General Surgery

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First Aid in Accidents and Life Support

Definition of Trauma

Trauma originates from the Greek word meaning ‘wound’. It implies that a physical force exerted on a person has led to a physical injury. External energy forms and forces that can lead to injury include chemical, thermal, ionizing radiation and, most frequently, those of mechanical origin. The degree and severity of trauma sustained can vary substantially and depend upon the magnitude of force exerted.

Major trauma denotes injuries to more than one body region and organ system. The approach to trauma must be methodical and exact, because the signs, particularly in the presence of other injury, may easily be missed. The general principles of resuscitation and ATLS (Advanced Trauma and Life Support) must be followed.

The Magnitude of the Problem

Trauma remains the most common cause of death and disability in children and young adults in the resource-rich countries. Globally, approximately 10 000 people die daily as a result of an injury. Road traffic accidents (RTA), falls and intentional violence have been identified as the major vectors of traumatic injury. A large proportion of the severely injured survivors experience long-term or permanent disability as a result of their injuries. The challenge remains to appreciate and diagnose the injuries at an early stage, with an awareness of important features that may influence the outcome.

The Significance of Time in the Outcome

In the seconds prior to the application of the external injury force or vector, the patient is at their normal baseline, which can be called **time zero**. All subsequent events, including the acute physiological response to injury, the body’s internal mechanisms to maintain homeostasis, the healing processes and the actions instigated by health professionals, are associated with a ‘**timeline**’. Being familiar with the ‘timeline principle’, one should be aware that there is a critical time window in which we can intervene for a positive treatment outcome, before the loss of compensatory mechanisms.

Overall, interventions can be distinguished as emergency (life-saving), acute (restoring hemodynamic stability) and delayed or semi-elective, focusing on the treatment of post-fracture fixation complications (non-union, infection and mal-union from the orthopedic trauma point of view). The clinician should bear in mind that a successful management plan is dependent on, ***first***, the time needed to evaluate and diagnose the nature of the problem and, ***second***, the time taken to respond effectively to the condition discovered.

The importance of time can be summarized as follow:

- The 'timeline concept' is an essential component of trauma management.
- Assessment should be completed within a set time.
- The time to respond is limited.
- Both assessment and response should take place in the time window prior to irreversible damage or death.

The Patient's Response to Injury

From the time of the accident, a cascade of physiological responses will be upregulated to maintain survival. All such responses are part of homeostatic mechanisms that alter with the time elapsed following injury. The timing and nature of interventions should be altered accordingly. Important patient responses that require prompt attention include the body temperature, oxygenation and organ perfusion.

A decline in body temperature is a frequent finding after injury and may be due to exposure, blood loss and inactivity. Measures should be taken not only to prevent further reduction in temperature but also to restore it. Covering the patient with appropriate blankets during transportation, resuscitation and in the theatre environment will minimize the risk of hypothermia, coagulation disturbances and ongoing bleeding. Patient oxygenation can be optimized with the administration of inspired oxygen or ventilation if needed. Blood loss can give rise to an altered level of consciousness, low blood pressure, reduced perfusion of the extremities (skin discoloration) and tachycardia.

Another important part of the response to injury is the activation of the immune-inflammatory system. Under certain circumstances, extravasation of leukocytes may take place, with possible auto-destruction. Clinical decisions should aim to minimize the risk of an exaggerated immune–inflammatory reaction.

Management of Trauma Patient

The early assessment and management of severe trauma begins in the prehospital environment. Field hospitals principally function in three main areas (**Table 1**). Key information in the pre-alert includes basic demographic information (age and gender), mechanism of injury, injuries identified and vital signs, including respiratory rate, pulse, blood pressure and Glasgow Coma Scale (GCS).

Table 1: Type of treatment given in field hospitals.

	Examples	Further
First aid	Suturing cuts and lacerations, splinting simple fractures	Review at local hospital
Emergency care for life-threatening injuries	Endotracheal intubation, tracheotomy, relieving tension pneumothorax, stopping external haemorrhage, relieving an extradural haematoma, emergency thoracotomy/laparotomy for internal haemorrhage	After damage control surgery, transfer patients to base hospitals once stable
Initial care for non-life-threatening injuries	Debridement of contaminated wounds, reduction of fractures and dislocations, application of external fixators, vascular repairs	Transfer patients to base hospitals for definitive management

- **Initial Assessment**

The accurate and systematic assessment of injury is essential to establish the extent of injury to vital structures. This forms the basis of ATLS protocols. It is estimated that approximately 25% to 30% of deaths caused by trauma can be prevented when a systematic and organized approach is used. When critical injuries are present, lifesaving measures necessitate that a logical and sequential treatment priority be established based on the overall assessment of the patient.

<u>The following key points are essential during assessment of trauma:</u>

- ➢ Knowledge of timelines for important diagnoses is essential.
- ➢ Initial assessment should focus on what kills first.
- ➢ Screen high-risk patients before clinical signs become apparent, as it may be too late to intervene once signs develop.

