Trauma

Trauma has been dubbed the forgotten epidemic and the neglected disease of modern society. It kills and maims hundreds of thousands of individuals annually and costs society billions of dollars for direct expenditures and indirect losses. It has been estimated that the overall cost of gun violence in the USA in 1998 was US$100 billion. The American National Highway Traffic Safety Administration has calculated that, for each person killed in (MVA), 45 require emergency department treatment & 9 require hospital admission. Currently, in USA, the social cost of MVAs is estimated to be three times higher than those associated with gunshot wounds.

INJURY PREVENTION

Primary prevention aims to prevent an injury from occurring in the first place. Such primary prevention can be educational, such as anti drink_driving campaigns or legislative.

Secondary injury prevention attempts to lessen the consequences of injury &can be passive strategies (such as designation safer car or installing smoke detector) or active strategies such as wearing bicycle helmets or seatbelts. Tertiary injury prevention accepts that injury has occurred but aims to minimize the effect on a person by improving delivery of health care, both by individuals by systems.

CAUSES OF TRAUMA

Blunt trauma

The most common cause is the motor vehicle.Important factors related to MVA are mass &speed of vehicle. Speed is a critical factor: a 10% increase in impact speed translates into a 40% rise in the case fatality risk for both restrained &unrestrained occupants. Ejection from a vehicle is associated with significantly greater incidence of severe injury. Use of seatbelts is thought to reduce the risk of death or serious injury for front seat occupants by approximately 45%.Although seatbelts reduce mortality overall ,they cause a specific pattern of internal injuries .Patients with seatbelt marks have been found to have a fourfold increase in thoracic trauma & an eightfold increase in intrabdominal trauma.

Air bags provide a reduce risk of fatality of approximately 30%. Motorcyclists experience a death rate 35 times greater than the occupants of cars.

Penetrating trauma

The incidence of penetrating injuries is increasing.

Blast injury

Terrorism is now a global phenomenon. It is conceivable that civilian, as well as military, surgeons will be exposed to patients injured in explosions.

Crush injury

It has been reported in earthquake &mining accidents survivors, after excessive exercise& when limbs have been forced into abnormal posture for prolonged periods.

Prolonged crushing of a muscle mass causes death of the muscle cells, with release of myoglobin &vasoactive mediators into the circulation. Injured muscle also sequestrate many liters of fluid .Compartment syndrome of a limb may occur.

Thermal injury

Burn &frostbite

Initial assessment

Trauma care means the right care at the right time and in the right place. Principles involved in the initial assessment of a patient with major trauma are those outlined by the American College of Surgeons (ACS) in their Advanced Trauma Life Support (ATLS) guidelines.

Preparation

Trauma-receiving hospitals should receive advance warning about the impending arrival of seriously injured patients from the paramedic services. The patient's mechanism of injury, vital signs, and status should be communicated. This allows for the in-house trauma team to be called and for the emergency department (ED) staff to make appropriate preparations.

Primary survey

The primary survey aims to identify and immediately treat life-threatening injuries. Its basis is the ABCDE system.

Airway with control of the cervical spine

Assess the airway, and determine its adequacy while maintaining the cervical spine in the neutral position. The latter is achieved by using a hard collar and, in some cases, sandbags and tape. A chin lift, a jaw thrust, or an oropharyngeal airway maneuver may overcome upper airway obstruction. Suctioning may help to clear the mouth and pharynx of secretions or vomit.

Breathing

Assess the work of breathing and its efficacy by inspecting the patient and by palpating the trachea. Regarding inspection, ask these questions:

(1) Is the patient breathing at all? Is the patient in respiratory distress, tachypneic, grunting, or wheezing or using their accessory muscles?

(2) Are signs of disruption to the chest wall evident?

(3) Is paradoxical movement of the chest present, and if so, is this associated with a flail chest?

On palpation for the trachea, ask these questions:

(1) Is crepitus present?

(2) Is the trachea located in the midline?

On percussion and auscultation of the chest, look for signs consistent with pneumothorax or hemothorax

Inadequate respiration may result in hypoxemia, hypercarbia, cyanosis, depressed level of consciousness, bradycardia, or tachycardia. As a general rule, until stability has been assured, administer high-flow oxygen to all patients to help ensure adequate oxygen delivery.

