POLYTRAUMA

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Objectives: Approach to Multiple Injure(polytrauma) Patients

- Learn to diagnose, start initial management and know when to refer a patient
- Implement Management as per ATLS protocol
- Immobilization of cervical spine, in the context of managing the airway
- Understand the function of spinal board as a transfer tool only
- Understand Importance of interpersonal communication skills

(Polytrauma)
Multisystem trauma

Terminology:

- 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 dereanged vital signs

Scope of the Problem

UK - > 18, 000 deaths annually.

> 60, 000 hospital admission.

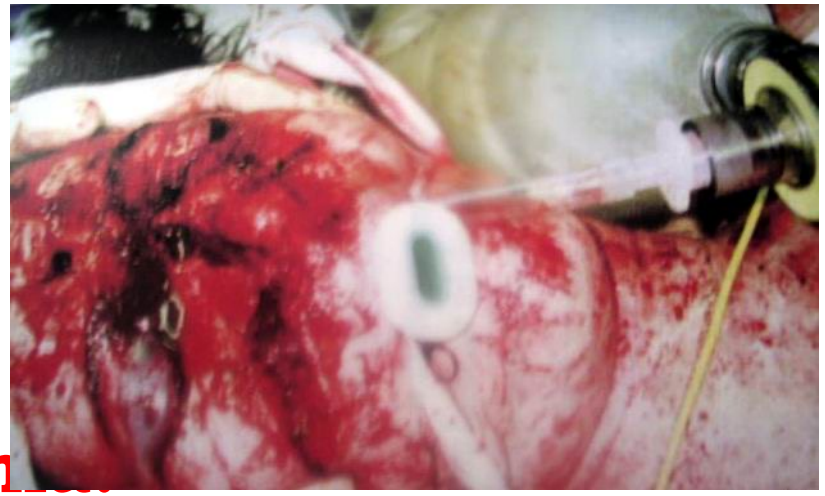
> Costing 2.2 billion pounds.

USA - > 120, 000 deaths annually.

> 100 billion dollars.

Types of injury

- Penetrating
- Blunt
- Blast
- Thermal
- Chemical
- Others - crush & barotrauma

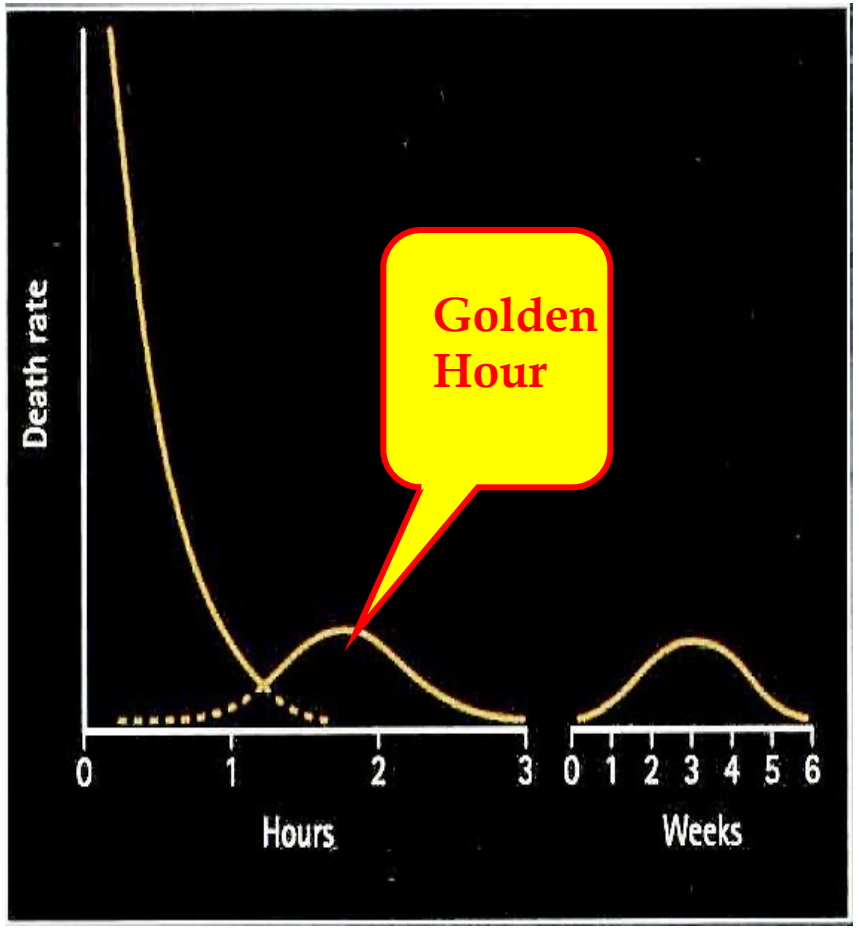


TRIMODAL DISTRIBUTION OF DEATH

Immediate death
(50%)
0 to 1 hr

Early death
(30%)
1 to 3 hrs

Late death
(20%)
1 to 6 wks



Trauma deaths

First peak

- Within minutes of injury
- Due to major neurological or vascular injury
- Medical treatment can rarely improve outcome (die on scene)

Second peak

- Occurs during the 'golden hour'
- Due to intracranial haematoma, major thoracic or abdominal injury
- Primary focus of intervention for the ATLS

Third peak

- Occurs after days or weeks
- Due to sepsis and multiple organ failure

ATLS PHILOSOPHY

Treat lethal injuries first

↓

Reassess

↓

Treat again/Transfer

PREHOSPITAL RETRIEVAL & MANAGEMENT

AIMS

Gain access to the patient

Smooth transfer

APPROACHES

''Scoop & Run policy''

''Stay & Play policy''

ATLS – COMPONENT STEPS

Primary survey

Identify what is killing the patient.

