Lec.1/ Trauma – Basics and Emergency Care

Key Points

Maxillofacial trauma is a challenging area of clinical practice due to its effects on both the function and aesthetics of the face. Injuries to the face may be associated with damage to vital structures such as the eyes, lacrimal apparatus, nasal airways, paranasal sinuses, tongue and various sensory and motor nerves.

✓ **Etiology:**

Road traffic accidents **(RTA)** or motor vehicle collisions (**MVC**); remain the most important cause of maxillofacial trauma all over the world. Vehicle safety design such as air bags, collapsible wind screen and the compulsory use of seat belt (or helmet for motor cyclist); all are factors that have great influence in reducing maxillofacial injuries from RTA.

Other etiological factors include: fall from height, assaults, industrial injuries, sports, agricultural and missile injuries.

Fall fom height; depending on several factors: (the height of the fall, the landing position, the location of contact, and the impact surface), these factors will determine the pattern and severity of trauma.

Missile injuries; include: blast injuries, bullets, shells…etc. 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, civil wars and terrorism.

✓ **Anatomically**:

The facial skeleton has been divided into **upper, middle** and **lower thirds**. The upper third is formed by the frontal bone, the middle third is the region extending downwards from the frontal bone to the level of the upper teeth, and the lower third is the mandible.

Fractures of the middle third of are termed '**midfacial' fractures** or '**fractures of the midface'**

When facial fractures extend into the skull base or frontal bone especially the posterior wall of frontal sinus or orbital roof; they are usually referred to as '**craniofacial' injuries**, these will often require combined management with a neurosurgeon.

✓ **The Cushioned effect of the facial bones:**

The midface can be considered as a fragile **'matchbox'** sitting below and in front of a hard shell (the cranium) containing the brain. The midfacial bones have the capacity to absorb impact energy protecting the brain, any impact is cushioned as the bones collapse and preventing the force transfer to the brain, that's why the severely facial traumatized patients are conscious.

In the mandible the condylar neck act as cushioned effect and fracture to absorb the force, but when the mandible absorb the entire force; the cushioning effect is reduced and brain injury can result as in boxer's knockout punch.

A blow to the skull is transmitted directly to the intracranial contents (A) The 'matchbox' like structure of the midface cushions the force of impact (B) An impact to the mandible (C) is transmitted indirectly to the cranial base. Damage to the brain may be prevented by protective fracture of the condylar neck.

✓ **As an incidence**:

The most common facial fractures are nasal and mandibular fractures, followed by injuries to the zygoma and maxilla respectively.

✓ **Immediate intervention:**

Definitive repair of a facial fracture is never a life-saving measure, but there is cases with priority 1 (which should be managed within seconds) and immediate intervention is required for:

1. **Airway management (establishment of surgical airway).**
2. **Profuse facial bleeding.**
3. **Sight or vision-threatening injuries as retrobulbar hemorrhage**

✓ **Peaks of mortality**: Mortality of 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 multi-organ failure occur and lead to death.

Emergency Care: Preparation and (ATLS)

Preparation is divided into a ***prehospital phase*** essentially limited to first aid in the field of injury and done mostly by the paramedics while the second ***in-hospital phase*** in which the patient has been brought to the hospital where he or she can be managed according to the extent of injury. **Triage** is a sorting of patients based on the urgency of treatment and the available resources to provide that treatment, may be carried out in both prehospital and in-hospital phases. This is based on the principle that the most severely injured patient requires the more urgent treatment.

There are several systems for the management of traumapatients of which the **Advanced Trauma Life Support (ATLS)** is now generally recognized as the '**gold standard'**. ATLS was originally introduced by the American College of Surgeons Committee of Trauma and is now taught in over **50** countries worldwide.

