[Color index : Important | Notes | Extra] Editing file link

ED - Polytrauma

Objectives:

- ★ Learn to diagnose, start initial management and know when to refer a patient with a condition that requires urgent specialist management
- ★ Implement Management as per Advanced trauma life support(ATLS) protocol
- ★ Learn about in-line immobilization of cervical spine, in the context of managing the airway
- ★ Understand the function of spinal board as a transfer tool only
- ★ Review emergent orthopedic conditions that are critical, and their initial management; e.g. open book pelvic fracture, bilateral femur fractures, mangled extremity
- ★ Promote the Importance of interpersonal communication skills

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References: 435 Lectures And Notes, Apley, Toronto notes, 433 Team

Multisystem Trauma (Polytrauma)

Introduction:

★ Injury = the result of a harmful event that arises from the release of specific forms of energy.
★ "Polytrauma" = Multisystem trauma = injury of two or more systems, or system with deranged vital signs and High mortality rate.
★ In the developed world **trauma** is the leading cause of death in people under the age of 40 years.
★ Road accidents have the largest proportion of trauma cases.

★ In UK:
- 18,000 deaths annually.
- 60,000 hospital admission.
- Costing 2.2 billion pounds.

★ In USA:
- 120,000 deaths annually.
- 100 billion dollars.

Mechanisms of injury in trauma:

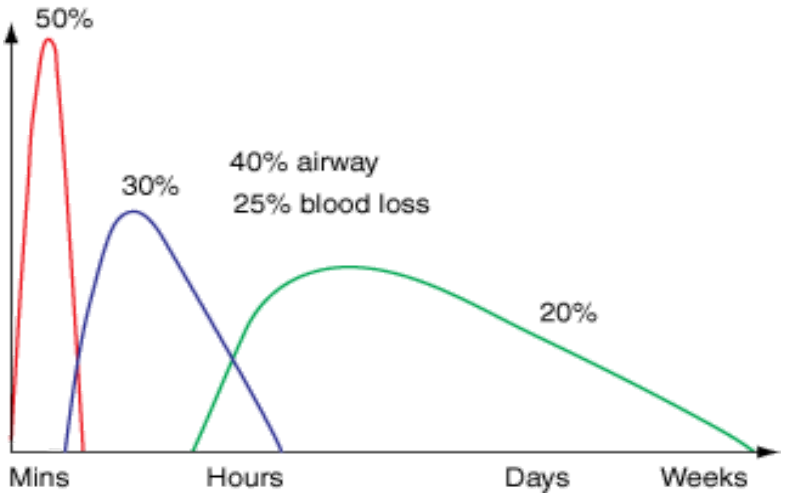
- **Penetrating**
- **Blunt**
- **Blast**
- **Burns**: Thermal & Chemical
- **Others** - crush & barotrauma.

Trimodal death distribution:

1st Peak **Immediate death** (0 to 1 hr)	2nd Peak **Early death** (1 to 3 hrs)	3rd Peak **Late death** (1 to 6 wks)
★ Accounts for **50%** of deaths. ★ Occurs within minutes of injury. ★ Due to **major** neurological or vascular injury (unsurvivable injuries) ★ Medical treatment can rarely improve outcome (**die on scene**)	★ Accounts for **30%** of deaths. ★ Occurs during "*the golden hour*" ★ Due to intracranial haematoma, major thoracic or abdominal injury. ★ Primary focus of intervention for the **ATLS** methodology	★ Accounts for **20%** of deaths. ★ Occurs after days or weeks. ★ Due to **complications** (sepsis and multiple organ failure)

First 1 to 2 hours is the golden hours

*Why is it called "*the golden hour*"?
Hence death in this peak is mostly due to hypoxia and loss of blood (hypovolemic shock) which is **potentially preventable**.

