Pediatric maxillofacial trauma in Upper Egypt, aprospective study

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ABSTRACT

Background: Trauma in children is the most frequent injury seen in the Emergency Department leading to morbidity and mortality. Maxillofacial fractures occur in a significant proportion worldwide and the incidence of maxillofacial pediatric trauma is less compared to adults. However, they may lead to serious complications. The aim of this study is to study the incidence and pattern of pediatric maxillofacial trauma in Upper Egypt and to determine the management of this trauma as regard as bone and soft tissue injuries.

Methods: This study was a prospective study which was conducted at Maxillofacial / Head and Neck Surgery Unit of General Surgery Department in Sohag University Hospitals. The study includes patients with maxillofacial trauma less than 16 years during the period from April 2017 to April 2018. Medical records of 63 pediatric patients were reviewed during this period. Relevant data in relation to demographics, age, sex, etiology/mechanism of injury, pattern and distribution of injuries and associated injuries were collected associated with discussing the treatment protocols. All the patients were treated by conservative approaches, except those in whom surgical interventions were mandatory according to the guidelines.

Results: Patient age ranged from 2 to 16 years with a range (median) 7 years. The mean age is 8.21 years. The male: female ratio was 3.5: 1. The Group C (6 to <12 years group) was the most common group to be injured by 25 patients (39.68%) and the group A (1 to <3 years group) was the least group to be injured by 2 patients (3.17%). The most common cause of maxillofacial injuries was falling from highet (FFH) with 37 (58.73%) patients, followed by motor car accident (MCA) affecting 20 (31.75%) patients. Mandibular fractures were found to be highest incidence with (49.38%) followed by Midface fractures with (24.69%). The soft tissue injuries were associated the pediatric maxillofacial trauma were found to be 22.22% of all cases. All the fractures were healed successfully.

Conclusions: The FFH were the main cause. Males and parasymhesial fractures have the highest predominance. The treatment choice of pediatric fractures (conservatively or surgically) is chosen according to guidelines. Pediatric fractures must be followed longitudinally to avoid post-traumatic complications.

Keywords: Pediatric, Maxillofacial injuries, Fall, Mandible, Fracture, Upper Egypt

INTRODUCTION

Trauma in children is the most frequent injury seen in the Emergency Department leading to morbidity and mortality. *(1),(2)*

Trauma is defined as an injury of the body resulting from an external force and is one of the leading health problems that people are facing. *(3)*

Maxillofacial fractures occur in a significant proportion worldwide and can occur as an isolated injury or in combination with other severe injuries including cranial, spinal, and upper and lower body injuries requiring prompt diagnosis with possible emergency interventions. *(4)*

Children are more susceptible to craniofacial trauma due to their greater cranial mass-to-body ratio. The incidence of pediatric facial fractures

ranges from 1 to 14 % in children under 16 years and 0.87–1 % in those younger than 5 years. [5]

METHODS

This study was a prospective study which conducted at Maxillofacial / Head and Neck Surgery Unit of General Surgery Department inSohag University Hospitals, in the period from April 2017 to April 2018.

A full history data were taken from all patients or their parents including items of the personal history as name, age, sex and address. These data also included mode of trauma that was categorized into FFH, MCA, assault from others, animal kick and sport related injuries. The patients were categorized into 4 groups according to their ages:

Group A (1 to <3 years), Group B (3 to <6 years), Group C (6 to <12 years), and Group D (12 to ≤16years).

All of these patients were brought to the ED (emergency department) of Sohag University Hospitals by their relatives and full resuscitation was done according to ATLS protocols. Clinical examinations were performed for all patients and were assessed by investigations either laboratory or radiological that were done especially for poly-traumatized patients.

Classification of maxillofacial injuries:

Type of maxillofacial injuries that were recorded categorized into soft tissue injuries and maxillofacial fractures.

