





Golden Rules of the Golden Hour in Trauma



Narendra Nath Jena

National General Secretary- Society for Emergency Medicine, India (SEMI)

Honorary National Professor (EM) – IMA CGP

Director , Institute of Emergency Medicine

Meenakshi Mission Hospital & Research Centre, Madurai, India



Why it is important ???

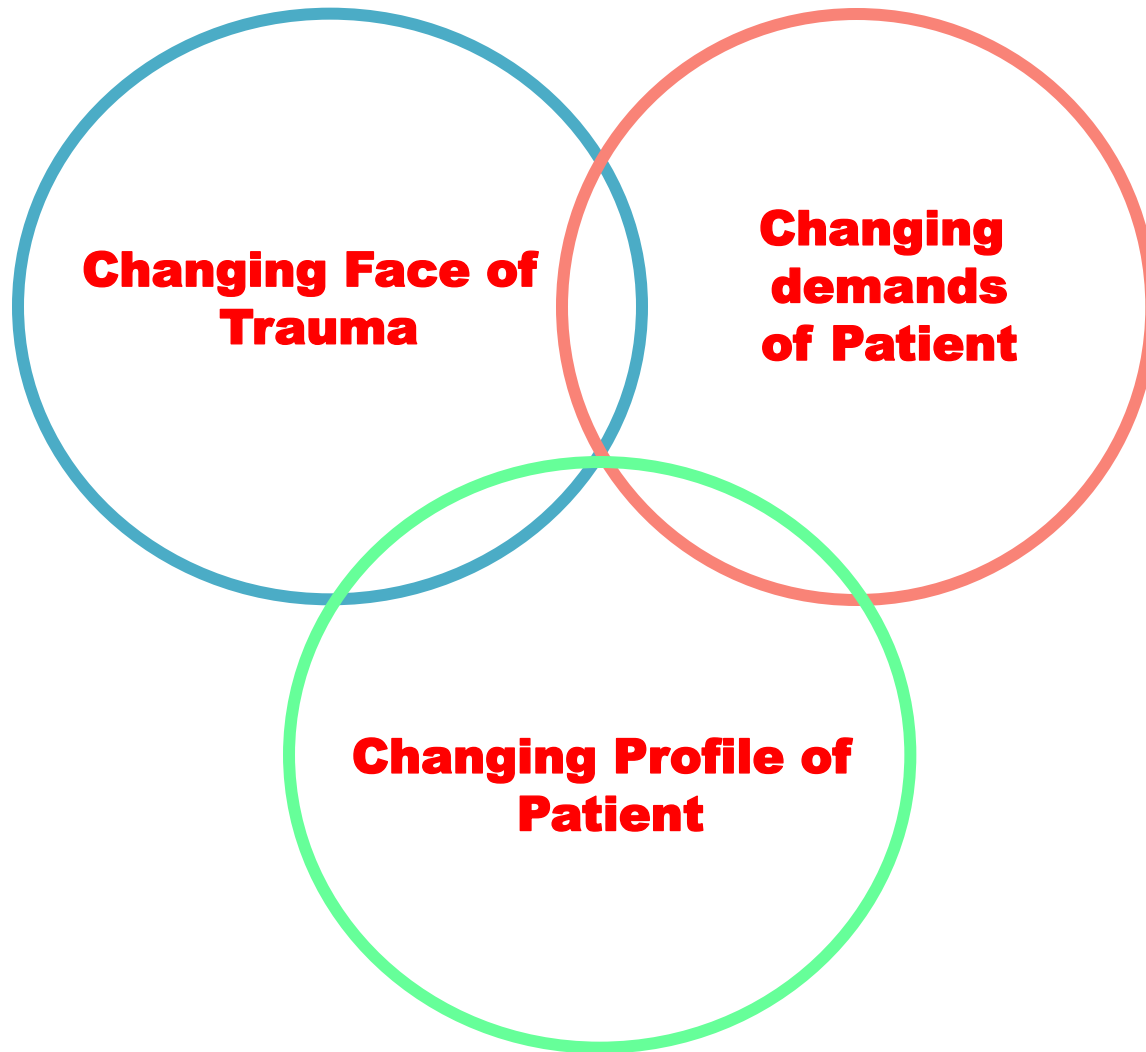
- Trauma is the neglected disease in developing nations...
- WHO estimates that 5.8 million deaths annually...
- Developing countries accounts highest death...
- Maximum proportion die before reaching hospital...
- Two third of the victims belong to the age group between 15- 45 years...

Most of the trauma related deaths are preventable, and its high time to realize this fact.