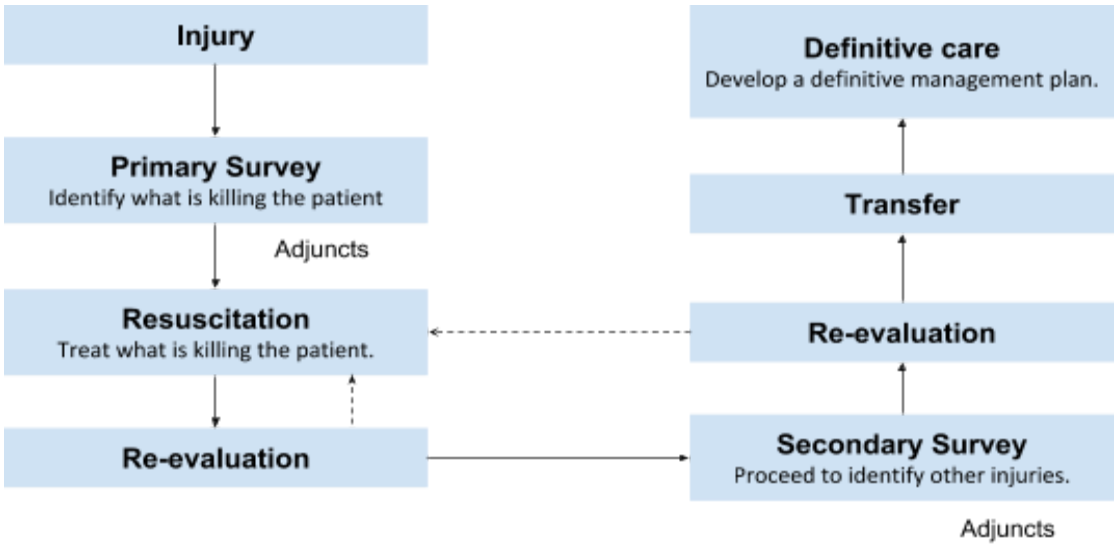


Advanced Trauma Life Support (ATLS):

Prehospital retrieval and management:

AIMS	APPROACHES
★ Gain access to the patient	★ ''Scoop & Run policy''[1]
★ Smooth transfer	★ ''Stay & Play policy''[2]

ATLS – Component Steps (Algorithm):



What I mean by primary survey and secondary survey?

- Primary: ABCDE
- Secondary: history, PE "head to toes examination" and investigations

- Nowadays we have **Tertiary survey**: reassessing the patient from the beginning: **ABCD** and **head to toes examination** to make sure not to miss anything.
- Mainly in trauma, patient might be stable in primary assessment then after 1H the patient deteriorates due to any reason: contentious bleeding, or decompensated with trauma.

Why we should examine the patient after ABCDE? because sometimes patient will bleed from hidden areas like back so you should examine from head to toes not to miss anything.

Trauma centers organisation:

★ **Level 1**: Regional trauma centres. الجامعي، الحرس ، التخصصي ، العسكري ، الشميسي

★ **Level 2**: Community Trauma centers. مستشفى الملك سلمان ومستشفى الإيمان

★ **Level 3**: Rural trauma centers. مستشفى المزاحمية و حريملاء

[1] Scoop and run is the approach of pre-hospital trauma care in which the patient is transported as fast as possible to the hospital without trying to stabilize him at the scene Click here

[2] Stay and play is the approach of pre-hospital trauma care in which the patient receives treatment and/or stabilization on scene before being transported to the hospital

Multiple casualties: Several casualties at the same time = multiple victims

1. **Alert ER services**
2. **Assess the scene** - without putting your safety at risk
3. **Triage** 'do the most for the most'

Triage (START triage algorithm): 4 things:

★ Ability to **walk** ★ **Airway** ★ **Respiratory rate** ★ **Pulse rate** or **capillary return**

How to triage? By **START** triage "**adult**"= Simple Triage and Rapid Treatment or **JUMPSTART** triage "**pediatric**"

TRIAGE SIEVE/SORT algorithm:

★ **TRIAGE SIEVE (on the field):** to separate dead & the walking from the injured. ask whoever can walk to evacuate the area

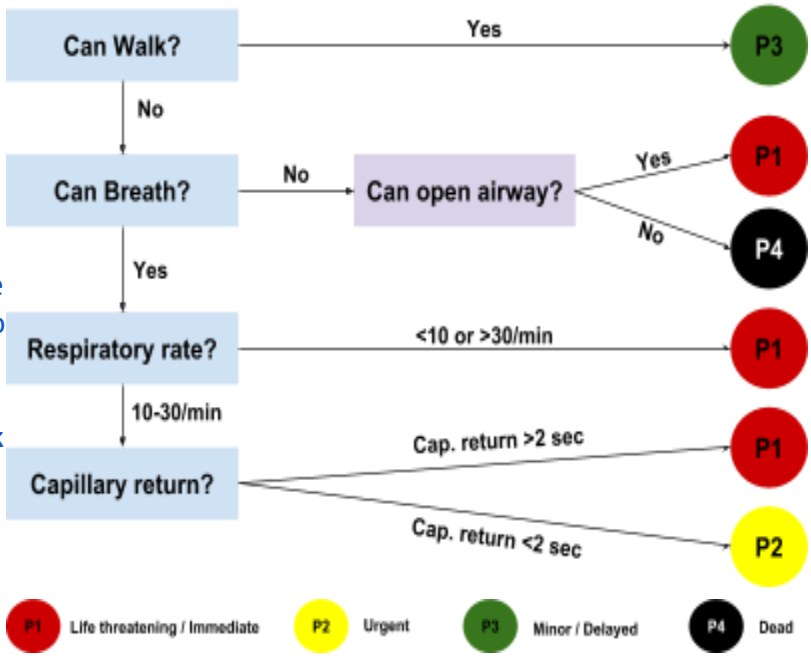
★ **TRIAGE SORT (2nd step):** to categorize the casualties according to local protocols.

