Maxillofacial Injuries in Children: A 10 year Retrospective Study

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Abstract

Objectives Fractures of facial bones in children are relatively uncommon although both children and adults are subjected to similar types of injuries. This study aims to evaluate the epidemiology of facial bone fractures among children under 14 years, their management and outcome.

Materials and Methods This retrospective study included maxillofacial injuries treated in 112 children under 14 years admitted due to maxillofacial injuries during the period from 2001 to 2011.

Results Of them ten (8.93 %) were below 5 years, 44 (39.29 %) between 6 and 10 years and 58 (51.78 %) between 11 and 14 years of age. Male to female ratio was 1.8:1. Fall from a height was the most common etiology. The most common jaw involved in the fracture was the mandible. Conservative management was done in 83.04 % of cases and open reduction and internal fixation was performed in 16.96 % of cases. Five (4.46 %) cases accounted for post-operative wound infection.

Conclusion Fracture of the mandible is the most common maxillofacial injury in children, most often caused by fall from a height. The osteogenic potential of the mandible in children leads to conservative management of these fractures. Opportunities for prevention of maxillofacial trauma

should be taken into consideration by parents and care takers.

Keywords Trauma · Pediatric · Maxillofacial injuries · Mandible · Non-surgical measures

Introduction

Trauma in children is the most frequent injury seen in the emergency department leading to morbidity and mortality [1]. Trauma is defined as bodily injury resulting from an external force [2] and is one of the leading health problems that children are facing. Dento-alveolar and soft injuries account for majority of the pediatric maxillofacial injuries but the frequency of facial fractures are considerably low [1–6].

Children are more susceptible to craniofacial trauma due to their greater cranial mass-to-body ratio [7]. 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. The incidence of facial fractures in children in India is 5.5 % [2]. The reduced incidence of facial fractures in children when compared to adults is probably due to the flexibility of the facial bone, lack of pneumatization of the paranasal sinuses and protection of the malar region by the prominent buccal pad of fat in infants [8]. Young children are less often involved in occupational or violence related accidents which are typical causes of adult facial fractures [7].

Trauma to the facial region is especially significant because of the conspicuous location of the human face, its esthetic importance and psychological image adversely affecting important functions like speech, mastication, respiration and deglutition [9]. The common etiologies are

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fall from a height, road traffic accidents, sports injuries and physical assault. Diagnosis is mainly based on clinical and radiographic examinations. The objective of trauma management in children involves managing the soft tissues, bone trauma and combination of the two besides emergency care of life threatening injuries [9]. This study was conducted to analyze the data collected pertaining to children who sustained maxillofacial injuries.

Materials and Methods

A retrospective study of pediatric patients with maxillofacial injuries was carried out for a period of 10 years from 2001 to 2011 at the Department of Pedodontics and Preventive Dentistry and Oral and Maxillofacial Surgery of Modern Dental College and Research Centre, Indore, India. Data collected for medical history included signs displayed by patients and results of clinical and radiological examinations. Those with isolated soft tissue injuries were excluded from study as many of them had only minor injuries and were treated in the out patient department which had poor follow-up. Records of these patients were studied for age, gender distribution, etiology and type of injuries, treatment and outcome and were analyzed. For comparison the existing literature related to pediatric facial bone fractures were reviewed.

Results

The incidence in relation to age is shown in Fig. 1. Out of 112 children with facial bone fractures 102 were above 5 years of age accounting for 91.07 % of the total. It can be seen that children in the 11–14 years age group were more commonly involved with a peak incidence at 12 years. Gender distribution shows that 72 (64.29 %) were males and 40 (35.71 %) were females with a male to female ratio of 1.8:1 (Fig. 2). The etiology of each injury was recorded from the patients' case files and mode of injury noted (Fig. 3). Fall from a height was the most frequent etiology accounting for 71.42 % of cases, followed by sports injury (15.17 %) and road traffic accident (10.71 %). Others injuries such as physical abuse and assault accounted for 2.68 % (Fig. 3). Dentoalveolar fractures including maxilla and mandible were the most common fractures encountered accounting for 40 % of cases. Table 1 shows mandible was most commonly involved accounting for 89.29 % while involvement of maxilla was 10.71 %. Table 2 shows that in mandibular fractures after dentoalveolar fractures (35.95 %), parasymphysis was most commonly involved accounting for 26.8 % followed by condylar and subcondylar fractures (18.95 %), angle, body

Fig. 1 Age group distribution

Fig. 2 Gender-wise distribution

and ramus (12.42 %) with symphysis being the least accounting for only 5.88 %, One patient had zygoma fracture besides mandibular fracture. Two patients had clinical and/or radiological evidence of head injury. Intermaxillary fixation alone was done in 29 cases mainly those with condylar and subcondylar fractures. Intermaxillary fixation by direct or eyelet wiring was done in 83 (74.11 %) cases of dentoalveolar, symphysis and parasymphseal fractures. Miniplate with arch bars was done in 19 (16.96 %) cases to reduce and fix badly displaced fractures of angle and ramus of mandible mainly at the lower border of the mandible. In children under 5 years (8.93 %) and those with mixed dentition, in whom wiring and arch bars could not be placed were reduced and