Resuscitation

Treat what is killing the patient.

Secondary survey

Proceed to identify other injuries.

Definitive care

Develop a definitive management plan.

ORGANISATION OF TRAUMA CENTRES

LEVEL 1 – REGIONAL TRAUMA CENTRES

LEVEL 2 – COMMUNITY TRAUMA CENTRES

LEVEL 3 – RURAL TRAUMA CENTRES

MANAGEMENT IN HOSPITAL

THE TRAUMA TEAM

comprised as per hospital policy for eg initially of

4 Doctors

At least 1 Anaesthetist

1 Orthopaedician

1 General surgeon

5 Nurses

1 Radiographer

LEADER OF THE TRAUMA TEAM

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

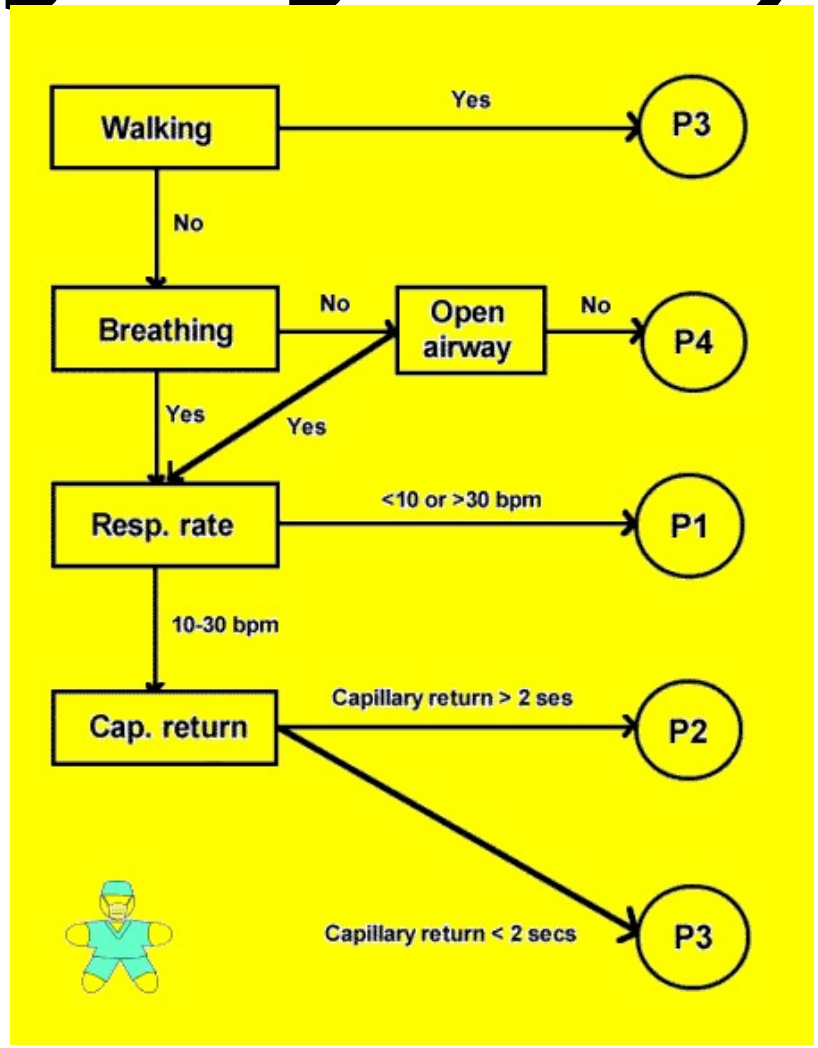
Multiple casualties

- **Several causalities at the same time**.

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

Triage(START triage algorithm)

- Ability to walk
- Airway
- Respiratory rate
- Pulse rate or capillary return



How to triage?

1. Can the patient walk?

Yes → delayed

No → check for breathing

2. Is the patient breathing?

No → open the airway

→ Are they breathing now?

Yes → IMMEDIATE

No → DEAD

Yes → count the rate

<10 & > 30 / min – IMMEDIATE

10 – 30 /min – check circulation

3. Check the circulation

Capillary refill> 2 sec- IMMEDIATE

Capillary refill < 2 secs - urgent

TRIAGE SEIVE/SORT algorithm

TRIAGE SIEVE(on the field) – to separate dead & the walking from the injured

TRIAGE SORT(2nd step) – to categorize the casualties according to local protocols.

