

Surgery

Susmit

2022-06-24

Contents

CABG	4
Investigations for IHD	4
Indications for surgery	4
Graft selection	4
 Blood transfusion	 6
Indications	6
Complications	6
Blood & blood products	7
Clinical factoids	7
 Burns	 8
Mechanism of fluid loss	8
Assessment	8
Fluid resuscitation	8
Definitive management	9

Grafts and Flaps	10
Graft	10
Flap	10
Causes of graft failure	10
Important anticancer drugs	11
Deadly Dozen and ATLS	12
“Deadly dozen” of chest injury	12
Lung cancer	13
Types	13
Features	13
Investigations	14
Treatment	14
Orthopaedics	15
Orthopaedic emergencies	15
Osteomyelitis	16
Congenital clubfoot / talipes equinovarus	19
Low Back Pain (LBP)	20
Breast cancer	22
Aetiology	22
Features	22
Staging	23
Treatment	24

Random-ish general surgery concepts	25
Sepsis, SIRS, MODS, MSOF	25
Haemorrhage	26
Incisions in abdominal surgery	26
Vascular surgery	28
Deep Vein Thrombosis (DVT)	28
Ischaemic limb	30
Varicose veins	32
Splenectomy	33
Indications	33
Urology	34
LUTS (lower urinary tract symptoms)	34
Renal stones	35
Bladder stones	37
Ruptured urethra	38
Bladder cancer	39

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-section) \Rightarrow 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 \rightarrow 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 β -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 stimul (Pituitary tumour)

Deadly Dozen and ATLS

“Deadly dozen” of chest injury

Immediately life threatening

Manage in 1^o survey

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

Potentially life threatening

Manage in 2^o 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 (*Mycobacterium TB*)
- Syphilis (*Treponema 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 Cavus
- Midfoot Adductus
- Hindfoot
 - Varus
 - Equinus

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: \uparrow 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: < 2cm
 - 2: 2-5cm
 - 3: 5-10cm
 - 4: >10cm
- **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
 - Toilect 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 \Rightarrow less bleeding
- Disadvantages
 - Less vascular area \Rightarrow heals late
 - \uparrow 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 ≤ 1.5 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