

# Surgery

Susmit

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# CABG

## Investigations for IHD

- ECG (first line)
- Cardiac enzymes (in acute coronary syndrome)
- Exercise tolerance test
- Echo: Evaluate
  - ventricular function
  - regional wall motion abnormalities
  - valvular lesions
- **Coronary angiography: gold std**
  - Extent, severity and location of stenoses
  - 70% reduction of diameter (i.e. >90% reduction of cross-sec) => severe

## Indications for surgery

- 50% stenosis of the left coronary artery (“*left main stem*”)
- 50% stenosis of the proximal *LAD*
- 2/3 main coronary arteries diseased (*RCA*, *LAD*, *LCx*)

## Graft selection

### Types

- **Venous:** long saphenous vein

- **Arterial:**
  - LIMA most common
    - \* left internal mammary / left internal thoracic artery
    - \* Branch of *left subclavian*
  - Others
    - \* RIMA
    - \* Radial
    - \* Gastroepiploic
    - \* Inf epigastric

# Blood transfusion

## Indications

- Acute blood loss
- Periop anaemia
- Symptomatic chronic anaemia

## Complications

### Single transfusion

- Haemolysis (haemolytic transfusion reaction)
- Fever (febrile transfusion reaction)
- Allergic reaction
- Infections
  - Hep B, C
  - HIV
  - Malaria
  - Bacterial inf
- Air embolism
- Thrombophlebitis
- TRALI

### Massive transfusion

- Coagulopathy
- Hypothermia
- Hypo-Ca

- Hypo-K
- Hyper-K

## Blood & blood products

- Whole blood
- Components
  - Packed red cells
  - FFP
    - \* Plasma stored at -40 to -50°C
    - \* Rich in *coagulation factors*
    - \* 2y shelf-life
  - Cryoprecipitate
    - \* Supernatant of FFP
    - \* Rich in factor VIII, fibrinogen, and vWF (von Willebrand factor)
      - Without vWF, factor VIII has a very low half life. So normally in blood it's transported bound to vWF.
    - \* Stored at -30°C
    - \* Indications:
      - Haemophilia
      - Fibrinogen deficiency
      - Von Willebrand disease
  - Platelet concentrate
  - Prothrombin complex concentrate

## Clinical factoids

- Target Hb level: 10g/dL
- 1 unit transfusion = 1g/dL improvement



# Burns

## Mechanism of fluid loss

Intense inflammation in burnt areas  $\rightarrow$   $\uparrow$  permeability  $\rightarrow$  leakage of fluid into extravascular compartment

## Assessment

- Rule of 9:
  - First approx
  - Adult
    - \* Head-neck  $\rightarrow$  9%
    - \* Each upper limb  $\rightarrow$  9%
    - \* Torso front 18%
    - \* Torso back 18%
    - \* Each lower limb 18%
    - \* Perineum 1%
- Lund and Browder chart
  - More accurate
- For smaller burns, a piece of paper about the size of the hand to measure the burnt area directly. Size of hand  $\approx$  1%.

## Fluid resuscitation

### Indications

- If  $>10\%$  TBSA in children or  $>15\%$  TBSA in adults (B&L)

- To correct hypovolaemia
- " " electrolyte imbalance
- To prevent shock
- To provide nutrition

## Principles

- **Parkland formula:**  $4 \cdot W \cdot A$  mL fluid for the 1st 24h
  - Infuse  $\frac{1}{2}$  over 8h,  $\frac{1}{2}$  over 16h
- First 12h → crystalloid only (massive fluid shift to extravascular compartment takes protein out with it)
- Then add colloid (human albumin solution)
  - Provides necessary oncotic pressure for keeping infused fluid within the vascular compartment

## Definitive management

### Superficial partial-thickness burns

- Regular dressing
- Heal spontaneously within 2 wks without scar irrespective of choice of dressing

### Deep partial-thickness/full-thickness burns

- Nanocrystalline silver dressing until surgery (to prevent colonisation)
- Escharotomy for circumferential full-thickness burns
- Debridement + split-skin grafting

- Without surgery, heal by hypertrophic scarring

### **Nanocrystalline silver dressing**

- 1% silver sulfadiazine
- 0.5% silver nitrate
- Mafenide nitrate
- Silver sulfadiazine + cerium nitrate

# Grafts and Flaps

## Graft

- Tissue transferred *without its original blood supply*
- Need to revascularise in recipient site

## Types of skin graft

- Split-thickness skin graft: epidermis + part of dermis
- Full-thickness skin graft: epidermis + whole dermis
- Composite skin graft: skin + cartilage, skin + fat etc.

