

Definitive Management of Trauma Patients: From the Perspective of an Anaesthesiologist

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Abstract

Trauma is the leading cause of mortality and morbidity, especially in the young population during their productive years. It has been rightly termed as the scourge of the modern industrialised world. The continuously increasing number of trauma victims has resulted in the urgent need of physicians trained in providing emergency and trauma care. The anaesthesiologists; because of their expertise in airway management, vascular access, shock resuscitation, haemodynamic monitoring, and mechanical ventilation; are frequently entrusted with the care of these patients. The care of trauma patient involves teamwork, coordination, and multidisciplinary approach.

Keywords: Trauma; Anaesthesiologist; Resuscitation; Definitive Management.

Introduction

Trauma affects all ages and classes of patients, from young and vigorous to elderly and frail. It can also be described as disruption of normal anatomy and physiology due to application of external energy.^{1,2} Anaesthesiologists see trauma patients in the emergency department, in the operation room and in the intensive care and therefore must be aware of the specific medical issues associated with this challenging population.

Basic Considerations

Trauma care is a coordinated effort, where outcomes depend as much on the coordination of services as on the quality of each individual practitioner.³ Hence the following salient features apply to all trauma patients:

- Team organization
- Multi trauma priorities
- Emergency airway management

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- Fluid resuscitation

Specific Trauma and Anaesthetic Considerations

Traumatic brain injury (TBI)

The Glasgow Coma Scale determines the severity of TBI(mild, moderate, or severe). The focused neurological examination is a vital component of preoperative assessment. Early intubation may be required to secure the airway to combat agitated behaviour, the need for diagnostic studies and the potential complication of respiratory depression or pulmonary aspiration.⁴ Benzodiazepines should be used with care in the preoperative period and the anaesthesiologist should strive to have the patient's sensorium as clear as possible after anaesthesia. The anaesthetic management should differ according to the severity of the injury and the GCS score (Fig. 1)



Fig. 1: Missile injury head

Spinal cord injury

Fall from height and high speed motor vehicle crash contribute the majority of serious spinal cord injuries. Early intubation is universally indicated for patients with cervical spine fracture and quadriplegia especially for deficit above C4 level.⁵ The evaluation of the airway, breathing and circulation (ABC) is of paramount importance (Fig.2). Glucocorticoid bolus (30mg/kg of methylprednisolone administered over 15 min, followed after 45 min by a maintenance infusion of 5.4mg/kg/hr over next 23 hours) has been recommended, if the patient sustained the injury less than 08 hours back from the time of medical attention. The efficacy of this regimen is only established for closed injuries of the spinal cord.

The efficacy for penetrating injuries and closed injuries below the conus medullaris is not established. Therefore, it seems prudent not to administer methyl prednisolone to these patients as it doubles the wound infection rate and increases the chance of gastro intestinal haemorrhage.

The need for spinal stabilization surgery is dictated by the neurologic status of the patient and the specific anatomical location. For an uncooperative patient, the preferred approach is a rapid sequence intubation with maintenance of manual in-line axial stabilization throughout the procedure. For cooperative patients an awake fiberoptic intubation is the safest approach. Hemodynamic instability may complicate emergent spinal surgery. Aggressive fluid administration is indicated in such patients.



Fig. 2: Immobilization of spine in trauma patient

Ocular Trauma

Many of the patients with severe ocular trauma have concurrent head and facial injuries that hamper initial recognition and evaluation of the same.⁶ Penetrating eye trauma continues to be a

complicated and challenging condition (Fig.3). Preoperative documentation of existing visual function and the proportion of visual deficit is mandated; as it may affect subsequent treatment decisions and the timing of surgery. A computerized tomography (CT) scan to rule out head trauma is also advised. It becomes important to avoid increases in intraocular pressure; hence judicious use of sedatives and narcotics is mandatory. It is imperative that the open globe should be protected with a shield and a broad spectrum antibiotic administered. General anaesthesia is indicated for patients with severe lacerating injuries, uncooperative patients and in paediatric population. Care must be taken during anaesthesia induction to not apply direct pressure to the globe with the face mask. Management objectives include (a) patient safety, (b) avoidance of elevated IOP, (c) provision of a stable operative field, (d) avoidance of external pressure, and (e) minimizing bleeding. Any intravenous agent with the exception of ketamine is acceptable.⁷ Use of succinylcholine as muscle relaxant should be dictated by the need for securing an anticipated difficult airway, rather than concerns about loss of ocular contents. Care should be taken to avoid oculo-cardiac reflex. During emergence, increase in IOP is avoided by judicious use of antiemetics and narcotics.



