CME article

Initial management of trauma victims

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Abstract

Trauma constitutes a large proportion of the number of lives lost, especially in the productive age group. Trauma-related deaths have a trimodal distribution: First, at site or on transfer due to severity of trauma injuries. The injury could be so severe that nothing can be done to save the life of that trauma victim. Second phase of deaths is usually due to hypovolaemia and are often treatable and avoidable. Timely and appropriate intervention at this stage can reduce the effects of trauma and prevent morbidity secondary to the injury. The third phase includes those patients who die of complications of trauma such as infection, embolism, sepsis, ARDS and septic shock. A well-managed second phase is likely to reduce the incidence of the third phase. A systematic approach to a victim of trauma is very necessary so that any life-threatening injury is not missed. The approach to trauma must be done in the following steps: Primary survey and resuscitation, secondary survey and definitive care. This article outlines the various steps of the initial management of trauma.

Keywords: Primary survey, resuscitation, secondary survey, shock, trauma.

Introduction

Trauma constitutes a large proportion of the number of lives lost, especially in the productive age group. The most effective way of reducing trauma related deaths is by prevention which involves building safer roads and educating the masses on observation of road discipline etc. Wearing of protective gear must be made mandatory.

Once trauma occurs, all efforts will need to be made to reduce morbidity and mortality. Trauma-related deaths have a trimodal distribution: First, at site or on transfer due to severity of trauma injuries. It may not be possible to prevent these without any behavioural change. The injury could be so severe that nothing can be done to save the life of that trauma victim. Second phase of deaths is usually due to hypovolaemia and other trauma related injuries. These are often treatable and avoidable. Timely and appropriate intervention at this stage can reduce the effects of trauma and prevent morbidity secondary to the injury. The third phase includes those patients who die of complications of trauma such as infection, embolism, sepsis, Acute respiratory distress syndrome (ARDS) and septic shock. A well-managed second phase is likely to reduce the incidence of the third phase.

When a patient/patients sustain trauma, it is a natural tendency for onlookers, police or fire personnel to pick them up, load them into the closest vehicle and send them off to the hospital nearest to the site of trauma. Although their intentions are to enable the patient/victim to reach a hospital as early as possible, they may actually cause more harm. Many of these patients may have sustained cervical spine injuries which may be undisplaced at first but get displaced if careful attention to prevention of neck movements is not given during transfer. In view of this, the salient features of trauma care must be widely publicised in schools and colleges. In India, the ambulance drivers are often not formally trained to deal with trauma and are just glorified drivers. The doctors and other medical personnel are mostly

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involved in patient care only after the patient reaches the hospital. A systematic approach to a victim of trauma is very necessary so that any life-threatening injury is not missed.

The approach to trauma must be done in the following steps: Primary survey and resuscitation, secondary survey and definitive care.

Primary survey and resuscitation

The purpose of this step is to very quickly evaluate for any life-threatening emergency and deal with it right away. Often an obvious external trauma such as fracture femur diverts the attention of the caregivers but a life-threatening injury is missed. This should be performed in the following order: A, B and C - A stands for airway with cervical spine control, B stands for breathing and C for circulation with haemorrhage control. The order of examination is important. Each step is assessed and the system optimised as necessary before proceeding to the next step.

Step 1: 10 s survey - A very quick way of evaluating airway, breathing and circulation is to address the patient and talk to him (For *e.g.*, Ask the patient's name). If he replies appropriately, it is evident that his airway is patent, he is breathing and circulation to his brain is reasonable. Assess response to call and if no response, give a painful stimulus. The response can be quickly graded as AVPU, where A = Alert, V = Responds to verbal commands, P = Responds to pain and U = Unresponsive.

Step 2: Check airway. All patients sustaining trauma must be assumed to have cervical spine injury until proved otherwise. The mechanism of injury would provide a clue to the possibility of cervical trauma. Any trauma patient who is unconscious must be presumed to have cervical spine injury until further evaluation excludes it. The neck must be immobilised in a rigid cervical collar as early as possible.

If the airway is not patent or the patient's ability to maintain his airway is questionable, the airway must be secured. Signs of compromised airway include snoring, stridor, agitation (hypoxia), active accessory muscles of ventilation/paradoxical chest movements and cyanosis.

