ aqueous production
  - Caution in asthma, heart failure
- Prostaglandin analogues
  - Latanoprost, travoprost
  - ↑ uveoscleral outflow
- α-agonists
  - Brimonidine, apraclonidine
  - ↓ aqueous production and ↑ uveoscleral outflow
- Carbonic anhydrase inhibitors
  - Dorzolamide drops, acetazolamide PO
- Miotics
  - Pilocarpine

Non-medical Options
- Laser trabeculoplasty
- Surgery (trabeculectomy) is used if drugs fail
  - New channel allows aqueous to flow into conjunctival bleb

Commonest Causes of Blindness Worldwide
- Trachoma
- Cataracts
- Glaucoma
- Keratomalacia: vitamin A deficiency
- Onchocerciasis
- Diabetic Retinopathy
The Eye in DM

The Problem
- DM is leading cause of blindness up to 60yrs
- 30% have ocular problems @ presentation
- BP < 130/80 and normoglycaemia → ↓ diabetic retinopathy

Pathogenesis

Cataract
- DM accelerates cataract formation
- Lens absorbs glucose which is converted to sorbitol by aldose reductase.

Retinopathy
- Microangiopathy → occlusion
  - Occlusion → ischaemia → new vessel formation in retina
    - Bleed → vitreous haemorrhage
    - Carry fibrous tissue c ¯ them → retinal detachment
- Occlusion also → cotton wool spots (ischaemia)
- Vascular leakage → oedema and lipid exudates
- Rupture of microaneurysms → blot haemorrhage

Screening
- All diabetics should be screened annually
- Fundus photography
- Refer those c ¯ maculopathy, NPDR and PDR to ophthalmologist
  - 30% NPDR develop PDR in 1yr

Ix
- Fluorescein angiography

Mx
- Good BP and glycaemic control
- Rx concurrent disease: HTN, dyslipidaemia, renal disease, smoking, anaemia
- Laser photocoagulation
  - Maculopathy: focal or grid
  - Proliferative disease: pan-retinal (macula spared)

CN Palsies
- CNIII and VI palsies may occur
- In diabetic CNIII palsy the pupil may be spared as its nerve fibres run peripherally and receive blood from pial vessels.

Fundoscopy Findings

Background Retinopathy: Leakage
- Dots: microaneurysms
- Blot haemorrhages
- Hard exudates: yellow lipid patches

Pre-proliferative Retinopathy: Ischaemia
- Cotton-wool spots (infarcts)
- Venous beading
- Dark Haemorrhages
- Intra-retinal microvascular abnormalities

Proliferative Retinopathy
- New vessels
- Pre-retinal or vitreous haemorrhage
- Retinal detachment

Maculopathy
- Caused by macular oedema
- ↓ acuity may be only sign
- Hard exudates w/i one disc width of macula
Cataracts

Presentation
- Increasing myopia
- Blurred vision → gradual visual loss
- Dazzling in sunshine / bright lights
- Monocular diplopia

Causes
- ↑ Age: 75% of >65s
- DM
- Steroids
- Congenital
  - Idiopathic
  - Infection: rubella
  - Metabolic: Wilson’s, galactosaemia
  - Myotonic dystrophy

Ix
- Visual acuity
- Dilated Fundoscopy
- Tonometry
- Blood glucose to exclude DM

Mx

Conservative
- Glasses
- Mydriatic drops and sunglasses may give some relief

Surgery
- Consider if symptoms affect lifestyle or driving (<6/10)
- Day-case surgery under LA
  - Phacoemulsion + lens implant
- 1% risk of serious complications
  - Anterior uveitis / iritis
  - VH
  - Retinal detachment
  - Secondary glaucoma
  - Endophthalmitis (→ blindness in 0.1%)
- Post-op capsule thickening is common
  - Easily Rx c ¯ laser capsulotomy.
- Post-op eye irritation is common and requires drops

The Retina
- Outer pigmented layer in contact ¯ the choroid
- Inner sensory layer in contact ¯ vitreous
- At centre is fovea

Optic Disc

Colour
- Should be pale pink
- Paler in optic atrophy

Contour
- Margins blurred in papilloedema and optic neuritis

Cup
- Physiological cup lies centrally and should occupy 1/3 of disc diameter
- Cup widening and deepening in glaucoma

Retinitis Pigmentosa
- Most prevalent inherited degeneration of the macula
- Various modes of inheritance
  - Mostly AR
  - AD has best prognosis
  - X-linked has worst prognosis
- Affects ~ 1/2000

Presentation
- Night blindness
- ↓↓ visual fields → tunnel vision
- Most are registrable blind (<3/60) by mid 30s

Fundoscopy
- Pale optic disc: optic atrophy
- Peripheral retina pigmentation: spares the macula

Associations
- Friedrich’s ataxia
- Refsum’s disease
- Kearns-Sayre Syndrome
- Usher’s Syndrome

Retinoblastoma
- Commonest intraocular tumour in children
- 1:15,000 LBs

Inheritance
- Hereditary type differs from non-hereditary type
- AD mutation of RB gene (a TSG)
- Pts. typically have one mutant allele in every retinal cell; if the other allele mutates → retinoblastoma.