Treatment of a patient with immediately life-threatening physiological derangements may delay and in some cases may preclude completing the recommended diagnostic evaluation in the ED.

Signs of a tension pneumothorax include a deviated trachea, distended neck veins, hypoxia, tachycardia, and hypotension. Tension pneumothorax is a clinical diagnosis and requires immediate decompression with a 14-gauge cannula in the second intercostal space (ICS) midclavicular line (MCL), to convert this life-threatening complication into a simple pneumothorax, which then can be treated with a chest tube.

Circulation and hemorrhage control

Urgent treatment of patients with exsanguinations hemorrhage or shock can be lifesaving. This assessment includes identifying and managing rapid external hemorrhage. This can often be achieved with a simple pressure dressing, but surgical intervention may be required in some cases.

Shock in trauma patients, defined as inadequate organ perfusion and tissue oxygenation, is most commonly caused by hypovolemia. Shock secondary to tension pneumothorax, cardiac tamponade, or spinal cord injury also may occur.

Signs of shock include tachypnea, tachycardia, poor pulse volume, hypotension, pallor, poor capillary refill, oliguria, and a depressed level of consciousness. In patients with hypovolemia, the neck veins may be flat. Healthy mental status generally implies an adequate cerebral perfusion pressure, while diminished mentation may be associated with shock with or without intracranial trauma.

During patient assessment, 1 or 2 members of the trauma team must be responsible for inserting at least 2 large-bore (14-gauge) peripheral lines; obtaining relevant bloods, including cross-matching; and initiating volume resuscitation. The ATLS recommendation for patients presenting with hypotension is a 2000-mL crystalloid volume challenge.

A systematic approach for detecting the source of hypovolemic shock should consider 5 sources of ongoing hemorrhage:

(1) External (eg, from the scalp, skin, or nose),

(2) pleural cavities,

(3) Peritoneal cavity,

(4) Pelvis and/or retroperitoneum, and

(5) long-bone fracture

Ongoing hemorrhage and hypotension may require transfusion with uncrossed matched blood and immediate surgical intervention. In general, hypovolemia unresponsive to an initial 2000-mL fluid challenge implies substantial previous losses or ongoing hemorrhage.

Disability

Determine the disability of the patient by performing gross mental status and motor examinations. Determine whether a serious head or spinal cord injury exists. Assess the gross mental status using the Glasgow Coma Scale.

Eye Opening (E)

Spontaneous 4

To loud voice 3

To pain 2

Nil 1

Best Motor Score (M)

Obeys 6

Localizes 5

Withdraws 4

Abnormal flexion 3

Extension 2

Nil 1

Verbal Response (V)

Oriented 5

Confused, disoriented 4

Inappropriate words 3

Incomprehensible sounds 2

Nil 1

Exposure

Patients should be completely disrobed during the initial assessment and the subsequent secondary survey. This helps ensure that significant injuries are not missed. At the same time, efforts to prevent significant hypothermia by using a warm ambient room (28-30°C), overhead heating, and warmed IV fluids, should be instituted. The patient's temperature should be

monitored as early as possible, and strenuous efforts should be made to avoid significant hypothermia.

Ongoing monitoring

Use of urinary catheters is mandatory after severe injury; however, precautions to avoid urethral injury should be taken for patients with pelvic trauma and for those who have blood at the urethral meatus. Digital rectal examination to identify a high-riding prostate should precede catheter insertion. Gastric tubes should be inserted into all major trauma patients requiring endotracheal intubation. If a head injury is suspected, the gastric tube should be passed via the mouth.

Children, in particular, are prone to gastric dilatation, which can significantly impair their respiration. Immediate decompression can greatly improve the patient's vital signs. Ongoing monitoring of pulse rate, blood pressure, respiratory rate, and urine output is required.

Radiology

Initial imaging in the resuscitation room should be limited to a lateral cervical spinal image, anteroposterior (AP) chest radiography, and AP pelvic image.

The need for more sophisticated imaging (focused abdominal sonar for trauma FAST) scan, CTscan, or diagnostic peritoneal lavage should be considered at this stage.

Secondary survey

This survey usually is not started until the immediate life-threatening injuries are addressed and the primary survey is complete. The secondary survey includes a detailed history, complete physical examination.

The history should include assessment of the following items, which can be remembered by using the AMPLE acronym:

A = history of patient's allergies;

M = patient's medication history;

P = Past medical, surgical and social history;

L = Time of last meal; and

E = Full description of events leading to injury, scene findings, notable interventions, and recordings en route to the hospital.