➔ If we have 50 patients, we will see who is **able to walk** then we will ask them to leave the area.

➔ Then we will go to the patients who cannot walk and **check their airways "breathing".** If no breathing, we will open the airway → if there is response, we should **interfere right now** otherwise they might die (no breathing → no oxygen). If there is no response, we leave them as there is nothing to do for them.

➔ If breathing is ok, I will count the **RR** if below 10 or above 30 interfere right now if in between → **check the circulation by capillary refill** if less than 2 seconds it is urgent if more than 2 seconds immediately interfere.

➔ Depending on this we will categorize the patient



Triage Categories				
Cat/Priority	**Definition**	**Colour**	**Treatment**	**Example**
Cat 1 / P1	Critical & life-threatening **(can't wait)**	**Red**	Immediate	Tension pneumothorax
Cat 2 / P2	Urgent, but can wait for **30 mins**.	**Yellow**	Urgent	Fractured femur
Cat 3 / P3	Minor, less serious injuries.	**Green**	Delayed	Sprained ankle
Cat 4 / P4	Dead, or not expected to survive.	**White or Black**		

Make the area safe If the area is not save, don't go in، **DO NOT HELP**

- ★ protect yourself, the casualty and other road users
  - Park your car safely, turn lights on, set hazard lights flashing
  - Do not across a busy motorway to reach other side
  - Set others to warn other coming drivers
  - Setup warning triangles or lights 200 metres in each direction
- ★ **Switch off ignition** of any damaged vehicle
- ★ Is anyone smoking?

On-scene priorities

- Stay safe.
- Obtain access.
- Protect the cervical spine.
- Free the airway.
- Ensure ventilation.
- Arrest haemorrhage.
- Combat shock.
- Control pain.
- Splint fractures.
- Transfer to hospital.

Check <u>all</u> casualties

- ★ quick assess
- ★ <u>not moving</u>
- ★ apply life-saving treatment

How to move unconscious casualty?

- ★ **Do not move** the casualty unless it is absolutely necessary
- ★ Assume **<u>neck injury</u>** <u>until proved otherwise:</u>
  - Support head and neck with your hands, so he can breathe freely. **Apply a collar,** if possible
  - There should be only 1 axis (head, neck, thorax) **no moving to sides, no flexion, no extension.**
  - Move with help of 3-4 other people, 1 support head (<u>he is directing others</u>), other one shoulders and chest, other one hips and abdomen, last one - legs.

Management in Hospitals:

The trauma team: comprised as per hospital policy for e.g. initially of:

- **4 Doctors**: (at least)
  - 1 Anaesthetist
  - 1 Orthopaedician
  - 1 General surgeon
  - Respiratory therapist
- **5 Nurses**
- **1 Radiographer**

When do we call the trauma team?

- ➢ After we receive the patient, doing primary assessment and the patient becomes more stable
- ➢ In major trauma

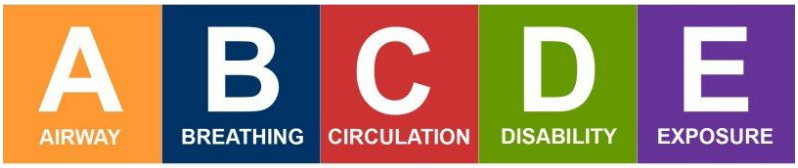
Who should the <u>LEADER</u> of the trauma team? Usually the ER consultant unless there are someone more expert than him **preferably the GS otherwise it's led by ER consultant**.

