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EMERGENCY CARE IN PATIENTS WITH HEAD AND NECK INJURIES

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ABSTRACT:

Trauma accounts for a significant proportion of annual mortality world-wide. Being the most exposed part of the body, face is more vulnerable to such injuries. Multimodal optimization of surgical care significantly improves patient's physical and psychological function with reduced patient morbidity and mortality after surgical procedure. The physical examination begins with revaluation of the patient's vital signs. If the patient's vital signs are worsening or if there is a deterioration of any system evaluated during the primary survey, the secondary survey is halted and resuscitation is continued. The Advanced Trauma Life Support Programs (ATLS) were built around three core concepts which represented a dramatic change in traditional “medical” thinking. The first concept defines the ATLS approach. Treat the greatest threat to life first. The loss of an airway kills faster that the loss of intravascular volume which kills faster than an acute intracranial bleed. This principle is simplified as the “ABCDE” approach to the trauma evaluation. The second principle is that an indicated treatment should not wait for a definitive diagnosis. And third, an extensive history is not a critical component of the initial evaluation of the injured patient. Life threatening injuries must be managed appropriately, prioritized evaluation and intervention are essential.

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INTRODUCTION

With the advent of modernization and backed by a thriving economy, India over the past few decades has seen considerable increase in motorization development and production. However, not being backed by proper road administration, proper understanding of machinery and lack of traffic rule enforcement has led to proportionately increasing number of road traffic accidents with injuries to craniofacial skeleton being the most challenging, alarming and disfiguring. Adding to the factors are interpersonal violence, occupational and sports injuries which also contribute to the already increasing number of craniofacial trauma. Maxillofacial trauma is commonly associated with multiple system injuries and occurs in 33% of severely injured trauma victims brought into emergency rooms.

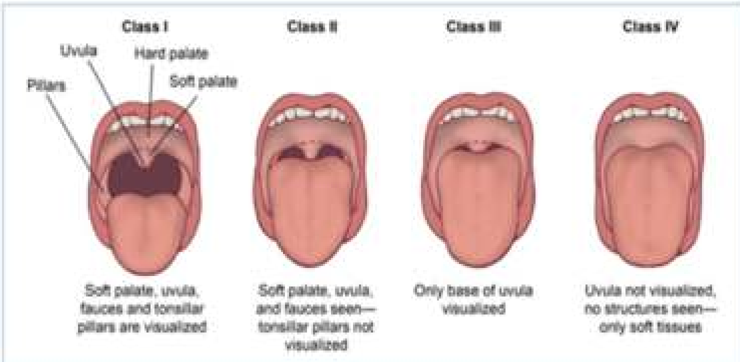

Figure 1 Mallampati classification [4]

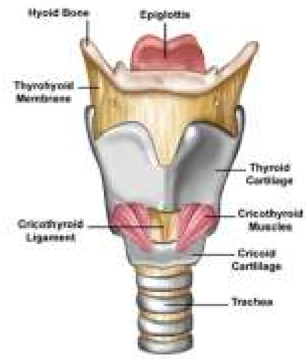

Figure 2 Anatomical considerations for cricothyroidotomy[6]

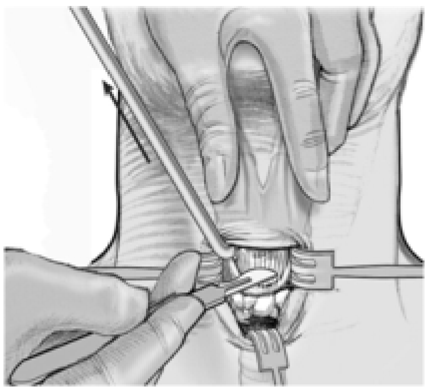

Figure 3 Incision for cricothyroidotomy[6]

Figure 4 Surgical open tracheostomy.[10]

This requires a 3-cm vertical skin incision initiated below the inferior cricoid cartilage. The strap muscles are retracted laterally. The thyroid isthmus is retracted either superiorly or inferiorly or divided. An incision is created in the anterior trachea at the first or second tracheal rings. A sideways "H" incision at the level of the second tracheal ring is ideal and provides an open-book exposure without resection

