Polytrauma: Initial Approach and Stabilization

Virginie Wurlod, Dr. med vet
Louisiana State University, Baton Rouge, LA, USA

Introduction

Patients presenting to an emergency service with polytrauma can be very challenging. While severe visible injuries such as degloving wounds can cause distress to practitioners, threatening internal injuries are easily overlooked, leading to more compromising conditions such as cardiopulmonary arrest.

Trauma types

Traumatic injuries can result from of a variety of causes, such as road traffic accidents, bite wounds, high-rise falls or gunshot wounds. These injuries are of two types: (1) blunt traumatic injury or (2) penetrating traumatic injury. Both injuries can affect all organ system so assessment of all organ systems is important.

Epidemiologic studies have shown that trauma patients are mostly young males. Geriatric patients account for only 9% of the presenting traumas and only 6% of trauma patients have pre-existing illness. With appropriate care, survival to discharge rate for the trauma patient is usually very good (85-88%).

The most common traumatic injuries according to various studies are:

(1) Thoracic injuries range from 38-72%, (pulmonary contusions, pneumothorax, hemothorax and rib fractures)
(2) Abdominal injuries: 12-50% {hemoperitoneum (23-38%), urinary tract rupture (2-3%), abdominal hernia (5%)}
(3) Head injuries 24-25%
(4) Orthopedic injuries: fractures and luxations (87%)
(5) Soft tissue injuries: abrasions (56%), lacerations (26%), subcutaneous emphysema (10%) and major degloving (8%).

A list of negative predictors for survival have also been described[5], and include conditions such as recumbency at admission, cranium fractures and head trauma, disseminated intravascular coagulation, acute respiratory distress syndrome, multiple organ dysfunction syndrome, pneumonia and cardiopulmonary arrest.

Primary survey of the trauma patient

When a polytrauma patient presents to the emergency service, an initial step by step approach is recommended using ABCD: Airway, Breathing, Circulation and Disability.

Airway and Breathing

Airway and breathing can be assessed simultaneously in trauma patients. Primary airway obstruction or disease is uncommon in trauma patients, but can be observed with significant injuries to the head and neck. On the other hand, abnormal breathing pattern is seen in a majority of trauma patients. Visual assessment of the airways and breathing pattern and chest auscultation are the most effective way to localize and diagnose these problems. Additionally, pulse oximetry and "Thoracic Focused Assessment with Sonography for Trauma" (FAST) scan can help assess oxygenation and intrathoracic injuries. Thoracic radiographs should be performed in all polytrauma cases, but only if the patient is stable enough. If a pneumothorax is suspected, thoracocentesis should be performed prior to radiographs.

Patients presenting with respiratory distress can usually be divided in two broad categories and treatment targeted for each category:

(1) Patient with increased respiratory rate and/or effort: Increased respiratory rate is often seen in patients with severe pain, or patients with lung contusions or mild pneumothorax. An increase in respiratory effort is commonly associated with pleural space disease and is commonly seen in patients with severe pneumothorax or hemothorax. Dyspneic patients should receive flow-by oxygen or be placed in an oxygen cage as soon as possible. Stress should be avoided and minimal restrain used.
(2) Apneic-hypoventilating patient: patient in a hypoventilating state/apnea. This is uncommon in trauma patients, but can be seen in patients with traumatic brain injuries, or patients going into cardiopulmonary arrest. Patients with severe thoracic injuries associated with multiple rib fractures can also hypoventilate due to pain. Apneic or severely hypoventilating patients should be intubated and positive pressure ventilation initiated to maintain normal end-tidal CO_2 and normal oxygenation.

Circulation
Assessing perfusion on trauma patient is vital, as many traumatic injuries are associated with acute hemorrhage. Perfusion parameters such as heart rate, mucous membrane color, capillary refill time, pulse quality, temperature of extremities, rectal temperature and blood pressure should be evaluated.

Hypovolemic shock is the most common type of shock observed in trauma patients, and fluid resuscitation should be initiated in all cases in shock. Different fluid types can be used for fluid resuscitation: (1) isotonic crystalloids, (2) 7.5% hypertonic saline, (3) synthetic colloids or (4) blood products. Most trauma patients respond well to a ¼ shock dose of isotonic crystalloid (20ml/kg IV over 15-20 minutes). If a traumatic brain injury is suspected, hypertonic saline can be used to restore intravascular volume and decreased intracranial pressure (4-5ml/kg IV over 5 minutes). Due to a rising concern about the use of synthetic colloids, use as first line treatment for hemorrhagic shock should be evaluated on a case by case basis and its use considered if the patient does not stabilize with isotonic crystalloids alone. If significant blood loss is suspected, blood products should also be considered to restore appropriate oxygen carrying capacity and clotting ability.