- ★ Most experienced
- ★ Preferably a general surgeon
- ★ Takes all TRIAGE decisions
- ★ Should be familiar with each members' skills
- ★ Prioritize procedures
- ★ Communicate with consultants & family members

Trauma team CALL-OUT criterion : (trauma code)

- Penetrating injuries.
- Two or more proximal bone fractures.
- Flail chest & pulmonary contusion.
- Evidence of high energy trauma, if:
  - fall from > 6ft
  - changes in velocity of 32 kmph
  - 35 cm displacement of side wall of car
  - ejection of the patient
  - roll-over انقلاب
  - death of another person in same car
  - blast injuries

Assessment approach to injured patient (ATLS algorithm):



★ Primary survey & resuscitation: (**ABCDE**)

- **A**irway and securing cervical spine
- **B**reathing
- **C**irculation and haemorrhage control
- **D**ysfunction of the central nervous system
- **E**xposure

★ Adjunct to primary survey (Only imaging permitted during this phase is):

After we finish the primary assessment we will not go to the next step until we are sure everything is Ok and we fixed any problem in ABCD, after that we go to "adjunct to primary survey":
X-ray for chest and pelvis, US using fast, inserting IV line and draw blood to send it to the lab, ECG, inserting foley catheter if needed then we go to secondary assessment

- **X-ray:**
  - AP supine chest
  - AP plain pelvic
  - Cross table lateral C- spine X-ray **(outdated)**

* CT scanning is the method of choice for pts with acute major trauma; it should be obtained at the earliest opportunity.
* If the pt's not stable enough for CT, X-ray chest, pelvis, spine and limbs is obtained.

- **Ultrasound:**
  - FAST[3] has replaced peritoneal lavage for detecting intraperitoneal fluid of blood

★ Secondary survey

★ Definitive treatment

★ Consider Early Transfer

Delayed or prolonged transfer to hospital is associated with poor outcomes, but the ABCs must be addressed before transferring the patient. The destination hospital should be matched to injury severity, and a 'trauma call' made.

[3] Focused assessment with sonography in trauma

ATLS - Primary Survey

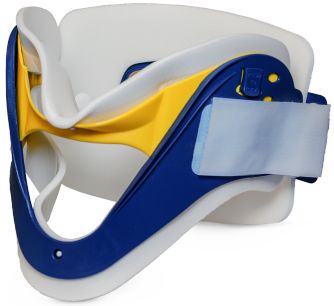
Life-threatening injuries in the ABC categories are treated first; the exception to this is *catastrophic external haemorrhage*, in which situation bleeding is controlled first and then the ABC system is followed.

Airway and cervical spine:

How to open the airway? Chin lift or **Jaw thrust** "in sitting of trauma"

5 things to do in airway "basic things":

1. Open the mouth in right way either "Jaw thrust or chin lift" according to the case.
2. Suctions.
3. Use adjunct nasopharyngeal or oropharyngeal airways if needed
4. Apply O2.
5. More ventilation if hypoxic.



★ **Always** assume that patient has cervical spine injury

★ If patient can talk then he is able to maintain his own airway

- If conscious → Ask the pt's name
- If unconscious → Look for added sounds (stridor), cyanosis, etc
- If the pt does not respond to any questions → **resuscitate**.

★ If airway is compromised <u>initially</u> attempt a jaw thrust and clear airway of foreign bodies, suction, adjuncts to open airways.

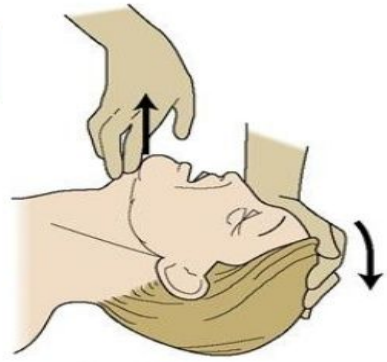
- Remember to avoid causing harm → NP tube, nasopharyngeal airway in **base skull fracture**

★ Give 100% Oxygen (face mask, bag valve(depends how much the patient needed you can use alternative such non rebreather mask)

★ Assist airway & breathing including ''definitive airways'' (endotracheal tube/cricothyroidotomy)

★ **Sequence of events:**

1. Chin lift (*if no c spine concern*)
2. **Jaw thrust**(if spine injury suspected)
3. Suction
4. Oropharyngeal / Orotracheal tube
5. Endotracheal intubation
6. Cricothyroidotomy
7. Tracheostomy



Head tilt–chin lift maneuver

Jaw-thrust maneuver

When to intubate the patient in case of trauma?