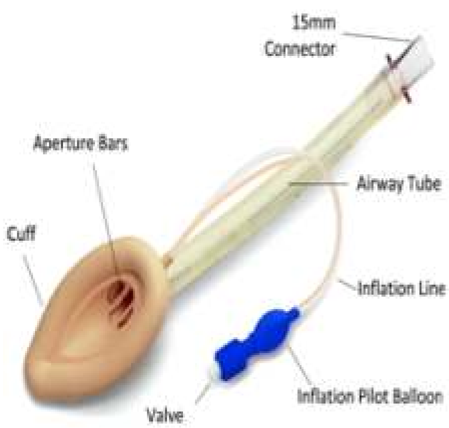

Figure 5 Parts of laryngeal mask airway[4]

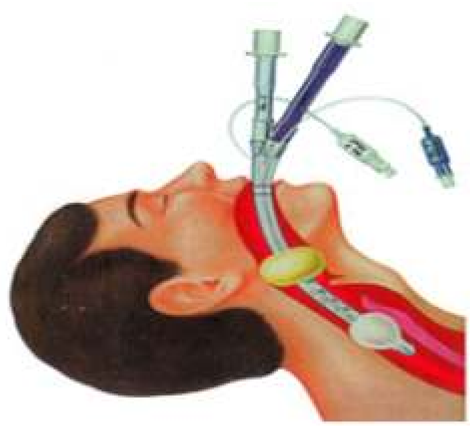

Figure 6 Combitube placement[11]

Studies have found that in maxillofacial region, along with the nasal bone, mandible is one of the most vulnerable facial bone to trauma due to its projection and prominent position with reported incidences of 24.3 to 75% [1]. Definitive facial fracture repair may be delayed until life-threatening injuries are corrected or the respiratory, neurologic, and cardiovascular status of the patient has been stabilized. Early assessment of organ systems that are life-sustaining and the immediate management of critical injuries are imperative first steps in the successful resuscitation of a trauma victim.

EARLY ASSESSMENT AND MANAGEMENT OF THE TRAUMA PATIENT

The overall management consists of a rapid primary survey, resuscitation of vital functions, a detailed secondary survey, and lastly the initiation of definitive care. The primary survey identifies injuries in a systematic fashion.

The mnemonic ABCDE defines the specific prioritized evaluations and interventions should be followed in all injured patients[2]:

· A – Airway maintenance with cervical spine protection

· B – Breathing and ventilation

· C – Circulation with hemorrhage control

· D – Disability: neurologic status

· E – Exposure/Environmental control with temperature control

Although the steps in the assessment and early management of trauma patients are outlined in a linear fashion, during the primary survey, life threatening conditions are identified and management is begun simultaneously. The patient's airway is evaluated and protected before moving forward to assess breathing, circulation, and disability. The secondary survey involving tests and observations does not begin until the

TABLE 1: INDICATIONS FOR TRACHEOSTOMY PLACEMENT [7] -:
• Ventilator dependence/respiratory failure • Prolonged intubation (>1 week) • Inability to protect airway • Inability to generate sufficient respiration • Upper airway obstruction • Definitive therapy of obstructive sleep apnea and obesity • Hypoventilation syndrome • Where there is severe maxillo-facial trauma • Where a patient can no longer manage their own secretions. • Where mucous membranes may become inflamed and swell so much that they may occlu de airways. Inflamed membranes also secrete large amounts of mucous. • Where an aspirated object may cause laryngeal muscles to spasm (making it difficult to pass an endotracheal tube) • When long term intubations are required • Where a decreased level of consc iousness causes upper airway obstruction due to relaxation of structures

TABLE 2: Percutaneous tracheostomy: indications and contraindications[8]
Indications • Inability to maintain/protect airway • Upper airway obstruction/cancer (laryngectomy) • Prolong ventilator requirements Absolute contraindications • Unstable cervical spine injuries • Coagulopathy • Emergency airway • Pediatric age (<15 years old) Relative contraindications • Obesity • Short neck • Enlarged thyroid isthmus/goiters • High-riding innominate artery • Previous tracheostomy • High positive end-expiratory pressure requirement

TABLE 3: RISKS OF TRACHEOSTOMY PLACEMENT[9]	
Standard Surgical Risks	Tracheostomy-Specific Risks
Pain	Hemopneumothorax
Infection	Damage to trachea or esophagus (including tracheoesophageal fistula)
Bleeding	Tracheal stenosis
Need for additional procedures	Inability to decannulate
Damage to surrounding structures	Mucous plug
Scar	Tracheoinnominate fistula/erosion

TABLE4: Composition of common crystalloids[14]