Origin of Trauma





Changing Face of Trauma





Changing Face of Trauma



Worldwide - Burden

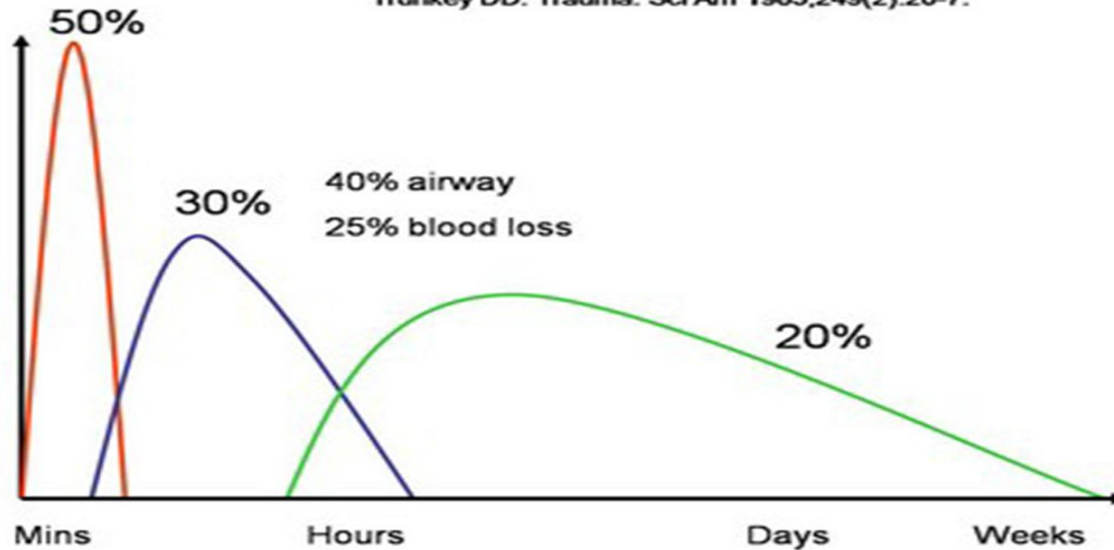
- Account for 9% of global mortality.
- Injuries incurs temporary or permanent disabilities.
- By 2020, 2nd leading cause of death after IHD.



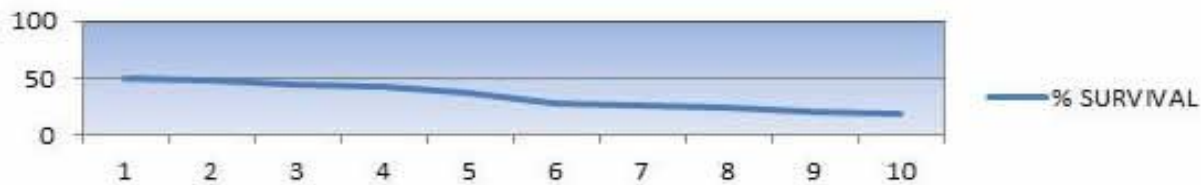
Source : <http://www.who.int/topics/injuries/about/en/>

Trimodal Distribution of Death

Trunkey DD. Trauma. Sci Am 1983;249(2):20-7.



% SURVIVAL VS DELAY IN MINUTES



DETECTION OF COLLAPSE	REPORT OF ALARM 911 OR DIRECT	EMS/FIRE RESPONSE TIME			
		DISPATCH UNITS	TURN OUT	RESPONSE TIME	SET UP
TIME VARIES	TIME DIRECTLY MANAGEABLE				



The first peak

1st

- Death at the time of injury (50%)
- Primary injury to major organs such as brain, heart, great vessels
- The injuries are irrecoverable, rapid treatment and transfer may salvage some patients
- **Primary prevention**



The Second Peak

- From the end of the first peak to several hours (30%)
- **GOLDEN HOUR**
- Morbidity and mortality are prevented by avoidance of a secondary injury due to hypoxia , hemorrhage , inadequate tissue perfusion
- **ATLS – Pre hospital and in hospital**



The Third Peak



- Death occurs days or weeks after the injury (20%)
- Sepsis and multiple organ failure
- Advances in intensive care reduce deaths
- Improvements in initial management on admission reduce morbidity and mortality



The Golden Hour

Creator of “The Golden Hour” concept

- Father of Trauma Medicine
- Pioneer of treatment of Shock Trauma
- Founder of 1st Trauma center at the university of Maryland
- First to perform open Heart surgery & invented surgical clamp bears his name



R Adams Cowley

"There is a golden hour between life and death. If you are critically injured you have less than 60 minutes to survive. You might not die right then; it may be three days or two weeks later -- but something has happened in your body that is irreparable."



Source : Tribute to Adams Cowley,MD.2005-12-24 at Wayback Machine.
Univ of Maryland Medical Center, R Adams Cowley Shock Trauma Center.

Immediate Life threatening conditions

- Airway obstruction
- Tension pneumothorax
- Open pneumothorax (Sucking chest wound)
- Massive hemothorax
- Flail chest
- Cardiac tamponade
- Pelvic fractures with massive hemorrhage

ATOM FCP

Era of Life Preservation



Potential Life threatening conditions

- Lung contusion with or without Flail chest
- Myocardial contusion
- Aortic rupture
- Diaphragmatic rupture
- Tracheobronchial tree injury - larynx, trachea, bronchus
- Esophageal trauma



Golden Hour Rules...

- Preparation ..
- Triage..
- Primary survey...
- Resuscitation..
- Adjuncts to primary survey and resuscitation..
- Secondary survey..
- Adjuncts to secondary survey
- Continued post resuscitation monitoring and reevaluation..
- Definitive care....