Once the initial fluid bolus is over, all perfusion parameters should be reassessed. If the patient is still in shock, fluid resuscitation should be continued.

Disability
A full neurologic assessment of a polytrauma patient is important to exclude potential traumatic brain injury and help the practitioner provide a more accurate prognosis to the owner. It is important to perform this brief neurologic assessment before giving any opioids, as opioids could affect the mentation and cranial nerves assessment. The neurologic assessment should include mentation, cranial nerves function, gait, motor function and pain sensation. Is the animal responsive and alert? Does it have normal menace response and pupilar light reflex? Is anisocoria present? Can the animal move and feel all its limbs?

For assessment of initial and serial neurologic function in traumatic brain injury, the Modified Glasgow Coma Scale (MGCS) is commonly used. This has been modified from the Glasgow Coma Scale used for humans. The scale helps provide an objective assessment of the patient and a better informed prognosis. The MGCS evaluates motor activity, brain stem reflexes and level of consciousness and gives for each category, a score from 1-6. The final score is obtained by adding each category's score. Higher score being indicate a better survival rate.

Table 1: Modified Glasgow Coma Scale core category and suggested prognosis (Platt et al. J Vet Intern Med 2001)

Score Category	Actual MGCS score	Suggested Prognosis
I	3–8	Grave
II	9–14	Guarded
III	15–18	Good

MGCS, Modified Glasgow Coma Scale.

Table 2: Modified Glasgow Coma Scale (Platt et al. J Vet Intern Med 2001)

	Score
Motor activity	
Normal gait, normal spinal reflexes	6
Hemiparesis, tetraparesis, or decerebrate activity	5
Recumbent, intermittent extensor rigidity	4
Recumbent, constant extensor rigidity	3
Recumbent, constant extensor rigidity with opisthotonus	2
Recumbent, hypotonia of muscles, depressed or absent spinal reflexes	1
Brain stem reflexes	
Normal pupillary light reflexes and oculocephalic reflexes	6
Slow pupillary light reflexes and normal to reduced oculocephalic reflexes	5
Bilateral unresponsive miosis with normal to reduced oculocephalic reflexes	4
Pinpoint pupils with reduced to absent oculocephalic reflexes	3
Unilateral, unresponsive mydriasis with reduced to absent oculocephalic reflexes	2
Bilateral, unresponsive mydriasis with reduced to absent oculocephalic reflexes	1
Level of consciousness	
Occasional periods of alertness and responsive to environment	6
Depression or delirium, capable of responding but response may be inappropriate	5
Semicomatose, responsive to visual stimuli	4
Semicomatose, responsive to auditory stimuli	3
Semicomatose, responsive only to repeated noxious stimuli	2
Comatose, unresponsive to repeated noxious stimuli	1

Once "Airway-Breathing-Circulation-Disability" have been evaluated, analgesia should be considered. Full mu opioid agonists are recommended due to their short onset of action and reversal potential. Methadone, fentanyl, hydromorphone and morphine are all good options. Buprenorphine can be used, but has a delayed onset of action and its use in trauma patients might not be ideal. Butorphanol is an effective sedative, but does not have enough analgesic properties for polytrauma patients. To avoid secondary kidney injury, NSAIDs should be withheld until the patient is fully volume resuscitated and has a normal hydration. Corticosteroids are not recommended during the initial stabilization process of trauma patients.

Full assessment

After focusing on ABCD, all other injuries need to be evaluated, with special focus on (1) internal injuries, (2) urinary tract injuries, (3) wounds and (4) fractures. Multiple diagnostic modalities can be used to assess traumatic injuries. These range from emergency blood work and FAST scan, to complete blood work, radiographs, contrast studies, CT and MRI.

Emergency blood work

Initial emergency blood work at presentation is used to evaluate possible acute hemorrhage and abnormal perfusion. It should include at least the big four (PCV/TS, glucose and BUN), and a lactate.

(1) PCV/TS: Evaluation of PCV/TS helps diagnose acute hemorrhage and its severity. If both PCV and TS are normal on presentation, significant hemorrhage is unlikely. But PCV/TS should be rechecked after fluid resuscitation. If the PCV is normal, but TS is low, an acute hemorrhage is suspected. Normal PCV with low TS are related to the loss of proteins and splenic contraction. If both PCV and TS are low on presentation, severe hemorrhage should be considered. Typical locations for internal hemorrhage include peritoneum and retroperitoneum spaces, thoracic cavity and around fracture sites.