Phase 1/ primary survey (ABCs) which is in order of priority:

Airway and cervical spine control
Breathing and ventilation (oxygenation)
Circulation and control of hemorrhage
Disability – assessment of neurological deficit
Exposure and environmental control

• Airway and cervical spine control

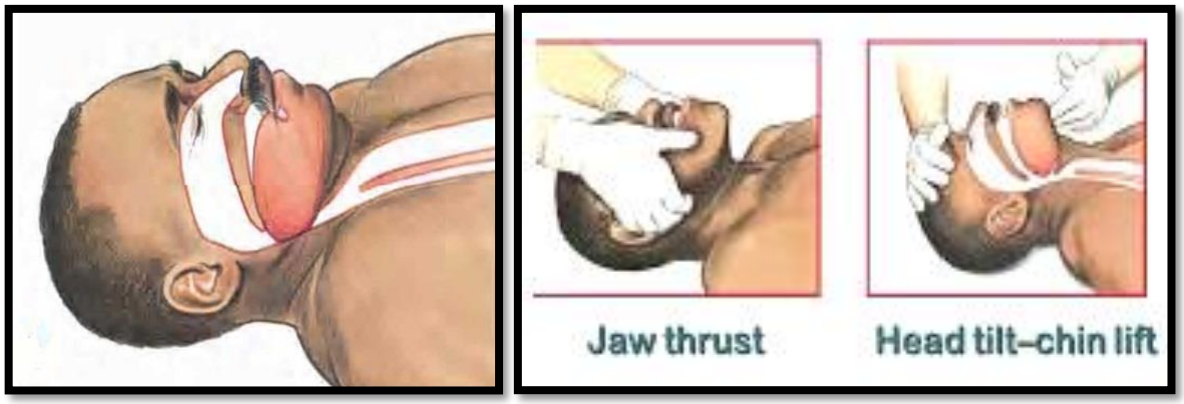
The highest priority in the initial assessment of the trauma patient is the maintenance of a patent airway because whatever the cause, obstruction of the patient's airway will rapidly lead to asphyxia. The most important early measure is to talk to the patient and stimulate a verbal response. A positive, appropriate verbal response indicates that airway is patent, ventilation is intact, and brain perfusion is adequate.

The most important factor controlling the patency of the airway is level of consciousness, a fully conscious patient is able to maintain an adequate airway even in the presence of severe disruption of the facial skeleton while 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.

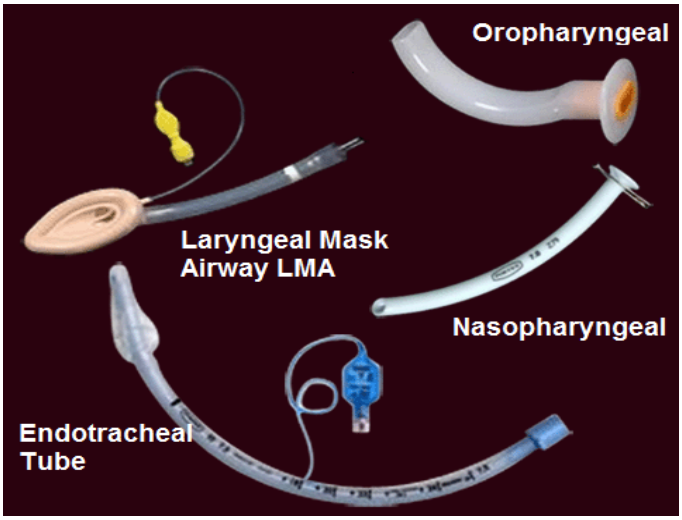
Patient's position plays a major role in prevention of airway obstruction and suffocation from bleeding and secretions, the patient with facial trauma should be placed in seating position or lying on the side (if you leave the patients facing towards heaven; it will not be long before they get there!!)