A.T.L.S.
(ADVANCED TRAUMA LIFE SUPPORT)



Preparation

Prehospital phase [EMS]

- Notify receiving hospital
- Airway maintenance, control of external bleeding and shock, immobilization of the patient

Inhospital phase

- Resuscitation area
- Equipment, monitor , warmed fluid
- Trauma team
- Protective communicable disease



Triage

- Sorting of patients according to
 - ✓ ABCDEs
 - ✓ Available resources



Concepts of Golden hour

- Treat the greatest threat to life **FIRST**
- The lack of a definitive diagnosis should never impede the application of an indicated treatment
- A detailed history is not essential to begin the evaluation
- **“ABCDE”** approach



Primary Survey

Patients are assessed and treatment priorities established based on their injuries, vital signs, and injury mechanisms

- **ABCDE'** s of trauma care
 - A** Airway and c-spine protection
 - B** Breathing and ventilation
 - C** Circulation with hemorrhage control
 - D** Disability and Neurological status
 - E** Exposure and Environmental control



Dr. James K. Styner
Nebraska, USA, 1978

Advanced Trauma Life Support



A-Airway

How do we intervene the airway?



The Golden Hour

Sun, Aug 31, 2008

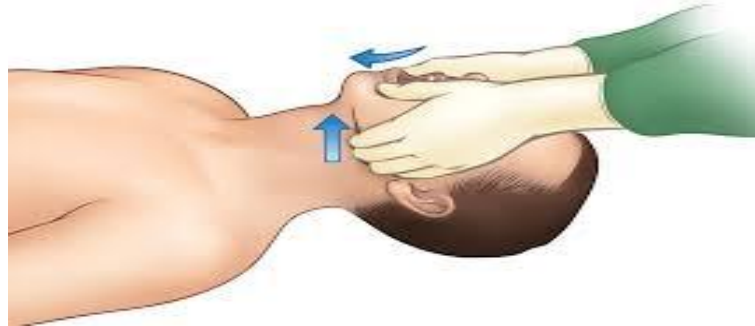
By Charlie Eisele, BS, NREMT-P

JEMS Editorial Board member



Airway Interventions

- Supplemental oxygen
- Suction
- Chin lift / jaw thrust
- Oral airway
- Definitive airways



- ✓ *RSI for agitated patients with c-spine immobilization*
- ✓ *ETI for comatose patients (GCS<8)*

Airway



- Manual in line stabilization of C-spine while doing intubation
- Apply rigid neck collar after intubation (look for tracheal shift, distended neck veins, lacerations)
- Patients with severe Maxillo-facial injuries may need surgical airway.
- Maintaining adequate oxygenation is very important in preventing secondary injuries especially in head injury patients .

Cannot Intubate / Cannot Ventilate ??



Needle
Cricothyroidotomy



B-Breathing

Airway patency alone does not ensure adequate ventilation

What can we look for clinically to assess a patient's 'breathing' status?



Breathing with supplemental O₂

- **Inspect**- Equal chest rise, paradoxical chest movements, contusions, sucking chest wound, distended neck veins
- **Auscultate**- Equal breath sounds, absence of breath sounds
- **Palpate**- Tracheal shift, Chest wall tenderness, subcutaneous emphysema, sternum #, rib #
- **Percuss**- hyper resonance, dull note
- Give supplemental O₂ to all trauma patients



Life threatening injuries

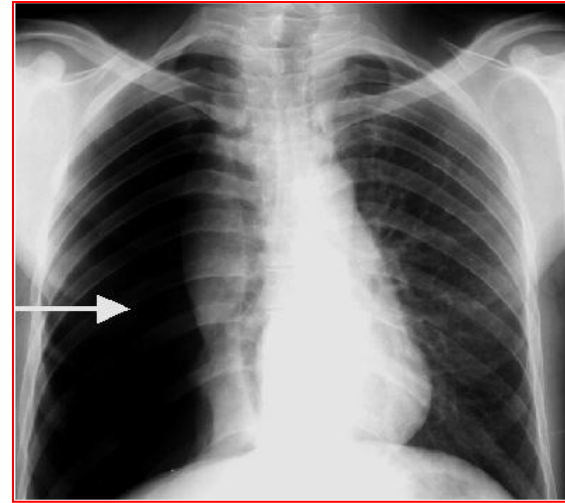
- ✓ Tension pneumothorax
- ✓ Flail chest
- ✓ Open chest wound
- ✓ Massive hemothorax



Tension pneumothorax

Air moves into the thoracic cavity and is not able to escape

- Air hunger
- Respiratory distress
- Tachycardia
- hypotension



- Tracheal deviation
- Unilateral absence of breath sound
- Distention of neck veins
- Cyanosis

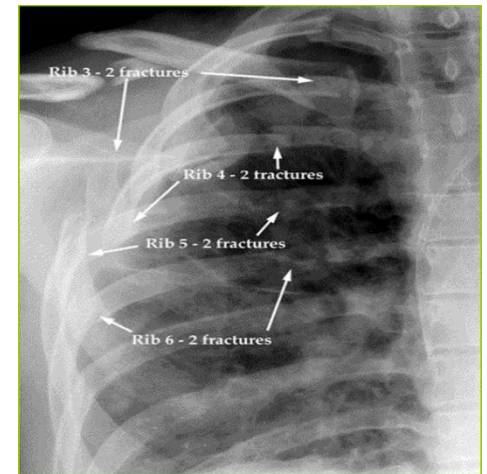
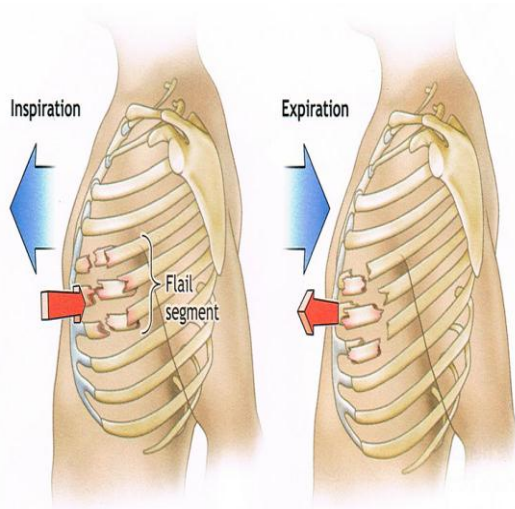
Management

