**POLYTRAUMA**

**Definition**:

1. ISS > 15 and ISS > 17 have emerged as the favoured severity score cut-off points for defining polytrauma.
2. Anatomic injury score > 2 in at least two body regions

| | *N* | Polytrauma | Death |
|---|---|---|---|
| Total | 336 | 44 (13%) | 14 (4%)<br>0.0252–0.0726 |
| ISS>15 | 131 | 44 (34%) | 13 (10%)<br>0.0539–0.1637 |
| ISS > 17 | 102 | 40 (39%) | 11 (11%)<br>0.0551–0.1848 |
| 2 × AIS > 2 | 64 | 37 (58%) | 8 (13%)<br>0.0555–0.2315 |

**Demographics of Polytrauma**

Commonest cause for death between 15-45 years

65% of multiple trauma patients had cerebral injuries, 58% thoracic trauma and 81% extremity fractures (37% open injuries).

**Philosophy and trauma team organization**

The treatment of complex injuries in multiple organ systems demands a team approach. The team must be able to evaluate the patient swiftly and arrive at decisions quickly and efficiently in regard to performing lifesaving procedure. Audit of trauma care before and after the implementation of a regional trauma care system in San Diego showed significant improvement in the following: suboptimal care of the trauma victim, delay in evaluation of the victim, delay in disposition, suboptimal assessment, and trauma mortality from 13.6% to 2.7%.

A decrease of haemorrhage-induced deaths (25–15%) has occurred within the last decade. No considerable changes in the incidence and pattern of death were found. The predominant cause of death after trauma continues to be central nervous system (CNS) injury (21.6–71.5%), followed by exsanguination (12.5– 26.6%), while sepsis (3.1–17%) and multi-organ failure (MOF) (1.6–9%) continue to be predominant causes of late death. [Injury, Int. J. Care Injured 40 (2009) 907–911]

**Polytrauma in 3 periods**

| | 1975–84 (n = 1469) | 1985–94 (n = 1937) | 1995–2004 (n = 1443) |
|---|---|---|---|
| Aggressive Rx with IV fluid | 80% | 97%, | 98% |
| Chest tube insertion | 41% | 83% | 27% |
| Intubation | 82% | 94% | 59%. |
| FAST [U/S] | 17% | 92%, | 97% |
| Peritoneal lavage | 44% | 28% | 0% |
| MODS | 14.2% | 18.9% | 19.8% |
| Mortality rate | 37% | 22% | 18% |

Polytrauma management has significantly changed over the past 30 years.

1. Pre hospital aggressive management
2. A continuous decrease in almost all injuries over the entire study period. :

The number of MVA victims with severe injuries markedly decreased over the past 30 years.

a. This may be due to the an increased number of vehicles, making traffic denser and slower,

b. Improvements in technical safety
   - 1976 compulsory seat belt
   - motorcycle helmet law;
   - speed cameras
   - Conviction against drink driving
   - Antilock brake systems,
   - construction strategies for road crossings,
   - highway entries and exits.

3. Rapid transfer
4. The very aggressive resuscitation protocols of the 80s and early 90s favoring high amounts of crystalloids have been critically discussed in recent years.
5. Better management of extremity

The function of the **team leader** is to assess the clinical situation, gather information about treatment needs from the other services, direct the set up of the operating room space, **determine priorities**, and set limits on time and complexity of procedures. It is imperative that the various teams determine as quickly as possible what the operative plan is for the patient's specific injuries. Often these are attending or chief resident level decisions, and therefore this level of input must be sought quickly, with direct attending-to-attending conversations if necessary. The ultimate goal for the polytrauma patient in the operating room is to get out of the operating room as soon as possible.

