UNIT NO. 5

# INITIAL MANAGEMENT OF MAJOR TRAUMA FOR PHYSICIAN FIRST RESPONDERS

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## ABSTRACT

**Family physicians may be called upon to respond to trauma patients in their clinics or at scene of injury. Managing trauma can be daunting to any physician who encounters it infrequently. The physician first responder needs to shut out the chaos and distractions at scene and focus on a systematic primary survey to assess for injuries with the potential to cause rapid deterioration, institute crucial life-saving interventions and effect rapid evacuation to hospital. This article details a simple approach to guide the family physician to assess and prioritise management of the trauma patient, and augment the work of the paramedics in the pre-hospital phase.**


**Keywords: Major trauma, Pre-hospital**

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## INTRODUCTION

Family physicians may be called upon to respond to trauma patients in their clinics or at scene of injury. As a first responder, the priorities are to perform a primary survey to assess for severe injuries and injuries with potential to cause rapid deterioration, institute crucial life-saving interventions and effect rapid evacuation to hospital. Due to the wide spectrum of possible organ system involvement, severity and varying mechanisms of injury, major trauma can be daunting to any physician who encounters it infrequently. This article details a simple approach to guide the family physician to systematically assess and prioritise the management of the trauma patient and augment the work of the paramedics in the crucial pre-hospital phase.

When first approaching the trauma patient, the physician needs to ensure the following:

1) Activation of Emergency Medical Services (EMS) in the form of Singapore Civil Defense Force (SCDF) ambulance. Information to be provided to the despatcher includes number of patients to be conveyed, what happened, apparent injuries and location of incident. Relevant information regarding access route to the incident site will aid the rapid deployment of SCDF ambulance to the scene. It has been reported that 31.2% of calls to SCDF are trauma-related and mean ambulance response time (time of call to arrival at scene) is 8 minutes (SD 4.8 min)[1].
2) Personal protection. At the very least, double gloves and eye shields should be worn to protect against blood and fluid borne diseases. Full protection should include mask and gown.
3) Crowd control and safety of rescuers. In a multiple casualty situation, the responding physicians need to be able to ensure that the rescuers are not in danger, delegate crowd control and life saving measures, like holding the airway open or applying pressure to stop haemorrhage, to members of the public.

## PRIMARY SURVEY

**Overview** — The primary survey promulgated by Advanced Trauma Life Support™ (ATLS™)[2] is an easy to remember, organised approach to management of a severely injured patient. In the settings of a primary health clinic or incident scene, limited resources necessitates a targeted systematic survey performed in a set order, which searches for injuries that pose the most immediate threats to life. Any problems identified in the primary survey are managed immediately, in the order they are detected, before moving on to the next step of the survey.

The primary survey consists of the following steps:

- **A**irway assessment (and cervical spine stabilisation when appropriate)
- **B**reathing assessment
- **C**irculation assessment (assess perfusion, control hemorrhage)
- **D**isability assessment (perform basic neurologic evaluation)
- **E**xposure and environmental control

A. i) **Airway assessment** — in major trauma, airway obstruction is an imminently preventable cause of death[3,4]. Rapid airway assessment[5] in a conscious patient includes getting the patient to talk (eg. by asking for the name). If the patient is able to answer and speak normally, the airway is patent. Look for signs of respiratory distress like tachypnea and use of accessory muscles of respiration. Look for evidence of airway obstruction like stridor, altered voice, or injuries with potential to cause airway obstruction like facial trauma or burns, oral bleeding or anterior neck crepitus.

ii) Airway intervention – If airway obstruction is imminent, perform jaw thrust with in-line cervical immobilisation, provide suctioning if available, and apply supplemental oxygen until evacuation to emergency department (ED). Poor lighting, unfamiliar equipment and inexperienced operators are all non-

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ideal circumstances to attempt to secure the airway, and hence oral intubation is discouraged as multiple unsuccessful attempts will worsen the airway obstruction. One retrospective review of patients who received airway support from paramedics working in a major urban EMS system found that patients assisted with bag mask ventilation (BMV) were more likely to survive than those treated with intubation due to delays in transfer and morbidity from failed attempts[6].

