SURGERY

1 GENERAL SURGERY

Hospital Acquired Infections

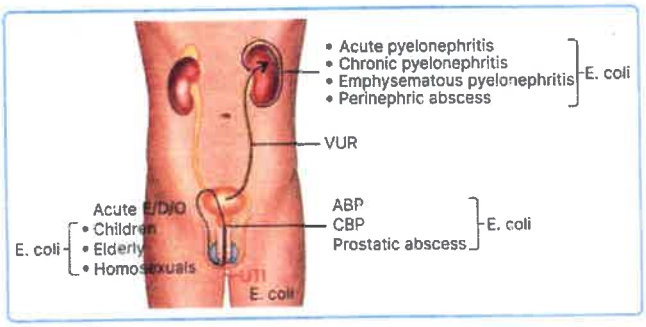
00:00:03

- It's an infection occurring within (**Mnemonic**: 2/3/30)
  - 48 hours (2 days) of notified admission
  - 3 days of discharge
  - 30 days of an operation

Types of HAI (Mnemonic: USSRBAN)

- The most common hospital-acquired infection: UTI
- 2nd MC hospital-acquired infection is Surgical Site infection/wound infection
  - Also most common hospital-acquired infection in surgical patient
- 3rd MC hospital-acquired infection: Respiratory infection
- 4th MC hospital-acquired infection: Bacteremia
- 5th MC hospital-acquired infection: Antibiotic-associated diarrhea
- The most common organism responsible for UTI is E.coli

Conditions where E.coli is the most common organism responsible for infections



- UTI
- Prostate: Acute bacterial prostatitis, Chronic bacterial prostatitis, Prostatic abscess
- The ejaculatory duct is close to the prostate → The infection can then enter the Epididymis and then into the testis
- Involvement of Epididymis: Epididymitis
- Involvement of Testis: Orchitis
- Involvement of both testis and epididymis: Acute epididymo-orchitis in children, elderly and homosexuals
- Some patients have Vescico-urethral reflex
  - So, the infections can go via the ureter into the kidney.
- This can cause Acute pyelonephritis, Chronic pyelonephritis, Emphysematous pyelonephritis, Perinephric abscess
- Cholangitis, Pyogenic liver abscess (Worldwide), Spontaneous bacterial peritonitis in adults, Infected pancreatic necrosis, Anorectal abscess

Scoring systems for severity of wound infection

00:06:17

- Southampton wound grading system
- Asepsis wound score

Southampton wound grading system

00:06:30

Note: Mnemonic- NBECPD

Grade	Appearance	Subtypes/Appearance
0	Normal	
I	• Normal healing with mild Bruising /Erythema	• IA- Some bruising • IB – Considerable bruising • IC – Mild erythema
II	Erythema plus other signs of inflammation	• IIA – At one point • IIB – Around the sutures • IIC – Along the wound • IID – Around the wound

III	Clear or Hemo-serous discharge	• **IIIA** – At one point only (< 2 cm) • **IIIB** – Along the wound (> 2 cm) • **IIIC** – Large volume • **IIID** – Prolonged (> 3 days)
IV	Pus	• **IVA** – At one point only (< 2cm) • **IVB** – Along the wound (> 2 cm)
V	Deep wound infection with or without tissue breakdown	

Asepsis wound score

00:11:21

A	• Additional Treatment o Antibiotic for wound infection o Drainage of Pus under local anesthesia o Debridement of the wound under general anesthesia
S	Serous discharge
E	Erythema
P	Purulent exudate
S	Separation of deep tissues
I	Isolation of bacteria from the wound
S	• Stay as an inpatient o Prolonged over 14 days as a result of wound infection

Difference Between Erysipelas and Cellulitis

00:13:01

Erysipelas	**Cellulitis**
	
Well-defined margin	Ill-defined or Indistinct margins
The most common organism: Streptococcus pyogenes	The most common organism: Streptococcus pyogenes
Associated with bulla/vesicle formation	Bulla formation in severe cases only
Involvement of upper subcutaneous tissue and lymphatics	Involvement of deeper subcutaneous tissue
Common site: Face, bridge of nose & cheeks	Common site: Legs

Carbuncle

00:16:16

PYQ: FMGE 2020

- Infected mass filled with dead tissue
- Multiple openings with pus discharge

- Pus drains onto the skin
- The most common organism is Staphylococcus aureus
- The most common site is the nape of the neck
- Etiology: More common in Diabetics and Immunocompromised state
- Treatment: Incision and drainage + Antibiotics
- Cruciate/Criss cross incision is given

Gas Gangrene

PYQ: FMGE 2019 00:18:52

- Thin brown exudates with spreading infection
- Gas gangrene means there is presence of gas in gangrenous tissues
- The most common organism responsible is Clostridium perfringes (Anaerobe)
- **Risk factors:**
  - Diabetes mellitus
  - Immunocompromised state
  - Wound containing necrotic or foreign material -situations that provide anaearobic environment
- **Clinical features:**
  - Severe local wound pain
  - Crepitus due to gas in gangrenous tissues
  - Thin, brown, sweet smelling exudate from the wound
  - Myonecrosis
- **Treatment:**
  - IV Penicillin + Extensive debridement of the affected tissue

Necrotising fascitis

PYQ: NEET PG 2023 00:23:45

Clinical features

- It is characterized by blackish discolouration of skin, erythema and edema
- Woody hard texture of subcutaneous tissue on palpation
- Necrosis of the skin, superficial fascia, deep fascia
- Typically, muscle is spared
- It is a polymicrobial infection (i.e. Both aerobe & anaerobes are responsible)
- The single most common organism is Group A Beta hemolytic streptococci.
- The most important presenting symptom is severe pain.
- Sometimes without treatment pain decreases: Ominous sign
- The pain decreases due to thrombosis of small vessels and destruction of peripheral nerves

Risk factors

- DM
- Immunocompromised patients

Management

- Urgent surgical debridement + IV fluids + IV Antibiotics
- Without surgical debridement – 100% mortality

Chronic Burrowing Ulcer

00:28:05

- Also known as Meleney's gangrene/Burrowing phagedenic ulcer/Progressive synergistic gangrene.
- It is caused by synergistic infection of:
  - Microaerophilic Non-Hemolytic Streptococci
  - Aerobic Hemolytic Staphylococci
- The patients have burrowing cutaneous fissures and sinus tract, both opening at distal site