**Primary Survey [Prehospital]**

| | |
|---|---|
| A | Airway |
| B | Breathing |
| C | Circulation |
| D | Disability (Neurology) |
| E | Exposure (complete undress and protect from Hypothermia) |

**Airway**

- Assessment: Listening air movement nose/mouth and chest movement,
- Look for intercostal retraction,
- Observe for foreign body obstruction in the oropharynx, Stridor
- Chin lift technique or Jaw thrust
- Use: Nasopharyngeal airway, intubation or cricothyroidectomy

**Intubate:** Pitfalls: Difficult intubation; Laryngeal injury, Equipment failure

Indication a.GCS: < 8

b.Can't maintain ventilation

c.Severe maxillofacial injury risk for aspiration: bleeding/vomiting

d. Apnea

**Cricothyroidectomy:**

Upper respiratory track injury and bag or tube ventilation not possible

Patient requiring prolong intubation

**Technique**:

Chin lift

Nasopharyngeal or orophalangeal airway

Ventilate with a bag valve mask (2 persons)

Supplemental Oxygen by mask

Intubation: When indicated

Cricothyroidectomy when indicated

Alleviate tension pneumothorax

Seal open pneumothorax

**Breathing**

- Assess: Respiratory rate and depth; Cyanosis is late feature.
- Look For: Trachea, Percussion, Auscultation
- **Respiratory causes**: Tension Pneumothorax, Open Pneumothorax, Flail chest, Massive hemothorax
- Rx: Flail chest management
- Chest tube management

**Circulation**

**Assessment**: BP, Pulse, Pulse Oxymetry, Skin color, Level of consciousness. Classically in a hypovolemic shock, tachycardia is the earliest measurable circulatory sign of shock.

**Pitfalls**: Elderly patient with Pacemaker [Tachycardia may not be present]
Children may show few signs of hypervolemia;
Well-trained athlete has compensatory mechanism
Neurogenic shock: Bradycardia despite fall in blood pressure.

**Type of shock**

A. Hemorrhagic
B. Cardiogenic
C. Neurogenic
D. Septic (Warm pink skin and wide pulse pressure)

**Physiological classification of the shock**

| | |
|---|---|
| I: Loss < 15% | Replacement of fluid corrects [no need for transfusion] |
| II: Loss 15-30% | Tachycardia >100, tachypnea<br>Decrease pulse pressure (due to increased diastolic)<br>Urine out put is only mildly affected (N = 30ml/hr)<br>May need blood transfusion |
| III: Loss 30-40%. | Classic sign of inadequate perfusion (Low systolic pressure) |
| IV: Loss>40%. | Life threatening.<br>Marked tachycardia,<br>Significant fall in systolic and an unobtainable diastolic pressure<br>Urinary output is negligible, metal status is markedly depressed. |

**Management of Shock**

2 lines: 14 gauge
Antecubital- Femoral - Subclavian or Jugular
Children: < 6yrs Intraosseous needle
Ringer lactate I choice (Saline II)
Bolus: 1-2 lts given as rapidly as possible and in children 20 ml/kg

3:1 rule ie., 3ml of fluid for 1 ml of blood loss

Assess: BP, Pulse, Urine output, Level of consciousness, Respiratory rate

Dopamine drip in some situation

Treat the cause for shock

Urine output: 0.5ml/Kg in adults and 1ml/Kg in infants

3 responses on fluid transfusion:

a. Rapid Response: Hemodynamic returning to normal. Usually loss is <20%
b. Transient Response: 20-40% loss, Need blood transfusion
c. No response: Surgical intervention for blood loss (always look for Percardial effusion)

**Transfusion**

Fluid: The initial bolus is 1,000 mL of Ringer's lactate in adults or 20 mL/kg in children.
If no response such as urine output, and CVP, repeat fluid infusion in 5 minutes.