The fractures are classified into mandibular, midface, fronto-orbital fractures and dento-alveolar fractures:

- The **mandibular fractures** were subdivided according to ***Killey***[6] into condyle, ramus, angle, body, symphyseal and parasymphyseal.
- The **midface fractures** were also classified as Le Fort I, II, and III types, zygomatic complex, naso-orbital-ethmoidal (NOE) and nasal fractures.
- The **fronto-orbital fractures** include frontal bone fracture, lateral orbital wall fracture, medial orbital wall fracture, supra-orbital wall fracture and infra-orbital wall fracture.
- **Dento-alveolar fractures.**

Concomitant injuries:

Facial fractures usually result from severe trauma, so it is not surprising that there are often associated injuries. Associated injuries include Neurocranial, Ophthalmological, Cardiothoracic, Orthopedic or Abdominal injuries.

Plan of treatment:

When formulating a plan of treatment for pediatric patients with facial trauma, a number of elements must be considered. These include:

1. The age of the patient:
2. The anatomic site:
3. The complexity of the injury:
4. The time elapsed since injury:
5. Concomitant injury:
6. The surgical approach (if intervention is required) :

Postoperative evaluation:

Post-operative evaluation and follow up is very important in pediatric population due to good healing power and crucial complication that may occur such as infection, wound dehiscence, malocclusion and TMJ ankylosis.

Follow up of our patients was done at 7^{th}, 15^{th}, 30^{th} days and at end of 2^{nd} month and end of 3^{rd} month, in outpatient's clinic of Maxillofacial / Head and Neck Surgery Unit of General Surgery Department inSohag University Hospitals.

All these previous data were recorded, tabulated and statistically analyzed.

Inclusion criteria:

All patients with maxillofacial trauma either isolated or associated with other injuries, will be eligible for the study.

Exclusion criteria:

Patients with maxillofacial trauma above 16 years.

RESULTS

Fractures were treated either by conservative management (observation) or surgical management according to the guidelines, depending on the diagnosis, patients' ages, and the associated clinical findings. The surgical intervention included closed reduction with mono-fixation, or maxillo-mandibular fixation (MMF). The open reduction and internal rigid fixations (ORIF) were used when they are mandatory.

Age and gender distribution:

In our study, out of 63 patients treated in our unit, there were 49 (77.78%) males and 14 (22.22%) females, with male: female ratio was 3.5: 1.

The group A (1 to <3 years group) was the least group to be injured by 2 patients (3.17%), and in group B (3 to <6 years group) the number of patients was 19 patients (30.16%), Group C (6 to <12 years group) was the most common to be injured by 25 patients (39.68%) and lastly the number of the patients in group D (12 to ≤16years group) was 17 patients (26.98%).

Mode of trauma:

The most common cause of maxillofacial injuries was falling from highet (FFH) with 37 (58.73%) patients, followed by motor car accident (MCA) affecting 20 (31.75%) patients, animal kick 3 patients (4.76%), sport related injury 2 patients (3.17%) and assault from others was 1 patient (1.59%).

Address distribution:

A total of 63 patients were treated at in our unit, 45 (71.43%) patients from Sohag governorate, 14 (22.22%) patients from Qena governorate, and 4 (6.35%) patients from Aswan governorate.

Concomitant injuries:

We found in our study that abdominal surgical injuries is the most common associated injuries with maxillofacial injury in pediatric population, most of these injuries that were found in 11 (17.46%) patients in the form of intra-abdominal collection. The second most common associated injury was orthopedic injury in 9 (14.29%) patients, then Neurosurgery in 8 (12.70%) patients, Cardiothoracic in 2 (3.17%) and finally one patient (1.59%) with ophthalmic injury .

Type of Injuries:

We found in our study that out of 63 patients that,

- Isolated soft tissue injuries were in 8 (12.70%) patients.
- Forty-nine (77.78%) patients had isolated fractures.
- All the rest of the injuries 6 (9.52%) patients were combined soft tissue and hard tissue injuries.

Anatomic location of fractures:

There were 81 fracture sites in 55 patients treated during the period studied. Mandibular fractures were the most common fractures with 27 subjects sustaining 40 (49.38%) mandibular fractures, followed by 20 (24.69%) midfacial fractures, 14 (17.28%) fronto-orbital fractures and the least common fractures were dento-alveolar fractures by only 7 (8.64%) fractures.