- Bleeding "hypovolemic shock"
- Hypoxia
- GCS is low (8 or lower)
- Severe head injury

B- Breathing & ventilation:

- ★ Exposure
- ★ Inspection
- ★ Palpation
- ★ Movement
- ★ Auscultation

The aim is to hunt out & treat the **5 life threatening thoracic conditions which include:**

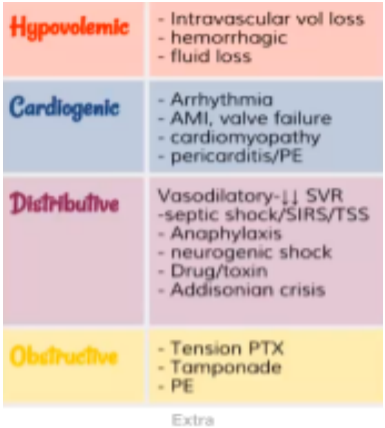
Tension pneumothorax	Respiratory distress, tracheal deviation, diminished breath sounds and distended neck veins Treated with immediate needle thoracocentesis thro' 2nd intercostal space in mid clavicular line. + resonant percussion + eventually you will need chest tube decompression is temporary
Massive Pneumothorax / hemothorax	you will find it dull in percussion + signs in hypotension so you have to resuscitate Chest tube placement is the definitive treatment
Open pneumothorax	Treated by *sealing* the wound with occlusive dressing and tube thoracostomy treated by one way valve as temporary treatment and the definitive is chest tube
Flail segment	Requires an endotracheal intubation and mechanical ventilation if there is lung contusion it will add to severity but the treatment is the same
Cardiac tamponade	Almost always seen with a penetrating wound **Beck's triad:** ● Hypotension ● Distended neck veins ● Muffled heart sounds(important to differentiate it from tension pneumothorax) Managed with needle pericardiocentesis then thoracotomy & repair as definitive management

C- Circulation and haemorrhage control:

- ★ Adults-consider up to **2 L** of fluids if patient is hypotensive, cardiac arrest (until blood available) Nowadays depending on the last edition, we give **1 L** crystalloid if no response, immediately give blood
- ★ Children- give 20 ml/kg of body weight
- ★ Assess for bleeding and shock and control external haemorrhage.
- ★ Assess pulse, capillary return and state of neck veins Don't forget to check vascular status of the patient "pulses"
- ★ Identify exsanguinating haemorrhage and apply direct pressure
- ★ Use FAST to identify body cavity haemorrhage.
- ★ Place two large calibre intravenous cannulas Site IV or IO cannulas, and draw samples for diagnostic tests and cross-matching.
- ★ Give intravenous fluids (crystalloid or colloid) If blood is available, initially treat shock with 2 L of warmed Hartmann's.
- ★ Attach patient to ECG monitor
- ★ Tachycardia in a cold patient indicates shock

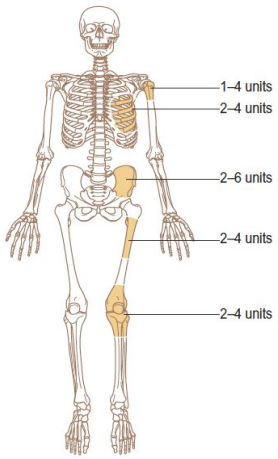
Causes of shock following injury:

- **Hypovolemic**.the most common so assume it's until proven otherwise
- Obstructive.
- **Cardiogenic**.
- **Neurogenic**.
- Septic.



Assessment of blood loss:

- External or obvious
- Internal or covert
  - Chest
  - Abdomen
  - Pelvis
  - Limbs (fractured bone)



Resuscitation:

★ Arrest bleeding ★ Obtain vascular access

Response to initial fluid challenge:

★**Immediate response & sustained return of vital signs.**	➢ <20% blood loss ➢ Bleeding ceases spontaneously(apply pressure)
★**Transient response with later deterioration.**	➢ Bleeding within body cavities ➢ Surgical intervention is required.
★**No improvement or response**	➢ >40% of blood vol is lost ➢ Requires immediate surgery ➢ Continued IV fluids is detrimental

Classification of Hypovolemic Shock and Physiologic Changes:

	Class I	Class II	Class III	Class IV
Blood loss (ml)	Up to 750	750 - 1500	1500 - 2000	> 2000
% TBV '% of blood loss'	15%	30%	40%	>40%
Pulse rate	< 100	> 100	>120	>140
Blood pressure	Normal	Normal	**Decreased**	Decreased
Pulse pressure	Normal or inc	**Decreased**	Decreased	Decreased
Respiratory rate	14-20	20-30	30-40	>35
Urine output	> 30 ml/hr	20-30	5-15	**Negligible**
Mental status	Slightly anxious	Mildly anxious	Anxious/confused	Confused/lethargic
Fluid Replacement	Crystalloid	Crystalloid	Crystalloid and blood	Crystalloid and Blood