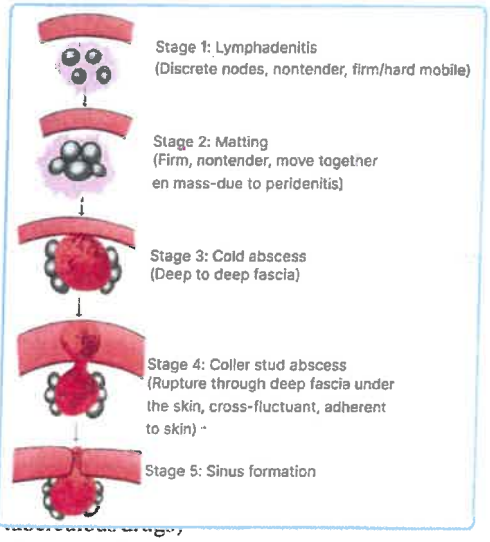
Tuberculous Lymphadenitis

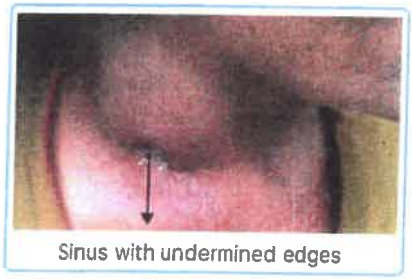
00:29:55

- It is most common in children & young adults.
- Most commonly affected lymph nodes: Deep cervical lymph nodes.
- TB bacilli gain entrance to the lymph nodes through the tonsils.
- In 80% cases, tuberculous process is limited to the affected lymph nodes

Stages of Tuberculous Lymphadenitis

PYQ: FMGE 2020




Sinus with undermined edges

Treatment

- ATT (Anti
- Excision of abscess cavity, lymph nodes and fibrous capsule is performed, if the abscess fails to resolve even after the ATT.

Enteric Fever (Typhoid)

PYQ: FMGE 2020, 2021 00:34:25

- Most common organism responsible – Salmonella Typhi/Para Typhi.
- Most common cause of Ileal perforation in tropical countries (like India).
- Small perforation in the terminal ileum is seen
- **Pathology:**

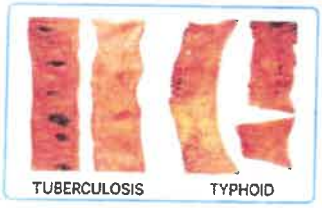
Ulceration + Necrosis of ileocecal in Peyer's Patches → Longitudinal ulcers in Distal ileum → Ileal perforation (Occurs in 3rd week)

Clinical features

- High grade fever with abdominal pain simultaneously

Complication

- Paralytic ileus >Intestinal hemorrhage
- Ileal perforation occurs if no treatment is taken- Occurs during 3rd week



Signs

- Rose spots
- Splenomegaly
- Leukopenia with shift to left
- Relative bradycardia

SIRS (Systemic Inflammatory Response Syndrome)

PYQ: NEET PG 2023 00:37:47

- It is the body's inflammatory response to infectious or non-infectious insults.
- Mediators of SIRS are IL-1, IL-6, and TNF-α.
- **Parameters of SIRS (Mnemonic: THR Counts)**

- To confirm the diagnosis of SIRS presence of ≥2 out of 4 signs is essential.

Important Information

- Sepsis – SIRS + Established focus of infection.
- Severe sepsis – Sepsis with organ dysfunction and hypoperfusion.
- Septic shock- Severe sepsis not responding to IV Fluids.

MODS (Multi-Organ Dysfunction Syndrome)

PYQ: INICET 2022 00:41:08

- Simultaneous presence of physiologic dysfunction and/or failure of 2 or more than 2 organs.

Prevention of Wound Infection

00:41:55

- The most important factor is hand washing
- Hair removal before surgery
  - Best method: on table clipping of hair
- The method of hair removal with maximum infectious rate: Pre-operative shaving(minor cuts can cause bacterial proliferation) >Use of depilatory creams> on table clipping of hair
- Use of prophylactic antibiotics
  - Best time to give prophylactic antibiotics is at the time of induction of anaesthesia or 30 minutes to 1 hour prior to surgery
- Cleaning of parts
  - Abdominal surgery: Patient is cleaned from umbilicus to mid thigh
  - Cleaning is done from medial to lateral direction
  - Perineum is cleaned from lateral to medial direction because the genitalia is most infectious

- Ideal OT parameters
  - Ideal temperature: 18-25 degree Celsius
  - Relative humidity: 50-60%
  - Positive pressure: 2 mmHg above atmospheric pressure
  - Air exchanges: 15 air exchanges per hour, of these 4 should be of fresh air
  - Ultra clean laminal flow should be maintained inside the OT

Causes of Post-Operative Fever

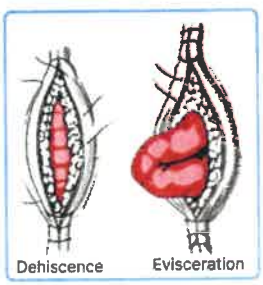
00:45:55

- POD 1-2: Atelectasis
- POD 2-3: UTI
- POD 3-7: Wound infection (SSI)
- POD 5-7: DVT/ Thrombo-phlebitis
- POD > 7: Drug fever

Wound Dehiscence

00:47:13

- Occurs usually on 5th – 8th post-op day
- It is also known as Burst abdomen
- First sign of wound dehiscence Serous / Serosanguinous/pink coloured discharge from the wound is called the Salmon fluid sign.
- Types
  - Partial
  - Total dehiscence (Evisceration)



Evisceration

- Extrusion of abdominal viscera after disruption of all layers.

Management

- In cases of partial dehiscence- Prompt elective closure.
- Wound dehiscence with evisceration
  - The wound is covered with a moist towel
  - The exposed bowel is rinsed with Ringer lactate containing antibiotics & returned to the peritoneal cavity
  - The wound is closed by tension suturing.