Associations
- 5% occur ¯ pineal or other tumour
- ↑ risk of osteosarcoma and rhabdomyosarcoma

Signs
- Stabismus
- Leukocoria (white pupil) → no red reflex

Rx
- Depends on size
- Options include: chemo, radio, enucleation
The External Eye

Inflammatory Lid Swellings

Stye or hordeolum externum
- An abscess / infection in a lash follicle which points outwards.
- Rx: local Abx – e.g. fusidic acid

Chalazion or hordeolum internum
- Abscess of the Meibomian glands which points inwards onto conjunctiva.
  - Sebaceous glands of eyelid

Blepharitis
- Chronic inflammation of eyelid
- Causes: seborrhoeic dermatitis, staphs
- Features
  - Red eyes
  - Gritty / itchy sensation
  - Scales on lashes.
  - Often assoc. c rosacea
- Rx
  - Clean crusts of lashes c warm soaks
  - May need fusidic acid drops

Entropion
- Lid inversion → corneal irritation
- Degeneration of lower lid fascia

Ectropion
- Low lid eversion → watering and exposure keratitis
- Assoc. c ageing and facial N. palsy

Ptosis
- True ptosis is intrinsic LPS weakness
- Bilateral
  - Congenital
  - Senile
  - MG
  - Myotonic dystrophy
- Unilateral
  - 3rd Nerve palsy
  - Horner’s syndrome (partial)
  - Mechanical: xanthelasma, trauma

Exophthalmos / Proptosis
- Protrusion of one or both eyes

Common Causes
- Graves’ Disease
  - 25-50%
  - ↑ risk in smoker’s
- Anti-TSH Abs → retro-orbital inflammation and lymphocyte infiltration → swelling
- Orbital cellulitis
- Trauma

Other Causes
- Idiopathic orbital inflammatory disease
- Vasculitis: Wegener’s
- Neoplasm
  - Lymphoma
  - Optic glioma: assoc. c NF-1
  - Capillary haemangioma
  - Mets
- Carotico-cavernous fistula

Lagophthalmos
- Difficulty in lid closure over the globe which may → exposure keratitis
- Causes: exophthalmos, facial palsy, injury
- Rx
  - Lubricate eyes c liquid paraffin ointment
  - Temporary tarsorrhaphy may be needed if corneal ulcers develop.

Pinguecula
- Yellow vascular nodules either side of the cornea

Pterygium
- Similar to pinguecula but grows over the cornea → ↓ vision.
- Benign growth of conjunctiva
- Assoc. c dusty, wind-blown life-styles, sun exposure

Orbital Swellings

 Orbital Cellulitis

Pathophysiology
- Infection spreads locally: e.g. from paranasal sinuses, eyelid or external eye.
- Staphs, pneumococcus, GAS

Presentation
- Usually a child c inflammation of the orbit + lid swelling
- Pain and ↓ range of eye movement
- Exophthalmos
- Systemic signs: e.g. fever
- ± tenderness over the sinuses

Rx
- IV Abx: Cefuroxime (20mg/kg/8h IV)

Complications
- Local extension → meningitis and cavernous sinus thrombosis.
- Blindness due to optic N. pressure.

Carotico-cavernous fistula
- May follow carotid aneurysm rupture c reflux of blood into cavernous sinus.
- Causes: spontaneous, trauma
- Presentation
  - Engorgement of eye vessels
  - Lid and conjunctival oedema,
  - Pulsatile exophthalmos
  - Eye bruit

Rx
- Oral antivirals: famciclovir, aciclovir

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Refractive Errors
Refractive errors arise from disorders of the size and shape of the eye.