- ✓ Immediate decompression:
Needle decompression
- ✓ Definitive treatment: Chest tube



Flail chest

Multiple adjacent ribs are broken in multiple places, separating a segment, so a part of the chest wall moves independently.



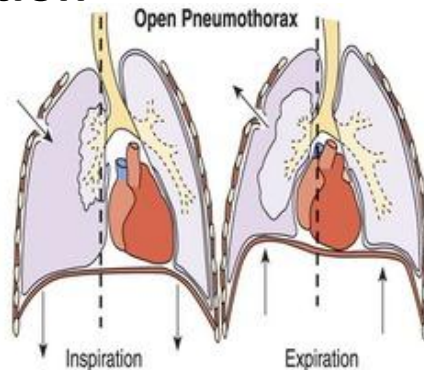
Produces free-floating chest wall segment

Usually secondary to blunt trauma

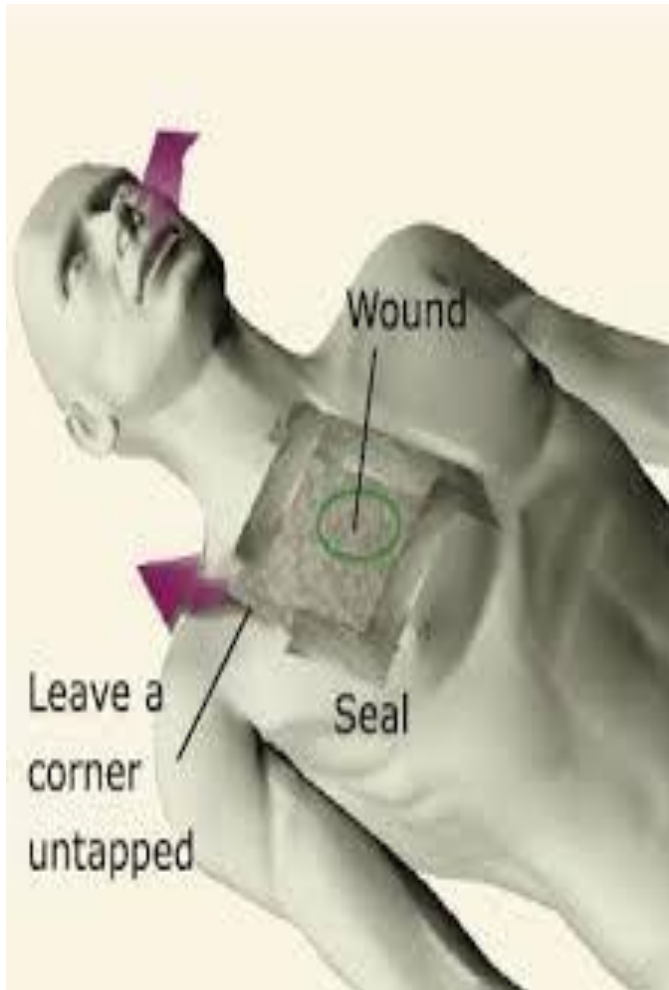
More common in older patients

Open chest wound

- Chest wall remains open
- Equilibrium between Intrathoracic & atmospheric pressure occurs ..
- If the opening more than 2/3 the diameter of trachea air passes through the defect
- Impair Ventilation



Open chest wound



**Open pneumothorax (Sucking chest wound)
3 way occlusive dressing**

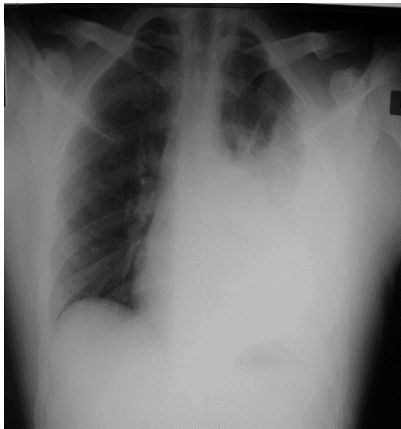


Massive hemothorax

Blood accumulates in the pleural cavity.