2 WOUND HEALING, TISSUE REPAIR AND SCAR

Surgical Classification of Wound

PYQ: NEET 2022 00:00:10

Class I	Class II	Class III	Class IV
• Also known as clean wound • **It includes** o Uninfected operative wounds without inflammation o Respiratory, alimentary, genital, or urinary tract are not entered • These wounds are closed primarily (if necessary, drained with closed drainage)	• Also known as Clean contaminated wound • **It includes** o Operative wound in which the Respiratory tract, GIT, and Genito urinary tract are entered under controlled conditions without unusual contamination	• Also known as Contaminated wounds • **It includes** o Open, fresh Accidental wounds o Operations with major breaks in sterile techniques or gross spillage from GIT o Incisions in which acute non-purulent inflammation is encountered	• Also known as Dirty wound • **It includes** o Old traumatic wound with retained devitalized tissue o Wound with clinical infection or perforated viscera with a high degree of contamination o Organism causing postoperative infection is already present in the wound before the operation o Associated with severe inflammation
• **Examples** o Inguinal hernia operation o Mastectomy (romovac drain) o Thyroidectomy (romovac drain) o Joint replacement o Abdominal Aortic Aneurysm repair	• **Examples** o Cholecystectomy o CBD exploration o Elective GI surgery (Elective colonic Resection, Elective Gastrectomy)	• **Examples** o Appendicular perforation o Gastric perforation o Enterotomy during bowel obstruction o Human bite o Open fracture o Open cardiac massage	• **Examples** o Perforated diverticulitis o Fecal peritonitis o Presence of frank pus o Necrotizing soft tissue infection

Risk of infection	Antibiotic prophylaxis Given at the time of induction
Clean wound: 5% risk	Not required (usually)
Clean contaminated wound: 10% risk	Usually required
Contaminated: 20-30% risk	Required
Dirty wound: 30-40% risk	Treatment is required (not prophylaxis)

- Frequent hand washing decreases the risk of infection.

Chronic wound

- Does not heal within 3 months.
- Delay occurs in the inflammatory phase.
- Example: Pressure ulcer/sore

Degloving Injury

00:11:08

- Avulsion injury
- Skin & subcutaneous fat are stripped by avulsion from underlying fascia.
- Leaves neuromuscular structures, tendons & bone exposed

Compartment Syndrome

00:12:18

- If pressure is greater than 30 mmHg → impaired perfusion → ischemia → pain
- Typically seen in closed lower limb injuries due to collection of blood.

Clinical features

- Severe pain
- Pain on passive stretching of affected compartment muscle
- Distal sensory disturbances
- Absence of distal pulses/pulselessness (late sign)
- Paralysis (worst prognosis)

Treatment

- Fasciotomy
- Indication for fasciotomy
  - If compartment pressure is > 30 mmHg
  - Clinical signs and symptoms of compartment syndrome
- Procedure
  - Two longitudinal incisions should be given – one on the medial and the other on the lateral side
  - Incised layers are
    → Skin
    → Subcutaneous fat
    → Fascia
- After incision, the Muscle should be bulging through the fascia

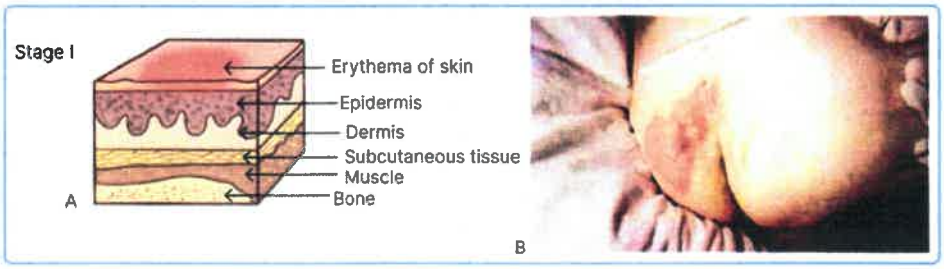
Fasciotomy

Pressure Sore/pressure ulcer

00:17:00

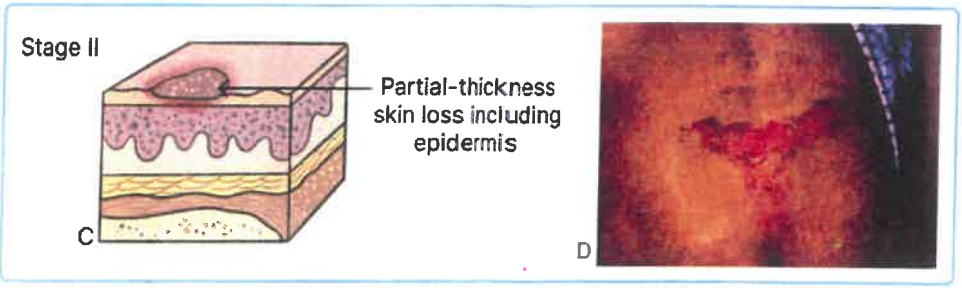
Stage I

- Non blanchable erythema of skin without breach in epidermis
- Early superficial ulcer



Stage II

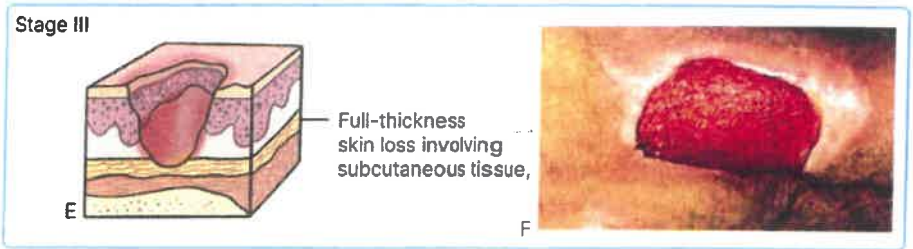
- Partial thickness less, including epidermis + dermis.
- Late superficial ulcer



Stage III

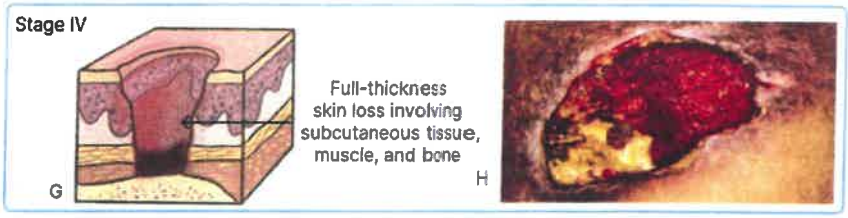
PYQ: FMGE 2022

- Full-thickness skin loss involving subcutaneous tissues but not through the underlying fascia.
- Early deep ulcer



Stage IV

- Full-thickness skin loss involving subcutaneous tissue, muscle bone, joints, or tendon.
- Late deep ulcer



Management

- Can be prevented by
  - Good skincare
  - Use of special pressure dispersion cushions/foams
  - Use of low air loss & air fluidized beds
  - Urinary and fecal diversion- if required
- In cases of bed-bound patients, patients should be turned at least every 2 hourly
- Wheelchair-bound patients: Patients should lift themselves off their seats every 10 seconds every 10 minutes.
- MC used flap for pressure sores: Extensor fascia lata flap with lateral cutaneous nerve of thigh

Vacuum-Assisted Closure

- Aka negative pressure wound therapy (NPWT)
  - (-125 mmHg) pressure is applied 2-3 times a week.
- Promotes wound healing by applying a vacuum through a special sealed dressing.
- Continued vacuum by NPWT.
  - Draws out excess fluid from the wound
  - Increases blood flow to the area.
- Vacuum can be applied continuously or intermittently.