Open the airway first with a jaw thrust, oral airway or a nasopharyngeal airway. An oral airway is preferred if the patient is unconscious and may have sustained a base of the skull fracture. A nasopharyngeal airway is chosen if the gag reflex is intact and the patient is semiconscious. Insertion of a nasopharyngeal airway in a patient with base of skull fracture carries the danger of passing it into the brain. Provide oxygen using face mask and ventilate as necessary.

Indications for endotracheal intubation or tracheostomy for securing the airway include obstructed airway, apnoea, hypoxia, severe head injury, maxillofacial injury, penetrating neck trauma with expanding haematoma and chest trauma.

Endotracheal intubation is the most definitive airway. It is required in patients who are unconscious, not able to maintain their own airway, who have sustained extensive faciomaxillary injuries or airway burns. A rapid sequence induction and intubation is preferred. The cervical collar limits not only neck movements but also limits mouth opening. This makes securing airway more difficult. So, when securing the airway, it is recommended that the cervical collar is removed and manual immobilisation of the neck given. The collar is reapplied after airway is secured (*Figure 1*).

Figure 1: Airway management – Laryngoscopy and endotracheal intubation with manual inline stabilisation

The level of sedation required for intubation would depend on the level of consciousness and haemodynamic stability. Generally, midazolam or etomidate is used for induction or sedation and succinyl choline as the muscle relaxant for intubation.

If endotracheal intubation is difficult, airway can be maintained using airway adjuncts such as laryngeal mask airway, laryngeal tube. If these are inadequate, a cricothyrotomy may need to be performed. This should be followed by a regular tracheostomy. Cricothyrotomy image, image showing in figure is for thoracostomy and pericardiocentesis. Cricothyrotomy is advocated as the initial choice as it can be done very quickly. Time is of essence in a hypoxic emergency.

Step 3: Breathing - Look, listen and feel: Inspect (look) at the chest for the respiratory rate, depth and pattern. If the patient's breathing is inadequate as evidenced clinically (rate and depth) or if the patient is cyanosed/oxygen saturation is low (< 93%), breathing must be assisted and oxygen supplementation given as required. Look for presence of flail chest, open chest wounds and use of accessory muscles of respirations.

Palpate (feel) for tracheal shift, broken ribs and subcutaneous emphysema. Percuss for diagnosis of haemothorax and pneumothorax. Auscultate both sides of the chest for equality of breath sounds and for any added sounds. Rule out endobronchial intubation, if an endotracheal tube is already in place.

If breath sounds are unequal, inspect the neck for any distended veins, tracheal position and percuss the chest. If neck veins are distended, trachea is deviated and the chest is resonant to percuss on the side of reduced air entry, suspect tension pneumothorax. The patient may require needle thoracostomy *(Figure 2)*. A large bore (16-18 G cannula) is inserted in the second intercostal space in the midclavicular line. If air hisses out, decompression of chest would have been achieved. Chest tube insertion can follow later during secondary survey.

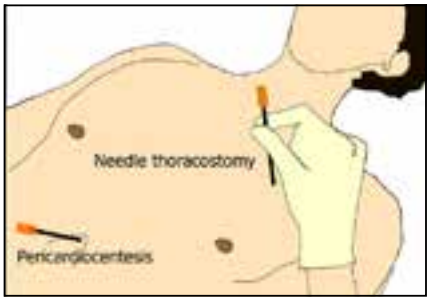

Figure 2: Needle thoracostomy and pericardiocentesis

Step 4: Check circulation. Feel the radial pulse for its rate, rhythm, quality (strong, feeble and thready) and equality with opposite side. Check blood pressure. The commonest cause of shock in trauma is hypovolaemia. Neurogenic shock is a possibility in cases of spinal injury. Obstructive shock can occur in tension pneumothorax and cardiac tamponade. Septic shock is unlikely but not impossible in trauma.

If feeble, irregular or hypotensive, rule out the possibility of a pericardial tamponade by looking at neck veins. If the neck veins are distended, radial pulse is not felt, heart sounds are faint and needle thoracostomy has not treated the condition, perform a pericardiocentesis *(Figure 2)*. Ultrasound of the heart is very useful to confirm the diagnosis and guide the protcedure. If ultrasound is not available, it is reasonable to proceed with landmark-guided drainage of the pericardium.