Crystalloid	Osmolality (mOsm kg^{-1})	pH	Na^+ mmol l^{-1}	K^+ mmol l^{-1}	HCO_3^- mmol l^{-1}	Cl^- mmol l^{-1}	Ca_2^+ mmol l^{-1}
0.9% Saline	300	5.0	150	0	0	150	0
Hartmann's	280	6.5	131	5.0	29[a]	111	2
Plasmalyte 5%	299	5.5	140	5	50[b]	98	0
Dextrose 4%	278	4.0	0	0	0	0	0
Dextrose in 0.18% Saline	286	4.5	31	0	0	31	31
7.5% Saline	2400		1250			1250	

[a] HCO_3^- is provided as lactate

[b] 27 mmol l^{-1} as acetate and 23 mmol l^{-1} as gluconate

primary survey (ABCs) is completed, resuscitation is initiated, and the patients ABCs are re-evaluated

Resuscitation

A. Airway Evaluation in the Trauma Patient

All patients of trauma should be suspected to have an altered or compromised airway till ruled out. They should continue to receive supplemental oxygen and have cervical immobilisation done using manual-inline stabilisation during examination and airway management.[3]

The most utilized predictive scheme for airway assessment is the Mallampati classification 1983, which assigns three gradations of increasing difficulty in visualizing the posterior pharyngeal structures in order to predict difficult laryngeal exposure (Fig 1)[4]

Once it has been identified that the patient has an inadequate airway, one can adopt[3]:

1. Simple airway strategy
2. Definitive airway strategy (endotracheal intubation or surgical airway), or
3. Semi-definitive airway strategy for making the

TABLE 5: Glasgow Coma Scale (GCS) by Teasdale G.and Jennett B.[16]

Eye opening

- Spontaneous – 4
- To speech – 3
- To pain – 2
- None – 1

Motor response

- Obeys commands – 6
- Localizes to pain – 5
- Normal flexion (withdrawal) – 4
- Abnormal flexion (decorticate) – 3
- Abnormal extension (decerebrate) – 2
- Flaccid – 1

Verbal response

- Oriented – 5
- Confused conversation – 4
- Inappropriate words – 3
- Incomprehensible sounds – 2
- None – 1

TABLE 6: Traditional classification of hypothermia and revised definitions for the trauma patient[17]

Degree of hypothermia	Traditional classification (^{0}C)	Trauma classification (^{0}C)
Mild	32—35	34—36
Moderate	28—32	32—34
Severe	20—28	<32
Profound	14—20	
Deep	<14	

airway patent as per existing situation

SIMPLE AIRWAY STRATEGY

This includes Head tilt and Chin lift (avoid in patients with cervical trauma)/jaw thrust or the use of basic adjuncts such as oropharyngeal airway in unresponsive patients without gag reflex, and/or nasopharyngeal airway in patients with more active reflexes but without evidence of fracture of base of skull.[3]

DEFINITIVE AIRWAY STRATEGY

This includes either endotracheal intubation(ETI) or a surgical airway. Options for achieving ETI may include any one of the following airway aids depending on the situation, device availability and presence of operator with necessary expertise

1. Direct laryngoscopy and tracheal intubation.
2. Video laryngoscopy and intubation.
3. Fibreoptic tracheal intubation.
4. Lightwand-guided tracheal intubation.
5. Intubating LMA/C-Trac-aided tracheal intubation.
6. Blind nasal intubation[3]

Surgical airway should be resorted when there is severe glottis oedema and/or oropharyngeal haemorrhage, fracture of the larynx and when endotracheal tube fails to be passed through the vocal cords. 1% of trauma patients requiring intubation require a surgical airway[3]. Surgical airway techniques include-:

Cricothyrotomy

Surgical cricothyrotomy has potential applications in patients who require an elective or emergency surgical airway. In cases where intermaxillary fixation is needed or when nasal or submental intubation is not desired, it allows intraoperative and postoperative intermaxillary fixation without compromising the airway.[5]

Cricothyrotomy can be performed using the following three techniques(Fig.2- 3):

A. A needle using a 12-14 gauge cannula. The cannula, after withdrawing the needle, is connected to 40- 50 psi source delivering oxygen at 15L/minute. Intermittent insufflation, 1 second on and 4 second off, can provide satisfactory jet insufflation.