Systemic / pulmonary vessel disruption

Penetrating wounds medial to the nipple line anteriorly or
medial to the scapula posteriorly



Management

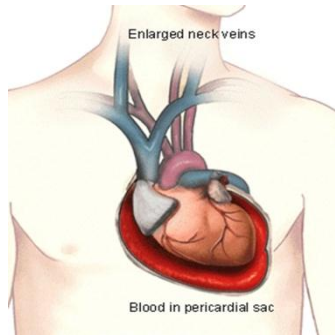
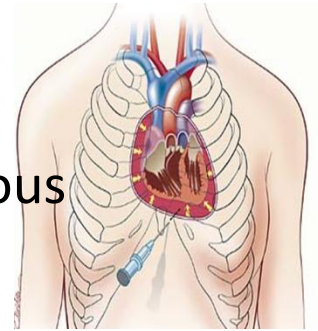
- ✓ Secure airway
- ✓ Assist breathing with high concentration O₂
- ✓ Aggressive fluid resuscitation
- ✓ Transfuse blood as soon as possible
- ✓ ICD insertion
- ✓ Thoracotomy is indicated if there is >1500ml blood loss or continuous loss > 200ml/hr



Cardiac Tamponade

Beck's triad

- **Hypotension**- decreased stroke volume
- **Jugular-venous distension** - impaired venous return to the heart
- **Muffled heart sounds** - Blood inside the pericardium.
- **Pulses paradoxus** - drop of at least 10mmHg in arterial blood pressure on inspiration.



(Electro mechanical dissociation in the absence of Hypovolemia or tension pneumothorax)

Management : Pericardiocentesis



C- Circulation

Rapid assessment of hemodynamic status

- ✓ Level of consciousness
- ✓ Skin color
- ✓ Pulses in four extremities
- ✓ Blood pressure and pulse pressure



Circulation with bleeding control

- Hemorrhagic shock is **most common cause** of post injury death..
- Look for S/O hypoperfusion - level of consciousness, PR, BP, capillary refill (>2 sec), skin colour, urine output..
- All hemorrhages do not produce shock, S/O shock not seen until **30% of blood is lost.**



Classification of Hemorrhagic Shock

Class of haemorrhagic shock				
	I	II	III	IV
Blood loss (mL)	Up to 750	750–1500	1500–2000	> 2000
Blood loss (% blood volume)	Up to 15	15–30	30–40	> 40
Pulse rate (per minute)	< 100	100–120	120–140	> 140
Blood pressure	Normal	Normal	Decreased	Decreased
Pulse pressure (mm Hg)	Normal or increased	Decreased	Decreased	Decreased
Respiratory rate (per minute)	14–20	20–30	30–40	> 35
Urine output (mL/hour)	> 30	20–30	5–15	Negligible
Central nervous system/ mental status	Slightly anxious	Mildly anxious	Anxious, confused	Confused, lethargic



Blood loss due to fracture

Site of fracture	Blood loss (approx)
Pelvic #	2500-4000ml
Femur #	1500-2000ml
Tibia & Fibula #	1000-1500ml
Humerus #	500-800ml
Forearm bones #	250-400ml

Pelvic disruption with massive hemorrhage

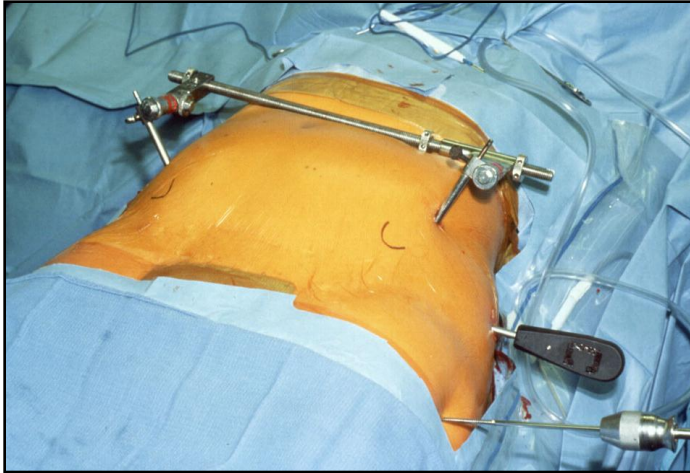
- ✓ Polytrauma patient having Pelvic injury – approx 25 %
- ✓ Mortality rate is high approx. 5% and rises up to 22% with complex pelvis fracture..
- ✓ Uncontrolled pelvic hemorrhage accounts for 39% of trauma related deaths.



Pelvic Binding



External fixation



- Good control of anterior instability
- Exposure not a problem
- Technically demanding

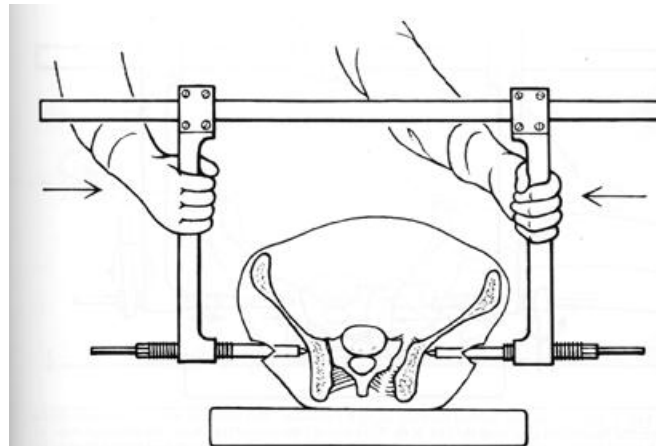


FIG. 3. While an assistant holds the clamp in position, the surgeon slides the sidearms medially until the Steinmann pin touches the outer cortex of the ilium.