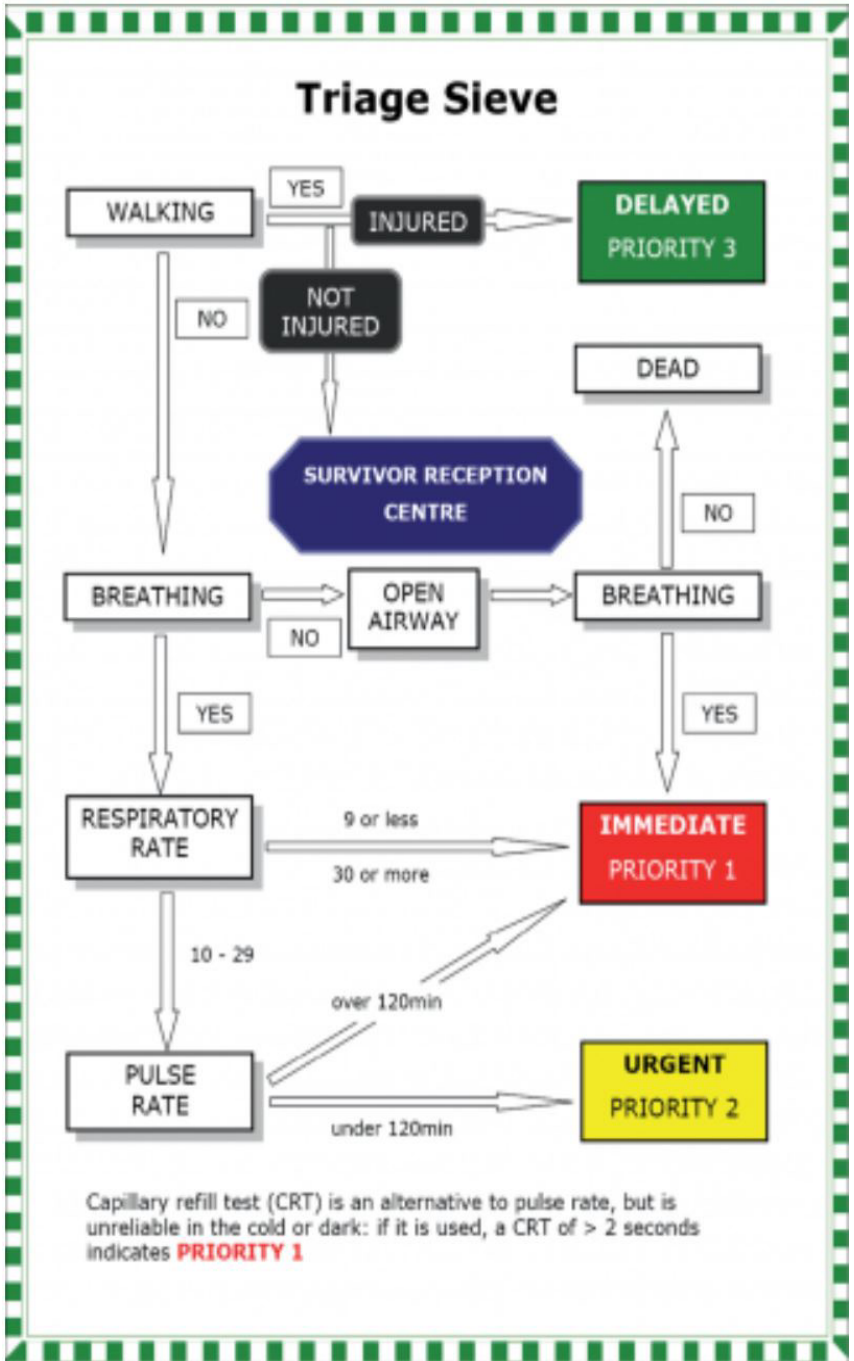
Cat 1 : critical & cannot wait.

Cat 2 : urgent – can wait for 30 mins at most

Cat 3 : less serious injuries.

Cat 4 : expectant – survival not likely.

Triage categories				
Cat	**Definition**	**Colour**	**Treatment**	**Example**
P1	Life-threatening	Red	Immediate	Tension pneumothorax
P2	Urgent	Yellow	Urgent	Fractured femur
P3	Minor	Green	Delayed	Sprained ankle
P4	Dead	White		



1. Make the area safe

- Protect yourself, the casualty and other site 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
  - Set up warning triangles or lights 200 metres in each direction

- Switch off ignition of any damaged vehicle
- Is anyone smoking?
- Is there a chemical spill
- Are there live electrical wires
- Could there be a secondary incendiary devise

2. Check **all** casualties

- Quick assess
- Not moving
- Apply life-saving treatment

How to move unconscious casualty

- **Do not move** the casualty unless it is absolutely necessary
- Assume **neck injury** until proved otherwise
  - 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 (he is directing others), other one shoulders and chest, other one hips and abdomen, last one - legs.

Skill Video Demonstations

- Applying cervical collar
- log rolling and spinal board
- Inline Immobilization
- spinal clearance

TRAUMA TEAM CALL-OUT CRITERION(in hospital)

- Penetrating injuries
- Two or more proximal bone fractures
- Flail chest & pulmonary contusion
- Evidence of high energy trauma

- fall from > 6ft
-changes in velocity of 32 kmph
- 35 cm displacement of side wall of car
- ejection of the patient
- roll-over
- death of another person in same car
- blast injuries

-Assessment approach to trauma patient in hospital setting- ATLS algorithm

Primary survey & resuscitation follows ABCDE sequence

Only imaging permitted during this phase is

- AP supine chest X-ray
- AP plain pelvic film
- FAST(focused assessment by ultrasonography)
- Cross table lateral C- spine X-ray(outdated)

Assessment of the injured patient

- Primary survey and resuscitation
  - A = Airway and securing cervical spine
  - B = Breathing
  - C = Circulation and haemorrhage control
  - D = Dysfunction of the central nervous system
  - E = Exposure
- Adjunct to primary survey: Xrays , U.S
- Secondary survey
- Definitive treatment
- Consider Early Transfer

Airway and cervical spine

- Always assume that patient has cervical spine injury
- If patient can talk then he is able to maintain own airway
- If airway compromised initially attempt a jaw thrust and clear airway of foreign bodies, suction, adjuncts to open airways.
  - Remember to avoid causing harm eg NP tube, nasopharyngeal airway in base skull fracture
- Give 100% Oxygen (face mask, bag valve)
- Assist airway & breathing including ''definitive airways'' (endotracheal tube/cricothyroidotomy)