In the unconscious patient, use the jaw thrust manoeuvre to open the airway while applying in-line cervical immobilisation. Remove any obstruction (eg, foreign body, vomitus). Use airway adjuncts like the oropharyngeal airway, if available. If breathing is laboured or absent, assisted ventilations should be performed with BMV or, if unavailable, via mouth-to-mouth with an oral barrier. SCDF paramedics are trained to insert laryngeal masks (LMA) which allows "hands-free" bagging. LMA does not prevent aspiration and should be converted to a cuffed endotracheal tube upon arrival at the ED.

If the patient is in extremis and the rescuer is unable to bag the patient because of upper airway obstruction, needle cricothyrotomy may be attempted using a large bore (14 gauge or larger) intravenous cannula inserted through the cricothyroid membrane and connected to high flow oxygen. The rescuer should regulate inspiration and expiration according to the ratio 1:3 seconds. Needle cricothyrotomy allows oxygenation but hypercapnoea builds up after 20 minutes. It is a temporising measure until surgical cricothyrotomy can be performed in the ED.

B. i) **Breathing assessment** — Chest trauma accounts for up to 25 percent of trauma-related deaths, due to its harmful effects on oxygenation and ventilation[7]. Chest injuries which affect breathing and ventilation requiring immediate intervention include tension pneumothorax, open sucking chest wound and circumferential full-thickness chest burns. Inspect the chest wall looking for signs of injury. In a noisy environment, auscultation may be technically difficult, instead visually inspect for asymmetric or paradoxical movement (eg, flail chest). Distended neck veins, unilateral decreased chest movement or air entry, hypotension and shifting of the trachea to the contralateral side indicate tension pneumothorax.
ii) Breathing interventions. Presumptively treat patients exhibiting signs of tension pneumothorax with needle decompression using a large bore (14 gauge or larger) intravenous cannula, in the second intercostal space in the mid-clavicular line. Needle decompression is followed immediately by emergent transfer to ED for chest tube insertion.

Open sucking chest wound should be covered with dressing, taped on three sides forming a one-way "exhalation valve" to prevent a tension pneumothorax from forming.

Circumferential full thickness chest burns which prevent chest expansion should be released by escharotomy longitudinally along both anterior axillary lines, transverse across the costal margin and second intercostal space. Using a scalpel, incise down to adipose tissue. As full thickness burns are insensate, anaesthesia is not required. The ability to ventilate the patient is immediately apparent after successful escharotomy.

C. i) **Circulation assessment** — the patient's circulatory status may be clinically assessed by palpating the central pulses (carotid or femoral) and assessing for signs of shock such as prolonged capillary refill more than two seconds, cool extremities, tachycardia and altered mental state not due to head injury. If pulses are present and capillary refill is normal, blood pressure measurement may be deferred till the arrival of SCDF paramedics. It should be noted that in young trauma patients, hypotension generally does not manifest until at least 30 percent of the patient's blood volume has been lost2. In such cases, delayed capillary refill (which is prolonged by compensatory peripheral vasoconstriction) may be the most sensitive sign of shock. Attention should be turned to location of sources of exsanguinating haemorrhage.
ii) Circulation interventions – External exsanguinating hemorrhage must be controlled by a combination of direct manual pressure, proximal compression with a tourniquet and elevation, if the source of bleeding is a limb. Commercial haemostatic agents may be used if available. Occult haemorrhage may occur in the thoracic, peritoneal or retroperitoneal cavities. Only retroperitoneal bleeding from unstable pelvic fractures is amenable to stabilisation in the pre-hospital setting. Patients with pain, ecchymosis or crepitus at the pelvis should be stabilised by tying a sheet firmly around the pelvis at the level of the anterior superior iliac spine. Particularly in open-book fractures, this manoeuvre will tamponade pelvic bleeding by "reducing" the pelvic volume. Significant haemorrhage may also occur in muscle or soft tissue from long bone fractures (eg. femur) and such bleeding can be controlled by traction and splinting.