Transfusion: Packed cell than whole blood;
Cross matched blood (1 hr)
Type specific (10 mnts)
O –ve for immediate transfusion

Warm fluids: 39°C to prevent hypothermia

Coagulopathy: PT, APTT, Platelet = Platelet transfusion,
Cryoprecipitate and fresh frozen plasma

**Search for causes of hemodynamic instability.**

1. Chest/Abdomen bleeding
2. Orthopedics injuries: Pelvis; open vascular

**Hemothorax**

Dx Clinical: Tachycardia, tachypnea, dyspnea
X ray: Tracheal shift, evidence of hemo or pneumo or hemopneumo thorax

Rx a. Placement of a chest tube [In general, initial bleeding greater than a liter or continued active bleeding will prompt an exploratory thoracotomy]
b. Blood replacement.

Principle: Removing blood from the plueral space allows the lung to fully expand, which causes tamponade of bleeding surfaces of the lung and internal chest wall in the operating room.

**Flail Chest**

Diagnosis: Paradoxical movement of the flail segment on the breathing

X ray: Multiple segmental fracture of the rib

Treatment: O2, resuscitate

If hypoxia: intubation and ventilation

**Active bleeding into the abdominal cavity**

1. Traditionally this was done by a diagnostic peritoneal lavage.
   2. Now: ultrasound technology [Focused Assessment Sonography for Trauma] (FAST)
   An unstable patient: a positive FAST examination is an indication for an immediate exploratory laparotomy.
2. For patients who are hemodynamically stable, a CT scan of the abdomen has become the diagnostic test.
   Many patients with solid organ injuries, such as spleen and liver lacerations, now are treated non-operatively. These patients are monitored closely for anemia or instability.
3. Most difficult cavities in which to identify and control hemorrhage is the retroperitoneum. The most common cause of retroperitoneal bleeding from blunt trauma is a pelvic fracture.

**Cardiac Tamponade**

Hypovolemic and distended vein

Muffled heart sounds; Distended neck veins, low blood pressure, low heart beat

Pulsus paradox (decrease blood pressure during inspiration and exceeds by 10).

ECG monitored; Needle aspiration through Xiphisternal approach

16 needle- 3 way stop cock; Xiphisternal; Cranial towards tip of the scapula (L)

**Pelvic fractures includes**

External Fixator

Blood transfusion

Therapeutic embolization [however usually venous bleed than arterial bleed]. When there is arterial bleeding, an embolization effective in 85%.

If no bleeding from the open wound, assume severe exsanguination and urgent replacement is indicated. Inadequate replacement can cause multi-organ failure.

**Disability**

| | |
|---|---|
| A | Alert |
| V | Vocal response |
| P | Responds to Pain |
| U | Unresponsive to all stimuli |

3 causes: Hypoxia

Hypovolemia

Head injury

**Head**

Epidural Hemorrhage is due to damage to middle meningeal artery

Subdural Hemorrhage is due to damage to venous sinus

Subarchnoid Hemorrhage bleeding from cerebral arteries

**CT**

CT: Assess for fracture; Any depression

Hematomas, Look for asymmetry in the ventricle, Cerebral contusion

Maxillofacial injury, Cervical spine

Midline shifts: >5 mm need surgical depression

**Concussion**

Common: Acceleration-deceleration

Temporary neurologic dyfunction;

Confusion and disorientation

Retrograde and antegrade amnesia

Loss of consciousness (< 6hrs)

**Extradural and Subarachnoid Haematoma**

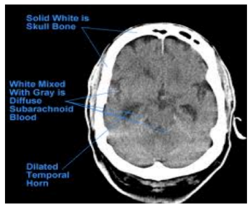
Mainly located in temporal or temporoparietal

Middle meningeal artery (2/3rd)