Fig. 3: Ocular Trauma

Complex Facial Injuries

Life threatening edema of the airway with impending obstruction, profuse bleeding, severe ocular, nasal, and/or jaw dysfunction; and major skin deformities are the potential consequences of facial trauma^{8,9}. Significant bone trauma can coexist with soft tissue injury. The face as a whole is constituted of three anatomic regions. The lower third includes the mandible; the middle third comprises of maxilla, nasal bones, orbits and zygomatic arch; whereas the upper third contains the frontal bone, frontal sinuses, frontozygomatic

process and nasopharyngeal complex. The initial evaluation should focus on the life threatening problems and complete assessment of more emergent injuries. Severe orofacial trauma may culminate in upper and occasionally lower airway obstruction, necessitating a detailed airway evaluation in all such patients (Fig. 4). Malocclusion is an important indicator of significant maxillofacial injury. The ability of the patient to open the mouth should be ascertained including the presence or absence of pain.

A thorough evaluation of the oral cavity to note the presence of loose or missing teeth, tongue protrusion/ mobility and source of haemorrhage is mandated. Radiographic analysis including plain films and CT scan are essential in evaluating the extent of facial injuries as well as associated injuries. The judicious use of sedatives and analgesics is indicated, which may be beneficial in relieving muscle spasm associated with fracture(s).

The restricted mouth opening and technical difficulty in obtaining appropriate seal may lead to difficult mask ventilation. In patients with a compromised but stable airway; an awake intubation technique may be the best option for securing definitive airway.¹⁰ The choice of anaesthetic technique should take into consideration that facial reconstruction procedures are lengthy with intermittent intervals of intense stimulation; and may involve significant blood loss. Post-surgical edema may effect airway patency, and hence the need to administer intravenous dexamethasone. The extubation is attempted after confirmation of intact airway reflexes.



Fig. 4: Airway Obstruction in Facial Trauma

Thoracic Trauma

Chest trauma accounts for 50-70% of deaths following road traffic accidents (Fig. 5). It is the second commonest cause of mortality after

head injury. Penetrating chest injury carries an overall mortality rate of 10%, ranging from 3% in stab wounds to over 15% in gunshot wounds. Immediate death is due to cardiac injury with chamber disruption, injury to pulmonary vessels, or due to aortic rupture, and cannot be treated.¹¹ In blunt trauma, surgery is required in less than 10% of cases; 15-30% of patients with penetrating injuries require surgery (Fig. 6). Majority (>90%) of these require simple procedures.

Most of the deaths occur within 4 hrs, and are due to uncontrolled haemorrhage, uncorrected hypoxia, and cardiac tamponade. About 30% of these deaths are preventable, and efforts should be directed towards early diagnosis and treatment of these conditions (Fig. 7). Majority of early deaths can be prevented by early diagnosis and timely treatment. All efforts should be directed towards detection of causes of early death that include-

- (a) Airway obstruction
- (b) Tension Pneumothorax
- (c) Massive Hemothorax
- (d) Open Pneumothorax
- (e) Flail chest with pulmonary contusion



Fig. 5: Traumatic chest wall injury

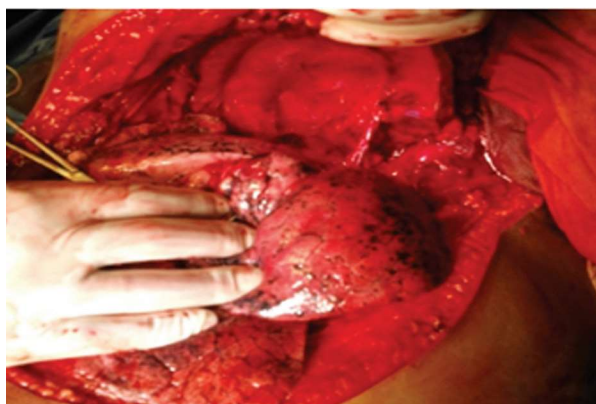


Fig. 6: Emergency thoracotomy



Fig. 7: Blunt trauma chest with intercostal drain.

