**Oral and Maxillofacial surgery/Fifth year**

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**Maxillofacial trauma**

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axillofacial trauma can involve any part of the face and it can have serious effects on both the function and esthetics of the face. The incidence of maxillofacial trauma varies from country to country (and even within the same country), depending on several factors, including the geographic area, the socioeconomic status, the cultural background, alcohol and drug abuse, road traffic legislations and seasons.

**Etiology**

The etiology of maxillofacial trauma directly affects the incidence, the clinical presentation, and the treatment modalities. The main causes include:

* **Road traffic accidents (RTA);** also termed motor vehicle collisions, are still among the most frequent causes of facial fractures all over the world.
* **Assaults and interpersonal violence;** the face is frequently the target for most acts of physical aggression because of its prominent and easily reachable position. Assault-related fractures tend to affect males and young people due to their greater involvement in situations of violence.
* **Fall;** is a relatively frequent cause, the height of the fall, the landing position, the location of contact, and the impact surface determine the pattern and severity of maxillofacial trauma.
* **Sport-related injuries;** the mechanisms of injury can be divided into three categories: impact with another individual, impact with the ground, and impact with equipment. It usually affects young people who participate more in sports than older people.
* **Work-related accidents;** these injuries could be related to human error, technical failure, and improper use of equipment due to a lack of training and/or instruction.
* **Gunshot or missile injuries;** this type of injury usually cause complex pattern of trauma characterized by bone and soft tissue loss and comminuted fractures of the facial bones. These injuries are prevalent in areas of wars, turbulent political transitions, insurrections, rebellions, and civil wars.

**Preliminary management of maxillofacial injuries**

Mortality from trauma has a trimodal distribution with three clearly defined peaks.

1. The first peak in mortality is within seconds or minutes of the event, when the degree of injury received is the most severe such as severe injury to the brain and the major cardiovascular structures, such as the heart and great vessels.
2. The second peak occurs some minutes to 1 or more hours after the event. Death is attributed to unrecognized serious complications, such as airway compromise, hemorrhage, and head injury. The **golden hour** of care after injury is characterized by the need for rapid assessment and resuscitation.
3. The third peak occurs days to weeks after the event, when sepsis or multiorgan failure occur and lead to death.

Prehospital care involves delivering active professional intervention and emergency measures at the scene of the event by trained paramedical personnel. This active prehospital care encompasses securing an airway with appropriate cervical spine control, securing appropriate intravenous access and initiating fluid resuscitation, and stabilizing the patient before rapid transfer to an emergency department.

**Primary survey**

During the primary survey, life-threatening conditions are identified and reversed quickly. The **advanced trauma life support** **(ATLS)** was developed by the American College of Surgeons Committee of Trauma to ensure a quick and efficient evaluation of the patient’s injuries and almost-simultaneous lifesaving intervention. The principles of ATLS are:

* **A**irway with cervical spine control
* **B**reathing and ventilation
* **C**irculation and hemorrhage control
* **D**isability due to neurological deficit
* **E**xposure and environment control

**Airway and cervical spine control**

All patients who have been subjected to maxillofacial or head trauma should be presumed to have sustained a cervical spine injury until proven otherwise. The consequences of cervical spine damage can be so catastrophic that every effort should be made to prevent any further harm to the patient; therefore the cervical spine should be immobilized in the neutral position by means of a semirigid cervical collar or spinal board until definitive radiographs showing all seven cervical vertebrae and the first thoracic vertebra are taken to rule out cervical injury.

The provision of an unobstructed airway is of prime importance in order to maintain cerebral oxygenation and to avoid hypercarbia with subsequent possible permanent cerebral impairment. The most important factor controlling the patency of the airway in a patient with facial injuries is the level of consciousness. A fully conscious and upright patient is usually able to maintain an adequate airway even in the presence of severe disruption of the facial skeleton. However, a semi- or unconscious patient will rapidly obstruct from the presence of blood and mucus in the airway, inability to cough or inability to adopt a posture to keep the airway clear. Progressive swelling will compound all these problems.

Several techniques exist to provide an unobstructed airway; these should be adopted in a logical stepwise manner:

