Management of craniofacial injuries: a primer for residents

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Abstract

Craniofacial injuries can occur in a significant proportion in traumatic brain injury patients and can be associated with many other concomitant life-threatening systemic injuries i.e. limbs fractures, chest injuries, spinal injuries and orbital injuries. An understanding of the presentations of craniofacial injuries, associated systemic injuries and patterns of traumatic brain injuries is crucial for improving care, survival and recovery of these patients. In present article we discuss the approach to craniofacial injuries which is based on time tested principles of surgery a good understanding of surgical anatomy, detailed history, accurate yet elaborative clinical evaluation, appropriate radiological investigations and decision to select management protocol for a given case. Evaluation of these patients should include a coordinated and systematic examination to aim to evaluate of all areas and all the residents

while examining these patients in emergency room should remember that facial swelling, altered sensorium, restless patient, presence of endotracheal and nasogastric tube can obscure the detail examination and distort the facial appearance.

Key words: craniofacial trauma, maxillofacial Injuries, traumatic brain injury, head injuries.

Introduction

Craniofacial trauma is one of the most challenging injuries that are posed by pre-hospital care providers and personnel's involved in emergency care. (1) These injuries can not only be life-threatening (as these can compromise airway or can cause significant hemorrhage) but also cause disfigurement. (2, 3) In present article we discuss the approach to craniofacial injuries which is based on time tested principles of surgery a good understanding of surgical anatomy, detailed

history, accurate yet elaborative clinical evaluation, appropriate radiological investigations and decision to select management protocol for a given case.

Etiology

Craniofacial injuries can be life threatening (involvement of airway i.e. blood in oral cavity or in nose, injuries to neck vessels i.e. carotid and vertebral arteries or injuries to the brain and spine) requiring special attention or can be aesthetically significant. A number of etiologic factors (ranging from road traffic accidents to assaults), demographic properties and fracture patterns have been identified which varies widely (due to social, economic, cultural consequences) in different regions of the world. (4-8) Leading cause of facial injuries include motor vehicle accidents, pedestrian collisions, stumbling, sports injuries, industrial accidents, assaults and warfare injuries. (9-13) However all the patients may not be attended by a singly facility i.e. may go to emergency room, may go to craniofacial faculties or may be seen by a neurosurgeon depending on the complexities of their injuries. (1, 14-16)

Clinical evaluation

Craniofacial skeleton can be divided into upper third (above superior orbital rim), middle third (midface- superior orbital rim down through maxillary teeth) and lower third – mandible. It is mainly composed of frontal bone, temporal bones, nasal bone, zygomas, maxilla and mandible. In addition ethmoid, lacrimal, sphenoid bones contribute to inner part of the orbits. (17) Facial injuries can be categorized into soft tissue injuries, skeletal

injuries and a combination of both. Like any other discipline of medicine clinical evaluation start with details history taking. The details which need to be included are the mechanism of injury, any history of loss of consciousness, any history of previous medical or surgical disease. The detail history should include in what circumstances injury has occurred, ask details about the direction of the impact and speed of the vehicle.

Physical Examination

Detail physical examination include careful but gentle palpation, assessment of mobility of bone fragments, and numbness or paresthesia, occlusal malfunction, assessment of integrity of the mandible, detail ocular examination including test for visual acuity (Table 1). (18-20) One need to remember that in injuries to the facial skeleton are of special concern as these can be a marker for substantial transfer of energy to the intracranial contents. (21)

Associated injuries

Craniofacial injuries can be associated with many other concomitant life-threatening systemic injuries i.e. cranial trauma, limbs fractures, chest injuries, spinal injuries and orbital injuries. (22-30) Evaluation of these patients should include a coordinated and systematic examination to aim to evaluate of all areas, local or general, in order not to miss any of the injuries. All the residents while examining these patients in emergency room should remember that facial swelling, altered sensorium, restless patient, presence of endotracheal and nasogastric tube can obscure the detail examination and distort the facial appearance.

TABLE 1
Key findings to suspect craniofacial injuries of physical examination

Type of injury	Examination findings
General considerations	<ul style="list-style-type: none"> • Facial asymmetry or deformity • Local tenderness • Abnormal facial instability • Step-offs • Periorbital edema or crepitus • Infraorbital numbness • Epistaxis • CSF rhinorrhea or otorrhea • Epiphora • Exophthalmus or enophthalmus • Nasal septum for position, integrity • Any evidence of septal hematoma
Epistaxis	Mucosal disruption Disruption of the membrane of maxillary sinus
Abnormal occlusion	Mandibular fracture preventing normal movements
Malar fracture	Infra orbital/upper lip numbness on the affected side The affected side of face may be flattened Periorbital edema Ecchymosis of the lower lid Lateral sub-conjunctival hemorrhage
Zygomatic arch fractures	A dimple palpable on the arch Local tenderness Restricted range of mouth opening
Ocular injuries	Suggest midface trauma Check for ocular integrity Telecanthus Orbital muscle/nerve entrapment Check extraocular motility Test visual acuity and visual fields Check pupillary light reflex
Cranial nerves	Details neurological examination (including motor and sensory divisions) of all 12 cranial nerves
Traumatic brain injury (suspect intracranial hemorrhages, cerebral contusion or laceration, or skull fractures)	History of vomiting Loss of consciousness Low Glasgow Coma Scale

Investigations

Apart from the basic blood investigations (e.g. Hb, PCV, ESR, WBC estimations) the

specific radiological investigations depend of the clinical indications and include plain radiographs, CT scan and on MRI.