## Flap

- Tissue transferred *with its original blood supply*

## Causes of graft failure

- Inadequate vascularity of recipient site: due to
  - residual pus
  - residual exudate
  - residual dead tissue
- Haematoma
- Shearing forces
- Group A  $\beta$ -haemolytic streptococcal infection
  - can destroy grafts completely
  - hence, contraindication to grafting

# Important anticancer drugs

- **Mitosis interferers**
  1. Vincristine
  2. Vinblastine
  3. Taxanes (e.g. Paclitaxel)
- **Antimetabolites** (i.e. DNA synthesis inhibitors)
  1. Methotrexate
  2. 5-FU
- **DNA damagers**
  1. Platinum drugs
    - Cisplatin
    - Carboplatin
    - Oxaloplatin
  2. Cyclophosphamide
  3. Bleomycin
  4. Doxorubicin
  5. Etoposide
- **Hormones**
  1. Tamoxifen: ER blocker (Breast ca)
  2. Goserelin: GnRH analogue; downregulate ant. pituitary  
→ ↓ testosterone (Prostate ca)
  3. Flutamide: Androgen antagonist (Prostate ca)
  4. Bromocriptine: D2 agonist; blocks ant. pituitary stim  
(Pituitary tumour)

# Deadly Dozen and ATLS

## “Deadly dozen” of chest injury

### Immediately life threatening

*Manage in 1<sup>o</sup> survey*

- Airway obstruction
- Tension pneumo
- Open pneumo
- Massive haemothorax
- Flail chest
- Pericardial tamponade

### Potentially life threatening

*Manage in 2<sup>o</sup> survey*

- Tracheobronchial injury
- Oesophageal injury
- Aortic injury
- Myocardial contusion
- Pulmonary contusion
- Diaphragm rupture

# Lung cancer

## Types

- Non-small cell (NSCLC)
  - Squamous
  - Adeno
  - Large cell
  - Carcinoid
- Small cell (SCLC)

## Features

- Cough (esp. changing cough)
- Dyspnoea
- Haemoptysis
- Wt loss
- Chest pain
- Clubbing
- Pancoast → compress sympathetic trunk → *Horner's*
  - Miosis
  - Enophthalmos
  - Anhidrosis
  - Partial ptosis
- Paraneoplastic features (SCLC)
  - SIADH
  - Cushing
  - Lambert-Eaton

## Investigations

### Diagnostic

- Chest X-ray
- Chest CT
- Sputum cytology
- Bronchoscopy + biopsy
- PET-CT

### Staging

- USG whole abdomen
- X-ray skull
- Bone scintigraphy (aka isotope bone scan)
- Pleural fluid cytology (if effusion)

## Treatment

- If NSCLC && within T3 N1 M0
  - Surgery: Choice depends on extent of pathology
    1. Segmentectomy
    2. Lobectomy
    3. Pneumonectomy
  - Chemo:
    1. Platins
    2. Gemcitabine
  - Radio
- Else (i.e. SCLC and > T3N1M0 NSCLC)



- Palliative therapy
- Surgery not helpful
- Median survival: a few months

# Orthopaedics

## Orthopaedic emergencies

*Open DESC*

- Open fracture
- Dislocation
  - Because dislocation  $\Rightarrow$  ruptured synovial membrane  $\Rightarrow$  stoppage of synovial fluid production  $\Rightarrow$  articular cartilage, which has no blood supply and derives nutrition from synoFlu, eventually dies  $\Rightarrow$  waiting too long can lead to permanent joint immobility
- Epiphyseal injury
- Septic arthritis
- Compartment syndrome

# Osteomyelitis

## Types

According to duration, *acute* and *chronic*.