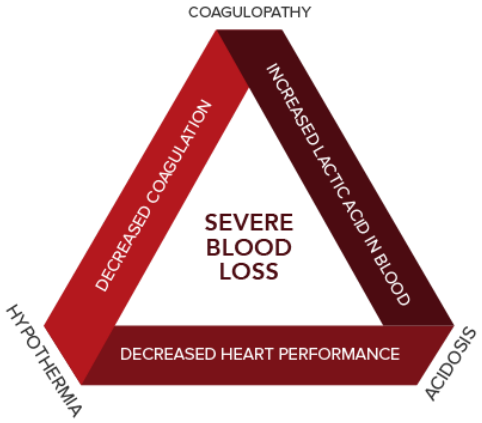
Fluid resuscitation:

DEBATE:

1st Hit ⇒ Shock due to primary haemorrhage ⇒
2nd Hit ⇒Ongoing bleeding 2^{o} resuscitation regimen ⇒ Lethal Triad of Death

Voluminous crystalloid:

- Dilutes coagulation factors
- Causes hyperchloremic and lactate acidosis
- Supplies inadequate O2 to under-perfused tissue



Current concepts: Balanced Resuscitation:

1. Fluid Replacement in Balanced Resuscitation:

- Initial fluid replacement with up to **2L** of crystalloid to achieve **Permissive hypotension** of SBP 80-90 mmHg, until definitive control of bleeding is obtained (check radial pulse) unless there is intracranial hemorrhage you want it to be as normotensive as possible to maintain the cerebral perfusion.
- Permissive hypotension or hypotensive resuscitation is the use of restrictive fluid therapy, specifically in the trauma patient, that increases systemic blood pressure without reaching normotension. Turn **off** the tap and do not infuse too much of fluid and blood products

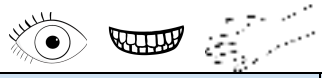
2. Haemostatic Resuscitation:

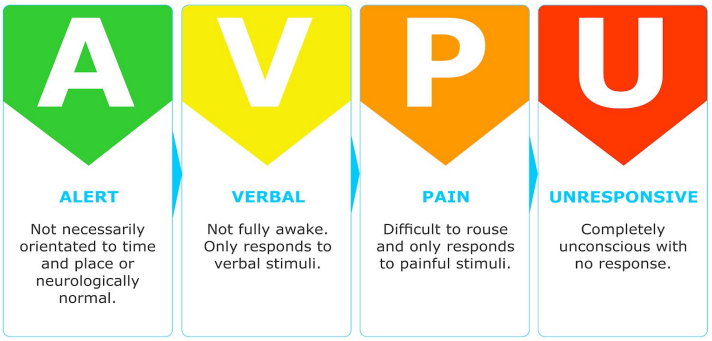
- Early blood versus HBOC Hemoglobin-based oxygen carriers transfusion decreases MODS Multiple organ dysfunction syndrome
- Packed RBC, FFP and Platelets in 1:1:1 ratio
- Cryoprecipitate, Tranexamic acid, Recombinant factor-VIIa
- Storage blood of < 2 weeks to minimize TRALI Transfusion-related acute lung injury, MODS

Disability/Dysfunction:

★ Assess **level of consciousness** using **AVPU** method
  - **A** = alert
  - **V** = responding to voice
  - **P** = responding to pain
  - **U** = unresponsive

★ Assess **pupil** size, equality and responsiveness

★ **GCS**[4]: 



Eye opening		Verbal response		Motor response	
Spontaneous	4	Oriented	5	Obeys commands	6
To voice	3	Confused	4	Localises pain	5
To pain	2	Inappropriate words	3	Withdraws	4
None	1	Incomp sounds	2	Flexion(pain)	3
		None	1	Extension (pain)	2
				None	1

Total: 3-15 **Mild:13-15** **Moderate: 9-12** **Sever:3-8**

Exposure:

★ Fully undress patients ★ Avoid hypothermia

Hypothermia prevention and treatment strategies:

- Limit casualties' exposure
- **Warm**(not room temp"22-25" or you will cause hypothermia) IV fluids and blood products(do not warm the blood bag it will cause hemolysis but the tube itself is warm enough to warm the blood to the temp needed) before transfusion
- Use forced air warming devices before and after surgery
- Use carbon polymer heating mattress