Abdominal Trauma

Abdominal trauma is fairly common in clinical practice. This is seen either as a component of polytrauma or all by itself. The extent of injury suffered by a patient depends upon many factors such as the site of injury, offending agent, the force applied, the acceleration and deceleration kinetics and the probable trajectory of the offending agent etc. Abdominal injuries may result from blunt or penetrating trauma¹². The presence of abdominal injuries in a setting of polytrauma may be missed as these injuries do not have dramatic presentations like those of head, chest or major orthopedic injuries. Clinical features may be trivial or subtle, or at times delayed, so that a few patients with abdominal trauma may be missed altogether.

The delay in recognition of abdominal injuries and thus late institution of therapy contributes to the morbidity and escalates the mortality of abdominal trauma victims. It is therefore necessary that the treating doctor is aware of the spectrum of abdominal injuries, their varied presentation and the management protocols involved¹³. The approach to the management of a patient with abdominal trauma involves assessment, resuscitation, investigations, non-operative management and, when required, operative therapies (Fig. 8).

The probability of abdominal injuries exists in all patients with blunt injuries to the chest, pelvis or thoracolumbar spine¹⁴. A high index of suspicion should always be maintained in such patients and in the victims of polytrauma. The presence of abdominal trauma should be suspected in patients with hypotension which cannot be explained by external or internal loss due to skeletal, soft tissue or chest injuries. It should also be suspected in patients with deemed isolated head injuries who are hypotensive. In case of penetrating injuries, the possibility of abdominal injuries should be suspected in all patients with wounds of entry or exit in the anterior or lateral abdominal wall, lumbar

and renal areas, lower chest and pelvis including perineum. In case of high velocity missiles one may expect abdominal visceral injury even in patients with wounds of entry as far away as thighs.



Fig. 8: Thoraco-abdominal Trauma

Penetrating Trauma

Penetrating injuries resulting from firearms and knife can affect any region of the body. Initial assessment should establish the trajectory and energy transmission of the injury so as to estimate the organ systems at risky. Patients who are haemodynamically unstable after trauma should be taken to the operation theatre immediately (Fig. 9). Damage control principles are applied with the goal of controlling haemorrhage and ensuring haemostatic resuscitation (Fig. 10)¹⁵.



Fig. 9: Missile injury of thorax.

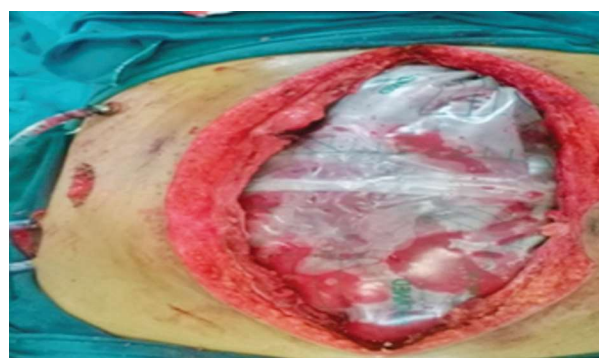


Fig. 10: Damage control surgery.

Orthopaedic Injuries

The management of musculoskeletal trauma presents a wide variety of challenges to the anaesthesiologist because of haemorrhage from wounds and fractures, infections from open fractures, limb loss from vascular injury and development of compartment syndrome; and loss of function from spinal or peripheral neurologic injuries¹⁶. Since many procedures might be appropriately managed under regional anaesthesia; familiarity with regional anaesthetic techniques is essential. In addition, the anaesthesiologist may need skill with fiberoptic intubation, haemodilution, intra-operative cell saver techniques, and invasive haemodynamic monitoring. The clinical picture, treatment plan and anaesthetic management of orthopaedic trauma must be focused on early definitive treatment. The time course of the injury is important because emergent intervention to attempt limb salvage, control haemorrhage, nerve repair or prevent infection is required (Fig. 11). Hence a thorough history and examination, supplemented with radiologic evaluation like CT scan or angiography is very vital. The choice of anaesthetic technique will depend on a multitude of factors including associated injuries, ability to cooperate, haemodynamic stability, coexisting diseases, and patient preference. Other specific considerations for intraoperative management include positioning, temperature management, use of tourniquets, potential for fat embolism and development of deep vein thrombosis. During prolonged surgery the anaesthesiologist must closely monitor electrolytes, coagulation abnormalities, fluid balance and the adequacy of ventilation as well as oxygenation.