## Acute

### ■ Causative organisms

- *Staph aureus*
- *Strep pyogenes*
- *Strep pneumo* (pneumococcus)
- *Salmonella*
- *Pseudomonas*

### ■ Clinical features

- Severe pain
- Tenderness
- Restricted movement
- Raised local temperature
- Fever (high grade)
- Tachycardia

### ■ Radiology

- Early phase
  - MRI: more sensitive in early phase
    - \* bone oedema

- \* periosteal elevation
- X-ray:
  - \* may be normal
  - \* soft tissue swelling
- 5-7d later
  - X-ray:
    - \* osteopenia
    - \* periosteal new bone formation

## Chronic

### ■ Causative organisms

- TB (*Myco TB*)
- Syphilis (*Trepa pallidum*)
- Fungal
- Parasitic

### ■ Clinical features

- Chronic discharging sinus
- Pieces of bone may come out through the sinus
- Joint swelling, stiffness
- May be past history of acute osteomyelitis
- May be recurrent pain, fever, swelling (acute on chronic)
- **Sequestrum** A segment of bone that is
  - Devitalised

- Avascular
- Surrounded by pus/granulation tissue

### • Involucrum

- Subperiosteal bone deposition surrounding the sequestrum.
- Purpose: walling off the sequestrum
- *Cloaca*: opening in involucrum due to rising pressure of the pus underneath

### ■ Radiology

- Bony destruction
- Surrounding soft tissue swelling
- Sequestrum
- Subperiosteal reaction (involucrum)

■ **Management**   **Sequestrectomy and saucerization** followed by **antibiotic therapy for 6 wks** according to C/S report of pus

### Complications of osteomyelitis

- Chronic osteomyelitis (if acute)
- Deformity
- Pathological fractures
- Septic arthritis
- Septicaemia

## Congenital clubfoot / talipes equinovarus

### Terminology

- Talipes = clubfoot
- Equinus deformity  $\Rightarrow$  dorsiflexed foot
- Varus deformity  $\Rightarrow$  plantar surface turned *inwards* (in-verted)
- Valgus deformity  $\Rightarrow$  plantar surface turned *outwards* (e-verted)

### Deformities in Congenital Clubfoot

#### CAVE

- Forefoot **C**avus
- Midfoot **A**dductus
- Hindfoot
  - **V**arus
  - **E**quinus

### Treatment

- **Conservative: Ignacio Ponceti method**
  - Serial plastering over 6 wks to correct deformities
- **Surgical: PMR (postero-medial release)**
  - If conservative fails

# Low Back Pain (LBP)

## Causes

- **Strenuous work**
- **Primary Back Pathologies**
  - *Spondylosis*: degenerative arthritis of the spine
  - *Spondylolysis*: defect in pars interarticularis without slippage
  - *Spondylolisthesis*: forward slippage of vertebral body
  - Lumbar *disc herniation*
  - *Spinal stenosis*: narrowed spinal canal → compression of spinal cord/nerve roots
  - *Fractures*
  - *Cauda equina syndrome*
    - \* Compression of cauda equina nerve roots
    - \* Most freq cause ⇒ lumbar disc protrusion at L4/5
  - *Scoliosis*
  - *Discitis*
- **Infections**
  - *Epidural abscess*
  - *Pott's disease*
- **Metastatic disease**
  - Sources:
    - \* Thyroid
    - \* Breast

- \* Lung
- \* Kidneys
- \* Prostate

- **Autoimmune conditions**

- *Ankylosing spondylitis*

## Investigations

- Plain X-rays
- CT: Best for assessing **bone anatomy**
- MRI: Detailed visualization of
  - Spinal cord
  - Meninges
  - Epidural space
  - Discs
  - Nerve roots
  - Bone marrow
- Bone scintigraphy
- DEXA (dual energy x-ray absorptiometry) scan: measure bone density
- Provocative discography
- Spinal biopsy