(2) BUN: Azotemia can be seen in trauma patients, and is most commonly associated with pre-renal azotemia due to hypoperfusion of the kidneys. Pre-existing renal disease, however, cannot be excluded without further investigations.

(3) Glucose: Hyperglycemia is commonly seen in polytrauma due to the high release of catecholamines during and after trauma.

(4) Lactate: When significant hemorrhage occurs during trauma, tissue hypoperfusion leads to anaerobic cellular metabolism and an increase in lactate concentration. Lactate measurement is, therefore, a very good tool to assess perfusion. Serial measurements also help assess response to treatment.

Focused assessment with sonography for trauma (FAST) scan

Abdominal and thoracic FAST scans have been developed as a screening technique for blunt and penetrating trauma. These have a high sensitivity for the diagnosis of free abdominal, pleural and pericardial fluid.[8] They screen the abdominal and thoracic cavities by evaluating the following locations:

(1) Abdominal FAST scan: Diaphragmatico-hepatic view, followed by the spleno-renal view, the cysto-colic view and completed at the hepato-renal view, assessing all four quadrants of the abdomen. The exam is performed with the patient in lateral recumbency.
(2) Thoracic FAST scan: Bilateral chest tube site views to assess pneumothorax, pericardial site view and the diaphragmatico-hepatic view. The exam can be performed with the patient in lateral or sternal recumbency.
These FAST techniques are cost effective and radiation sparing. They provide rapid initial evaluation of internal injuries, and can be measured serially.

If free abdominal fluid is found on a FAST scan, it is recommended to perform an abdominocentesis and evaluate the type of fluid aspirated. If the PCV/TS of the abdominal fluid is similar to the peripheral blood, active hemorrhage is present. If the fluid aspirated is yellow, uroabdomen should be suspected and the creatinine and potassium concentrations of the fluid compared to peripheral blood. Uroabdomen are associated with significantly higher concentrations of potassium and creatinine than peripheral blood.

Wounds and Fractures

Large wounds and degloving injuries can be overwhelming sights for the practitioner. It is important, however, to remember that, without significant associated bleeding, they represent very low immediate risk for the patient's life. Wounds should be covered on presentation to prevent contamination and antibiotic treatment started promptly. As soon as the patient is stable, the wounds should be clipped, cleaned and flushed. A new bandage should then be applied. Initial closure of the wound is rarely necessary and it is useful to reassess the wound the next day, allowing time for some tissues to declare themselves.

Fractures should be thoroughly evaluated on presentation, keeping in mind that fractures can be a source of significant hemorrhage. An orthopedic exam should be performed on all limbs, checking for swelling, crepitation, instability and pain. The spine should be evaluated for spinal fractures and a rectal exam should also be performed to discover pelvic fractures.

If possible, limb fractures distal to elbows and stifles should be stabilized using cast or splint. Radiographs should be delayed until the patient is stable enough to undergo deep sedation. If a spinal fractures if suspected, the animal should be kept immobilized on a rigid board.

Prognosis

The Animal trauma triage score

Prognostication has been improved with the use of various scoring systems. One is the animal trauma triage (ATT) score used to evaluate traumatic injuries. It is commonly used by emergency clinicians to assess the severity of a patient's traumatic injuries and is designed to provide prognostic value based upon injury severity. The ATT scoring system has six categories (perfusion, cardiac, respiratory, eye/muscle/integument, skeletal and neurologic) each of which is scored on a 0-3 scale (0 indicating slight to no injury and 3 indicating severe injury). Scores for each category are then added and the final score recflects injury severity. This scoring system is easy to use and relies only on initial physical exam and does not require any blood work or additional diagnostics. In a study evaluating the ATT scoring system, survivors have been shown to have significantly lower ATT scores than non-survivors. The ATT score is also a significant predictor for likelihood of survival seven days after initial presentation.[9]

The ATT score represents a useful prognostic tool. It, however, should never replace the initial triage and full physical assessment of the trauma patient although additional diagnostics are usually needed to fully assess and diagnose a trauma patient's full injuries.

Conclusion

With effective triage, appropriate treatment is more quickly secured and the survival rate of animals presenting with traumatic injury is greatly improved. In addition to triage, the ABCD systematic approach helps the practitioner focus on potential life threatening injuries and reduce the risk of overlooking internal injuries in polytrauma patients.

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