Primary effects of Negative pressure wound therapy

- Cause: Macro deformation → Draws wound edges together
  ↓
  Contraction (helps in wound edge approximation)
- Stabilization of wound environment- by protecting the wound from outside microorganisms, provides a warm & moist environment for wound
- Reduces edema- by removal of soft tissue exudate
- Micro deformation leading to cellular proliferation at the wound surface

Contraindications of NPWT

- **Mnemonic:** Munna
  - Malignancy in the wound
  - Untreated osteomyelitis
  - Non-enteric & undrained fistula
  - Necrotic tissue with eschar

Scar

00:27:05

- The maturation phase of wound healing leads to the formation of scar
- Maximum tensile strength: 12 weeks/3 months post-injury
  ↓
  Approximately 80% of uninjured skin

Types of Abnormal Scars

PYQ: NEET PG 2022 PYQ: FMGE 2021

Hypertrophic Scar	Keloid

• Has excessive scar tissue
• Scar doesn't extend beyond the boundary of the original wound/incision
• Results from
  o Prolonged inflammatory phase
  o Unfavourable scar sighting (across tension lines)
On histology
• Excess collagen
• Hypervascularity
• Well-organized type III collagen
Management
• Improves spontaneously with time
• For ongoing hypertrophy in the scar: intralesional steroids (triamcinolone)
• If scar persists after 1 year: Surgical excision + Primary closure of the wound
 
	• Has excessive scar tissue
	• Scar extends beyond the boundaries of the original wound or incision
	• Associated with
	  o Elevated levels of growth factors
	  o Deeply pigmented skin
	  o Genetic predisposition
	  o Sternum is the most common site.
	  o Especially seen in the triangular region with boundaries of each shoulder tip and Xiphisternum
	On Histology
	• Excess collagen & Hypervascularity
	• Contains disorganized Type I & III collagen
	Treatment
	• Rarely regresses with time
	• Often refractory to Medical & Surgical intervention
	• First line treatment: Silicone sheet + Pressure therapy + Intralesional injection of triamcinolone
	• In Refractory Cases, Excision + Postoperative Radiotherapy (External beam radiotherapy/Brachytherapy)
	 

3 TRAUMA/SHOCK

- **TRIAGE- means "to Sort"**
- Used in Mass Casualties (Bomb blast, Earthquake).

- Prioritizing Victims on Basis of Color Coding

Color	Type	Treatment
Red	Most Critically Injured Patient	Immediate Care Is Required.
Yellow	Less Critically Injured Patients	In-hospital treatment (delayed care) Is Required
Green	Ambulatory Patients	No Life/ Limb Threatening Injury
Black	Dead/ Moribund Patients	-

- In ATLS, ABCDE protocol is followed
- In ACLS & BLS, C>A>B protocol is followed.

ATLS 2018 Protocol

- Primary Survey: Aimed at Detecting and Treating Immediately Life- Threatening Injuries
- A - Airway Protection with Cervical Spine Stabilization
- B - Breathing (Ventilation + Oxygenation)
- C - Circulation with External Hemorrhage Control
- D - Disability (Brief Neurological Examination Done)
- E - Exposure with Environmental Control
- In All Patients of Trauma Cervical Spine Injury Should Be Suspected.
- 1st Step: Cervical Spine Stabilization Followed by ABCDE.

1. **Airway**
   - Clear the airway: suctioning the secretion or blood.
   - Chin lift/jaw thrust
   - Insertion of oropharyngeal or nasopharyngeal airway.
   - Definitive airway: Oral ET intubation with cuffed ET tube.

2. **Breathing** (Ventilation +Oxygenation)
   - Assess breathing
   - Assess Rate & Depth of Breath
   - Oxygen saturation

   } Ventilation problems

Important Information

In Maxillofacial Trauma
- Emergency Airway: Needle Cricothyroidotomy
- Definitive Airway: Tracheostomy

Ventilation Problems

- Tension Pneumothorax: ICD
- Massive Hemothorax: ICD
- Massive Pulmonary Contusion: Mechanical Ventilation

3. **Circulation with Hemorrhage Control**
   - R/O Shock
   - Most common cause of shock: Bleeding- Hypovolemic shock
   - Unstable Vital Suggestive of Shock
     - PR>100/min
     - BP<100 mmHg
   - **Management**
     - 2 Large Bore Green Cannula.
     - Blood for cross matching
     - According to ATLS 2018: 1 Litre of Warm Isotonic Crystalloids to be given in Adults. In Children 20 ml/Kg warms Isotonic Crystalloids to be given
   - **5 major locations of blood loss (Mneumonic: On the floor + 4 more)**
     - External blood loss at the site of accident or site of injury
     - Chest (hemothorax): CXR PA view
     - Abdomen (hemoperitoneum): FAST
     - Retroperitoneum
     - Multiple long bone fractures: X-ray pelvis AP view
   - **CT scan is not done as a part of primary survey.**
   - In ongoing shock
     - Manage ongoing bleeding
     - Blood transfusion is started: according to Trauma Transfusion Protocol, Packed Cells: Plasma: Platelets are given in the ratio of 1:1:1.

Important Information

- **Most important X-rays in trauma patient: Chest X-ray AP view and X-ray pelvis AP view.**

4. **Disability**
   - Brief Neurological Examination
   - Assess GCS and Pupils (For Size, Reaction and Equality).
   - Best predictor of survival: best motor response.