<1% of head injury

Rxed early excellent prognosis

Lucid interval - talk and die


**Subdural Hematoma**

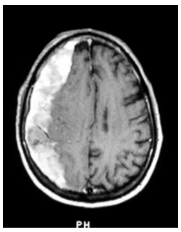
30% of severe head aches

Tearing of bridging vein; sometimes arterial

May be associated with cerebral contusion

Needs rapid surgical intervention

Hematoma: Acute = Hyperdense, Subacute =Mixed, Chronic = Hypodense



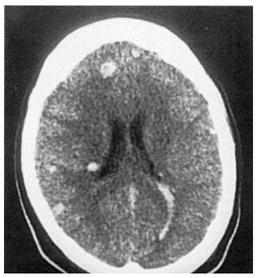

**Diffuse Axonal Injury**

Prolonged post-traumatic coma

Decortication and decrebrate

Remain severely disable if they survive

Exhibit autonomic dysfunction



**Pupillary finding**

Bilateral constricted: Drugs, Pontine lesion

Unilateral constricted: Carotid sheath inj (SS)

Unilateral dilated: Tentorial herniation (III), Ipsilateral hemiplegia

Bilateral dilated: Inadequate brain perfusion

Ipsilateral pupilary dilatation with contralateral hemiplegia suggests tentorial herniation.

**Management of head injury**

IV fluids: Normal saline or Ringer lactate

Intubate and ventilation. To decrease pCO2: cerebral vasoconstriction (pCO2 >30 and <45

Mannitol: clear evidence of neurologic deterioration

Phenobarbital/Phenytoin convulsant in acute phase; Diazepam may be used.

Indication for surgery: Depressed fracture, Open fracture, Space occupying hematoma

When neurosurgeons not available: Placed on the side of the larger pupil in comatose in patients with cerebrate or decorticate posturing that does not does not respond to endotracheal intubation

**Spine**

**Facts**

1. Cervical collar and back board (Once evaluated remove patient from the board)
2. Assessment in conscious and unconscious: always assume. Needs CT assessment
3. 5% head injury is associated with spinal injury
4. Spine injury: 55% Cervical, 15% Thoracic, 15% Thoracolumbar
5. 10% multiple of spinal injury

**Methyl prednisolone**

Its use is controversial

It is more harmful when cervical spine surgery is required.

In US: 30 mg/kg body weight bolus in one hour [within 8 hrs of injury]

**Neurological assessment**

**Sensory**

C6 - Thumb, C7- Middle and C8 little finger

T4 - Nipple; T10 - Umbilicus; T12 - Symphysis

S1 - lateral border of the foot, S3 Ischial tuberosity

**Motor**

| | |
|---|---|
| Deltoid | C5 |
| Biceps | C6 |
| Triceps | C7 |
| Finger flexor | C8 |

| | |
|---|---|
| Intrinsic | T1 |
| | |
| Hip flexor | L2 |
| Knee extension | L4, |
| Foot Dorsiflexion | L5 |
| Plantarflexion | S1. |

Reflexes and Rectal tone

Assessment:

1. Spinal shock : Placcid paralysis with incontinence
2. Neurogenic shock: BP low and pulse low
3. C5 quadriplegia means C5 is intact
4. Consistent with vertebral level
4. Complete or partial cord lesions
5. Sacral sparing;
   voluntary anal control
   Perianal sensation
   FHL
6. Presence of neurology means Cx spine is unstable. CT/MRI
7. Alert; no neurology; no neck pain: Stables. X rays not needed
8 " + Neck pain: Lateral view, clinical examination and +/- CT
4. Comatose +Altered LOC: X ray/CT
5. When in doubt, leave the collar on
6. Backboard: should not more than 2 hrs
7. When intubation: Neck should be in neutral position
8. Urinary catheter; Nasogastric tube
9. Methylprednisolone 30 mg/Kg within 15 mnts. Shldn't be started after 8 hrs.
10. 4 people needed for modified log roll

**Adjuncts to Primary Survey**

Blood gas analysis

ECG monitoring

Urinary or Gastric catheters (P/R before catheterization);

If cribriform plate is fractured, pass oral gastric tube. Aspiration equipment should be present

Important X rays

U/S

Pulse rate; BP; Oxygen saturation (Pulse oximetry),

Resp rate, arterial blood gas analysis, body temperature,

Urinary output

X rays: AP chest, Lateral Cx spine, AP Pelvis. U/S

Other X rays in secondary survey: Complete Cervical; Thoracolumbar.