* Chin lift and jaw thrust help improve the airway, but may be difficult to do in a conscious patient with mandibular fractures. Jaw thrust involves placing the fingers behind the angle of the mandible to push the jaw forwards and upwards while the thumbs push down on the chin or lower lip to open the mouth.
* A careful examination of the oral cavity should be made, any dentures or portions of broken dentures should be removed together with any avulsed teeth, or loose or broken teeth that are so mobile there is a risk of their being inhaled in addition to suction of secretions, blood and mucus to clear the airway.
* Insertion of oropharyngeal or nasopharyngeal airway can secure the airway, but they are not well tolerated by conscious patients due to stimulation of gag reflex. Nasopharyngeal airways are considered to be contraindicated if there is the possibility of anterior skull base fractures.
* Patients immobilized on a spinal board who vomit are in danger of aspiration as they cannot sit up to clear their airway. If such a patient is about to vomit they should be immediately turned on their side on the spinal board.
* Temporary reduction and stabilization of anterior mandibular fractures with a (stay or bridle wire) around stable teeth on either side of the fracture if possible can reduce bleeding and support the mandible.
* Collapsed maxillary fractures may cause airway obstruction. It can be displaced backwards and downwards along the inclined surface of the relatively thick skull base, resulting in impaction of the soft palate into the pharyngeal space. The maxilla should be gently repositioned to maintain the airway and control hemorrhage.
* Endotracheal intubation is necessary to secure airway if the patient has more severe damage, cannot maintain the airway, requires ventilation, when significant swelling is anticipated or in patients with multiple injuries with combined trauma to the head, face and chest.
* Emergency surgical airway is required when the airway cannot be secured by any other means. Surgical airway is obtained by cricothyroidotomy (also known as cricothyrotomy) or tracheostomy.

Cricothyroidotomy is the fastest and safest method of obtaining a surgical airway. **Needle cricothyroidotomy** is a temporary procedure that is used to oxygenate patients (for approximately 45 minutes) while a definitive airway is being quickly prepared, in this procedure a cannula is introduced into the lumen of the trachea through the cricothyroid membrane to deliver oxygen.

In **surgical cricothyroidotomy** the cricothyroid membrane, which is usually superficial and palpable, is perforated with a scalpel blade. A standard tracheostomy tube can then be inserted and maintained in the usual manner. Some surgeons prefer to replace a cricothyroidotomy with a tracheostomy within 24 hours. This is because cricothyroidotomy has been reported to be associated with a higher risk of glottic and sub-glottic stenosis than tracheostomies.

**Surgical tracheostomy;** an incision is made halfway between cricoid cartilage and suprasternal notch, dissection continues down to the 2nd and 3rd tracheal rings, then a window is excised through the trachea and the tracheostomy tube is inserted and secured.

Indications for tracheostomy in maxillofacial injuries

1. When prolonged artificial ventilation is necessary (for example, associated head and chest injuries).
2. To facilitate general anesthesia during surgical repair of complex facial injuries.
3. To ensure a safe postoperative recovery after extensive surgery.
4. Following obstruction of the airway from laryngeal edema or occasionally direct injury to the base of the tongue and oropharynx.
5. Following serious hemorrhage into the airway, particularly when a further secondary hemorrhage is a possibility.

**Breathing and ventilation**

Once airway is secured, the efficiency of breathing and ventilation must be assessed by auscultation and chest radiographs. The respiratory rate should also be determined. Serious chest injuries that compromise ventilation are:

**Pneumothorax** which develops from damage to the chest wall or laceration of the lung pleura, with a resulting loss of negative intrapleural pressure, it can be: open, closed or tension pneumothorax. **Hemothorax** is the collection of blood in the pleural cavity. **Hemopneumothorax**.

The emergency treatment of the majority of these conditions requires thoracostomy drainage with chest tube placed in the fourth intercostal space anterior to the midaxillary line.

**Flail chest** occurs when three or more adjacent ribs are fractured in at least two locations, resulting in a freely moving segment of chest wall during respirations.

**Diaphragmatic rupture** may result in herniation of intraabdominal contents into the chest. This herniation results in compression of the lung and displacement of the mediastinum to the contralateral side, followed by marked respiratory distress, cyanosis, and hypotension.

Breathing problems may also arise following aspiration of teeth, dentures, vomit and other foreign materials. In this case endoscopy may be necessary to remove denture fragments or other foreign bodies.

**Circulation and hemorrhage control**

Definitive bleeding control is essential, along with appropriate replacement of intravascular volume. The majority of fractures of the facial skeleton are relatively closed injuries and life-threatening hemorrhage is uncommon and hemorrhagic shock is unusual but clinically significant blood loss can occur in patients with panfacial fractures. Blood loss in young children can quickly result in hypovolemia.

 The parameters reflecting the degree of hypovolemia are:

* Tachycardia; defined as heart rate greater than 100 beats/min in an adult.
* Hypotension
* Narrowing pulse pressure (systolic minus diastolic)
* Tachypnea
* Delayed capillary return
* Falling urinary output
* Deteriorating mental status (i.e., increasing confusion)

The source of bleeding can be external or internal, bleeding can occur from external wounds, such as the scalp which can be controlled by direct manual pressure on the wound or by suturing. Obvious bleeding vessels should be secured with artery forceps, ligated if possible.

Another source of bleeding can occur from grossly displaced fracture of the mandible or midface, this can be controlled by manual reduction of the fracture and temporary immobilization either manually, or by means of a stay wire.