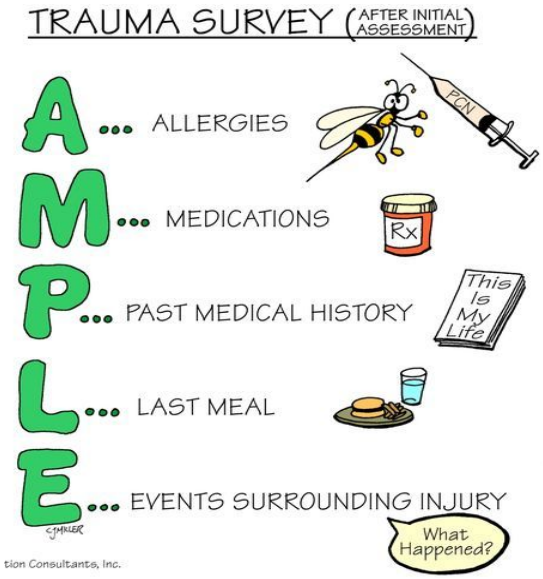
[4] Glascow Coma Scale

ATLS - Secondary Survey

★ Comprises of head to toe examination of the stable pt

★ Requires
- **Detailed** history (AMPLE)
- Thorough examination
- KEEP MONITORING the vital signs by monitoring devices
- pulse oximeter
- rectal thermometer

★ Detailed radiographic procedures
- C.T., USG, M.R.I.



Examination:

Head & ENT	Neck
• Glasgow coma scale • Reaction and size of pupils • Plantar response • Nose fracture, septal hematoma • Signs of rhinorrhoea,otorrhoea (base of skull) **Sign of basal skull fracture:** • Raccoon eyes • Cerebrospinal fluid rhinorrhea • Battle's sign – bruising of the mastoid process of the temporal bone and otorrhea • Hemotympanum • Bleeding (sometimes profuse) from the nose and ears.	Make sure about immobilizing the cervical spine, opening airway and examining for presence of hematoma. • Subcutaneous emphysema • Cervical spine fractures (specially C1,C2,C7) • Penetrating neck injuries
Thorax	**Pelvis**
Search for potentially life threatening injuries: • Pulmonary complication • Myocardial contusion • Aortic tear • Diaphragmatic tear • Esophageal tear • Tracheobronchial tear • Early thoracotomy if initial haemorrhage > 1500 ml • belt sign indicate injury	Clinical assessment: • **X-ray** • Stabilize pelvis with fixator/clamps • If urethral injury is suspected: ○ high up prostate in PR ○ blood in meatus ○ perineal haematoma • suspected: ○ ascending urethrogram ○ suprapubic cystostomy • Not suspected: ○ Trial catheter with gentle manipulation ○ Fine catheter ○ Lots of lubricants In OT (operation theatre or **OR**)

Abdomen Don't forget to do Abdominal examination

- Fingers and tubes in every orifice
- NGT and Urinary catheter for diagnosis & treatment
- Rectal exam
- Wounds coverage
- Eviscerated bowels packed by warm wet mops

For rigid and distended abdomen:

- Ultrasound
- Four quadrant tap
- **CT**
- Diagnostic peritoneal lavage
- Laparoscopic examination

★ Any deterioration ⇒ Consider rapid surgical exploration

Spinal injury	Extremities
• Thorough sensory and motor examination • Prevent further damage in unstable fractures • Log rolling for full neurological examination-5 people required • Use a long spine board for transportation	• Full assessment of limbs for assessment of injury • Always look for distal pulse & neuro-status • Carefully look for skin & soft tissue viability • Look out for impending Compartment syndrome

Cervical spine radiography is indicated for trauma patients unless they exhibit all of the following criteria:
1. No posterior midline cervical spine tenderness.
2. No evidence of intoxication.
3. Normal level of alertness.
4. No focal neurologic deficit.
5. No painful distracting injuries.

- NEXUS Criteria(99.6% sensitive)

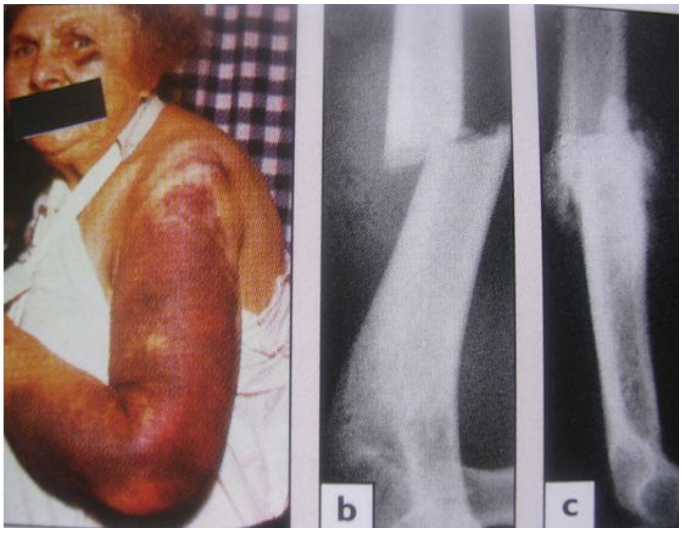
F- Fracture management: اللي يهمنا بالاورثو