Note: essential diagnostic X rays should not be avoided in the pregnant patient

CVP is simple procedure and used to assess the ability of the right side of the heart to accept a fluid load.

Elevation of CVP suspect overhydration, CCF, Cardiac tamponade, pneumothorax

Declining CVP suspect: under treated shock

Venous access:

Femoral venipuncture: Seldinger technique

Venous cut down

| | |
|---|---|
| A | Allergy |
| M | Medication |
| P | Past medical history/Pregnancy |
| L | Last meal |
| E | Events related to injury(Mechanism) |

**Secondary Survey**

1. Simple fractures are stabilized during the secondary survey. After a neurovascular assessment, long bone fractures are straightened and splinted.

2. A repeat neurovascular assessment then is done to ensure that realignment and splinting has not resulted in a worsening of the examination.

3. Radiographs of extremity fractures occur at the discretion of the trauma team leader. Often, plain radiographs are delayed until higher priority imaging; such as CT scans of the head and abdomen are done.

4. In some cases, patients may be taken directly to the operating room for laparotomy, thoracotomy, or craniotomy. In these cases, it is may be possible for the orthopedic team to obtain additional radiographs or to image the extremity fractures with fluoroscopy.

**Mangled Extremity:** in a polytrauma, completely insensate with a mangled extremity an amputation is desirable when circulation is compromised. Opinion from II orthopedic surgeon is required.

A diminished pulse, or an ankle-brachial index <0.9, indicates a high likelihood of an arterial injury. However, the extremity still may feel warm, and have normal capillary refill indicating adequate arterial inflow. In these cases, the suspected arterial injury is additionally evaluated with angiography.

**Extremity injury**

Although it is well accepted that early fixation of a femur fracture is a rapid and effective treatment, in the context of multiple procedures it represents added time and blood loss that can be avoided by a femoral traction pin and delayed repair.

**Table 3**
Distribution of initial treatments for major fractures regardless of the localisation.

| Primary treatment | USA *n* = 77 | GER *n* = 93 | *p*-Value |
|---|---|---|---|
| Definitive stabilisation | 44 (57.1%) | 61 (65.6%) | n.s. |
| Traction | 7 (9.1%) | 1 (1.1%) | n.s. |
| Temporizing Ext. fixation | 19 (24.8%) | 21 (22.6%) | n.s. |
| Ext. fix as def. treatment | 7 (9.1%) | 10 (10.8%) | n.s. |

**Table 4**
Mean duration until definitive treatment of major fractures, specified according to body regions.

| Duration until definitive treatment | USA *n* = 77 | GER *n* = 93 | *p*-Value |
|---|---|---|---|
| All fractures | 5.5 days ± 4.2 | 6.6 days ± 8.7 | n.s. |
| Humerus fractures | 5 days ± 3.7 | 6.6 days ± 6.1 | n.s. |
| Radius fractures | 6 days ± 4.7 | 6.1 days ± 8.7 | n.s. |
| Femur fractures | 7.9 days ± 8.3 | 5.5 days ± 7.9 | n.s. |
| Tibia fractures | 6.2 days ± 5.6 | 6.2 days ± 9.1 | n.s. |
| Pelvis fractures | 5 days ± 2.8 | 7.1 days ± 9.6 | n.s. |

**Priority for Musculoskeletal Priority:**

**a.**Fractures: Concomitant injuries to major vessels [Supracondylar fractures, Femoral fracture with femoral artery and Knee dislocation with popliteal artery injury.