Fig. 11: Vascular injury in extremity trauma.

The Pregnant Trauma Patient

This presents unique problems to the anaesthesiologist and the resuscitation team. The significant changes in maternal physiology associated with pregnancy may confuse and obfuscate the evaluation and management of

these patients¹⁷. The primary focus of resuscitation and early management is the mother. Therefore stabilization of the mother's general condition takes priority. Haemodynamic alterations that affect evaluation and management include changes in baseline blood pressure, cardiac output and the dilutional anaemia. All resuscitative efforts should be attempted in the lateral decubitus position as there is a possibility of the supine hypotensive syndrome in the mother. Besides this the anaesthesiologist must be vigilant about the effects of trauma on the foetus. The same broadly depends on the gestational age of the foetus, the severity and type of trauma and the extent of disruption of normal uterine and foetal relationship. During the primary survey of the injured pregnant patient early endotracheal intubation is preferred because of increased risk of aspiration, decreased tolerance to apnoea and foetal distress associated with hypoxia. The secondary survey should include some form of foetal assessment. The cardiotocographic monitoring should be instituted as early as possible.

Laboratory investigations should include haemoglobin, haematocrit, type and crossmatch, urine analysis, coagulation parameters, lactate determination and blood gas analysis. Prophylactic measures to reduce gastric pH and volume are warranted because aspiration of gastric contents during general anaesthesia is a major cause of maternal morbidity and mortality. The choice of anaesthetic technique in the pregnant patient with trauma will be determined by the operative procedure, concomitant injuries, pre-existing conditions and maternal preference. The regional anaesthesia is advantageous in most situations. Whenever general anaesthesia is administered, adequate preoxygenation is mandatory coupled with left uterine displacement during induction. Concerns about the possible deleterious effect(s) of anaesthetic agents on the growth and development of the human foetus should be factored into the anaesthesia plan.

Paediatric Trauma

Trauma is the leading cause of long-term morbidity and death in children. The most common lethal injuries resulting from trauma in this subset of patients are severe head and intrathoracic injuries (Fig. 12). Head injuries make up 80% of isolated injuries and cause 70% of all paediatric trauma deaths. A multidisciplinary coordinated team approach is the most effective management strategy to improve outcome and survival

of injured children. . Prompt and systematic evaluation for identification, prioritization, and timely management of fatal injuries is crucial¹⁸. The primary survey focuses on airway management, obtaining vascular access, resuscitation, and prevention of secondary brain injury. The secondary survey entails a thorough head-to-toe examination, neurological assessment, and diagnostic imaging studies. Knowledge and understanding of the unique characteristics and needs of the injured paediatric population greatly facilitates to optimize their care, management and final outcome.



Fig. 12: Paediatric Polytrauma

Geriatric Trauma

Outcomes from trauma are dramatically worse in elderly patients, with significant morbidity and mortality after identical anatomic injuries. The same may be attributed to decreased basal metabolic rate; limited cardiopulmonary reserve; impaired wound healing and increased susceptibility to sepsis¹⁹. For the anaesthesiologist close attention to detail is required to achieve optimal results which include modalities like nutritional support, continuous insulin infusion and perioperative beta blockade. Anaesthetic medications including induction agents should be chosen with the intention of maintaining haemodynamic stability and ought to be carefully titrated to the patients' response.

Conclusion

Trauma is a leading cause of mortality in persons between 1 and 44 years of age. The financial and emotional burden of disability due to injury is quite significant in all age groups. Timely and appropriate interventions have the potential to save lives; highlighting the paramount importance of quick recognition, rapid resuscitation, and definitive treatment. The involvement of anaesthesiologists in the management of trauma victims assumes great significance in view of their acquired skills of advanced airway management, shock resuscitation and invasive haemodynamic monitoring.

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