Look very quickly for any obvious bleeding from any part of the body. If present, apply pressure and stop the bleeding. Application of a tourniquet is not advisable unless absolutely necessary. If applied, it should be removed as early as possible to avoid injury to tissues.

Check the abdomen and pelvis. Abdominal trauma can be penetrating or nonpenetrating. Inspect and then palpate the abdomen for any distension, abrasion or contusion. Spring the pelvis to rule out pelvic instability due to fracture. Perform a focused abdominal sonography in trauma (FAST) to rule out liver and splenic injuries. If any abdominal injury with haemorrhage is suspected, the patient will need an urgent life-saving laparotomy.

'Damage control laparotomy' should be done as soon as possible in patients with evidence of abdominal trauma and maintaining a systolic BP at 80–90 mm Hg with fluid resuscitation is unsuccessful. The aim of this laparotomy is to stop the bleeding, often only packing, after which the mid-line incision is temporarily closed within 30 minutes with towel clamps. This laparotomy is described as not a surgery, but a resuscitative procedure.

An intravenous line should be secured and intravenous fluids, preferably at 40-42°C (crystalloids – saline, ringer lactate or plasmalyte) infused very quickly to

restore volume. Dextrose containing solutions are not recommended. One or two large peripheral lines are preferred for the initial resuscitation. Insertion of central lines is not recommended (unless done by skilled personnel) as it takes much longer to insert, requires expertise and can be associated with complications. If a peripheral intravenous access is not available, intraosseous needle can be inserted and fluids infused into the bone marrow. All infusions that can be given intravenously can also be given intraosseously. External jugular venous access is another option for quick transfusion of large amounts of fluids and blood products.

The American College of Surgeons Classification of haemorrhagic shock (*Table 1*) can be used as a quick guide to gauge the amount of blood lost. If the patient is tachycardic (heart rate > 120/min) and hypotensive (systolic blood pressure is < 90 mmHg), the patient has Class III shock or higher where the patient has lost > 30-40% blood volume. Such patients will also require transfusion of blood products (packed cells and fresh frozen plasma). It may be necessary to activate massive transfusion protocol (when available at the hospital – *Table 2*) if the patient is bleeding profusely. Replacing the lost volume along with haemorrhage control is important to restore perfusion and prevent tissue damage.

In cases where the haemostasis is insecure or not definitive, volumes should be controlled to maintain systolic BP at 80–90 mm Hg till the bleeding can be stopped. This is called *'hypotensive fluid resuscitation' or 'permissive hypotension'*. All through the resuscitation, it is important to maintain the patient warm. Hypothermia impairs coagulation, increases bleeding, depresses respiration and circulation as well as increases chances of infection.

The pelvis should be examined by springing the pelvis. This should be done only once and if any instability is noted, the pelvis should be immobilised by application of pelvic binder and later on with an external fixator to stop bleeding.

Secondary survey

Once the life-threatening emergencies are ruled out or dealt with, a more detailed head-to-toe examination of the patient is required.

Look for responsiveness: Assess Glasgow Coma Scale (GCS) by observing opening of eyes, best verbal response and best motor response. GCS ≤ 8 is defined as coma. Examine the pupils for any inequality in size and reaction to light. If conscious, grossly check vision (finger counting).

Head: Inspect and feel the head. Look for injuries on the scalp, depressed fractures, cuts and bleeding injuries. Inspect the eyes for any conjunctival haemorrhages, periorbital discolouration, haemotympanum, nasal bleeds, facial (maxilla, mandible, zygoma) fractures. If there are unequal pupils, look for lateralising signs such as absent sensation or motor power on one side. If present, the patient must be taken for computerised tomography scan.

Neck: Carefully remove the cervical collar when another person gives manual inline stabilisation. Inspect and feel the neck for any injuries, neck vein distension, tracheal deviation and cervical spine for any tenderness. Reapply the collar after completion of neck examination.