Fig. 3 Mode of injury

Table 1 Jaw involved in injury

Sl no.	Jaw involved	No.	Percentage
1	Mandible	100	89.29
2	Maxilla	12	10.71

Table 2 Pattern of mandibular fracture

Sl no.	Site of fracture	No.	Percentage
1	Dentoalveolar	55	35.95
2	Parasymphysis	41	26.8
3	Condylar and subcondylar	29	18.95
4	Angle, body and ramus	19	12.42
5	Symphysis	9	5.88
	Total	153	100

Table 3 Literature review

Study	Continent	Country	Years	No. of pt.	Etiologies				Ratio	
					RTA (%)	Falls (%)	Sports (%)	Others (%)	M (%)	F (%)
Karim et al. [9]	Asia	India	3	45	28.8	53.3	6.6	11	66.6	33.3
Kumarswamy et al. [2]	Asia	India	5	95	30	41	22	5	65.1	35.9
Gassner et al. [1]	Europe	Austria	10	381	30	24	17	29	66	34
Holland et al. [8]	Australia	Sydney	4	46	63	17	0	20	67	33
Qudah et al. [12]	Middle east	Jordan	5	227	20	52	8	20	70	30
Wymann et al. [7]	Europe	Switzerland	3	291	22	64	9	5	60	40
Posnik et al. [14]	USA	Washington	4	137	50	23	20	7	63	37
Bamjee et al. [15]	Africa	South Africa	4	326	29	23	0	48	70	30
Present study	Asia	India	10	112	10.71	71.42	15.17	2.68	64.29	35.71

immobilized by cap splints made of acrylic and retained by cementation, circum-mandibular, circum-maxillary or circum-zygomatic wiring. Post-operative wound infection was seen in 5 (4.46 %) cases of compound fractures in whom plating was done. Table 3 shows comparative findings with relevant studies worldwide.

Discussion

Facial bone fractures in children under 5 years are infrequent as most children live a relatively protected existence with close adult supervision, strict limitations on their physical environment and constant safeguards to limit injury. Although falls from limited heights are frequent the momentum gained by the child's small body is of a low velocity. These low-impact forces can usually be absorbed by their well-padded skin, elastic skeleton and cartilaginous growth centers. In our study we observed that 8.93 % of children with facial bone fractures were <5 years of age. However, the fractures are more common after 10 years of age as there is rapid progression of neuromotor development which results in a general desire for independent activity, more frequent social interactions with other children, and a wider range of activities outside the house, with less stringent parental and adult supervision. These factors result in increased opportunity for direct facial trauma. The incidence of facial bone fractures were 39.29 and 51.78 % among children 6–10 years and 11–14 years respectively. In this study, the most common involved age group is 11–14 years. The comprehensive study on this subject was conducted first by Rowe et al. [10].

The predominance of males over females with a ratio of 1.8:1 is mainly due to boys being generally more aggressive and spending more time in outdoor activities compared to girls. In similar series, Holland et al. [8] reported that 3 % of children presenting to the emergency

department with facial trauma, had a 2:1 male to female ratio. This was in accordance with earlier studies [1–15].

Fall from a height was the most common cause of these injuries accounting for 71.42 % in our study. This finding was similar to previous studies [1, 2, 7, 9, 12], however Holland et al. [8], Posnik et al. [14] and Bamjee et al. [15] reported that road traffic accident is the most common cause. Gassner et al. [1] reported that majority of accidents occurred during playing (58.2 %) followed by sporting activities (31.8 %), traffic accidents (5 %), assaults (3.9 %). The older children are mostly occupied with a multitude of activities such as sports, cycling and motor bike riding which accounted as second most frequent cause in our study.

Cranio-maxillofacial trauma may sometimes be associated with related injuries to other body regions. Mechanism of injury plays a key role in predicting potential concomitant injury, which can be grouped into low energy (falls, sports related accidents) and high energy (traffic accidents) categories. In our study lower incidence of injury to other organ system associated with former category is clearly observed. Associated head injuries due to fall are common in young patients. In our study 5 children suffered from head injury had etiology of falling from a height. This might be because of the larger craniofacial ratio and frontal prominence. Therefore, neurosurgical consultation should always be considered when dealing with pediatric maxillofacial fractures especially in children under 5 years [7].

The site and pattern of fracture depend upon the inter-relationship between cause of injury, force of the injury and the unique anatomic features of the child's stage of development [11]. Our study shows the highest incidence of dentoalveolar injuries accounting for 40 % of maxillofacial trauma. This was in accordance with other studies Gassner et al. [1] and Kumarswamy et al. [2]. In our study these injuries were treated by restoration of functionally stable tooth or teeth segment and preservation of esthetics. No concomitant bi-maxillary fracture cases which could happen in a high energy road accidents were observed in our study. However we came across low energy type road accidents such as fall from bicycles. It was noted that almost all secondary school going children are provided with bicycles by state government and utilization of these bicycles has been drastically increased in last few years leading to low energy type of fracture which involves either mandible or maxilla.