Myopia: Short-sightedness
The Problem
- The eye is too long
- Distant objects are focussed too far forward.
Causes
- Genetic
- Excessive close work in the early decades
The Solution
- Concave lenses

Astigmatism
The Problem
- Cornea or lens doesn’t have same degree of curvature in horizontal and vertical planes.
- Image of object is distorted longitudinally or vertically
The Solution
- Correcting lenses

Hypermetropia: long-sightedness
The Problem
- Eye is too short
- When eye is relaxed and not accommodating, objects are focussed behind the retina.
- Contraction of ciliary muscles to focus image → tiredness of gaze and possibly a convergent squint in children.
The Solution
- Convex lenses

Presbyopia
- With age, lens becomes stiff and less easy to deform.
- Start at about 40yrs and are complete by 60yrs.
- Use convex lenses.

Strabismus / Squint / Tropia
Esotropia = convergent squint
- Commonest type in children
- May be idiopathic or due to hypermetropia
Exotropia = divergent squint
- Older children
- Often intermittent

Non-Paralytic Squint
Diagnosis
- Corneal reflection: should fall centrally and symmetrically on each cornea.
- Cover test: movement of uncovered eye to take up fixation demonstrates manifest squint.
Management: 3 O’s
- Optical: correct refractive errors
- Orthoptic: patching good eye encourages use of squinting eye.
- Operations: e.g. resection and recession of rectus muscles – help alignment and cosmesis.

Paralytic Squint
- Diplopia is most on looking in direction of pull of paralysed muscle.
- Eye won’t fixate on covering.
- Cover each eye in turn: which ever eye sees the outer image is malfunctioning
CNIII
- Ptosis (LPS)
- Fixed dilated pupil (no parasympathetic)
- Eye looking down and out
- Causes
  ▪ Medical: DM, MS, infarction
  ▪ Surgical: ↑ ICP, cavernous sinus thrombosis, posterior communicating artery aneurysm
CNIV
- Diplopia especially on going down stairs
- Head tilt
- Test: can’t depress in adduction
- Causes
  ▪ Peripheral: DM (30%), trauma (30%), compression
  ▪ Central: MS, vascular, SOL
CNVI
- Eye is medially deviated and cannot abduct
- Diplopia in the horizontal plane.
- Causes
  ▪ Peripheral: DM, compression, trauma
  ▪ Central: MS, vascular, SOL
- Rx: botulinum toxin can eliminate need for surgery
Eye Trauma
- Record acuity of both eyes
- Take detailed Hx of event
- If unable to open injured eye, instil LA (e.g. tetracaine 1%)

Foreign Bodies
- X-ray orbit if metal FB suspected
- Fluorescein may show corneal abrasions

Mx
- Chloramphenicol drops 0.5% prevent infection
  - Usually coagulase-negative Staphylococcus
- Eye patch
- Cycloplegic drops may ↓ pain
  - Tropicamide, cyclopentolate

Intra-ocular Haemorrhage
- Blood in anterior chamber = hyphaema
- Small amounts clear spontaneously, but some may need evacuation.
- Complicated by corneal staining and glaucoma (pain)
- Keep IOP ↓ and monitor

Orbital Blowout Fracture
- Blunt injury → sudden ↑ in orbital pressure c herniation of orbital contents into maxillary sinus.

Presentation
- Ophthalmoplegia + Diplopia
  - Tethering of inferior rectus and inferior oblique
- Loss of sensation to lower lid skin
  - Infraorbital nerve injury
- Ipsilateral epistaxis
  - Damage to anterior ethmoidal artery
- ↓ acuity
- Irregular pupil that reacts slowly to light

Mx
- Fracture reduction and muscle release necessary.

Chemical Injury
- Alkaline solutions are particularly damaging
- Mx
  - Copious irrigation
  - Specialist referral

Floaters, Flashes and Haloes

Floaters
- Small dark spots in the visual field
- Sudden showers of floaters in one eye may be due to blood or retinal detachment

Causes
- Retinal detachment
- VH
- Diabetic retinopathy / Hypertension
- Old retinal branch vein occlusion
- Syneresis (degenerative opacities in the vitreous)

Flashes (Photopsia)
- Either from intraocular or intracerebral pathology
- Headache, n/v: migraine
- Flashes and floater: retinal detachment

Haloes
- Usually just diffractive phenomena
- May be caused by hazy ocular media – cataract, corneal oedema, acute glaucoma
- Haloes + eye pain = acute glaucoma
- Jagged haloes which change shape are usually migrainous.
Allergic Eye Disease

Seasonal Allergic Conjunctivitis (SAC)
- 50% of allergic eye disease
- Small papillae on tarsal conjunctivae
- **Rx**
  - Antazoline: antihistamine drops:
  - Cromoglycate: inhibits mast cell degranulation

Perennial Allergic Conjunctivitis (PAC)
- Symptoms all year c seasonal exacerbations
- Small papillae on tarsal conjunctivae
- **Rx:** olopatadine (antihistamine and mast-cell stabiliser)