Once SCDF paramedics arrive with intravenous equipment and fluids, patients with signs of shock, should receive two large-bore (16 gauge or larger) intravenous cannulas in the antecubital fossa of each arm and 1 litre intravenous normal saline started[2].

Non-hemorrhagic causes of shock include tension pneumothorax and cardiac tamponade. For cardiac tamponade, urgently transfer to ED for pericardiocentesis.

D. i) **Disability and neurologic evaluation** — Once the airway, breathing and circulation are stabilised, assess the patient's level of consciousness using either "AVPU": Alert, responds to Voice, responds to Pain, or Unresponsive; or the Glasgow Coma Scale (GCS). Assess the pupil size and reactivity and gross motor function and sensation. It is important to document the initial level of consciousness so that subsequent comparison can be made and deterioration identified.
ii) Neurological intervention – Patients with blunt trauma are assumed to have cervical spine injury until proven otherwise and cervical spine immobilisation should be performed.

Maintain in-line cervical immobilisation until proper spinal immobilisation equipment arrives (includes a hard cervical collar, foam pads to prohibit lateral head movement, and a long backboard). Patients with an isolated penetrating trauma and no secondary blunt injury, who have no neurologic deficits typically do not have an unstable spinal column injury[5] and do not require spinal immobilisation.

Patients trapped in a vehicle pose a challenge and the first responders and fire fighters need to work as a team to extricate the victim whilst providing spinal immobilisation and simultaneously performing primary survey.

E. **Exposure and environmental control** — after exposure to identify injuries, the patient should be kept warm and covered with a blanket.

## AFTER PRIMARY SURVEY

1) The primary survey should be **repeated** every few minutes until transfer is initiated deterioration can be identified early and the necessary remedial actions taken.

2) **Wounds** – While waiting for paramedic arrival, if time permits, wounds should be covered with dressing and fractures splinted. A "dough-nut" dressing should be placed around impaled objects to stabilise it and prevent it from moving. No attempts should be made to remove an impaled object as it may cause tamponaded bleeding to re-bleed.

3) **Analgesia** – If available, parenteral analgesia may be given to patients in obvious pain, however it should not delay transport to ED.

4) **History** – The AMPLE mnemonic is used to obtain a rapid, focused history from the patient and eye witnesses.
   **A** – Allergies
   **M** – Medications. In particular the use of anticoagulation (which may need subsequent reversal), antiplatelets (associated with increased morbidity[8]) and beta blockers (which may alter haemodynamic response to shock)
   **P** – Past medical history
   **L** – Last meal and drink
   **E** – Events. Knowing the mechanism of injury can aid ED personnel in identifying injury patterns. As a first responder, the physician should ask bystanders regarding the mechanism of the injury. Important mechanistic information to gather include: Seat belt use; Steering wheel deformation; Airbag deployment; Direction of impact and damage to the automobile; Distance ejected from the vehicle; Height of fall; State of destruction of helmet

5) **Transfer to ED** – Rapid transport to ED is critically important and paramedics should minimise the amount of time spent at scene initiating intravenous lines, dressing non-haemorrhaging wounds or splinting minor fractures[9]. If intravenous access is achieved without delaying transport, blood pressure targets enroute depends on the injury mechanism. A mean arterial pressure (MAP) around 65 mmHg or a systolic blood pressure (SBP) around 90 mmHg is a reasonable goal in penetrating trauma[10]. This strategy of controlled hypotension prevents prematurely expanding the intravascular volume which can lyse life-saving clots and cause re-bleeding before surgical haemostasis is achieved. In blunt trauma patients, particularly those with possible traumatic brain injury, a mean arterial pressure above 105 mmHg or a systolic blood pressure above 120 mmHg is reasonable to maintain cerebral perfusion.