- **Airway maintenance techniques (in sequence):**

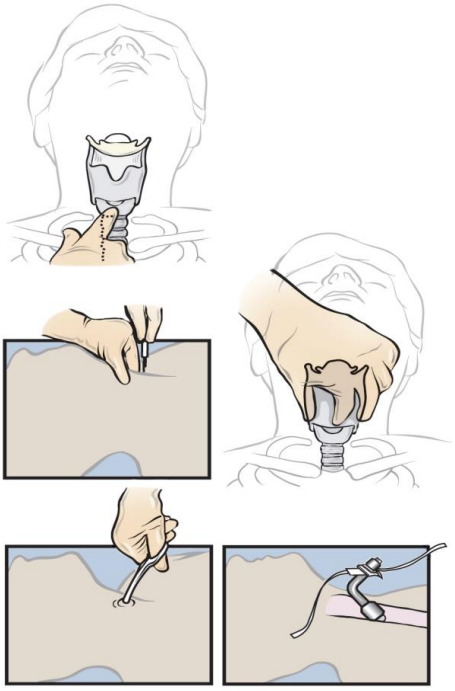
1- Careful examination and **clearance of blood, secretions, broken dentures and teeth** from oral cavity and oropharynx
2- Airway obstruction may follow collapsed maxillary or anterior mandibular fractures, it can be resolved by temporary reduction and stabilization of fractures with a (**stay or bridle wire**) around stable teeth on either side of the fracture.
3- By Simple maneuver as **Chin lift** or **Jaw thrust**: both techniques may be difficult to do in a conscious patient with mandibular fractures. Head tilt chin lift is used when spinal injury is excluded because of the head tilt in this maneuver. 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.



4- Insertion of **airway** (Oropharyngeal, Nasopharyngeal and Laryngeal mask airway (LMA)), but they are not well tolerated by conscious patients due to stimulation of gag reflex.
5- **Endotracheal intubation** is necessary to secure airway if the patient has more severe damage and cannot maintain the airway in compromised level of consciousness



6- 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.



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

The cricothyroidotomy procedure is relatively simple to perform and can be done under local anaesthesia, the key factor in the technique is identification of the cricothyroid membrane; the cricothyroid membrane is usually quite superficial and palpable. The skin and membrane are perforated with a scalpel blade then insert a standard tracheostomy tube.
The main complication of cricothyroidotomy is sub-glottic stenosis in children but it is effective and safe in adults.

Tracheostomy is generally regarded as obsolete in the emergency trauma setting. It is a relatively time-consuming procedure and is potentially unsafe. The trachea is deeper than the cricothyroid membrane and bleeding is more likely if the thyroid isthmus is encountered. For the inexperienced surgeon a surgical cricothyroidotomy is much quicker and safer to perform.
Tracheostomy still indicated in cases:

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.

In multiple injuries; **Spinal Immobilization** is initially required because of possible spinal injuries, and it is usually done by semi rigid collar or spinal board until damage is excluded by radiograph.

• Breathing and ventilation

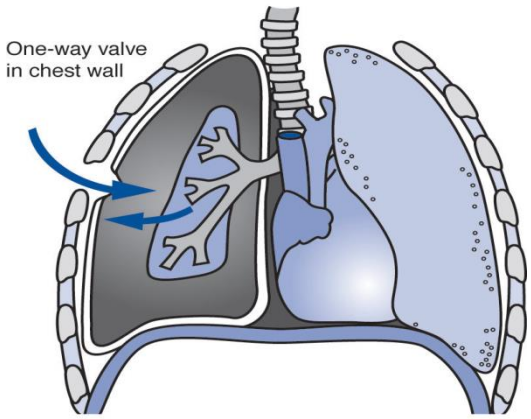
Airway patency alone does not ensure adequate ventilation – adequate gas exchange is required to maximize blood oxygenation and carbon dioxide elimination. Ventilation requires adequate function of the lungs, chest wall and diaphragm. A standard ***(look, listen, and feel)*** approach is often used to identify breathing difficulties.

- ***Look*** for:
  - The signs of hypoxia and agitation
  - Asymmetry of chest wall movement (flail segments)
  - Dilated neck veins (sign of increased intrathoracic pressure).
- ***Listen*** for: abnormal breath sounds as **stridor** (upper airway obstruction) and **wheezing** (lower airway obstruction).
- ***Feel*** for: warm air against your hand.

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.

- **Tension (closed) pneumothorax** develops when a chest wall injury allows air to pass into the pleural space but not out of it (a one-way valve). As a result; the accumulated air compresses the lung, impairs the lung function and increases the intrathoracic pressure enough to decrease venous return to the heart, causing shock. Treatment is immediate needle decompression by inserting a large-bore needle, followed by immediate chest tube insertion (see the figure below).
- **Open pneumothorax** is an unsealed opening in the chest wall; that compromise the respiratory process. The definitive management of the open pneumothorax is to place an occlusive dressing over the wound and immediately place an intercostal chest drain.