"Repair of the artery + Fasciotomy + Stabilise the fracture"

b. Compartments syndrome: Fasciotomy

c. Open injuries: Debridement and fixation

d. Closed shaft fractures: Femur --> Tibia ➔ Pelvis or Spine➔ upper limbs ➔

Complex joint reconstruction: Knee and ankle; Maxillo-facial injuries

**Fracture Treatment should be deferred**

1. Severe head injury with GCS <8 and ISS 40
2. Massive Intracranial Bleeding
3. Severe thoracic trauma
4. Cardiac decompensation
5. Significant clotting problems
6. Significant hypothermia <32

**"Damage control surgeries"**

**Coagulopathy**

With continued blood loss and heat loss, a viscous cycle of coagulopathy develops, which ultimately can lead to the patient's death. The coagulopathy is caused by a combination of blood loss, hemodilution with crystalloid infusion, and heat loss. Hypothermia exacerbates coagulopathy by causing certain coagulation proteins to be inactive at abnormally low temperatures. The oxygen demands of the tissues no longer can be sustained. When this occurs, lactate accumulates and the patient becomes acidotic. Uncorrected, severe acidosis leads to cardiorespiratory collapse and ultimately death.

**Systemic inflammatory response syndrome (SIRS)**

was defined as the presence of the following criteria: body temperature >38 8C, heart rate greater than 90 bpm, respiratory rate greater than 20/ min or $PaCO_2$ < 32 mmHg, and neutrophil count greater than 12,000/ml or less than 4,000/ml.

Pneumonia was diagnosed if the body temperature was at least 38.5 8C and if, in addition, one of the following criteria was met: infiltrate on chest X-ray in the absence of ARDS or positive culture in bronchoalveolar lavage fluid.

Multiple organ failure (MOF) was diagnosed according to a scoring system, when at least **three organs demonstrated** a grade II dysfunction.

The systemic inflammatory response syndrome (SIRS) has been advocated as a significant predictor of outcome in trauma. Recent trauma literature has proposed SIRS as a surrogate for physiological derangements characteristic of polytrauma with some authors recommending its inclusion into the definition of polytrauma.

**Molecular Biology in Polytrauma**

Early evaluation of the prognosis in polytrauma is difficult. The clinical condition and management of the patient are assessed by evaluation of cardiac, respiratory, renal, pulmonary effects. Organ dysfunction, which is not detectable by these parameters, does not guarantee a condition of the patient. As a result of the popularity of the microenvironment theory is gaining;

| | |
|---|---|
| Acute-phase reactants | LBP, CRP, Procalcitonin |
| Mediator activity | TNF, IL-1, IL-6, IL-10, IL-18 |
| Cellular activity | TNF-RI, TNF-RII, IL-1R-I, IL-1R-II, IL-6-R, mIL-6-R,ICAM 1 Eselectin, CD11b, elastase, HLA-DR class-II |

**LBP [Lipopolysacharide binding protein]**

Mainly hepatic origin

Ability to bind bacterial lipopolysaccharide (LPS).

LBP level rise during II or III day of trauma or sepsis; SIRS: Synstemic inflammatory response syndrome and MODS: Multiorgondysfunction syndrome.
LBP is significantly high in-patient with MODS with infection. Can be used to differentiate from SIRS and Nonseptic MODS [LBP of prognostic importance]

**C-reactive protein (CRP). [**Normal: 0.3 to 1.7 mg]
Elevated levels: within 8 hours but it not specific
Important for monitor
Not predictive of septic complications after major trauma.

**Procalcitonin (PCT).**
The liver is a potential source of production of PCT.
Higher levels are found after major surgical procedures
The prognostic value of PCT in trauma is as yet unclear.
May indicate : sepsis following SIRS

**IL1**
The circulating half-life of IL-1 is six minutes.
This makes its detection after injury much less likely
IL-1 did not correlate with death or MODS.
It appears to be a marker of traumatic insult, with significantly elevated levels occurring within one to four hours after trauma, and correlates with the severity of illness.