## SPECIAL CONSIDERATIONS IN TRAUMA

1) **Elderly trauma patients** – All elderly trauma patients are assumed to have sustained a significant injury and should be sent to ED, even if they appear well[11]. The severity of injury may be masked in elderly trauma patients because of medications (eg. Beta blockers). Blood pressure may appear to be in the "normal range" when they are actually hypotensive relative to their baseline hypertension. Apart from managing the actual injury sustained, the precipitating cause for the trauma (eg. syncope, myocardial infarction, sepsis, stroke) needs to be elucidated.

2) **Non-accidental injury** needs to be suspected in trauma patients at both extremes of age. Intimate partner violence needs to be suspected in the vulnerable population. These patients may have repeated attendances for trauma and appear difficult to deal with, or present with multiple vague complaints. When suspected, referral to the medical social worker and police is mandatory.

3) **Electrical injuries** – Rescuers need to be cautious that the source of electricity is removed or switched off. Electrocution injuries are caused by conversion of electrical energy to heat, which causes burns. Often the burns are more extensive that what appears on the surface. Apart from local burns and tissue destruction, other complications include rhabdomyolysis with hyperkalaemia and acute kidney injury, compartment syndrome, autonomic dysfunction and cardiac arrhythmias, hence it is recommended to transfer to the ED for evaluation. For collapsed patients, prolonged cardiopulmonary resuscitation (CPR) should be performed following electrical injury regardless of the initial rhythm, as most victims are young and good outcomes have been noted even among patients with asystole[12].

4) **Burns** – Patients are at risk of inhalation injury due to prolonged exposure to heat, such as when rescued from the fire in an unconscious state. In such cases supporting signs of inhalation injury include facial burns, carbonaceous sputum, and hoarse voice. Immediate transfer to ED is imperative as there may be impending upper airway obstruction. Altered mental state in rescued burns patients may be due to hypoxia, carbon monoxide or cyanide poisoning or intracranial injuries suffered from a blast. For other types of burns, first aid includes stopping the burning process by removing smoldering clothes, jewelry and rinsing with copious amounts of tap water to cool the burn. Chemical burns are dealt with in the same way by brushing off chemical residue and irrigating copiously with water to dilute the chemical.

5) **Wound Pitfalls**
   i. "Fight bite" – should be suspected as the cause for wounds around the knuckles of the hands. Patients, fearing prosecution, are not always forthcoming with how they got injured. These wounds are highly contaminated, may have breached the capsule of the metacarpophalangeal joint and require surgical debridement, prophylactic antibiotics and delayed closure.
   ii. Pressure jet injuries (water or paint) – these wounds typically look innocuous on the skin surface but actually penetrate deep along the tissue planes. There is a high risk of infection and surgical debridement is required.
   iii. Shin wounds in the elderly – these skin flaps tend to necrose and should not be sutured. Instead the flap should be unrolled, cleansed and wound edges approximated with steristrips. Follow up is imperative and referral for skin grafting if there is subsequent skin necrosis.

## CONCLUSIONS

Major trauma patients have a high risk of death and morbidity. When approaching a trauma patient as a physician first responder, following the described framework will help focus critical assessment and management, and optimise patient outcomes.

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### LEARNING POINTS

- **While performing the primary survey, delegate tasks like traffic control, applying pressure to stem haemorrhage, in-line cervical stabilisation to bystanders.**
- **Jaw thrust with bag-valve-mask ventilation is preferable to struggling with endotracheal intubation in non-ideal circumstances, causing delay in transport to hospital.**
- **Assume cervical spine injury in all cases of blunt trauma and immobilise the neck appropriately.**
- **All physicians should familiarise themselves with how to do needle chest decompression and needle cricothyrotomy as these procedures may be life-saving.**