Open internal fixation



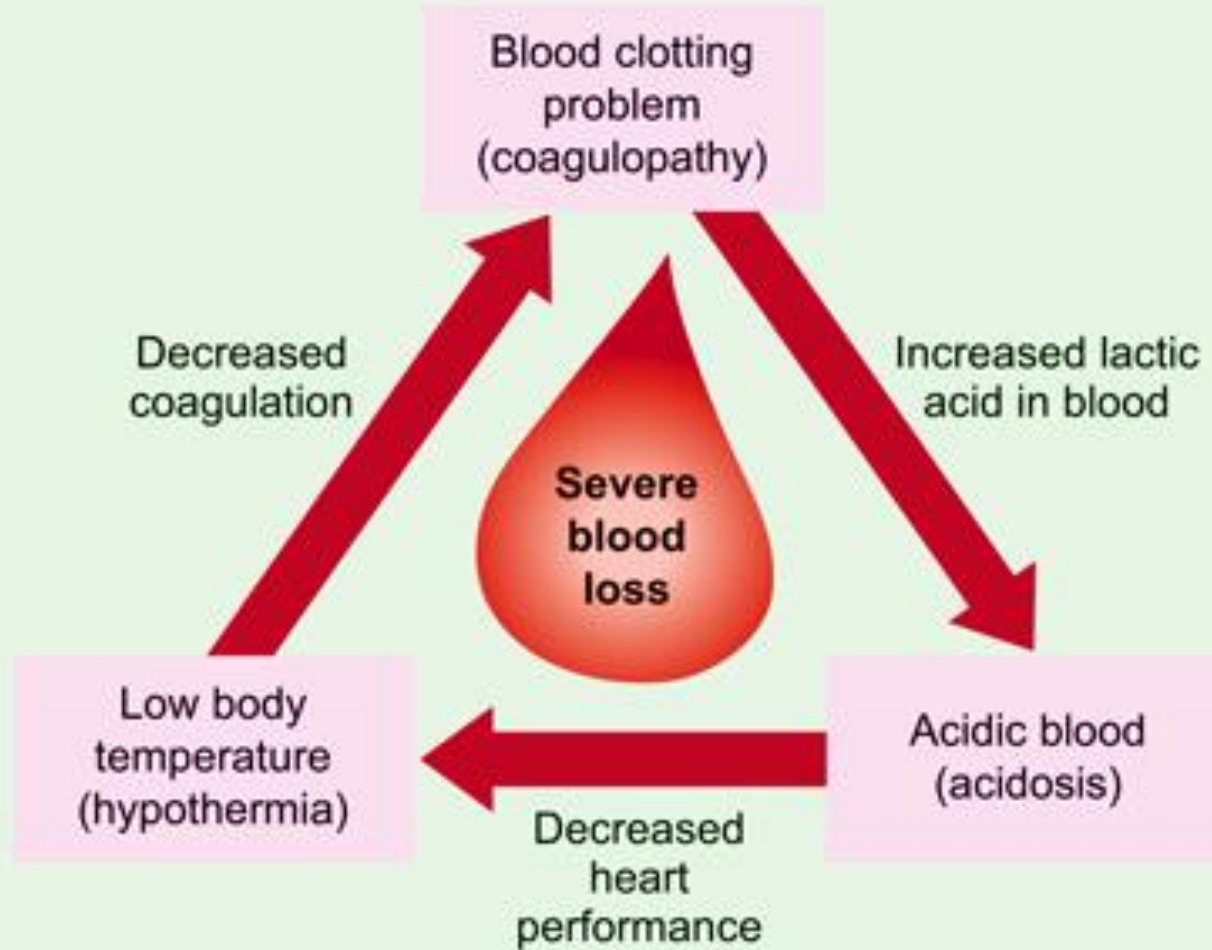
- Big exposures
- Definitive treatment
- Timing problematic in multi trauma
- Specialty skills required

Circulation Interventions

- Cardiac monitor
- Apply pressure to sites of external hemorrhage
- Establish IV access
 - ✓ *2 large bore IVs*
 - ✓ *Central lines if indicated*
- Volume resuscitation
 - ✓ *Foley catheter to monitor resuscitation*



Trauma Triad of Death



Source : Mattox KL, Moore EE, Feliciano DV, Trauma 7th ed.



Which fluids you prefer : Crystalloids or Colloids ?

September 2014, Volume 4, [Issue 3](#), pp 216–224

Fluid Resuscitation for Trauma Patients: Crystalloids Versus Colloids

- ✓ There has been no role for colloids in trauma resuscitation due to associated side effects like anaphylaxis or hypernatremia.
- ✓ Use of crystalloids has been thought to be without negative effects on coagulation.
- ✓ Crystalloids have no specific adverse effect on renal function



Blood transfusion in Trauma

[J Emerg Trauma Shock](#). 2011 Jan-Mar; 4(1): 103–108.

PMCID: PMC3097557

doi: [10.4103/0974-2700.76844](#)

Transfusion protocol in trauma

[Paramjit Kaur](#), [Sabita Basu](#),¹ [Gagandeep Kaur](#),¹ and [Ravneet Kaur](#)¹

[Indian J Anaesth](#). 2014 Sep-Oct; 58(5): 590–595.

PMCID: PMC4260305

doi: [10.4103/0019-5049.144662](#)

Massive transfusion and massive transfusion protocol

[Vijaya Patil](#) and [Madhavi Shetmahajan](#)

- Determine the severity of hemorrhagic shock.
- Expedite control of hemorrhage.
- Plan for Damage control surgery.