REVISED GCS (2014)

Eye Opening	Verbal Response	BEST Motor Response
Spontaneous - 4	Well Oriented - 5	Obeying Commands - 6
To loud voices (speech) -3	disoriented/confused - 4	Localising Pain - 5
To pain (pressure) - 2	Inappropriate words -3	Withdrawal to Pain (Normal Flexion) - 4
No response - 1	Incomprehensible sounds -2	Abnormal Flexion - 3
-	No response - 0	Extension posturing - 2
-		No response - 1

- Mnemonic for Verbal response: one (5) confused (4) word (3) sounds (2) nowhere (1).
- Mnemonic for best motor response: Obey (6) localities (5) with(4) flexion(3) and extension(2)
- Max Score: $E_4V_5M_6 = 15$.
- Min Score: $E_1V_1M_1 = 3$.
- Classification of head injury based on GCS score,
  - Mild head injury: 13 – 15
  - Moderate head injury: 9 – 12
  - Severe head injury: < 8

- V_{NT}: In Patients of Tracheostomy, Non-Testable elements (No Addition of Extra Score)
- Example: $E_4V_{NT}M_5$ – no score should be given to the non-testable component

Secondary Survey

- AMPLE history: 1st relatives
  - Allergies
  - Medications
  - Past illness/pregnancy
  - Last meal
  - Events related to injury

Secondary survey examination

1. Head & Face: To R/O Fractures & Lacerations
2. Neck: To R/O Neck Injuries
3. Chest: To R/O Rib Fractures
4. Abdomen
   - To R/O tenderness/bruising and also To Insert NG Tube
   - Patients with Maxillofacial Trauma: Oro Gastric Tube Is Inserted
   - Check Meatus for presence of Blood: If No Blood, then Urethral Injury is absent and Foley's Catheter Insertion can be done
5. Examination of Back: Log Roll Method
   - Ideal No of People Required: 5
   - Minimum no: 4
   - Digital rectal examination is Performed While Examination of Back.
6. Extremities: Look for Deformity, Crepitus & Any Abnormal Movement - To R/O Fracture

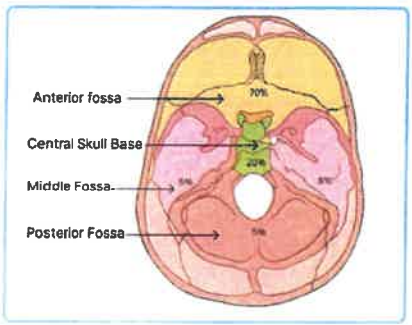
Repeat Neurological Examination

Trauma scoring system		
Revised trauma score	**Trauma and injury severity score (TRISS)**	**Mangled extremity severity score (MESS)**
(GB road) • Glasgow coma scale • Systolic Blood pressure • Respiratory rate	(ISS+RAM) • Injury severity score (ISS) • Revised trauma Score (RTS) • Age • Mechanism of injury (Blunt / penetrating)	(ELISA) • Energy that caused the injury • Limb ischemia • Shock • Age

HEAD INJURY

Skull base fracture

- Most common: Anterior cranial fossa fracture (70%)
- Middle cranial fossa fracture (20%)
- Posterior cranial fossa fracture (5%)



Important Information

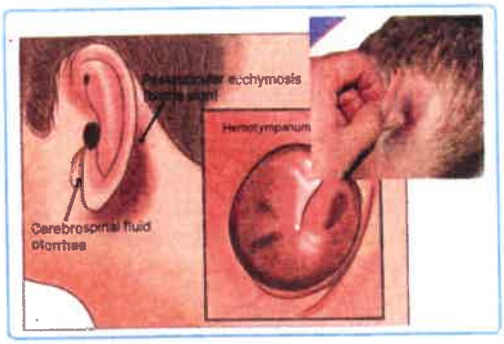
- ACF# > MCF# > PCF#

- Anterior cranial fossa is mainly composed of frontal bone-fracture leads to frontal lobe contusion
- Middle cranial fossa is mainly composed of temporal bone-fracture leads to temporal lobe contusion
- Posterior cranial fossa is mainly composed of occipital bone- fracture leads to occipital lobe contusion.
- Fracture of cribriform plate in anterior fossa lead to CSF rhinorrhea.

Anterior cranial fossa fracture (Most common)

- Mnemonic: Frontal ESCAPe
  - Frontal - Frontal lobe contusion
  - E - Epistaxis
  - S - Subconjunctival hematoma
  - C - CSF rhinorrhea
  - A - Anosmia
  - PE - PEriorbital hematoma: raccoon eyes

Middle Cranial Fossa Fracture



- Fracture of petrous part of temporal bone leads to dural laceration

Clinical features

- CSF otorrhea (Tympanic membrane rupture)
- Otorhinorrhea/Paradoxical rhinorrhea (if Tympanic membrane intact)
- Battle sign
- Hemotympanum
- VII, VIII nerve affected
- Temporal lobe contusion

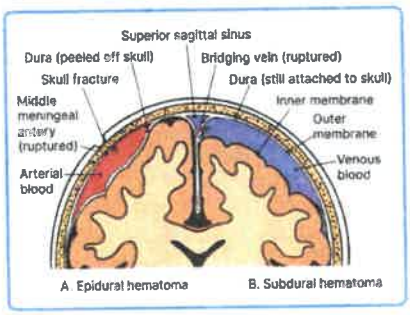
Post Cranial Fossa Fracture

- Fracture of occipital bone leading to contusion of occipital lobe

Clinical features

- Visual disturbances
- VI CN injury
- Jugular foramen syndrome (VERNET syndrome): IX, X, XI CN injury
- Basilar artery injury

Extradural vs Subdural Hematoma



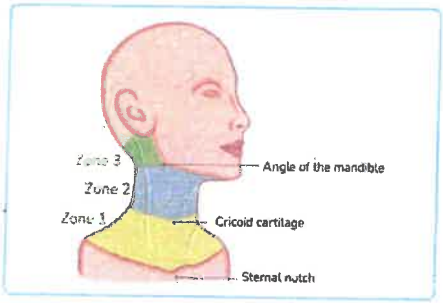
EDH	SDH
• Blood collection b/w skull and dura • Trivial trauma: Pterion (weakest part of the skull) leading to Anterior division Middle meningeal artery rupture (arterial bleed) • Does not cross suture line • Lucid interval is positive (one episode of consciousness between two episodes of unconsciousness) • Biconvex/Lenticular shape hyper dense lesion • Investigation of choice: NCCT 	• Blood collection b/w dura and arachnoid • Significant trauma required - injury of cortical/ bridging vein rupture (venous bleeding) Generally seen in elderly. • Crosses the suture line • Concavo-Convex shaped (Hyperdense lesion) • Investigation of choice: NCCT • Has poor prognosis 
• Management: Drainage via burr hole for small lesion and craniotomy for large lesion	