Plain radiographs

Plain radiographs have a limited role (less sensitivity to detect fractures of the skull base and facial skeleton) in the radiological evaluation of facial injuries and include skull radiographs (lateral as well as postanterior view), panorex radiographs (to evaluate the mandible), submentvertex view (to evaluate the zygomatic arch) cervical spine examination. While reading the radiographs a systematic approach (How the orbital outline, sinuses is are clear or is there any opacification or fluid levels suggestive of a fracture) will help to identify the facial fractures.

Computed tomography (CT scan)

Recently with the development of multislice CT and with significant technical advancement computed tomography (CT) has become the primary modality of imaging. CT scan detects cranio- facial injuries in detail and can help to exclude intracranial hemorrhages and can assess, identify and classify associated bone injuries. (31, 32) CT scan can also help to differentiated fracture in anatomically difficult areas which cannot be seen on conventional radiographs (e.g., the orbits, the naso-orbito-ethmoidal complex, the peri- and retroorbital skull base and the retro- maxillary region). (24, 33) CT scan has the additional advantage that it can be extended to the cervical spine (if necessary whole spine, thorax and abdomen) in an unstable with polytrauma. CT scan also has the capacity to evaluate the facial skeleton in axial and coronal planes. (Hassfeld et al. 1998; Gellrich et al. 1999, 2003) Computer assisted multiplanar reformatting allows to detect or exclude basal skull fractures, optic canal, orbital floor, maxilla, palate, and

mandible fractures as well as the extent of different dislocations. (34, 35)

Magnetic resonance imaging (MRI)

MRI may be used to investigate diffuse axonal injuries and in evaluating complications (i.e. CSF rhinorrhea). (36) MRI and MR angiography is helpful for the investigations of skull base trauma in cases of carotid-cavernous sinus fistula. MRI has a limited role particularly in a polytrauma patient with traumatic brain injury as it is more time-consuming than CT and much less effective in detecting fractures than CT. Presence of cardiac pacemakers and other implanted metals and electronic devices further limiting factors to perform an MRI.

Management***Initial management***

The initial management of any patient with the clinical suspicion of craniofacial who comes to the emergency room follows standard protocol i.e. airway management, breathing and circulation. Once the general condition of the patient is stabilized further investigations and appropriate surgical intervention can be planned (Table 2). Maintenance of the airway in of primary importance (adequate suction, removal of nay foreign bodies or blood clot from the oral cavity), chin lift or jaw thrust to prevent tongue fall, pulling of the maxilla forward to disimpact the fracture, endotracheal intubation (or laryngeal mask airway) and if all these measures fail or not possible than an option to provide surgical airway needs to be considered (i.e. cricothyroidotomy or

tracheostomy). While securing the airway look for any active source of bleeding (injury to the major neck vessels, massive midface fractures, extensive scalp lacerations etc.) and take adequate measures to control the bleeding (i.e. local pressure application or suturing the scalp lacerations).

TABLE 2**Summary of initial resuscitation approach and management**

Primary Survey	<ul style="list-style-type: none"> Allows rapid assessment of vital functions (pulse, blood pressure and oxygen saturation) and help to identify life-threatening conditions
Airway & breathing	<ul style="list-style-type: none"> Assessment for airway patency Noisy breathing (gurgling or high-pitched noises) suggests partial airway obstruction Look for any broken or avulsed teeth Look for any fragments of loose bones Look for vomitus or blood in oral cavity Look for any tongue fall
Circulation	<ul style="list-style-type: none"> Look for any source of massive bleeding scalp lacerations Severe midface fractures may result massive blood loss Look for any associated injuries (hemothorax, hemoperitoneum, long bone fractures etc.)
Disability	<ul style="list-style-type: none"> Assess of the patient's Glasgow Coma Scale (GCS) score Any neurological deficits
Secondary Survey (see Table 1)	<ul style="list-style-type: none"> It should be performed once the primary survey is complete and life-threatening conditions have been ruled out or managed A complete head-to-toe assessment so no injuries should be missed

TABLE 3**Basic principal for the management of facial injuries**

<ul style="list-style-type: none"> Never shaved eyebrows Repair with precise attention to the normal shape and borders (lips, nose and eyebrows) Accurately restored the bony framework and soft tissue of the nose Nasal septum hematoma needs surgical draining as it can cause dissolution of the septal cartilage Epistaxis can be controlled with head end elevation, cold compression and if necessary internal compression <ul style="list-style-type: none"> While managing fractures either it should be done before a significant edema is develops or once the edema is resolved (5-7 days after the injury)
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Surgical intervention

Once the patient general condition is stabilized, all the life threatening injuries are taken care off and a thorough clinical examination has been performed to rule out any intracranial injuries, surgery can be planned for facial injuries. Before planning for surgery identifies the extent of injuries i.e. whether these are soft tissue injuries (contusions, abrasions, puncture wounds, lacerations or abrasions) or involve the facial skeleton (fractures of different bones) or it is a combination of both. The purpose of surgical intervention is to regain the function with good aesthetic outcome (Table 3). Open facial wounds need thorough cleaning, meticulous approximation, conservative debridement and if necessary graft to cover the raw surfaces. Fractures will need rigid fixation of the fragments (by bone mini-plates and screws) to achieve perfect reduction, alignment and also needs good soft tissue cover and adequate time for bone healing to get completed.

Conclusion

Craniofacial injuries can occur in a significant proportion in traumatic brain injury patients and these will require prompt diagnosis and management. The management of these injuries is a challenge which is faced by residents in emergency room. An understanding of the presentations of craniofacial injuries, associated systemic injuries and patterns of traumatic brain injuries is crucial for improving care, survival and recovery of these patients.

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