Tension (closed) pneumothorax



Hemothorax is the collection of blood in the pleural cavity.

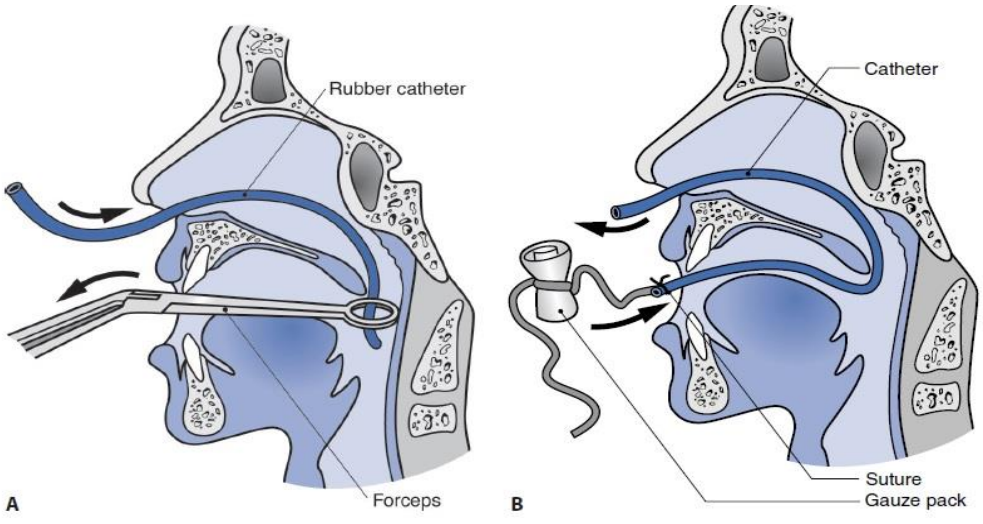
Flail chest occurs when three or more adjacent ribs are fractured in at least two locations, resulting in a freely moving segment of chest wall during respirations.

• Circulation and control of hemorrhage

Haemorrhage in the majority of fractures of the facial skeleton is not life-threatening and haemorrhagic shock is unusual. If shock is present this should immediately raise the suspicion of other injury.

1- Significant bleeding from external wounds (such as the scalp wounds) can be controlled by **pressure or suture bites with full thickness**, obvious bleeding vessels can be secured by **artery forceps** and **ligated** if possible.
2- Haemorrhage originates from a grossly displaced fractures of the mandible or midface can be controlled by **manual reduction** of the fracture and **temporary immobilization** either manually, or by means of a wire ligature passed around teeth on each side of the fracture line (‘bridle wire’).
3- Epistaxis is a consequence of injury to the central middle third of the face; this is usually stops spontaneously or controlled by **anterior nasal packs**. Profuse haemorrhage into the nasopharynx following injury to maxillary artery terminal branches in association with midface fractures is a common complication. A **postnasal (posterior nasal) pack** is needed in this situation as a matter of urgency. A variety of specifically designed **nasal balloons** or packs are now widely available. Usually the packs are left in situ around 24–48 hours.
4- Further interventions include **ligation of the external carotid and ethmoidal arteries** via the neck and orbit respectively. These steps are rarely required nowadays and are extremely difficult to undertake as emergency procedures. Due to the extensive collateral circulation of the face ligating a single vessel is unlikely to be successful.
5- **Superselective embolization** involves catheter-guided angiography used to identify bleeding points then using of a number of materials designed to stimulate clotting locally.

Posterior Nasal Pack placement



• Disability- assessment of neurological deficit

A rapid neurological evaluation is performed to assess the patient's level of consciousness. 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** respond to Verbal command.
- ✓ **P** respond to Painful stimuli.
- ✓ **U** Unresponsive.

The Glasgow Coma Scale is the international gold standard, which was developed in 1974, it has three variables: Best motor response, best verbal response and eye opening. The scores range from 3 (clinically dead) to 15, with a higher score representing an increased degree of consciousness.