- **Assessment Principles**

These principles are involved in the initial assessment of a patient with major trauma and have been outlined by the American College of Surgeons (ACS) in their guidelines regarding ATLS protocols. These principles are as follows:

1. Preparation and transport
2. Primary survey and resuscitation, including monitoring and radiography
3. Secondary survey, including special investigations, such as CT scanning or angiography
4. Ongoing reevaluation
5. Definitive care

Preparation and Transport

A fully equipped resuscitation area must be available and contain radiograph capability, operating rooms, vital signs monitors, sterilizing equipment, IV resuscitation equipment (e.g., warmed IV crystalloid solutions, different gauge IV needles), a blood bank, airway equipment (e.g., laryngoscopes, endotracheal tubes, suctions, tracheostomy and cricothyrotomy kits), ventilators and basic laboratory facilities.

Severely injured patients transported by helicopter from the scene of an accident are more likely to survive than patients brought to trauma centers by ground ambulance, according to a recent study.

Primary Survey

The primary survey aims to identify and manage the most immediately life-threatening pathologies first and follows **cABCDE**.

c: Exsanguinating external hemorrhaged

Exsanguinating external hemorrhage from massive arterial bleeding needs to be controlled even before the airway is managed. Bleeding must be controlled immediately by the application of packs and pressure directly onto the bleeding wound and artery. Hemostatic dressings that contain agents that augment local coagulation are now available.

A: Airway maintenance with cervical spine control

All trauma patients should have their cervical spine immobilized and protected throughout. An immediate assessment of the patient's airway is made. A compromised airway requires a stepwise progression, first clearing the airway by suctioning secretions or blood, followed by simple airway maneuvers such as a jaw thrust, chin lift and insertion of an oropharyngeal or nasopharyngeal airway. Advanced airway maneuvers necessitate the insertion of a cuffed endotracheal tube. This may require an anesthetic with rapid sequence induction or a surgical airway. Equipment and expertise for achieving a surgical airway must be available.

B: Breathing and ventilation

All patients should receive high-flow oxygen by mask. Life-threatening chest pathology such as tension pneumothorax, massive hemothorax, flail segment and cardiac tamponade should be diagnosed and managed immediately. Equipment and expertise for rapid insertion of intercostal chest drains should be available.

C: Circulation and hemorrhage control

All patients require adequate intravenous access with at least two large-bore intravenous (IV) cannulae. Blood should be taken for cross-match and laboratory assessment. An assessment of the hemodynamic status should be made to identify shocked patients: the skin may be pale, cool and sweaty, the pulse rate raised to over 100 per minute, and the blood pressure low. A pelvic binder should be applied to all hemodynamically unstable patients following blunt trauma and not removed until after a pelvic fracture has been excluded. Hypotensive trauma patients are treated as hypovolemic until proven otherwise. The priority is now simultaneous fluid resuscitation and identification of the source of the hemorrhage.

D: Disability (neurologic status)

On admission, the GCS score should be calculated **(Tables 2&3)**. Patients are managed with cervical spine protection (cervical collar and blocks) and protection of the thoracolumbar spine until a spinal injury has been excluded. Early whole body CT (WBCT) scan will rapidly identify the majority of intracranial and spinal pathology. The pupils assessed for size and reaction to light and the patient observed to determine whether they are moving all four limbs. The reactivity of the pupils to light provides a quick assessment of cerebral function.

A recommended system is the **AVPU** method:

A—Patient is **a**wake, **a**lert, and **a**ppropriate.

V—Patient responds to **v**oice.

P—Patient responds to **p**ain.

U—Patient is **u**nresponsive.

Another system of patient assessment is the **ACDU** method:

A—Patient is **a**lert.

C—Patient is **c**onfused.

D—Patient is **d**rowsy.

U—Patient is **u**nresponsive.

Table 2: Glasgow Coma Scale.

Best eye response (E)	Best verbal response (V)	Best motor response (M)
4 Eyes opening spontaneously	**5** Oriented	**6** Obeys commands
3 Eye opening to speech	**4** Confused	**5** Localises to pain
2 Eye opening in response to pain	**3** Inappropriates words	**4** Withdraws from pain
1 No eye opening	**2** Incomprehensible sounds	**3** Flexion in response to pain
	1 None	**2** Extension to pain
		1 No motor response

Total = **E** + **V** + **M**

Table 3: Head injury classification using the Glasgow Coma Scale (GCS) score.

Minor head injury	GCS 15 with no loss of consciousness (LOC)
Mild head injury	GCS 14 or 15 with LOC
Moderate head injury	GCS 9–13
Severe head injury	GCS 3–8

E: Exposure

The patients must be adequately exposed to allow a thorough and systematic clinical examination during the secondary survey but they must be kept warm. Trauma patients are frequently hypothermic and this will further increase coagulopathy. Every effort should be made to maintain normal temperature by minimizing unnecessary exposure of the patient, and by using warmed blankets and trolleys and warmed fluids during resuscitation.

Secondary Survey

All severely injured patients require a detailed top to toe examination after life-threatening injuries have been identified and managed during the primary survey. Patients may be intubated and unresponsive at this point, limiting the accuracy of clinical examination. Such patients should have a '**tertiary survey**' when extubated and alert, to identify any missed 'minor' injuries such as a scaphoid fracture in the wrist or a rotator cuff tear in the shoulder. These injuries have the potential to cause significant long-term disability. It is essential that the findings of the primary, secondary and tertiary surveys are clearly recorded in the patient case notes.

References

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