**IL6**
IL-6: Is prognostic significance in the differentiation of survivors from those who died.
It is less transient than IL1 and TNF and more easily assessed
Increased concentrations of IL-6 associated with a poor outcome in patients with ARDS.
In trauma patients, IL-6 is not predictive of septic complications but rather correlates with the magnitude of the injury.
It appears to be a marker of traumatic insult, with significantly elevated levels occurring within one to four hours after trauma, and correlates with the severity of illness.
IL-6 seems to be the most reliable marker systemic inflammation.
LBP appears to be an accurate and early marker of infection.
The use of these two markers together may offer the ability to detect the onset of SIRS and allow early intervention to prevent MODS.

**Table 1 ISS**

6 regions: Head &neck; face; thorax; abdomen, extremity, pelvis

Each region: AIS (abbreviated injury scale)

1.Minor 2.Moderate 3.Severe 4.Life threatening 5.Critical 6.Fatal

ISS is the sum of the squares of the highest AIS scores from three of the 6 body region. AIS 6 automatically converts the ISS to 75

ISS >16 = Major trauma (Mortality 10%); >40% = Damage control

**Table 2 Glasgow coma scale (Teasdale 1974)**

I Eye opening

. II Verbal performance

. III Motor response

. **Score:**

. <13 requires CT head

. GCS: 8 definite intubation [COMA]

.

| | | | |
|---|---|---|---|
| . | **Eye opening**: | Spontaneous | 4 |
| . | | Command | 3 |
| . | | Pain | 2 |
| . | | None | 1 |
| . | **Verbal** | : Oreinted | 5 |
| . | | Confused | 4 |
| . | | Inappropriate | 3 |
| . | | Nonspecific sounds | 2 |
| . | | None | 1 |
| . | **Motor** | Follows commands | 6 |
| . | | Localises pain | 5 |
| . | | withdraws for pain | 4 |
| . | | flexion to pain | 3 |
| . | | Extension to pain | 2 |
| . | | None | 1 |

**3. Mangled extremity severity Score [Helfet 1990)**

| **Type** | **Description** | **Points** |
|---|---|---|
| Injury | Low energy, Closed/type1 | 1 |
| | Medium energy | 2 |
| | High energy,shot gun | 3 |
| | Massive crush | 4 |
| Shock | Normotensive | 0 |

| | | |
|---|---|---|
| | Transient hypotension | 1 |
| | Prolonged Hypotension (<90) | 2 |
| Ischemia | Pulstalile limb without ischemia | 1 |
| | Diminished pulses without ischemia | 2 |
| | Moderate: No pulse; sluggish cap refill | 3 |
| | Pulseless, cool, paralysed & numb | 4 |
| Age | <30 | 0 |
| | 30-50 | 1 |
| | >50 | 2 |

Score: >7 = correlated well with primary amputation.

**Table 4 Adequate Resuscitation**

Chest X ray;

intake/Output ratio: Balanced or -ve fluid balance

PaO2/Inspired O2 Pressure : > 250

| | |
|---|---|
| Pulm art. pressure | <24 mmHg |
| Peak inspiratory pressure | <35 cm H2O |
| Platelet: | >95,000 ; |
| WBC | 2000-12000 |
| Intracranial pressure | <15 cm H2O |

**Controversies**

1. Early or late stabilization: Now damage control
2. Reamed or undreamed: No difference
3. Chest injury and head injury and peripheral trauma: Damage control
4. Methylprednisolone for spinal injury: Not necessary
5. Role of DVT and head injury: Not in first 48 hours
6. DPG Vs U/S: Now ultrasound

## Summary

The treatment of complex injuries in multiple organ systems demands a team approach. The team must be able to evaluate the patient swiftly and arrive at decisions quickly and efficiently in regard to performing lifesaving procedure.