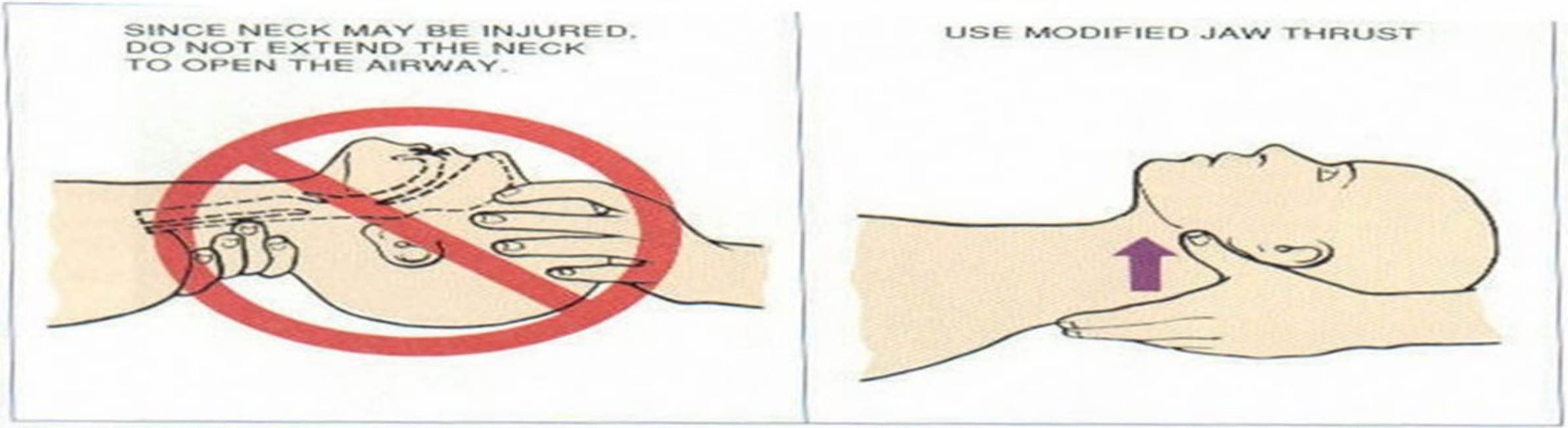


FIGURE 4-7A Opening the airway using modified jaw thrust. Maintain in-line stabilization while pushing up on the angle of the jaw with your thumbs.

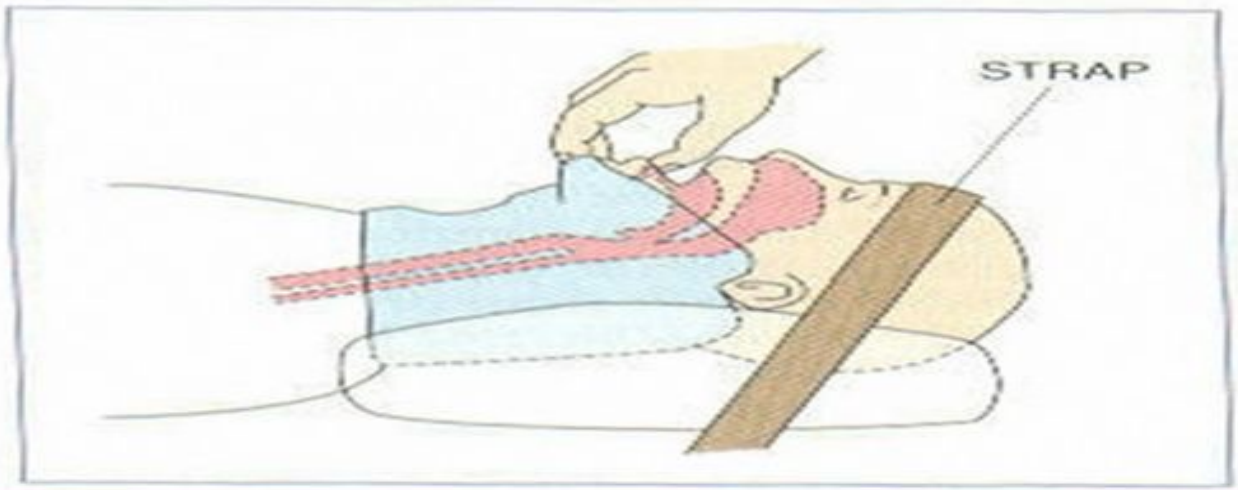


FIGURE 4-7B Jaw lift.

ATLS- PRIMARY SURVEY

A – Airway maintenance & Control of C.Spine

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.

A-AIRWAY: Sequence of events

chin lift(if no c spine concern)

Jaw thrust

suction

Oropharyngeal/ orotrachial tube

endotracheal intubation

Cricothyroidotomy

Tracheastomy

ATLS- Primary Survey
B- Breathing & ventilation

- Exposure
- Inspection
- Palpation
- Movement
- Auscultation

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

ATLS- Primary Survey
B- Breathing & ventilation

Five life threatening thoracic conditions:

1. **Tension Pneumothorax**
2. **Massive Pneumo/heamothorax**
3. **Open pneumothorax**
4. **Flail segment**
5. **Cardiac tamponade**

ATLS- Primary Survey
B- Breathing & ventilation

Tension pneumothorax: C/F

- **Respiratory distress**
- **Tracheal deviation**
- **Diminished breath sounds**
- **Distended neck veins**

Needle decompression video

Immediate needle thoracocentesis in 2nd intercostal space in mid clavicular line reqd.