# Breast cancer

## Aetiology

- Age
- Sex
- Genetic: family history (BRCA1, BRCA2, TP53)
- Geographic: ↑ in West
- Diet:
  - Low in phytoestrogens
  - High in alcohol
- ***Endocrine***: due to less exposure to *oestradiol*
  - More in
    - \* *Nullipara*
    - \* *Obese*: fat converts steroid hormones to oestradiol
    - \* *OCP/HRT* users
    - \* *Early menarche*
    - \* *Late menopause*
  - Less in
    - \* Breastfeeders
    - \* First child at early age

## Features

- Hard lump (painful in <10%)
- Nipple discharge
- Nipple retraction
- In *advanced*,

- Peau d’Orange ( $\geq T_3$ ): due to lymphatic congestion
- Ulceration ( $\geq T_3$ )
- Fixation to chest wall ( $\geq T_3$ )
- Palpable axillary nodes ( $\geq N_1$ )
- Constitutional
  - Wt loss
  - Anaemia
  - Anorexia

## Staging

1. TNM
2. Manchester (i, ii, iii, iv)

## TNM

- **T**: Tumour size
  - 1:  $< 2\text{cm}$
  - 2:  $2\text{-}5\text{cm}$
  - 3:  $5\text{-}10\text{cm}$
  - 4:  $>10\text{cm}$
- **N**: Nodal involvement
  - 0: No palpable axillary nodes
  - 1: Mobile palpable axillary nodes
  - 2: Fixed palpable axillary nodes
  - 3: Palpable supraclavicular nodes
- **M**:

- 0: No distant mets
- 1: Distant mets

## Manchester

- **Stg-I** =  $T_1N_0M_0$
- **Stg-II** =  $T_2N_1M_0$
- **Stg-IIIa** =  $T_3N_2M_0$
- **Stg-IIIb** =  $T_4N_3M_0$
- **Stg-IV** =  $M_1$  (irrespective of T and N stage)

## Treatment

### Options

- Surgery
  - Conservative
    - \* Lumpectomy
    - \* Quadrantectomy
    - \* Oncoplastic lumpectomy (lumpectomy + reconstruction to restore normal appearance)
  - Mastectomy
    - \* Simple
    - \* Radical
    - \* Modified radical mastectomy (MRM = simple + axillary node dissection)
- Chemo
- Radio
- Hormone: *tamoxifen*
- Immuno: *herceptin* (trastuzumab)

## Protocol

- Stg-i: conservative surgery
- Stg-ii:
  - MRM + chemo + horm (if ER+) + immuno (if HER+)
- Stg-iii:
  - Neoadjuvant chemo 2-3 cycles to downstage
  - Then mx of stg-ii
- Stg-iv:
  - Palliative
  - Toilet mastectomy + chemo + radio + horm + immuno

# Random-ish general surgery concepts

## Sepsis, SIRS, MODS, MSOF

### ■ SIRS (Systemic inflammatory response syndrome)

- Any two of
  - Hyperthermia ( $>38^{\circ}\text{C}$ ) or hypothermia ( $<36^{\circ}\text{C}$ )
  - Tachycardia or tachypnoea
  - Leucocytosis or leucopenia
- Causes
  - Sepsis
  - Polytrauma
  - Burns
  - Pancreatitis without infection

### ■ Sepsis

- SIRS + documented infection

### ■ MODS (Multiple organ dysfunction syndrome)

- Systemic effect of SIRS

### ■ MSOF (Multiple system organ failure)

- End stage of uncontrolled MODS
- Includes

- Heart failure
- Liver "
- Pulmonary "
- Shock

## Haemorrhage

- 1°: Occurs immediately due to injury/surgery.
- Reactionary: Within 24h
  - Due to
    - dislodgement of clot as a result of resuscitation and blood flow restoration
    - *slippage of ligature*
- 2°: Within 7-14d
  - Due to sloughing off of vessel wall
    - Precipitated by
      - \* Infection
      - \* Pressure necrosis
      - \* Cancer
- Principles of haemorrhage control
  - Pressure
  - Position (elevation in case of limb)
  - Packing