Epistaxis occurs due to injury to the middle third of the face, it usually stops spontaneously or is easily controlled by lightly packing the nose (anterior nasal packing). In some cases profuse bleeding into the nasopharynx may occur, in such cases postnasal pack is needed, specifically designed nasal balloons or packs are used or two urinary catheters can be used. Each is passed via both nostrils into the pharynx, inflated with saline and then gently withdrawn until the balloon wedges in the post-nasal space. Packs should be kept in situ for 24-48 hours.

Additional uncommon bleeding control measures include; **ligation of the** **vessels** like the external carotid artery and ethmoidal arteries, but these measures can be unsuccessful due to the collateral circulation. **Superselective embolization** involves catheter-guided angiography used to identify bleeding points then using of a number of materials designed to stimulate clotting locally.

Penetrating neck trauma from sharp injuries can cause internal bleeding from damage to the great vessels without signs of external hemorrhage. This is potentially serious, as the consequences of rapid neck swelling can be fatal. Patients showing signs of neck swelling or patients who show signs of hemodynamic instability should have protection of the airway and control of hemorrhage.

The major areas of internal hemorrhage in patients with multiple trauma are the chest, abdomen, retroperitoneum, pelvis, and long bones.

Adequate intravenous access is essential; typically two large-bore peripheral venous catheters are placed to administer fluid, blood, and plasma. The resuscitation fluid can be crystalloid, colloid, or blood, if crystalloid is used, it should be transfused in the ratio of 3 mL of crystalloid to 1 mL blood; an appropriate initial bolus in an adult patient would be 2000 mL transfused as quickly as possible (or 20 mL/kg in the child). The response of the patient can be assessed, and further fluid can be transfused depending on the patient’s response. In some cases of surgical shock group O negative blood transfusion can be used until type-specific blood is made available.

Urine output is a sensitive indicator of cardiac output. Therefore placement of a urinary catheter is essential in all significant trauma patients. Urine output levels below 0.5 mL/kg body weight per hour for an adult, 1 mL/kg body weight per hour for a child and 2 mL/kg body weight per hour for a child younger than 1 year old suggest inadequate fluid replacement.

**Disability due to neurological deficit**

A rapid assessment of the patient’s neurological disability can be made by noting the patient’s response on the four-point AVPU scale:

* **A** Alert.
* **V** Voice, able to respond to verbal command.
* **P** respond to painful stimuli.
* **U** Unresponsive.

This, coupled with an assessment of the pupil reaction, allows rapid assessment of the degree of head injury. Documenting the pupillary response and repeatedly examining the pupillary response to light directly and consensually until the patient is stable are important. Ipsilateral dilating pupil after maxillofacial trauma may be due to:

* Direct injury to the eye
* Optic nerve damage
* Oculomotor nerve compression
* It may be a sign of an increase in intracranial pressure especially when combined with decreased level of consciousness.

**Exposure and environment control**

All trauma patients must be fully exposed. Therefore the environment must be warm and appropriately protected to ensure that the patient suffers no further harm by being exposed to the surrounding ambient temperature. The patient should be fully examined including an examination of the back, if necessary, by using a logroll technique to ensure that otherwise hidden areas have been inspected.

**Secondary survey**

It is important at all stages of the management of the trauma victim that reassessment is regularly carried out to ensure that the patient is still stable and to detect any early deterioration. This head-to-toe examination involves examination of all body systems. Once the patient is stabilized and after adequate resuscitation a detailed assessment of the level of head injury is made using a combination of the pupil reactions and the Glasgow Coma Scale.

**Glasgow coma scale**

It is a method of neurological assessment of the level of consciousness; it provides a reliable, objective way of recording the conscious state of a patient. It can be used for initial evaluation as well as regularly recording improving or deteriorating status. Points are awarded using the criteria given in the scale to give a total score between 3 (deeply unconscious and unresponsive) and 15 (fully conscious, alert and orientated). Any patient with a GCS score of less than 8 should be considered as unable to protect their airway.

**Best eye response (E)**

Consists of 4 grades starting with the most severe:

1. No eye opening.
2. Eye opening in response to painful stimulus.
3. Eye opening in response to command.
4. Spontaneous eye opening.

**Best verbal response (V)**

Consists of 5 grades, starting with the most severe:

1. No verbal response.
2. Incomprehensible sounds.
3. Inappropriate words.
4. Confused conversation.
5. Orientated; coherent and appropriate response to questions.

**Best motor response (M)**

Consists of 6 grades, starting with the most severe:

1. Makes no movements.
2. Abnormal extension (decerebrate posture).
3. Abnormal flexion (decorticate posture).
4. Flexion/withdrawal to pain.
5. Localizes to pain.
6. Obeys commands.

**Vision threatening injuries**

These include:

1. Orbital compartment syndrome and retrobulbar hemorrhage.
2. Traumatic optic neuropathy.
3. Open and closed globe injuries.
4. Loss of eyelid integrity.

Once the patient is stabilized early recognition of vision threatening injuries is essential. The initial assessment examines vision in each eye, pupil size and reaction to light, presence of proptosis and eyelid integrity.