Breathing

- If open chest wound seal with occlusive dressing
- Definitive treatment for hemopneumothorax will include chest tube placement

- https://chest Tube insertion

ATLS- Primary Survey
B- Breathing & ventilation

Suction pneumothorax:

Sealing of the wound and

Tube thoracostomy

Flail segment:

Endotrachial intubation

Mechanical ventilation

ATLS- Primary Survey
B- Breathing & ventilation

Cardiac tamponade: almost always seen with a penetrating wound

Beck's triad: Hypotension

Distended neck veins

Muffled heart sounds

Treatment: Needle pericardiocentes

Thoracotomy & repair as def managemnt

ATLS- Primary Survey
C- Circulation and hge control

- Assess pulse, capillary return and state of neck veins
- Identify exsanguinating haemorrhage and apply direct pressure
- Place two large calibre intravenous cannulas
  Give intravenous fluids (crystalloid or colloid)
- Attach patient to ECG monitor

ATLS- Primary Survey

C- Circulation and hge control

Assessment of blood loss

- **External or obvious**
- **Internal or covert**
  - **chest**
  - **abdomen**
  - **pelvis**
  - **limbs**

Resuscitation

- **Arrest bleeding**
- **Obtain vascular access**

ATLS- Primary Survey
C- Circulation and hge control

Tachycardia in a cold patient indicates shock

Causes of shock following injury:

1. **Hypovolemic**
2. **Obstructive**
3. **Cardiogenic**
4. **Neurogenic**
5. **Septic**

ATLS- Primary Survey

C- Circulation and hge control

Adults-consider up to 2 lit of fluids if patient hypotensive, cardiac arrest(until blood available)

Children- 20mg/kg of body wt

Response to initial fluid challenge:

- **Immediate & sustained return of vital signs.**
- **Transient response with later deterioration**
- **No improvement**

ATLS- Primary Survey
C- Circulation and hge control

Immediate responders-<20% blood loss

Bleeding ceases spontaneously

Transient responders-

bleeding within body cavities

Surgical intervention reqd.

Non responders-

>40% of blood vol lost

require immediate surgery

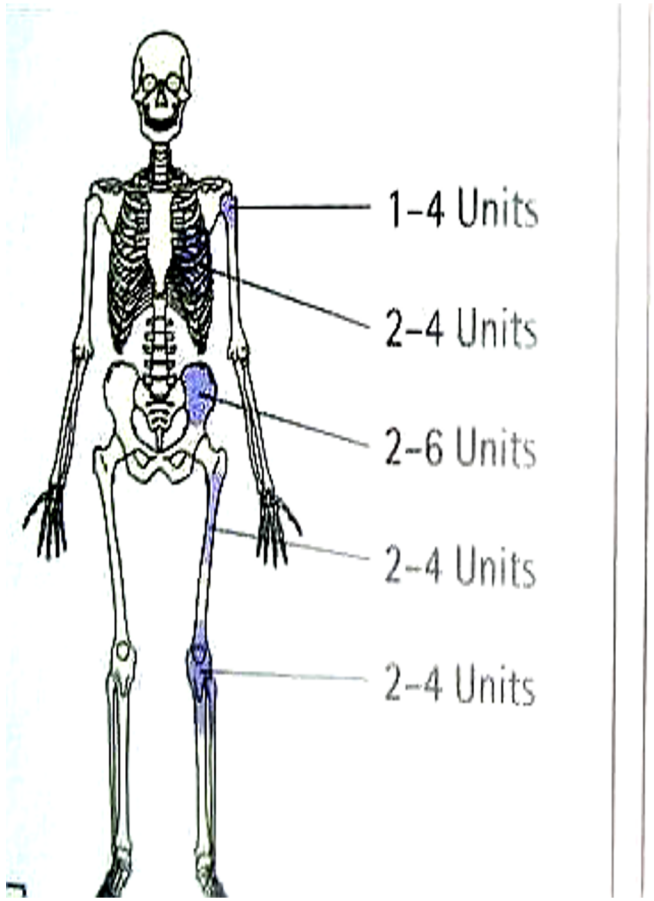
Continued IV fluids detrimental

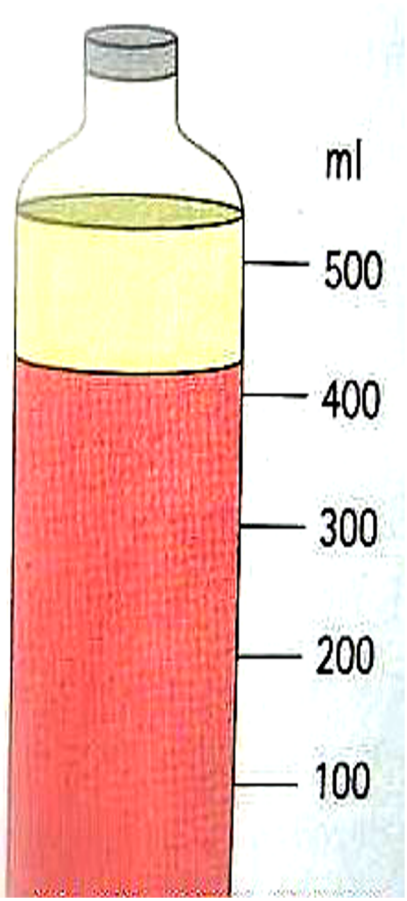
Classification of Hypovolaemic Shock and Physiologic Changes

	Class I	Class II	Class III	Class IV
Blood loss (liter)	Up to 0.75	0.75-1.5	1.5-2.0	> 2
% TBV	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		

What is your fluid replacement regimen?