Chest: Examine the chest by inspection, palpation, auscultation and percussion. Look for abrasions, contusions, rib fractures, flail segments and

Table 1: American College of Surgeons Classification of Haemorrhagic Shock

	I	II	III	IV
Blood loss (ml)	Up to 750 ml	750-1500	1500-2000	> 2000
Blood loss(% blood volume)	Up to 15	15-30	30-40	> 40
Pulse rate (per min)	< 100	100-120	120-140	> 140
Systolic blood pressure	Normal	Normal	Decreased	Decreased
Pulse pressure	Normal or increased	Decreased	Decreased	Decreased
Resp rate (per min)	14-20	20-30	30-40	>35
Urine output (ml/h)	> 30	20-30	5-15	Negligible
CNS/Mental status	Slightly anxious	Mildly anxious	Anxious, confused	Confused, lethargic
Skin and capillary refill	Normal < 2s	> 2 s, clammy skin	> 3 s, cool,pale skin	> 3 s, cold, mottled skin

Table 2: Massive transfusion protocol boxes

BOX	TESTING STRATEGY	CONTENT
1	Patient's Blood Group Specific/O Rh D Negative Saline Match Antibody Screening Keep Next Box Ready	2PRBC 2FFP 2 BT SET
2A	Repeat Group If Possible Type And Screen Saline Match Keep Next Box Ready	2PRBC 2FFP 5PLTC/1SDP 2 BT SET
2B	Type And Screen Saline Match Keep Next Box Ready	2PRBC 2FFP 2 BT SET
3A	Type And Screen Saline Match Keep Next Box Ready	2PRBC 2FFP 10 UNITS CRYO 2 BT SET
3B	Type And Screen Saline Match Keep Next Box Ready	2PRBC 2FFP 2 BT SET

PRBC - Packed red blood cells, FFP - Fresh frozen plasma, BT set - Blood transfusion set, PLTC - Platelet concentrate, SDP - Single donor platelets, CRYO - Cryoprecipitate

compare with other side. Rule out haemothorax, haemopneumothorax, simple or open pneumothorax. A flail chest will require stabilisation with tape whereas an open pneumothorax will need a cover on three sides to allow pleural air to escape but not allowing more air to enter the chest. The other chest injuries that can be life-threatening are tracheobronchial rupture, aortic rupture, myocardial contusion, and myocardial infarction. Look for oesophageal rupture, pulmonary contusion and diaphragmatic injury.

Abdomen: Examination of the abdomen with inspection, palpation, percussion and auscultation is repeated. An ultrasound of the abdomen may be done to look for injuries including liver or spleen injury. Large amounts of blood can accumulate in the abdomen before any distension is visible. Diagnostic peritoneal lavage is performed if ultrasound of the abdomen is not immediately available.

Limbs: The upper and lower limbs are also examined for the skin colour, feel (temperature), integrity, movement, presence of pulses, any obvious bleeders, abrasions, contusions, motor power and sensations. External bleeding can be stopped by application of pressure on the wound. If any injuries are noted, immobilise the limb.

Watch for compartment syndrome (increased intramuscular pressures) where the tissue oedema prevents any circulation to the distal parts of the limb. These can happen with fractures, crush injuries and haematomas in the limb. Features of compartment syndrome are absence of movement, sensation and blanching in the distal tissue. Decompression must be performed immediately to prevent loss of tissue due to ischaemia. Local hypoperfusion is more likely when systolic blood pressure is low and intramuscular pressure is high.

If the local hypoxaemia has been present for more than 2 hours and reperfusion is done late, there can be extensive vascular damage. That is why decompression should be done early. The forearm and lower leg compartments are at greatest risk.

Spine and Back: Lastly, the patient is log-rolled to examine the spine and the back for any injuries including vertebral injuries. A *per rectal* examination is done to look for any high-riding prostate which along with blood at the urethra may suggest urethral injuries. If this is the case, a suprapubic cystostomy may be needed. One must also note the anal sphincter tone, integrity of rectal wall and blood in the rectum.

Tubes and catheters: The patient is then placed supine. Tubes and catheters are inserted and x-rays obtained; Ryle's tube, urinary catheter, neck, chest and pelvic x-rays, ultrasound abdomen and if necessary, diagnostic peritoneal lavage are done at this stage.

All through the secondary survey, if there is any change in patient condition the primary survey starting with A, B and C will need to be performed.

Definitive care

After completion of the examination, ensure that the patient is covered and kept warm before proceeding to definitive care. The injuries observed during the primary and secondary surveys are further evaluated and managed by the respective specialists. The patient is transferred to appropriate facility as required for further management.

References

1. Advanced Trauma Life Support Course of the American College of Surgeons. 9th edition. 2012.