Examination of the patient

Head and face and neurology

Inspect the whole head. Look for scalp bleeding, and rapidly suture briskly bleeding lesions. Sutures or clips may be helpful in controlling bleeding from large flaps. Palpate for facial fractures and a mobile middle third of the face.

Hemotympanum and the presence of bruising around the eyes (ie, raccoon eyes) and mastoid process (ie, Battle sign) suggest basal skull fractures.

Recheck the pupils, and repeat GCS scoring. Evaluate the cranial nerves, peripheral motor and sensory function, coordination, and reflexes. Identify any neurological asymmetry. All such patients and those with an altered level of consciousness should undergo a head CT scanning.

Patients with a traumatic brain injury (TBI) are particularly susceptible to shock and hypoxia and under those circumstances have a greatly increased mortality rate.

Neck

While the collar is off, an assistant must stabilize the cervical spine to allow the neck to be examined closely. The neck must remain immobilized until the spine can be definitively cleared. Penetrating injuries of the neck may require angiographic, bronchoscopic, or radiologic examination.

Chest

Reexamine the chest. Initiate further investigations as indicated by physical examination findings or radiography results (eg, CT scan, aortography, or transesophageal echocardiography [TEE]).

Abdomen

Inspect, percuss, palpate, and auscultate the abdomen, noting tenderness and examining for fullness, rigidity, or guarding.

Remember that blood is not always a peritoneal irritant, and hemoperitoneum may occur without obvious external signs.

Inspection of the abdomen is confounded by distracting injuries and impaired consciousness from head injury or drugs and alcohol. FAST scans are now routine in the ED and may lead either to definitive operative care or further diagnostic examination by means of CT. DPL is now used on only rare occasions.

Limbs

Inspect, palpate, and move the limbs to determine their anatomic and functional integrity. Pay attention to the adequacy of the peripheral circulation and integrity of the nerve supply. Arterial insufficiency in patients with a displaced fracture or dislocation requires immediate treatment.

Log roll

The log roll refers to the slow controlled turning of the patient to assess the dependent part of the supine trauma victim. Care must be taken to avoid secondary injury from an as-yet undiagnosed unstable fracture. This examination concentrates on the back of the head, neck, back, and buttocks, and includes a rectal examination.

Definitive care &tertiary survey

After identifying injuries, initiating resuscitation &obtaining diagnostic studies, definitive care should begin. Tertiary survey is introduced to reduce the incidence &morbidity of missed injuries. It is means another head to toe examination &review of all available laboratory & imaging results.

Rehabilitation

Rehabilitation is aimed at minimizing the disadvantage experienced by a person as a result of functional impairment or disability.

Systemic injuries

Chest trauma

Chest injuries are common and contribute to many deaths. Life-threatening blunt chest injuries may affect the chest wall, lung parenchyma, the great vessels, and the heart itself. Injuries to the heart and great vessels usually result in exsanguinations hemorrhage or shock. Pericardial tamponade, tension pneumothorax, and massive hemothorax can be fatal if not recognized and treated immediately.

Tension pneumothorax

Tension pneumothorax is a potentially fatal condition unless immediately diagnosed and treated. Clinical features may include respiratory distress, tracheal deviation (away from the affected side), absence of breath sounds (on the affected side), hyper-resonant percussion note (on the affected side) and distended neck veins. Attendant shock with hypotension and tachycardia may occur. The plain chest radiograph demonstrates lucency on the affected hemothorax and shift of the mediastinum to the unaffected side. It is important to note that tension pneumothorax should be a clinical diagnosis and not a radiological one.

Treatment consists of immediate decompression followed by drainage. Decompression can be achieved by inserting a large-bore cannula (14-gauge) into the second ICS in the MCL on the affected side. Drainage is obtained by inserting a large-caliber (32F or larger) chest tube MCL and anterior axillary lines in the fourth or fifth ICS. The chest tube is attached to a pleural drainage device that can maintain an underwater seal and can apply low pressure variable negative pressure throughout the system.

Hemothorax

Massive hemothorax may result from blunt or penetrating trauma and requires rapid decompression with circulating volume restoration.