ATLS- Primary Survey
C- Circulation and hge control

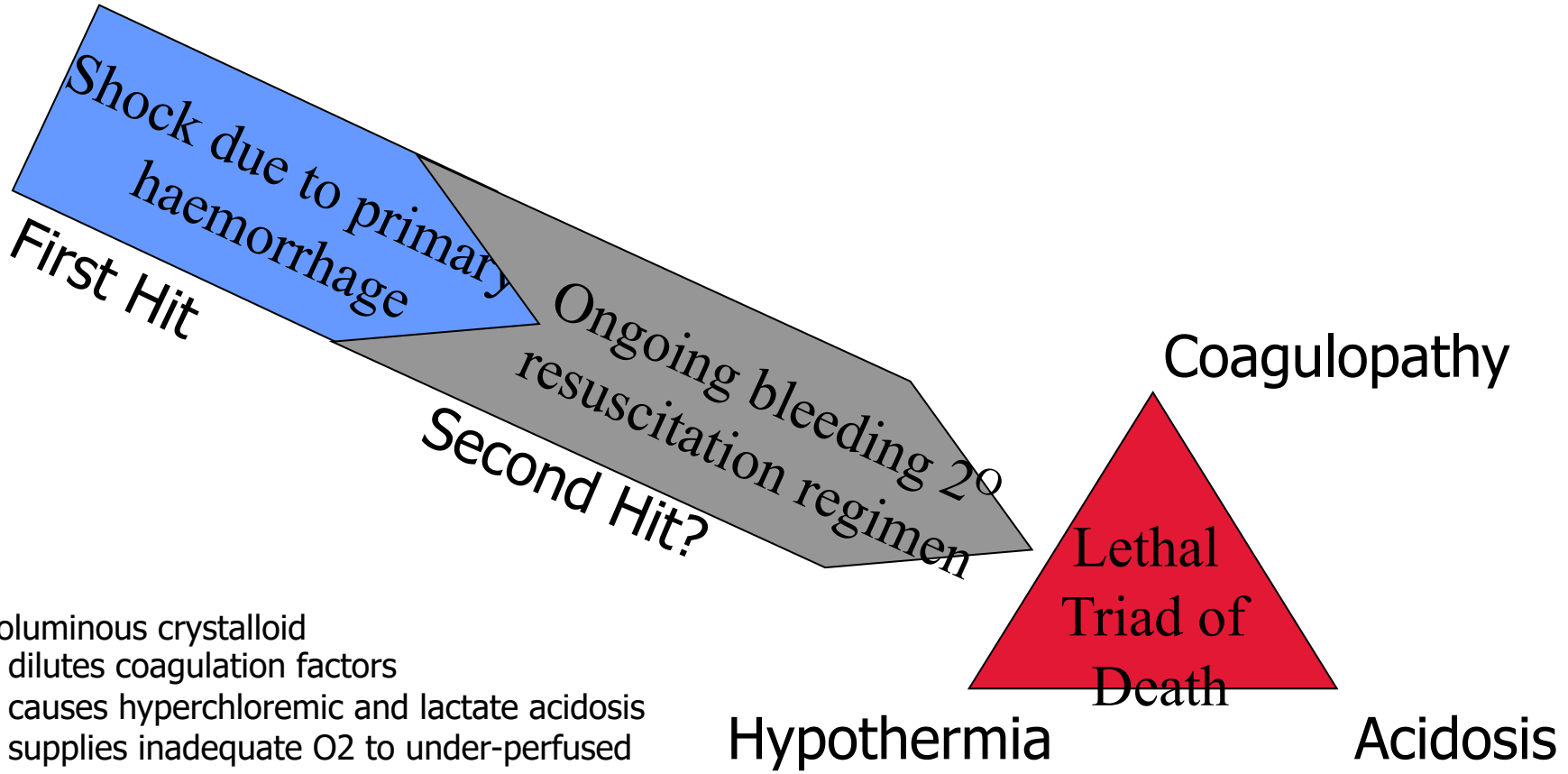




Estimation of blood loss

VIDEO: TESTING PELVIC STABILITY

Fluid resuscitation - DEBATE



Voluminous crystalloid
- dilutes coagulation factors
- causes hyperchloremic and lactate acidosis
- supplies inadequate O2 to under-perfused tissue

Current concepts

Permissive hypotension

Maintain systolic B.P. at 85 - 95 mm of Hg

Turn off the tap and do not infuse too much of fluid and blood products

Paradigm Shift in Resuscitation
To DCR in 1990s

HD Triage: Stable, Borderline, Unstable and In Extremis

C A B C D E

DAMAGE CONTROL RESUSCITATION

Permissive hypotension

Hemorrhage control

Hemostatic resuscitation

Damage Control Surgery

Definitive fracture fixation

Balanced Resuscitation

1. Fluid Replacement in Balanced Resuscitation
   - Initial fluid replacement with up to 2L crystalloid
     Permissive hypotension to achieve SBP to 80-90mmHg (radial pulse) until definitive control of bleeding is obtained

2. Haemostatic Resuscitation
   - Early blood *versus* HBOC transfusion decreases MODS
   - Packed RBC, FFP and Platelets in 1:1:1 ratio
   - Cryoprecipitate, Tranexamic acid, Recombinant factor-VIIa
   - Storage blood of < 2 weeks to minimize TRALI, MODS

ATLS- Primary Survey
D- Dysfunction

- Assess level of consciousness using AVPU method
  A = alert
  V = responding to voice
  P = responding to pain
  U = unresponsive
- GCS(glascow coma scale)
- Assess pupil size, equality and responsiveness