Diffuse Axonal Injury

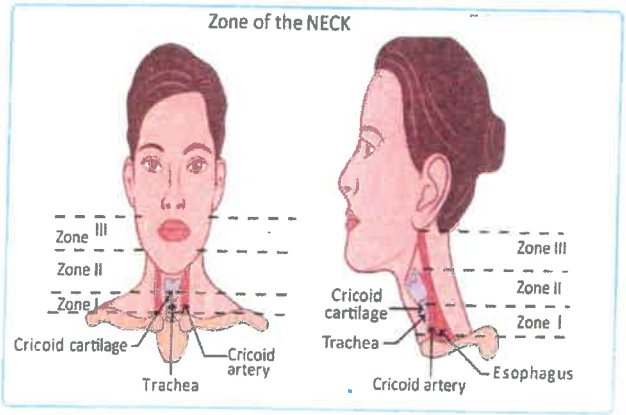
- Widespread axonal injury (shearing force) in both hemispheres
- Most common site: Lobar white matter (Junction of white and gray matter) >corpus callosum> brain stem
- Most common of post traumatic vegetative state
- In NCCT is normal, Investigation of choice: MRI
- Poor prognosis

NECK INJURIES

- Two most important anatomical landmarks in neck injuries are
  - Platysma
  - Sternocleidomastoid muscle
- Horizontal Zones of Neck Injury



Zone I	Between suprasternal notch & cricoid cartilage
Zone II	Between cricoid cartilage &angle of mandible
Zone III	Between angle of mandible & base of skull



- Injuries to zone I has the highest mortality due to presence of carotid vessels, Esophagus, and Trachea
- Zone 2 injuries is most common and most accessible as it is exposed.

THORACIC INJURIES

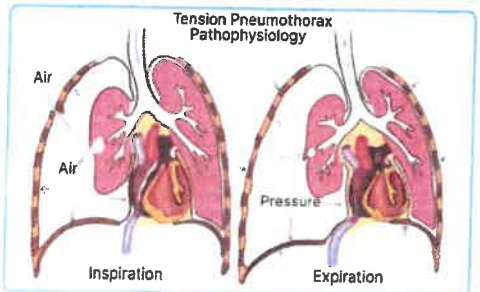
- Most common thoracic injury: Chest wall injuries
- Most common cause of death in blunt thoracic trauma is Trachea-bronchial injury
- Most common Cause of death in penetrating thoracic trauma is Hemothorax secondary to Pulmonary laceration

Important Information

- Most common rib fractures in CPR: 4th - 6th rib.
- Uncommon rib fracture: 1st, 10th - 12th ribs. If fractured indicates high velocity impact.

Tension pneumothorax

- Caused by formation of one-way valve air leak
- Collapse of ipsilateral lung
- Shift of mediastinum
- Depression of diaphragm: Compression of SVC & IVC leads to decreased venous return.



Clinical Findings

- Dyspnea
- Tachypnea
- Hypotension
- Distended neck veins
- On percussion: Hyper-resonance
- On auscultation: Absence of breath sounds

Diagnosis

- Clinical (tension pneumothorax and flail chest)

Management

- Insertion of wide bore needle through 2nd intercoastal space in MCL in children and 5th intercoastal space in MCL in adults
- Treatment of choice: ICD insertion through 5th ICS in MCL in both children and adults
- **According to ATLS**
  - In children ICD is inserted into 2nd intercostal space mid-clavicular line.
  - In adults ICD is inserted into 5th intercostal space slightly anterior mid-axillary line.
- Treatment of choice: ICD insertion in triangle of safety 5th intercostal space anterior axillary line

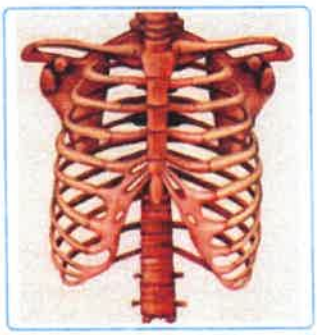
Pericardial Tamponade

- Caused by sudden accumulation of blood into pericardial space secondary to penetrating trauma.

Important Information

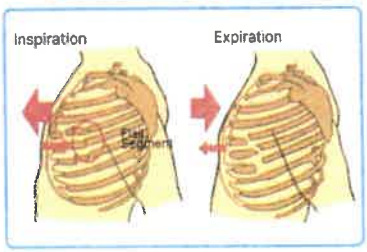
- Beck's Triad (Mnemonic: MDH)
  - M - Muffled heart sounds
  - D - Distended neck sounds
  - H - Hypotension

- Can be differentiated from tension pneumothorax by hyper-resonance and absent breath sounds.
- X-Ray: Enlarged cardiac shadow
- Investigation of choice: ECHO
- Treatment
  - Emergency: Needle pericardiocentesis
  - Treatment of choice: Surgical pericardiotomy



Flail Chest

- Definition: Fracture of two or more than two consecutive ribs at two or more than two places
- Part of chest wall is isolated leading to paradoxical respiration.
- Segment: Moves in opposite direction of chest wall → paradoxical respiration
- Increased risk of respiratory failure due to paradoxical respiration and voluntary splinting because of pain there is increased voluntary splinting → Mechanically impaired chest wall movements
- **Diagnosis: Clinically**
  - Observe the patient and paradoxical movement
  - Ask patient to cough → Thoracic cavity moves in → flail segment moves out
- **Treatment**
  - Flail chest only: Supplemental O_2 + analgesia (epidural) + physiotherapy
  - Flail chest with respiratory failure-intermittent positive pressure ventilation (IPPV)