Eye Opening		Verbal Response		Motor Response	
▪ Spontaneously	(4)	▪ Oriented	(5)	• Obeys commands	(6)
▪ To speech	(3)	▪ Confused	(4)	• Localizes pain	(5)
▪ To pain	(2)	▪ Words	(3)	• Normal flexion to pain	(4)
▪ None	(1)	▪ Sounds	(2)	• Abnormal flexion to pain	(3)
		▪ None	(1)	• Extension to pain	(2)
				• None	(1)

Patients with a head injury who had a GCS of 8 or less should be intubated (endotracheal intubation).

Pain stimulation is initiated gradually by pressing the nail tip with pen, the stimulus continues up to ten seconds.

If any of the three parameters could not been tested, then it should recorded as NT (not testable) as in swelling of eyelids prevent the eye opening or the tracheostomy prevent the verbal communication and so.

- **Exposure, Environment control and 'Eyes' (vision threatening injuries – VTI)**

Exposure:

- Means removing the clothes to ensure that no other injury is missed and it should be carried out in the emergency unit.

Environment:

- Special effort must be made to keep the patient from developing hypothermia during the early stages of trauma care by maintaining warm environment.

Eye: Vision threatening injuries:

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

- Sight or vision-threatening conditions: as Orbital compartment syndrome (retrobulbar odema and haemorrhage) and Loss of eyelid integrity. These injuries can be easily overlooked, especially if the patient has already been intubated.
- Orbital compartment syndrome is an acute emergency that may require decompression because of the compression and spasm of the posterior ciliary vessels that supply blood to the optic nerve leading to blindness.
- Visual assessment in the semi-conscious or unconscious patient is extremely difficult while in conscious patient it only takes a few seconds to assess the vision in each eye, by checking

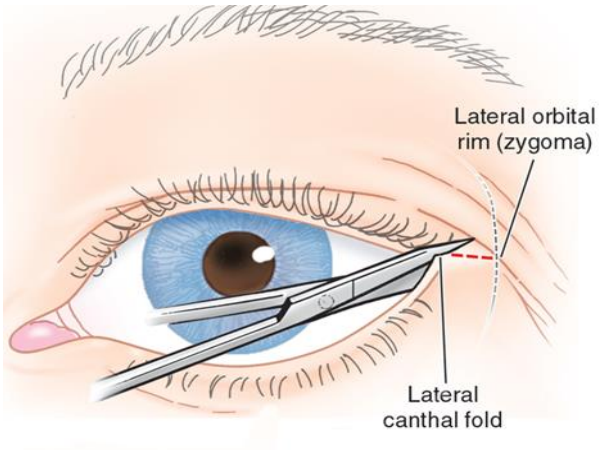
1- The pupil size.
2- Reaction to light.
3- Look for proptosis (protrusion of the eyeball) by palpation.

- **Signs and symptoms of retrobulbar haemorrhage:**

1. Pain
2. Decreasing visual acuity
3. Diplopia with developing ophthalmoplegia
4. Proptosis
5. Tense globe
6. Sub-conjunctival oedema/chemosis
7. Dilated pupil
8. Loss of direct light reflex (Relative afferent pupillary defect - RAPD)

- Surgical intervention can be done through a lateral canthotomy made with sharp scissors then blunt forceps inserted into the orbit between the inferior and lateral recti to enter the intraconal space to decompress the orbit.

Anatomical Note: Lateral canthal ligament: it is a fibrous ligament (Y shaped) attached to the tarsal plates (cartilaginous plates to support the upper and lower eye lids).



Phase 2/ Resuscitation:-

It includes CPR, IV fluids, hemostasis,…It is carried out with phase 1at the same time

Phase 3/ Secondary Survey:-

It does not begin until the primary survey (ABCDE) is completed and resuscitation efforts are well established, the patient is demonstrating normalization of **vital Signs (consciousness, pulse rate PR, respiratory rate RR and urine output UOP).**

It include head to toe evaluation of the patient, with full history that can be memorized as AMPLE (Allergy, Medications currently used, Past illness/ Pregnancy, Last meal, Events and Environment related to the injury).

Phase 4; Definitive Care:-

Finally the patient is admitted to the ward of specialty

This is the End of the Lecture – Good Luck