GCS

Eye opening

- **Spontaneous 4**
- **To voice 3**
- **To pain 2**
- **None 1**

Verbal response

- **Oriented 5**
- **Confused 4**
- **Inapp words 3**
- **Incomp sounds 2**
- **None 1**

Motor response

- **Obeys commands 6**
- **Localises pain 5**
- **Withdraws 4**
- **Flexion(pain) 3**
- **Extension (pain) 2**
- **None 1**

Total 3-15

ATLS- Primary Survey
E- Exposure

- Fully undress patients
- Avoid hypothermia

Hypothermia Prevention and Treatment Strategies

- Limit casualties' exposure
- Warm IV fluids and blood products before transfusion
- Use forced air warming devices before and after surgery
- Use carbon polymer heating mattress

Secondary survey (ATLS)

- **Comprises of head to toe exam of the stable pt**
- **Requires**

  Detailed history

  Thorough examination

  KEEP MONITORING the vital signs monitoring devices

  -pulse oximeter

  -rectal thermometer
- **Detailed radiographic procedures**

  -C.T., USG, M.R.I.

Secondary survey (ATLS)

HEAD,ENT

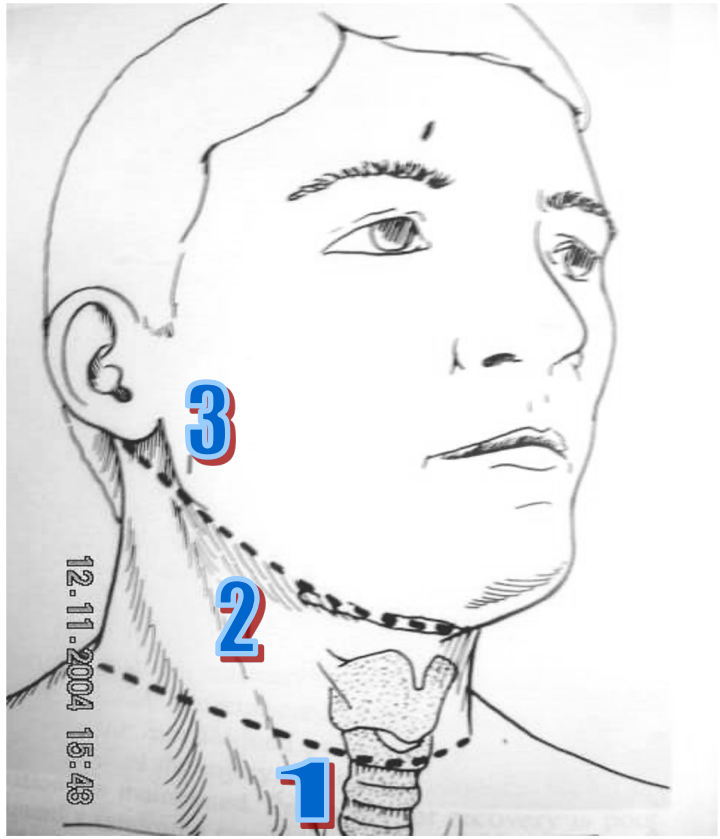
- **Glasgow coma scale**
- **Reaction and size of pupils**
- **Plantar response**
- **Signs of rhinorrhoea,otorrhoea(base of skull#)**
- **Nose fracture, septal hematoma**

Secondary survey (ATLS)

NECK

- **Subcut emphysema**
- **Cervical spine fractures**

  (specially C1,C2,C7)
- **Penetrating neck injuries**



Secondary survey (ATLS)

THORAX

Search for potentially life threatening injuries

- **Pulmonary complication**
- **Myocardial contusion**
- **Aortic tear**
- **Diaphragmatic tear**
- **Oesophageal tear**
- **Tracheobronchial tear**
- **Early thoracotomy if initial haemorrhage > 1500 ml**

Secondary survey (ATLS)

ABDOMEN

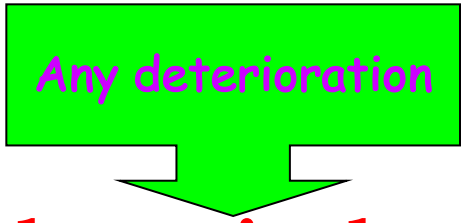
- **Fingers and tubes in every orifice**
- **Nasogastric and Urinary catheter for diagnosis and treatment**
- **Rectal exam**
- **Wounds coverage**
- **Eviscerated bowels packed by warm wet mops**

Secondary survey (ATLS)

ABDOMEN

For rigid and distended abdomen

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



Consider rapid surgical exploration

Secondary survey (ATLS) PELVIS

Clinical assessment

X-ray

→ **stabilize pelvis with fixator/clamps**

If urethral injury is suspected—high up prostate in PR

blood in meatus

perineal haematoma

Trial catheter
With gentle manipulation

Fine catheter

Lots of lubricants
In OT

If not

ascending urethrogram

suprapubic cystotomy

Secondary survey (ATLS)