The age of the patient, anatomic site involved, complexity of the fracture, time elapsed since injury and concomitant injuries are the factors to be considered before planning treatment in pediatric fractures. Open reduction and internal fixation implies subsequent periosteal dissection, which interrupts the osteogenic potential of the periosteum and creates scarring which further restricts growth

[7]. Hence conservative treatment of the growing bone is preferred whenever possible. In our study maxillofacial fractures were treated with observation and conservative treatment in 83.04 % of cases and with open reduction in 16.96 %. Holland et al. [8] treated 43 % of cases and Qudah and Bataineh [12] treated 92 % of cases by conservative approach.

Mandibular fractures were the most common injuries in pediatric trauma accounting for 89.29 % in our study. This was in accordance with Kumarswamy et al. [2], Karim et al. [9] and Qudah and Bataineh [12]. In contrary mid face fractures were more common in an Australian study by Holland et al. [8]. The low incidence of diagnosis of fractures of the mid face is probably because of the lack of modern radiological techniques such as computed tomography. In such scenario, we suggest that strict protocol including detail history recording, meticulous physical and clinical examinations along with utilization of proper radiographic techniques should be followed. In addition alveolar fractures, nasal fractures and zygomatic fractures are often treated in the out patient setting.

Maxillofacial fractures were reduced under conscious sedation or under general anesthesia depending on the cooperation of the patient. These fractures are treated by mono-mandibular fixation like arch bar, acrylic splints retained by cementation or perimandibular wiring for younger age group mainly in children under 2 years. Between 2 and 3 years 10 teeth are present in each arch and intermaxillary fixation can be achieved. In mixed dentition where few teeth are missing, open reduction and internal fixation is preferred. Such cases were routinely recalled every week initially later every month. The plates were removed after 6 months and followed up regularly. The radiographs taken during these follow ups showed good osteogenic potential of the involved bone. To overcome the second intervention, bioresorbable plates are often used now-a-days, but there are several disadvantages like bulkiness of plates, relatively longer time for resorption, chances of inhibition of facial growth when placed over growth centers and difficulty in comminuting thin bones due to larger screws and grooves and lastly longer time for placement [2]. Observation alone is sufficient for undisplaced and green stick fractures.

Complications like non union and fibrous union are almost never seen in pediatric patients due to the highly osteogenic potential of the periosteum that allows rapid union within 3 weeks. However, complications like infection, ankylosis and malocclusion do occur. In our study 5 (4.46 %) patients, mainly those who underwent open reduction and internal fixation with bone plates, suffered from post-operative wound infection. The main reason for infection was poor oral hygiene, improper medications taken by the patient and the low nutrition during the

healing period. Ankylosis is one of the major post-operative complications after condylar fractures. This is mainly due to highly osteogenic potential of the condyle. If the patient is less than 5 years of age, the fracture will usually heal spontaneously, with little condylar remodelling. In children 5–12 years of age, some bone remodelling occurs, but elastics may be required to allow mobility and help guide the occlusion. Children older than 12 years will have limited remodelling and will require elastics for 10–14 days followed by intense physiotherapy to regain mobility and function [13]. In our study no cases of post-operative ankylosis were noted. Maxillary widening or impaction and alteration of antero-posterior and/or transverse dimensions caused during surgical procedures are the main reasons for malocclusion after primary mid-facial trauma treatment due to which the occlusal plane might easily become oblique and tilted. Malocclusions are corrected primarily for aesthetic, functional and psychologic reasons. However, in some cases, treatment may increase resistance to caries, anterior tooth fracture and possibly to gingival and periodontal diseases. Minor occlusion can be improved by selective grinding of prematurely contacting teeth and by inserting crowns or on-lays to build up tooth surfaces that are below the plane of occlusion. Surrounding alveolar bone can be remodelled by applying mild orthodontic forces. Orthodontic extraction of one or more permanent teeth may be needed for repositioning of adjacent or erupting teeth. When orthodontic treatment alone is insufficient, orthognathic surgery is indicated for surgical correction of jaw abnormalities contributing to malocclusion.

Conclusion

Fractures in children are less common than soft tissue injuries due to multiple factors and exhibit different patterns of clinical features depending on the etiology and stage of bone maturation. Young children are more apt to have greenstick fractures and require observation or minimal fixation measures. As age increases, the severity of injuries sustained also increases which frequently require open reduction and fixation. Falls account for the majority of injuries in younger age group, road traffic accidents and sport injury being the second most as the age of the child

increases. Mandibular fractures usually require a brief period of immobilization followed by physiotherapy to reduce ankylosis and loss of function. The incidence of soft tissue injuries and nasal bone fracture is less reported as these patients get treated at private clinic and escape institutional record. Opportunities for prevention of trauma should be taken into consideration by the parents and care takers. Preventable measures such as early correction of malocclusion and wearing of mouth guard during contact sports have been recommended.

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