ABDOMINAL TRAUMA

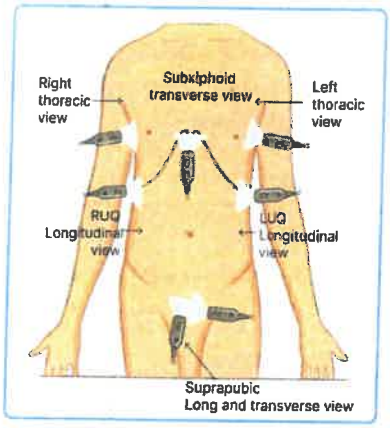
- Most common injured organ in blunt trauma abdomen: Spleen > liver
- Most common injured organ in penetrating trauma abdomen: Liver > Stomach > Small intestine
- Most common injured organ in gunshot wound: Small intestine
- Most common injured bowel in blunt trauma abdomen: jejunum
- Most common injured site in deceleration injury: Duodenojejunal Junction
- Most common injured structure in seat belt injury: Mesentery

Important Information

- First investigation done in blunt trauma abdomen: FAST
- Gold standard investigation in stable patients of blunt trauma abdomen: CECT

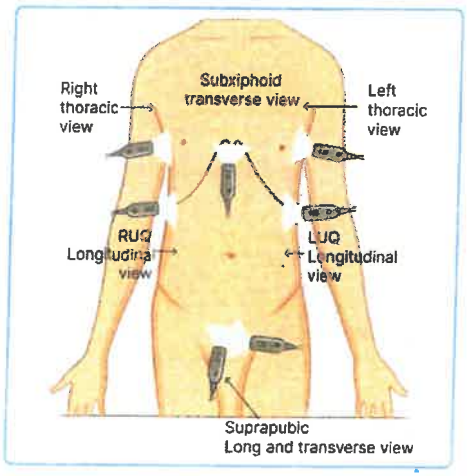
FAST (Focused Assessment with sonography for trauma)

- FAST is emergency USG done very fast.
- Performed within 2-4 minutes
- 4 P's are evaluated in the sequence
  1. Pericardial sac- Subxiphoid transverse view
  2. Perihepatic region- RUQ Longitudinal view
  3. Perisplenic region- LUQ Longitudinal view
  4. Pelvis- Suprapubic longitudinal and transverse view
- 4 P's are 4 views there in FAST.



e-FAST: Extended FAST

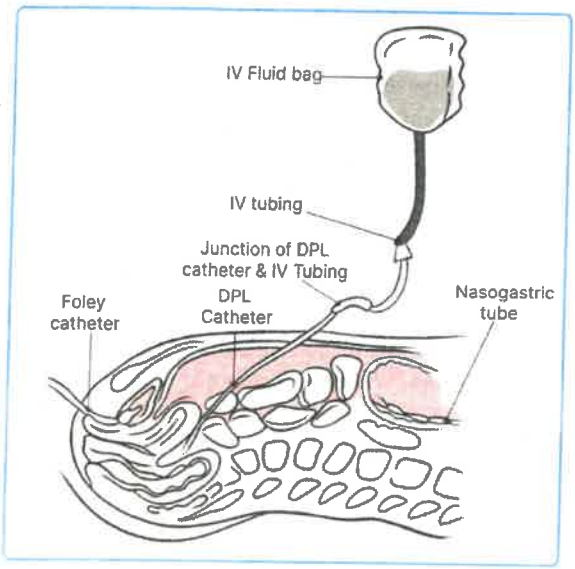
- It has 6 views 4 P's + Right Thoracic and left thoracic view



- STRATOSPHERE/BARCODE SIGN is seen in pneumothorax on performing e-FAST.
- FAST has replaced DPL (Diagnostic Peritoneal Lavage)

DIAGNOSTIC PERITONEAL LAVAGE

- Performed for blunt trauma abdomen patients
- Catheter is inserted through vertical infra-umbilical midline incision and it is directed towards pelvis.
- Aspiration is done and 1L of NS/RL is attached to the catheter.
- Effluent or lavage fluid is collected and sent for examination.



Positive DPL

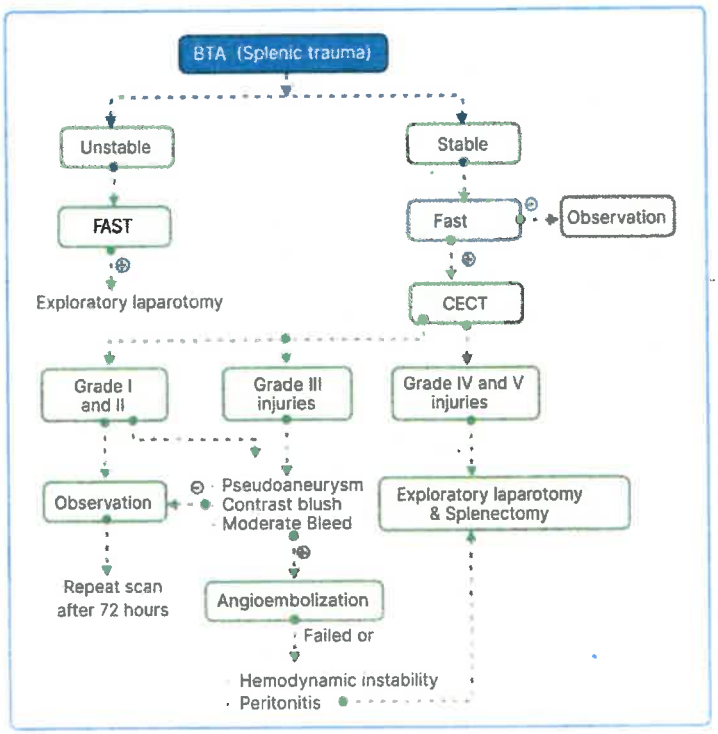
- > 10 mL of frank blood is aspirated directly from peritoneal cavity
- Returned effluent contains
  - RBCs > 1 lac/ mm3
  - WBCs > 500 / mm3
- Presence of bacteria, bile, fecal or vegetable matter
- Amylase > 174 IU/ dl

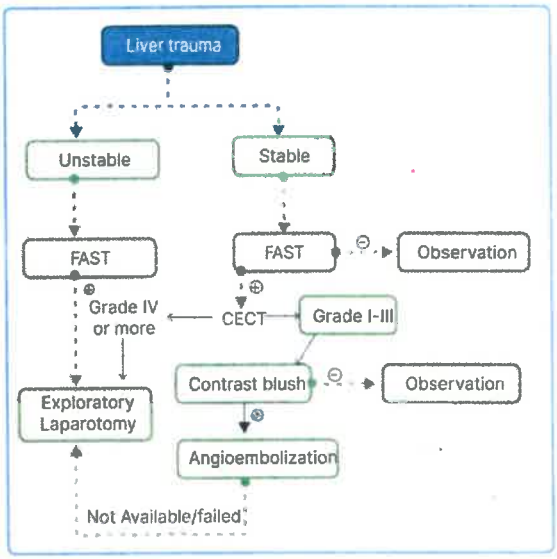
Penetrating trauma (stab and gunshot wound)