**Rule of 10**

10 mnts: Revive : ABC

10 hrs: Save the limb- Early stabilization

10 Days: Pick up minor injuries and fixation

10 wks: Controlled rehabilitation

10 months: Attempted return to normal life
10 years: Residual fracture problem

Many trauma surgeons now make the decision to apply damage control techniques based on the patient's physiology on arrival to the hospital, even before going to the operating room and identifying specific injuries. Orthopedic surgeons are most likely to be involved early in the resuscitation of patients with pelvic fractures, multiple long bone fractures, or mangled extremities. The care for complex pelvic fractures is evolving. Although early fixation and stabilization is desirable for long bone fractures, severely injured patients may not tolerate long surgery associated with significant blood loss. In these cases, abbreviated surgery, or damage control techniques need to be used at the discretion of the team leader.

Recent thinking:

1. The initial aim is to maintain a palpable radial pulse, which will need a systolic blood pressure (sBP) of 70 mmHg to 80 mmHg. If there is any suspicion of head injury, the SBP should be maintained > 90 mmHg in order to maintain cerebral perfusion.
2. When massive transfusion is required: gm in the use of blood transfusion. The early administration of fresh frozen plasma (FFP) and platelets improves survival and reduces the overall requirement for packed red cells in patients who require massive transfusion.
3. Tranexamic acid has an excellent safety record and a high therapeutic index, and its routine use in the early management of all patients with severe injuries should be considered.
4. Pelvic binders: Pelvic binders provide circumferential support for the bony ring of the pelvis.. hey are easy to apply and are now used routinely in many pre-hospital settings.
5. Injuries of the urethra can occur in association with most patterns of fracture in men but is more common in AP compression injuries.
   a) Pelvic fracture with no evidence of urethral injury [no blood at the meatus, no perineal haematoma and no history of haematuria) : Gentle 1 attempt at catheterization.
   b) If any urethral injury present (retrograde cystogram) is mandated.
   c)If the urethrogram is positive or the catheter cannot be passed, a senior urologist must be called. Decision making is about a suprapubic catheter a Seldinger technique50

6. If the patient is severely hypotensive (SBP < 70 mmHg) and not responding to resuscitation they should be taken to the operating theatre immediately. Should be operated with pelvic binder. Pelvic bleeding can be controlled by extraperitoneal packing

7. Trauma CT: CT scanning has become the benchmark for the secondary survey of the head, neck and trunk3 and should be undertaken as early as possible. In centres of excellence, the scan and a report detailing immediately life-threatening injuries can be obtained within 30 minutes of the patient's arrival.

8. Damage control in Polytrauma

**Fracture surgery in polytrauma**

Damage control surgery (DCS) is rapid emergency surgery undertaken to save life and/or limb while avoiding time consuming potentially damaging reconstruction.

The four key elements of DCS are:

1) control of haemorrhage;

2) decompression of cranium, thorax, pericardium, abdomen and limb compartments;

3) decontamination of wounds and ruptured viscera, and

4) fracture splintage using a pelvic binder, skeletal traction and plaster casts.

The aim is to maintain physiological equilibrium, do as little damage as possible, and transfer the patient to ITU for continued resuscitation as quickly as possible. For patients with fractures, the key decision to be taken in the first 12 to 24 hours.

Early care of all long-bone fractures within 24 hours of injury once the patient is physiologically stable. The most important aspect of this is the full resuscitation of the patient before surgery. It is not fit enough for extensive surgery to revascularise an ischaemic limb IIIc, an amputation may be life-saving.

**References**


1. Definition: Injury, Int. J. Care Injured 43 (2012) 196–199
2. Changes in strategies in Polytrauma. Injury, Int. J. Care Injured 40 (2009) 77–83
3. Definite fixation. Injury, Int. J. Care Injured 42 (2011) 650–65
4. Tscherene Clin Orthop 347: 62-78, 1998
5. JBJS: 78B.841
6. Instructional course lecture. 1995
7. Injury, Int. J. Care Injured 40 (2009) 907–911
8. Recent trend. J Bone Joint Surg Br 2012;94-B:446–53.