- ✓ Early blood and blood product resuscitation.
- ✓ O negative blood preferred until the crossmatching is ready.
- ✓ Blood product resuscitation ratio - PRBC: FFP: Platelets = 1:1:1
- ✓ Maintain SBP of 80 to 100 mmHg.
- ✓ Consider TXA and additional coagulation factors.



Inotropes in Trauma

[Ann Intensive Care](#). 2013; 3: 13.

PMCID: PMC3691630

Published online 2013 May 22. doi: [10.1186/2110-5820-3-13](https://doi.org/10.1186/2110-5820-3-13)

Does vasopressor therapy have an indication in hemorrhagic shock?

[François Beloncle](#),^{1,2} [Ferhat Meziani](#),^{3,4} [Nicolas Lerolle](#),^{1,2} [Peter Radermacher](#),⁵ and [Pierre Asfar](#)^{✉1,2}

- ✓ Inotrope/vasopressor drugs should only be used in a blood loss scenario during severe hypotension to avoid critical hypo perfusion and to buy time for fluid resuscitation.
- ✓ They should be stopped as soon as volume deficits are replaced, and a safe blood pressure is achieved.



D-Disability

- *GCS*
 - ✓ Utilized to determine severity of injury
 - ✓ Guide for urgency of head CT and ICP monitoring
- *Pupils size and light reaction*



E- Exposure

Primary assessment is incomplete without thorough examination of total body surface area.

Log roll should be done in all unconscious patients, back pain, limb weakness.

Inspect & palpate entire spine & back, P/R for anal tone, blood & prostate.



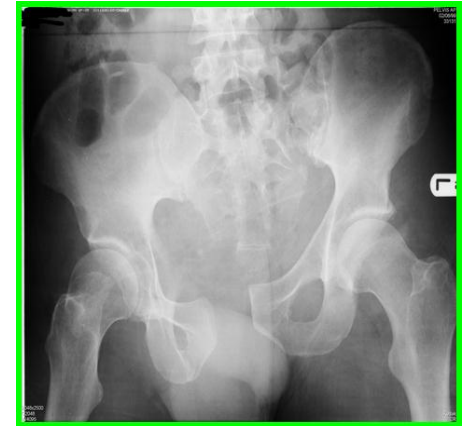
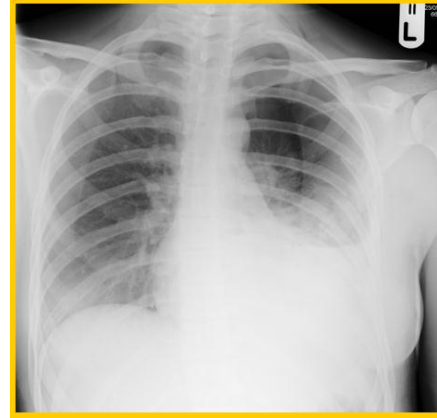
Exposure



- Blood at urethral meatus - S/O urethral rupture, *DO NOT CATHETERIZE*
- Watch for hypothermia
- Can causes acidosis, DIC, decreases micro circulation, and may worsens the patients condition

Adjuncts to primary survey and resuscitation

- **ECG**
- **ABG**
- **CBG**
- **HCG**
- **USG**
- Urinary and gastric catheter
- Trauma Xrays
- eFAST



E-FAST in Trauma

Emergency Medicine International
Volume 2013 (2013), Article ID 678380, 7 pages
<http://dx.doi.org/10.1155/2013/678380>

Research Article

Focused Assessment with Sonography in Trauma and Abdominal Computed Tomography Utilization in Adult Trauma Patients: Trends over the Last Decade

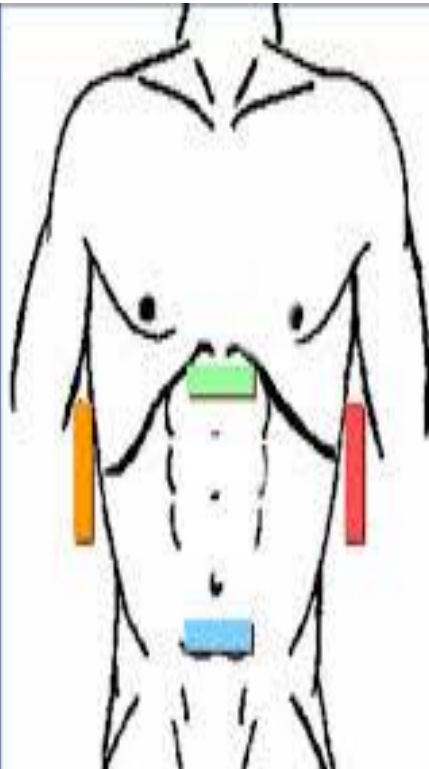
Alexander Y. Sheng,¹ Peregrine Dalziel,² Andrew S. Liteplo,² Peter Fagenholz,³ and Vicki E. Noble²