Spinal injury

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**

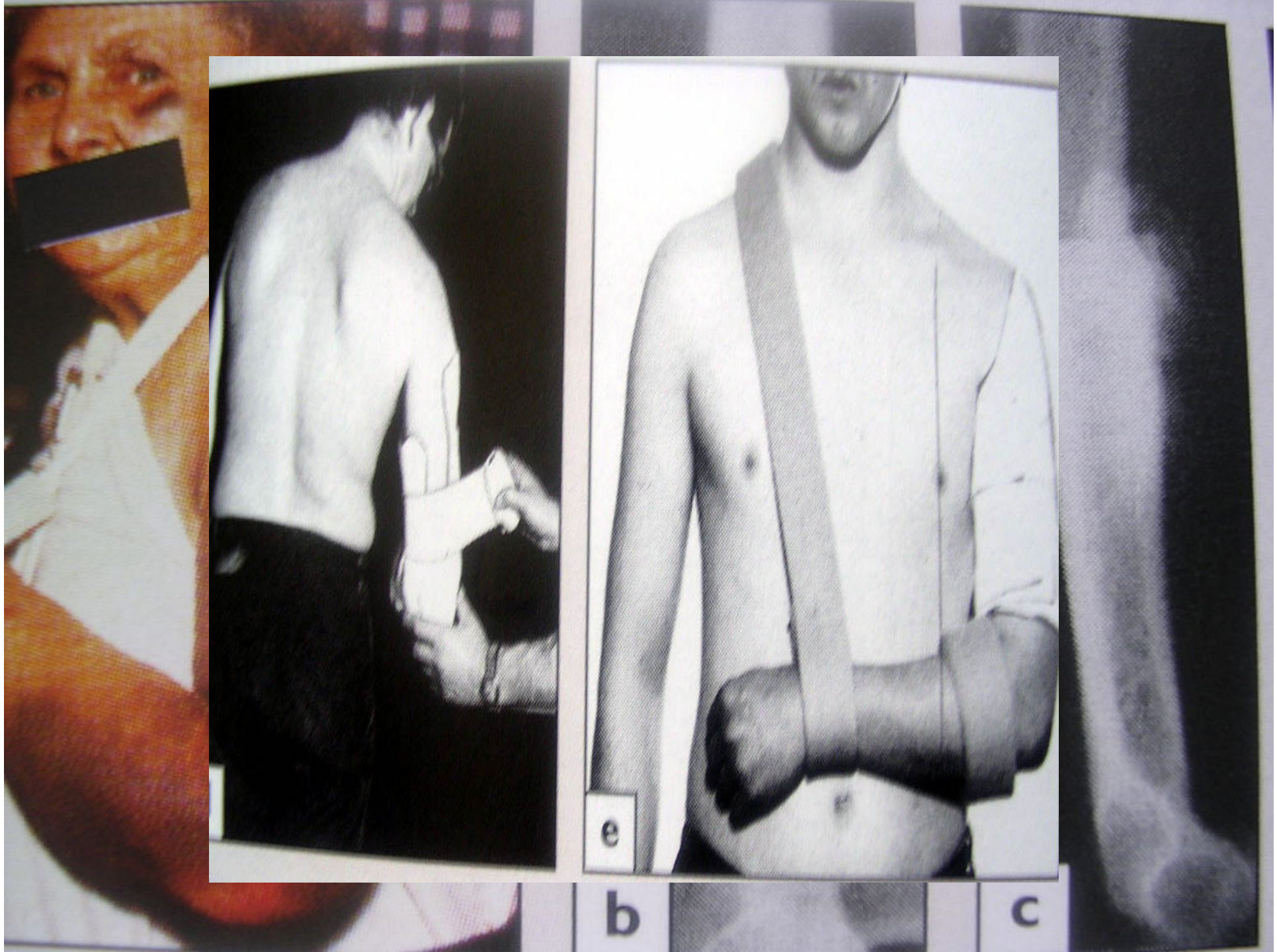
Secondary survey (ATLS)

EXTREMITIES

- **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**

ATLS-secondary survey
F- Fracture management

1. **Minor**
2. **Moderate** **open # of digits**
   undisplaced long bone or pelvis #
3. **Serious** **closed long bone #s**
   multiple hand/foot #s
4. **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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Medication; DON'T FORGET

- **Tetanus prophylaxis**
- **Anti D immunoglobulin in possible preg female**
- **Vasopressor drugs(selective)**
- **Antiobiotics(selective)**
- **Calcium gluconate(selective)**
- **Tranexamic acid(TXA)**

Definitive care plan(ATLS)

Multi-speciality approach

(Inter-disciplinary management)

The most appropriate person in-charge is the General/trauma surgeon.

Complications

- **Tetanus**
- **A.R.D.S.**
- **Fat embolism**
- **D.I.C.**
- **Compartment syndrome**
- **Multisystem organ failure (M.S.O.F.)**

Complications

A.R.D.S.

- **Tachypnoea**
- **dyspnea**
- **Bilateral infiltrates in CXR**

Treated with mechanical ‘’low tidal’’ ventilation with PEEP

Complications

Fat embolism

- **Around 72 hours**
- **Tachycardia**
- **Tachypnoea**
- **Dyspnoea**
- **Chest pain**
- **Petechial haemorrhage**

Treated with ----- mechanical ventilation

------fixation of fractures

Complications

Disseminated intravascular coagulation

- **Follows severe blood loss and sepsis**
- **Restlessness , confusion, neurological dysfunction,skin infarction , oliguria**
- **Excessive bleeding**
- **Prolonged PT,PTT,TT,hypofibrinogenemia**

Treatment– prevention and early correction of shock, warming fluids, giving less crystalloids

Complications

Compartment syndrome/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
- Renal failure

Treatment

- Prevention of renal failure-ensure high urine flow during using IV Crystalloids
- Fasciotomy and excision of devitalized muscles
- Amputation

Complications

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)

Characterised by two or more of the following

- **Temperature >38° C or < 36°C**
- **Tachycardia >90 /min**
- **Respiratory rate >20/min**
- **WBC count >12,000/cmm or <4,000/cmm**

Complications

M.S.O.F.

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.
- Proper priority to orthopedic conditions affect the patient life/limbs (open book pelvis fracture, bilateral femur fractures, mangled extremity).
- Importance of interpersonal and intrapersonal communication skills