- Cautery (diathermy)
- Ligation

## Incisions in abdominal surgery

### ■ Upper midline

- xiphoid → umbilicus
- **Structures cut**
  - Skin
  - Subcutaneous tissue
  - Linea alba
  - Fascia transversalis
  - Parietal peritoneum
- Advantages
  - Rapid
  - Less vascular area ⇒ less bleeding
- Disadvantages
  - Less vascular area ⇒ heals late
  - ↑ wound dehiscence, incisional hernia

### ■ Kocher / right subcostal

- From xiphoid, start cutting 2.5cm below parallelly to the costal margin
- Keep cutting till cut length = 10cm
- **Structures cut:** ???
- Use: gallbladder surgeries, rt hepatic lobectomy

## ■ Pfannenstiel

- Curved, 2.5cm above and parallel to the arch made by inguinal ligaments, extend equally on both sides of the midline
- Done in
  - Caesarean section
  - Prostatectomy
  - Bladder surgery



# Vascular surgery

## Deep Vein Thrombosis (DVT)

Formation of semisolid coagulum in a deep vein.

### Virchow's triad

- Abnormal surface (endothelial damage)
- Abnormal flow (stasis / turbulence)
- Abnormal blood (thrombophilia)

### Factors

- Immobility
  - Age
  - Obesity
  - Prolonged surgery
  - Pregnancy
  - Puerperium
  - Varicosity (effect of immobility, the rest are causes)
- Hormone-replacement therapy (high oestrogen)
- Previous DVT / PE
- Thrombophilia

### Common sites

- Popliteal vein
- Femoral "
- Iliac "

## **Prevention**

- Early mobilization
- Hydration
- Compression stockings
- Prophylactic LMW heparin
- Calf pumps
- Minimal use of tourniquets

## Ischaemic limb

(Ischaemia = reduced blood flow, NOT cell death)

### Features

- **Intermittent claudication**
  - Debilitating crampy myalgia that is
    - \* reliably brought on by walking
    - \* not present on taking the first step
    - \* reliably relieved by rest
  - Raised workload while walking → anaerobic metabolism → intermittent claudication
- **Rest pain**
  - Advanced ischaemia
  - Anaerobic metabolism occurring even at rest
  - Exacerbated by lying down / foot elevation (due to loss of gravitational aid in flow) → *pain worse at night and relieved by hanging the foot out of the bed.*
- Coldness, numbness, paraesthesia, colour change
- Ulceration
- Gangrene
- **Absent/diminished arterial pulse**
- Arterial bruit
- **Slow capillary refill**

### Investigations

#### ■ Specific

- Doppler USG
- Duplex scan:
  - Duplex = plain USG + doppler
  - Plain USG shows anatomy, doppler shows flow patterns
- Digital subtraction angiography
- CT angiography, MR angiography

## ■ General

- CBC (see if anaemia)
- RBS
- Lipid profile
- Serum urea and electrolytes

## Treatment

### ■ Non-surgical

- **Smoking cessation**
- Regular exercise
- Wt loss if obese
- **Drugs**
  - Beta blocker contraindicated: as sympathetic increases blood flow to muscles
  - Statin
  - Clopidogrel/aspirin
- **Angioplasty** with/without stenting

## ■ Surgical

- Bypass operation

# Varicose veins

## Management principles

- Avoid prolonged standing
- Compression stockings
- **Endothermal ablation**
  - *Laser ablation*
  - *Radiofrequency ablation*
- US-guided sclerotherapy
  - Sclerosing agent: sodium tetradecyl sulfate
- Open surgery
  - Sapheno-femoral junction (SFJ) ligation + great saphenous vein (GSV) stripping (*Trendelenburg operation*)

# Splenectomy

## Indications

*(Indications marked with ★ are absolute indications)*

- Traumatic rupture ★
- Splenic tumours (primary or secondary) ★
- Bleeding varices due to splenic vein thrombosis ★
- Hereditary spherocytosis ★
- Splenic abscess
- Hypersplenism
  - Hypersplenism = splenomegaly + any cytopoenia(s) + improvement of symptoms after splenectomy
- ITP
- Thalassaemia major