★ **Minor**

★ **Moderate**
- open # of digits
- undisplaced long bone or pelvis #

★ **Serious**
- closed long bone #s
- multiple hand/foot #s

★ **Severe**
- life threatening
- open long bone #
- pelvis # with displacement
- dislocation of major joints
- multiple amputations of digits
- amputation of limbs
- multiple closed long bone #s



Medications; DON'T FORGET

- ★ Tetanus prophylaxis
- ★ Anti D immunoglobulin in possible preg female
- ★ Vasopressor drugs (selective)
- ★ Antibiotics(very important in open fracture) (selective)
- ★ Calcium gluconate (selective)
- ★ Tranexamic acid (TXA)

Complications: *doctor did not talk about it

Early and right intervention can prevent some of these complication

Tetanus	
ARDS[5]	• Tachypnoea, Dyspnea, Bilateral infiltrates in CXR. • **Treated with:** mechanical ''low tidal'' ventilation with PEEP[6]
Fat embolism	• Around 72 hours 3 days after trauma • Tachycardia, Tachypnoea, Dyspnoea, Chest pain, Petechial haemorrhage. • **Treated with:** mechanical ventilation and fixation of fractures.
DIC[7]	• Follows severe blood loss and sepsis • Restlessness, confusion, neurological dysfunction, skin infarction, oliguria • Excessive bleeding, Prolonged PT, PTT, TT[8], hypofibrinogenemia • **Treatment with:** prevention and early correction of shock, warming fluids, giving less crystalloids

Compartment/Crush syndrome	• When a limb remains compressed for many hours/multiple fractures
	• Increased Compartment pressure and further ischaemia (of limb)
	• Cardiac arrest due to metabolic changes in blood → with **crush syndrome**
	• Renal failure → with **crush syndrome**
	• **Treatment with:**
	  ○ Prevention of renal failure-ensure high urine flow using IV Crystalloids
	  ○ Fasciotomy and excision of devitalized muscles
	  ○ Amputation

Multisystem organ failure (M.S.O.F.)	• Progressive and sequential dysfunction of physiological systems
	• Hypermetabolic state
	• It is invariably preceded by a condition known as **Systemic Inflammatory Response Syndrome (SIRS)**
	• SIRS is Characterised by **two or more** of the following:
	  ○ Temperature >38º C or < 36ºC
	  ○ Tachycardia >90 /min
	  ○ Respiratory rate >20/min
	  ○ WBC count >12,000/cmm or <4,000/cmm

[5] Acute respiratory distress syndrome
[6] Positive end-expiratory pressure
[7] Disseminated intravascular coagulation
[8] thrombin time

	• **Treatment:** Key word is **PREVENTION**
	  ○ Prompt stabilisation of fracture
	  ○ Treatment of shock
	  ○ Prevention of hypoxia
	  ○ Excision of all dirty and dead tissue
	  ○ Early diagnosis and treatment of infection
	  ○ Nutritional support

Conclusion

★ Diagnose, prioritize management as per ATLS PROTOCOL
★ Recognize when to immediately refer a patient that requires urgent specialist management.
★ Remember A includes in-line immobilization of cervical spine while managing the airway.
★ Function of spinal board as a transfer tool only
★ Proper priority to orthopedic conditions affect the patient life/limbs (open book pelvic fracture, bilateral femur fractures, mangled extremity).
★ Importance of interpersonal and intrapersonal communication skills
★ definitive care is multispecialty

MCQs

Q1) Patient came to ER with severe back after MVA otherwise normal ATLS was performed on the patient What is the next step?

A. Do physical examination spine
B. Xray spine
C. Ct spine
D. Mri spine

Ans: A

Q2) Patient presented to the ER after an RTA Examination suggest cauda equina syndrome also X-ray suggest burst fracture of the spine. What's the best modality to confirm the diagnosis?

A. Myelogram.
B. T99 bone scan.
C. PET scan.
D. CT scan

Ans: D