Giant Papillary Conjunctivitis
- Iatrogenic FBs: contact lenses, prostheses, sutures
- Giant papillae on tarsal conjunctivae
- **Rx:** removal of FB, mast cell stabilisers

Management of Allergic Eye Disorders

1. **Remove the allergen responsible where possible**
2. **General measures**
   - Cold compress
   - Artificial tears
   - Oral antihistamines: loratadine 10mg/d PO
3. **Eye drops**
   - Antihistamines: antazoline, azelastine
   - Mast cell stabilizers: cromoglycate, lodoxamide
   - Steroids: dexamethasone
     - Beware of inducing glaucoma
   - NSAIDs: diclofenac

Tropical Eye Disease

Trachoma

Pathophysiology
- Caused by Chlamydia trachomatis (A,B,C)
- Spread by flies
- Inflammatory reaction under lids → scarring → lid distortion → entropion → eyelashes scratch cornea → ulceration → blindness

**Rx**
- Tetracycline 1% ointment ± PO

Prevention
- Good sanitation
- Face washing

Onchocerciasis (River Blindness)

Pathophysiology
- Caused by microfilariae of nematode Onchocerca volvulus
- Spread by flies
- Fly bites → microfilariae infection → invade the eye → inflammation → fibrosis → corneal opacities and synechiae

**Rx**
- Ivermectin

Xerophthalmia and Keratomalacia

- Manifestations of vitamin A deficiency

Presentation
- Night blindness and dry conjunctivae (xerosis)
- Corneal ulceration and perforation

**Rx**
- Vitamin A / palmitate reverses early corneal changes
Eye Signs in Systemic Conditions

Hypertensive Retinopathy
- Keith-Wagener Classification
  1. Tortuosity and silver wiring
  2. AV nipping
  3. Flame haemorrhages and soft / cotton wool spots
  4. Papilloedema
- Grades 3 and 4 = malignant hypertension

Granulomatous Disorders
- TB, sarcoid, toxo, leprosy, brucella
- Uveitis (ant/post) and choroidoretinitis

Systemic Inflammatory Disease
- Conjunctivitis: SLE, reactive arthritis, IBD
- Scleritis / episcleritis: RA, vasculitis, SLE, IBD
- Iritis: ank spond, IBD, sarcoid
- Retinopathy: dermatomyositis

Keratoconjunctivitis Sicca / Sjogren’s
- ↓ tear production (Schirmer’s: <5mm in 5min)
- Dry eyes and dry mouth
- 10 or 20: SLE, RA, sarcoid
- Rx: artificial tears or saliva

Vascular Occlusion
- Emboli → amaurosis fugax: GCA, carotid atheroemboli
- Microemboli → Roth spots: infective endocarditis
  - Boat-shaped haemorrhage c pale centre

Metabolic
- Kayser-Fleischer Rings: Wilson’s
- Exophthalmos: Graves’
- Corneal calcification: HPT

HIV/AIDS
- CMV retinitis: pizza-pie fundus + flames
- HIV retinopathy: cotton wool spots

Ophthalmic Pharmacology

Mydriatics

Anti-Muscarinics
- Tropicamide
  - Duration: 3h
- Cyclopentolate
  - Duration: 24h
  - Preferred for paediatric use
  - Pupil dilatation + loss of light reflex
  - Cycloplegia (ciliary paralysis) → blurred vision

Sympathomimetics
- Para-hydroxyamphetamine, phenylephrine
- May be used c tropicamide
- Don’t affect the light reflex or accommodation

Indications
- Eye examination
- Prevention of synechiae in ant. uveitis / iritis

Caution
- May → acute glaucoma if shallow anterior chamber

Miotics

Effect
- Constrict the pupil

Pilocarpine
- Muscarinic agonist

Use
- Acute closed-angle glaucoma

Other

Tetracaine
- Anaesthetic used to permit examination of a painful eye

Lubricants
- Hypomellose
- Carbomer (viscotears)

Topical Anti-histamine
- Emedastine
- Antazoline

Chronic Open-Angle Glaucoma
- 1st line: β-blockers
  - Timolol, betaxolol
  - ↓ aqueous production
  - Caution in asthma, heart failure
- Prostaglandin Analogues
  - Latanoprost, travoprost
  - ↑ uveoscleral outflow
- α-agonists
  - Brimonidine, apraclonidine
  - ↓ aqueous production and ↑ uveoscleral outflow
- Carbonic anhydrase inhibitors
  - Dorzolamide drops, acetazolamide PO
- Miotics
  - Pilocarpine