# Urology

## LUTS (lower urinary tract symptoms)

- **Storage symptoms**: FUN
  - Frequency
  - Urgency
  - Urge incontinence
  - Nocturia
- **Voiding symptoms**: IHPS
  - Intermittency
  - Hesitancy
  - Poor stream (reduced stream)
  - Straining (muscular effort to initiate maintain or improve urinary flow)
- **Post-micturitional symptoms**
  - Incomplete emptying
  - Post-mic dribble



# Renal stones

## Features

- Asymptomatic
- Ureteric colic: loin → groin
- Renal pain: dull loin pain
- Haematuria
- Features of UTI, e.g.:
  - Frequency: too frequent voiding
  - Urgency: sudden compelling desire to urinate
  - Dysuria: burning pain during urination
  - Features of pyelonephritis (if ascending infection), e.g.:
    - \* Fever with chills
    - \* Vomiting
    - \* Renal angle tenderness
    - \* Rigidity, guarding

## Investigations

- X-ray KUB, IVU
- USG KUB
- CT KUB
- Urine RME, culture

## Treatment

- Assess size of stone by USG/CT
- **Small ( $\leq 5\text{mm}$ ):**
  - Conservative management

- 90% pass spontaneously
- Drink plenty of water
- Analgesics, antispasmodics
- Antiemetics
- Mobility
- > 5mm:
  - ESWL
    - \* for  $\leq 1.5\text{cm}$  stones
    - \* cystine stones resistant
    - \* results in *steinstrasse* (“stone street”)
    - \* contra
      - obese
      - pregnant
      - patients on oral anticoagulants
  - Ureteroscopy + retrieval by Dormia basket: for <6mm stones in distal ureter
  - PCNL
    - \* for larger stones / ESWL contraindications / ESWL resistant stones
  - Open surgeries: depending on location of stone
    - \* Nephrolithotomy
    - \* Pyelolithotomy
    - \* Ureterolithotomy

## Bladder stones

### Features

- 8x more common in males
- Asymptomatic
- Frequency
- Sense of incomplete voiding
- Pain (strangury)
  - at the end of micturition
  - referred to the tip of the penis or the labia majora
- Haematuria: terminal, few drops, bright red

### Investigations: usual

### Treatment

- *Perurethral litholapaxy*
- *Percutaneous suprapubic litholapaxy*
- *Suprapubic cystolithotomy*

# Ruptured urethra

## Features

- Perineal bruising & haematoma
- Bleeding from urethral meatus
- Urinary retention
- Pain

## Investigations

Confirmed by **urethrography** with water-soluble contrast

- Urethrogram = insert catheter upto urethral meatus, then inject contrast and image with x-rays

## Management

- Antibiotics
- Analgesics
- **Catheterisation** by percutaneous suprapubic puncture (Seldinger technique)
- *After bruising and swelling have settled* (8-12wks later), **delayed anastomotic urethroplasty**.

## Bladder cancer

Painless haematuria in 60yo male

4T

- Tumours
  - *Painless gross haematuria, until proved otherwise, is bladder cancer*
- TB
- Tension (hypertensive nephropathy)
- Tubular necrosis (ATN)

### Features

- Painless gross haematuria
  - may lead to large clots in the bladder → clot retention
- Frequency
- Pain may arise in later stages due to
  - extravesical spread
  - pyelonephritis

### Investigations

- Urine culture and cytology for malignant cells
- Hb, urea, electrolytes
- CT, MRI, USG, IVU
- *Cystourethroscopy*

## Treatment

- **Non-muscle invasive tumour:** (does not invade the detrusor)
  - **Endoscopic resection** followed by **intravesical BCG** chemotherapy
- **Muscle-invasive tumour**
  - External beam radiotherapy
  - Surgery
    - \* Partial cystectomy
    - \* Radical cystectomy and pelvic lymphadenectomy