- Most common injured organ: Liver > Stomach > Intestine
- Most common injured organ in GSW: SMALL Intestine
- Exploratory laparotomy is mandatory: GSW

Important Information

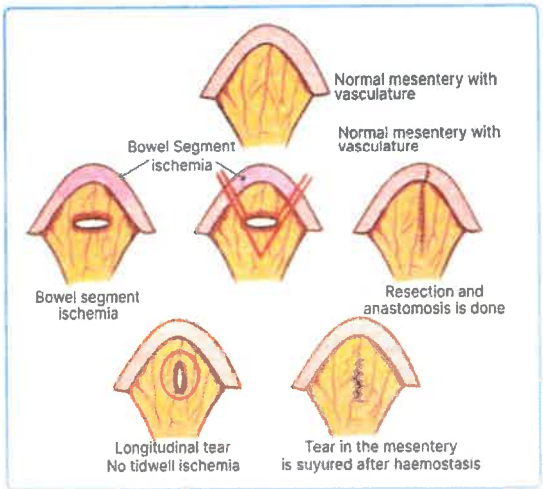
- **Kehr sign:** Pain is referred to tip of left shoulder via phrenic nerve (C_4, C_5) due to the irritation of under surface of diaphragm by collected blood.
- **Balance sign:** Fixed area of percussible dullness in the left upper quadrant due to coagulated blood.





Seat belt injury

- It involves neck, chest and abdomen
- Most common structure injured: Mesentery, sometimes associated with injury of Intra-abdominal structure - pancreaticoduodenal injuries
- Seat belt injury is associated with gut ischemia due to tear in the mesentery.
- **Two types of tear**
  - Longitudinal: Easily repairable, blood supply to bowel is not hampered.
  - Transverse: Blood supply is hampered to bowel requiring resection and anastomosis



Trauma Triad of Death

1. Hypothermia
2. Coagulopathy (Most common cause of death)
3. Metabolic acidosis

- In long duration surgeries, these three from a vicious cycle and increase mortality
- So, in unstable patient's damage control surgery is performed.

Damage control surgery

Phases of DCS -Damage Control Surgery/Abbreviated Laparotomy		
Phase I	**Phase II**	**Phase III**

(Initial exploration)
• Rapid Control haemorrhage and contamination
	(Secondary resuscitation)
	• Shift patient to ICU for 48 hrs
	• Correct
	  ○ Hypothermia
	  ○ Coagulopathy
	  ○ Metabolic acidosis
		(Definitive operation)
		• Planned Re-exploration
		• Stoma formation preferred over complex gastro-intestinal anastomosis

Stages of Damage Control Surgery

I	Patient selection
II	Operative control of hemorrhage and contamination (phase 1)
III	ICU Resuscitation (phase 2)
IV	Definitive surgery (phase 3)
V	Abdominal closure

Abdominal Compartment Syndrome

- **Normal IAP: 5-7 mmHg**
- Intra-abdominal HTN: ≥12 mmHg
- **Abdominal compartment syndrome: >20 mmHg**
  - Causes compression of intra-abdominal structures leading to pulmonary failure and mesenteric vascular compromise

Physiologic consequence of ACS	
Decreased	**Increased**
↓Venous return →↓ C.O. →↓ RBF →↓GFR and ↓ U.O. →↓ Visceral Blood flow • Hypotension • Oliguria • Anuria	• Peak inspiratory pressure: Hypoxia and hypercapnia • PCWP • Intra-pleural pressure • CVP • Cardiac rate • SVR • Mnemonic: ↑ PICS - ACS

- Diagnosis: Urinary bladder catheter - Gold Standard indirect diagnostic method

Grading of Abdominal Compartment Syndrome

Grade	Bladder Pressure (non 1-19)	Clinical Findings	Treatment
I	12-15 mmHg	None	Normovolemic resuscitation
II	16-20 mmHg	Oliguria, splanchnic hypoperfusion	Hypovolemic Resuscitation
III	21-25 mmHg	Anuria, ↑ ventilation pressure	Decompression
IV	>25 mmHg	Anuria + ↑ ventilation pressure + ↓ PO_2	Emergency Re-exploration

Renal trauma

- Most common injured part of urinary tract: Kidney
- Most common cause of renal trauma: RTA
- Best predictor of traumatic urinary system injury: hematuria
- Diagnosis investigation of choice for diagnosis of renal injuries for stable patients: CECT.
- Investigation of choice for diagnosis of renal injuries for unstable patients: Single shot IVP.

Shock

- Clinical Syndrome resulting from inadequate tissue perfusion.
- Most common type of shock: Hypovolemic Shock.
- Cause of hypovolemic shock: loss of blood volume, plasma volume, body sodium or water
- Min urine output
  - In Adults: 1 ml/Min (60 ml/hr)
  - In Children: 0.5 ml - 1 ml/min (30 - 60 ml/hr)

Important Information

- Best Clinical Indicator of Tissue perfusion: Urine Output
- Best indicator to detect fluid requirement for resuscitation: CVP.

ATLS classification of hypovolemic shock

Parameters	I	II	III	IV
Blood Loss	0 -15%	15 -30%	30-40%	>40%
PR	< 100/ min	> 100/ min	> 120/min	> 140/min
BP	N	N	↓	↓
Urine output	>30 ml/hr	20-30 ml/hr	5-15 ml/hr	nil
Fluid	crystalloids	Crystalloids	Blood transfusion	Blood transfusion

Physiologic characteristics of various shock

Types	CVP & PCWP	CO	SVR	venous O_2 saturation
• Hypovolemic	↓	↓	↑	↓
• Cardiogenic	↑	↓	↑	↓
• Septic ○ Hyperdynamic (early)	↑↓	↑	↓	↑
• Septic ○ Hypodynamic (late)	↑↓	↓	↑	↑↓
• Neurogenic	↓	↓	↓	↓
• Hypoadrenal	↓	↓	↓ / N	↓