Types of mandibular fractures:

We found that the parasymphyseal fracture was the most common mandibular fracture by 18 fractures (45%) followed by Condyle by 9 (22.50%), Symphysis 5 (12.50%), Angle 4 (10%), body 3 (7.50%) and ramus 1 (2.50%) with no coronoid fracture.

Types of Mid face fractures:

We found that the nasal fracture was the most common midfacial fracture by 10 fractures (50%), ZMC by 6 (30%), Le fort III by 2 (10%), Le fort I 1 (5%), NOE by 1 (5%) and no cases with Le fort II fracture.

Types of Fronto-orbital fractures:

We found that that Supraorbital fracture was the most common fronto-orbital fracture by 6 fractures (42.86%) , followed by Infraorbital fracture by 5 fractures (35.71%) , Frontal bone by 2 (14.29%) and lateral orbital wall fracture by 1 (7.14%) .

Management of soft tissue injury:

All of the patients with soft tissue injuries 14 (100%) whether isolated injury or combined with fracture were managed by suturing.

Treatment of Pediatric Facial Fractures:

Out of a total of 81 fractures, 23 fractures (28.40%) were managed conservatively and 8 fractures (9.88%) required open reduction and internal fixation (ORIF) only whereas 19 fractures (23.46%) were managed by maxillo-mandibular fixation. While, 17 fractures (20.99%) were managed by combination of ORIF and MMF and titanium mesh was used in 4 (4.94%) fractures. 6 fractures were managed by Arch bar and out of 10 nasal fractures, 4 fractures were managed by CR (Figure 7) (Table 6).

Postoperative complications:

By follow up, Out of 63 patients, just 3 patients suffered from complication postoperatively. 2 (3.17%) patients of them were with infection and one (1.59%) patient was with malocclusion (Figure 8).

DISCUSSION

Children are more susceptible to craniofacial trauma due to their greater cranial mass-to-body ratio. The incidence and etiology of CMF trauma are affected by age-related activities, so the incidence of pediatric facial fractures ranges from 1 to 14 % in children under 16 years and 0.87–1 % in those younger than 5 years. [5]

The predominance of males with the pediatric injury that represents in 49 (77.78%) patients out of 63 patients with male: female ratio was 3.5:1 is in agreed with earlier studies of facial injuries [7],[8]and[9]. Etiology and incidence of maxillofacial injuries tend to vary from one country to another, perhaps because of the differences in social, cultural, and environmental factors. [8]

In our study, FFH was responsible for (58.73%) of pediatric maxillofacial injuries and was the main cause for pediatric maxillofacial trauma in Upper Egypt. This is agree with other public studies as[8], [5]and [10]. In contrast to adults, interpersonal violence is a rare cause of facial fractures in children and represents in one patient (1.59%) out of 63 patients. These injuries occur more commonly in adolescents. [11]

There were 3 (4.76%) patients in whom the fractures were caused by animal injuries. These cases occurred in rural areas, where the children interact with farm animals which present in their environment. This is in agreement with previous studies [12], [13]and [14].

In our study , **abdominal surgical** injuries is the most common associated injuries with maxillofacial injury in pediatric population, most of these injuries that were found in 11 (17.46%) patients in the form of intra-abdominal collection and one patient from these undergo splenectomy that indicated high velocity injury that impact this patient . The second most common associated injury was **orthopedic** injury in 9

(14.29%) patients, then **Neurosurgery** in 8 (12.70%) patients, **Cardiothoracic** in 2 (3.17%) and finally one patient (1.59%) with **ophthalmic** injury in the form of rupture globe.

Initial evaluation and resuscitation were performed in accordance with Advanced Trauma Life Support (ATLS) protocols, Developed in 1978 to ensure uniformity in the triage and treatment of injured patients. [15]

ATLS consists of 5 basic principles:

(1) Assessment of airway, breathing, circulation, disability, and exposure; (2) do no harm;(3) Early treatment of life-threatening injuries;(4) Frequent assessment; and (5) Surgeon maintenance of a high index of suspicion for injuries. [16]

In our study, we found that isolated soft tissue injuries like abrasions and lacerations without bony involvement were there in 8 (12.70%) patients, and 6 (9.52%) patients had combined soft tissue and hard tissue injuries. So percent of soft tissue injury in pediatric trauma is 22,22% and this is agree with other study as [8] that reported soft tissue injury in 26% and [12] that reported soft tissue injury in 10.57% of their cases. .All of these patients were managed according to guidelines by suturing primarily under general or local anesthetization after the classic routine procedures of cleansing the wound and removing any particles from the dermis, tetanus immunization and excision of contused wound margins with administration of antibiotics.