Clinical signs are hypovolemia, absence of breath sounds (on the affected side), and dullness to percussion (on the affected side). In extreme cases, the AP plain chest radiograph shows a whiteout on the affected side with a contralateral shift of the mediastinum away from that side. The x-ray appearance can be confused with substantial lobar collapse; however, in the case of parenchymal collapse with volume loss, the shift of the mediastinum is classically towards the affected side.

Treatment includes adequate volume replacement and simultaneous pleural decompression. Appropriate intravenous access must be established with the insertion 2 large-bore intravenous cannulae (14-16 gauges). Decompression of the hemothorax is accomplished by inserting a large-bore (36F or 40F) chest tube into the pleural space of the affected side. In the setting of ongoing blood loss, crystalloids and colloids should be accompanied by cross-matched packed red blood cells according to local protocols and emerging evidence

Surgical intervention is usually indicated if the initial blood loss was 1500 mL or in the setting of ongoing loss of greater than 200 mL/h for 4 h, or any lesser amount in association with ongoing hemodynamic instability.

Flail chest

Flail chest often occurs secondary to crush injuries involving multiple rib and sternal fractures, resulting in significant disruption to the thoracic cage. As a result of this extremely painful condition, the patient is unable to breathe effectively because of pain and paradoxical chest movement upon inspiration. However, the major problem is with the underlying pulmonary parenchymal injury, not the disrupted bony thoracic cage.

Flail chest is clinically diagnosed by the presence of paradoxical chest-wall movement during spontaneous inspiration and palpation of the flail segment in association with crepitus. This is usually associated with trauma, marked respiratory distress and pain.

Treatment of patients with a flail chest consists of airway, breathing, and circulatory (ABC) care and control, accompanied by adequate pain relief. Treatment may include narcotic analgesics, nonsteroidal anti-inflammatory drugs (NSAIDs) for patients not considered at risk of renal

failure, and epidural analgesics. Adequate pain relief allows for physiotherapy, helps facilitate coughing to permit airway clearance, prevents atelectasis, and maintains adequate respiratory function. Full lung expansion may require temporary intermittent positive-pressure ventilation and as appropriate, pleural drainage. Flail-segment fixation may be considered in selected cases, but it is rarely done.

Abdominal trauma

Abdominal trauma, both blunt and penetrating, remains a significant cause of patient morbidity and mortality. Rapid diagnosis and treatment are essential to ensure a good patient outcome. Injury resulting from penetrating trauma is usually obvious on presentation. The likelihood of associated intra-abdominal injury is high, and subsequent diagnosis and treatment are usually more straightforward than those for other injuries.

Blunt trauma is often associated with other injuries, and diagnosis may not be clear cut and may involve many diagnostic modalities including physical examination, ultrasonography, DPL, CT scanning, and laparotomy.

Genitourinary system injuries

Renal injury should be suspected when a patient presents with back or flank contusions or gross hematuria. CT helps in identify 95% of injuries resulting from blunt trauma. Finding a concomitant anterior pelvic fracture (ie, below the urogenital diaphragm) with urethral injuries is most common and is associated with microscopic hematuria. The anterior pelvic fracture occurs most commonly from a force directed to the pubic rami, whereas the posterior pelvic fracture above the urogenital diaphragm often is associated with multisystem pathology. However, even in the absence of gross hematuria, renal artery thrombosis and disruption of the renal pedicle may be present and are most easily diagnosed with a contrast-enhanced CT scan, renal arteriogram, or intravenous pyelogram.

Exsanguinating pelvic trauma

Patients with exsanguinating pelvic trauma present with profound shock that is poorly responsive to even aggressive resuscitation. Pelvic fractures result from considerable force and are often accompanied by other injuries. When assessing and resuscitating such a patient, one must consider the other common sites of hemorrhage. Blood can collect into only 5 places:

(1) The floor or dressings by means of external hemorrhage (eg, through the scalp),

(2) The chest,

(3) The abdomen,

(4) The muscles adjacent to long bones, and (5) The retroperitoneum.

The mechanism of injury, the presence of posterior pelvic disruption, and the presence of pelvic instability suggest the possibility of major pelvic hemorrhag.Techniques for the management of exsanguinating pelvic hemorrhage initially may include external compression (pelvic wraps using a sheet), external fixation, angiography with embolization, and, open pelvic packing performed in the context of damage control laparotomy. These patients are often best treated in a room where both surgery and angiography can be performed.