- Perihepatic

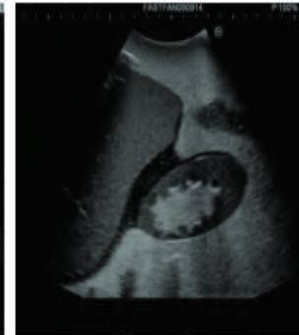
- Pericardial

- Perisplenic

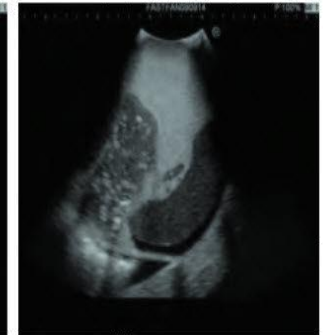
- Pelvic



① Cardiac Tamponade



② Right Upper Abdominal Bleeding



③ Left Upper Abdominal Bleeding



④ Pelvic Bleeding



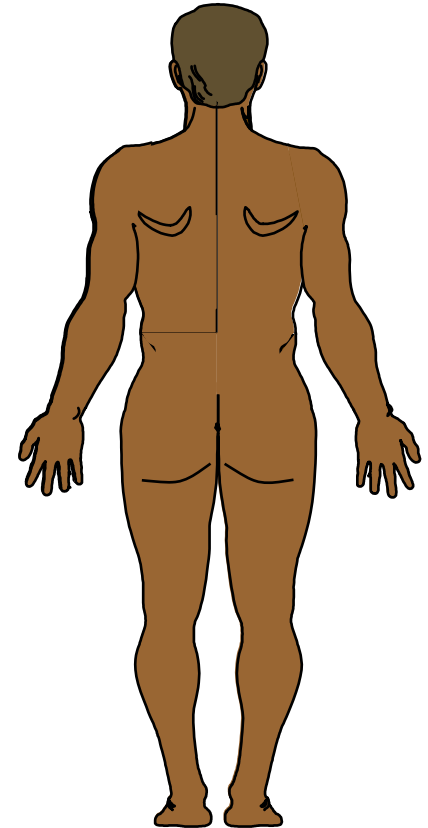
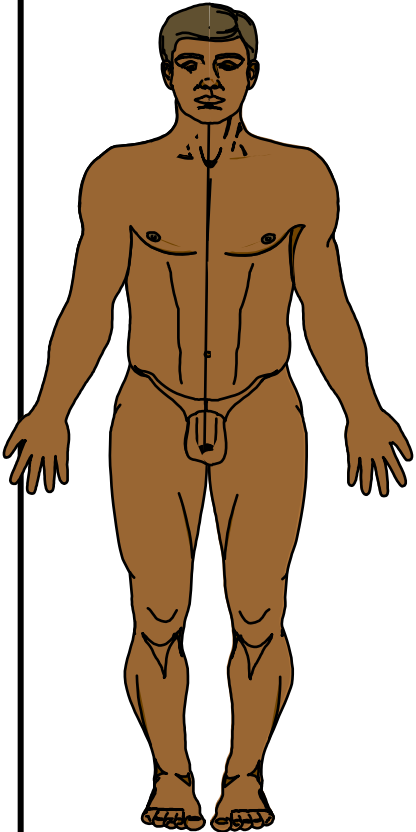
⑤ Pleural Bleeding



⑥ Peri-hepatic Bleeding

Secondary survey

- Rapid and thorough head to toe physical examination for identifying as many injuries as possible.
- Resuscitation should be continued during secondary assessment.
- Inspect & palpate for tenderness, crepitus, swelling, deformity, scalp lacerations, all peripheral pulses, motor & sensory function, scrotal hematoma.



Secondary Survey

AMPLE history

- ✓ Allergies
- ✓ Medications
- ✓ PMH
- ✓ Last meal
- ✓ Events



Adjuncts to secondary survey

- Standard trauma labs
- Standard trauma radiographs
- CT/FAST scans
- Patient must be monitored in radiology
- Patient should only go to radiology if stable



CT Scan in Trauma

- Abdominal CT scan visualizes solid organs and vessels well
- CT does NOT see hollow viscus, duodenum, diaphragm, or omentum well
- Some recent surgery literature advocates whole body scans on all trauma

News & Perspective > [BMC Emergency Medicine](#)

A Multicenter, Randomized Controlled Trial of Immediate Total-Body CT Scanning in Trauma Patients (REACT-2)

Joanne C Sierink; Teun Peter Saltzherr; Ludo FM Beenen; Jan SK Luitse; Markus W Hollmann; Johannes B Reitsma; Michael JR Edwards; Joachim Hohmann; Benn JA Beuker; Peter Patka; James W Suliburk; Marcel G Dijkgraaf; J Carel Goslings

[DISCLOSURES](#) | BMC Emerg Med. 2012;12(4)



Monitoring and revaluation

- Minimize missed injury
- High index of suspicion
- Adult urine output 0.5ml/kg/hr
- Pediatric urine output 1ml/kg/hr
- Pain relief .



Disposition of Trauma Patients

- Dictated by the patient's condition and available resources i.e. trauma team available
 - ✓ OR , admit, or transfer
- Transfers should be coordinated efforts
 - ✓ Stabilization begun prior to transfer
 - ✓ Decompensation should be anticipated
- Serial examinations
 - ✓ TBI with regain of consciousness
 - ✓ Abdominal exams for documented blunt trauma
 - ✓ Pulmonary contusions with blunt chest trauma



To Summarize

- Team Approach ..
- Priorities in management & resuscitation..
- Assumption of most serious injuries..
- Treatment before diagnosis..
- Thorough examination..
- Frequent reassessment..
- Monitoring...



"All that we are is the result of
what we have thought. The mind is
everything. What we think we
become." ~Buddha