B. A needle airway procedure as above, but where the ventilation is provided by low pressure ventilation.

C. "Surgical Airway" where a cuffed tube is inserted into the trachea through the cricothyroid membrane and ventilation is performed through a self-inflating bag or other ventilating technique.[6] (Fig.4)

Tracheostomy

Tracheostomy is a commonly performed elective procedure that is indicated in patients experiencing prolonged tracheal intubation for mechanical ventilatory support or as an emergent procedure in the event of sudden loss of an airway that cannot be secured by conventional methods.[7] (Table 1-3)

SEMI-DEFINITIVE AIRWAY STRATEGY

Currently, the LMA[4], the ProSeal laryngeal mask airway (PLMA) (Fig.5), the laryngeal tube (LT), the laryngeal tube with integrated suctioning tube (LTS) and the oesophageal tracheal combitube (OTC)[11] Fig.6 are the best evaluated and most widespread devices. Both the LMA and the PLMA have been shown to be perfectly suitable for routine anaesthesia and emergency airway management.

B. Breathing

After a definitive airway is confirmed, the patient's breathing is evaluated. The chest wall should be exposed to allow for a thorough inspection. Inspection will confirm appropriate chest movement with respiration. Palpation and percussion will confirm diaphragmatic excursion and may detect signs of blood or air in the pleural space.[2]

Diminished or absent breath sounds may indicate a pneumothorax or hemothorax. A tension pneumothorax develops if, after chest wall or lung injury, a one-way valve mechanism exists that allows air to enter the pleural space without exit. There is an eventual shift in the mediastinum to the contralateral side and compression of the major vessels entering the chest. With compression, there is a decrease in venous return to the heart and resulting decline in cardiac output. This lesion is suspected in the patient with signs of chest trauma, absence of breath sounds on one side, hyperresonance of the chest wall, hypotension, and shift of the trachea to the contralateral side. The treatment is immediate decompression of the pleural space with a large-bore needle inserted through the second intercostals space along the mid-clavicular line, followed by the formal insertion of a thoracostomy tube. Intubation and positive pressure ventilation can cause a relatively small pneumothorax to expand rapidly. Breathing should be repeatedly evaluated with auscultation of the chest and a chest radiograph should be obtained as soon as possible.[2]

C. Circulation

Hemorrhage and hemorrhagic shock that account for 30 to 40% of trauma deaths, are more amenable to interventions to reduce mortality and morbidity.[13] Furthermore, about 25% of CNS injuries are complicated by shock. Among those with multiple injuries, brain injury remains the primary cause of death, but hypotension increases mortality in this group two- to three-fold.[12]

Early Mortality

Hemorrhage leads to death during the prehospital period in 33 to 56% of cases, and exsanguination is the most common cause of death among those found dead upon the arrival of emergency medical services (EMS) personnel.[12] Hemorrhage accounts for the largest proportion of mortality occurring within the first hour of trauma center care, over 80% of operating room deaths after major trauma, and almost 50% of deaths in the first 24 hours of trauma care. After first few hours of trauma care, CNS injury replaces hemorrhage as the leading cause of trauma mortality. Very few hemorrhagic deaths occur after the first day. There are multiple potential sources of bleeding in the trauma patient. External blood loss is managed during the primary survey with pressure on the wound.[12]

Late Mortality and Morbidity

The presence of hemorrhagic shock is a predictor of poor outcome in the trauma patient. As the amount of blood loss increases, so do resuscitation requirements and physiologic derangements including hypotension and acidosis.[12] Hemorrhage is defined as an acute loss of circulating blood volume. The average adult blood volume is approximately 7% of body weight (70 ml/kg). Children have estimated blood volumes of 8–9% of body weight and infants estimated blood volumes are 9–10% of body weight. Blood loss of 10–15% of a healthy person's blood volume can generally be tolerated without clinical sequelae. Shock is defined as an abnormality in the circulatory system that results in inadequate tissue perfusion and oxygenation. Early signs of a collapsing circulatory system are tachycardia and peripheral vasoconstriction. As the system continues to fail, perfusion to central organs and muscle decreases in order to preserve cerebral perfusion.[2]

TYPES OF FLUID

Intravenous fluids may broadly be classified into colloid and crystalloid solutions. They have very different physical, chemical and physiological characteristics.