Regarding the bony fractures, there were 81 facial bones fractures in 55 patients (87, 3%). There were some patients had more than one fracture.

In our study, mandibular fracture is accounted for the most common facial bone fracture encountered in 27 subjects sustaining 40 (49.38%) mandibular fractures. This is agree with other public studies as [12], [7],[8], [17], [18], [11], [19], [20], [21]and [22]. Followed by 20 (24.69%) midfacial fractures, 14 (17.28%) fronto-orbital fractures and the least common fractures were dento-alveolar fractures by only 7 (8.64%) fractures. But, in other studies counted that the dentoalveolar fractures had the highest incidences of facial fracture as in [3] and [10].

Our study doesn't conflict with these studies because of many reasons as dentoalveolar fractures are the simplest maxillofacial fractures and could be managed by Eric Arc bars that don't required management in experienced tertiary center like our center. Also, [23] reported that dentoalveolar fractures was (12.3%) in Jordanian pediatrics and this percent is similar to our study.

We found that the parasymphesis was the most location to be fractured in the mandible by 18 fractures (45%) from the mandibular fractures followed by condyle that was reported in 9 fractures (22.5%) , then symphesis by 5 fractures (12,5%).

Many studies reported that the condylar region is the most frequent fractured site in mandible as [12]and [3].

Conservation was used for 23 (28.40%) fractures, followed by 36 (44, 45%) fractures were managed by MMF, 17 (20.99%) fractures from these were managed by combination with ORIF, 8 (9.88%) fractures were managed by only ORIF and titanium mesh was used in management of 4 (4.94%) fractures.

Many authors agree that the treatment of pediatric fractures should be conservative, because ORIFs have adverse effects on skeletal growth and unerupted teeth; another surgery is also needed for plates removal. [24]

Despite that others advocate the use of open reduction to provide a quick management, avoid a period of MMF, and prevent the presence of any discrepancy or TMJ ankylosis. [18]

In our opinion and as revealed from our results, the management of pediatric facial fractures could be detected according to the degree of displacement of the fracture and the age of the patient.

The conservative treatment or closed technique methods provide good results when used for minimally displaced fractures. It is (conservation or closed technique) the treatment of choice.

Postoperative complications such as infection, osteomyelitis, nerve injuries, non, and malunion, or major occlusal discrepancies were not recorded in this study except 2 (3.17%) patients with infection postoperative and 1 (1.59%) patient with malocclusion that treated conservatively by persistence of MMF with elastics for another 2 weeks.

Conclusion

- Injuries in Maxillofacial trauma are relatively uncommon in children. As age increases, the severity of injuries sustained also increases.
- In our study, boys more commonly sustained maxillofacial injuries (77.78%) compared to girls (22.22%) possibly due to more outdoor activities by boys.
- Our study showed that the incidence of maxillofacial fractures in children peaked in the 6 to <12 years group.
- The most frequent cause was accidental fall (58.73%), followed by RTAs by (31.75%). Increased incidence of falls seen in our study could be attributed to the vast majority of the area of the Upper Egypt being rural with low socio-economic status and parental neglecance.
- The most common bone to be fractured was the mandible in our series (49.38%). Of these, 45% of the fractures were found in the parasymphyseal region and 22.50% in the condylar region.
- Most of the fractures were neither severe nor complicated and were followed-up by observation only followed by closed reduction with conventional means like maxillomandibular fixation by Eric Arch bars, whereas surgical intervention was reserved for only severely displaced fractures.
- Pediatric patients with maxillofacial fractures must be followed longitudinally for the management of RMOs and late complications such as TMJ dysfunctions or growth disturbances.

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