Crystalloid solutions

Solutions of inorganic ions and small organic molecules dissolved in water are referred to as crystalloids (Table 4). The main solute is either glucose or sodium chloride (saline) and the solutions may be isotonic, hypotonic or hypertonic with respect to plasma. Isotonic saline has a concentration of 0.9% w/v (containing 0.9g NaCl in each liter of water). Potassium, calcium, and lactate may be added to more closely replicate the ionic makeup of plasma. Crystalloids with an ionic composition close to that of plasma may be referred to as "balanced" or "physiological".[13]

Colloid solutions

A colloid is a homogeneous non-crystalline substance consisting of large molecules or ultramicroscopic particles of one substance dispersed through a second substance - the particles do not settle and cannot be separated out by ordinary filtering or centrifuging like those of a suspension such as blood. Colloid solutions used in clinical practice for fluid therapy are divided into the semisynthetic colloids (gelatins, dextrans and hydroxyethyl starches) and the naturally occurring human plasma derivatives (human albumin solutions, plasma protein fraction, fresh frozen plasma, and immunoglobulin solution). Most colloid solutions are presented with the colloid molecules dissolved in isotonic saline but isotonic glucose, hypertonic saline and isotonic balanced or "physiological" electrolyte solutions are also used.[13]

Further fluid resuscitation and the need to transfuse blood are based upon estimates of the volume of blood loss and the patient's response to the initial fluid bolus. If the patient had minimal blood loss (10–15% of estimated blood volume) and a rapid response to the initial fluid with a return to normal vital parameters they are not likely to require blood transfusion. If the patients had moderate blood loss (20–40% of estimated blood volume) and only a transient response to the initial fluid bolus then ongoing fluid resuscitation is anticipated. It is likely that the patient will require blood transfusion but type-specific blood may be available. In the patient with severe hemorrhage (over 40% of estimated blood volume) immediate transfusion is required. In this situation type O blood will be used until type-specific blood is available.[2]

D. Disability (neurologic evaluation)

A decline in the patient's level of consciousness may be due to a decrease in cerebral perfusion or cerebral oxygenation, or may be due to an intracranial injury. The first response to an altered mental status is to re-evaluate airway, breathing, and circulation. A rapid neurologic assessment should include an evaluation of sensory and motor function.[2]

The Glasgow Coma Scale is a rapid objective clinical measure of neurologic function. The scale was initially published in 1974, by two neurosurgeons (Graham Teasdale and Bryan Jennett) at the University of Glasgow.[15-16] (Table.5)

The scale assesses eye opening, motor response, and verbal response. Each category is scored based upon best response and the scores are tallied to determine a Coma Score. The highest score obtainable is 15 (indicating an unaltered, awake patient) and the lowest is 3 (indicating deep coma).[2]

E. Exposure/environmental control

The primary survey concludes with complete exposure of the patient. During the resuscitation, and particularly once the patient is undressed, it is critical to protect the patient from developing hypothermia. Hypothermia develops in up to 70% of trauma patients at some point during resuscitation. Exposure, paralysis, and fluid administration all contribute to lowering the patient's core temperature. Hypothermia can produce a relative coagulopathy. It alters platelet function, the coagulation cascade, and the fibrinolytic system. A drop in the core temperature of just a few degrees is enough to produce a marked decrease in clotting ability.[1] (Table.6)

Hypothermia also produces a dramatic increase in oxygen consumption. Decrease in the core temperature of 0.3ºC produces a 7% increase in oxygen consumption and a decrease of 1.2ºC, produces a 92% increase in oxygen consumption. Hypothermia can produce negative inotropic changes in the heart and respiratory depression, and exacerbate hyperglycemia by decreasing insulin production and creating end-organ insulin resistance. Hypothermia, along with acidosis and coagulopathy, has been identified as a component of the ''lethal triad'' in injured patients, and has been shown to contribute to increased mortality in these patients.[1]

Rewarming of the trauma patient can be undertaken using either passive or active methods. Passive rewarming consists of optimizing environmental conditions while allowing the patient's own heat generating capabilities to correct the decrease in core temperature. Active rewarming includes external methods of rewarming as well as methods directed at rewarming the core. External rewarming techniques include the use of heating blankets, convective air blankets, reflective blankets, and radiant heat shields.[17-18]

SUMMARY

The treatment of trauma requires the rapid assessment of injuries and institution of life-preserving therapy. Because Timing is crucial, a systematic approach that can be rapidly and accurately applied is essential. This approach is termed the "initial assessment" and includes the following elements: Preparation, Triage, Primary survey (ABCDEs), Resuscitation, Adjuncts to primary survey and resuscitation. Specifically, appropriate monitoring and repeated clinical assessment are required, along with support for all major organ systems, including cardiorespiratory function, renal function and fluid and electrolyte balance. Multimodal optimization of surgical care significantly improves patient's physical and psychological function with reduced patient morbidity and mortality.

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