Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 9, Issue, 09, pp.57114-57117, September, 2017

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

A REVIEW OF PEDIATRIC MAXILLOFACIAL BONE FRACTURES MANAGED IN A LOW RESOURCE CENTER

***Dr. Charles E. Anyanechi**

Department of Dental Surgery, University of Calabar/University of Calabar Teaching Hospital, Calabar Eastern Highway, 540001 Calabar, Nigeria

ARTICLE INFO

Article History:
Received 04th June, 2017
Received in revised form
27th July, 2017
Accepted 30th August, 2017
Published online 29th September, 2017

Key words:

Maxillofacial,
Fractures,
Children,
Outcome.

ABSTRACT

Background: Maxillofacial fractures in children are rare, but present challenges that may adversely affect growth and development.
Objective: To analyze the pattern and management of maxillofacial bone fractures in patients aged one to 12 years.
Materials and Methods: A retrospective review was conducted on 47 pediatric patients with maxillofacial fractures that presented to our hospital over a 20-year period. Data on etiology, clinical characteristics, treatment and complications were analyzed.
Results: There were 47/3996 (1.2%) pediatric patients with 58/4623 (1.3%) fractures out of the 3996 patients and 4623 fractures that presented. There were 33 boys and 14 girls giving a male to female ratio of 2.4:1. The age of patients ranged from 5-12 years with mean age of 9.2±2.3 years. As the age increased, the frequency of patients with fractures increased (p=0.001). Road traffic accidents (RTA) was the commonest cause of fractures (39/47, 83%, p=0.000), and concomitant injuries occurred in 11/47 (23.4%) of the victims. Majority of the patients were managed conservatively (n=32/47, 68.1%). Those knocked down by motor vehicle had more multiple (n=6/8, 75%) and displaced (n=11/15, 73.3%, p=0.01) fractures, longer hospital stay (4-7 days), and concomitant injuries (n=8/11, 72.7%, p=0.01).
Conclusion: This study shows that the prevalence of maxillofacial fractures was low amongst one to 12 years age groups. As majority of them were knocked down by motor vehicle, preventive program if instituted will have a positive effect in reducing the prevalence of fractures.

Citation: Dr. Charles E. Anyanechi, 2017. "A review of pediatric maxillofacial bone fractures managed in a low resource center", *International Journal of Current Research*, 9, (09), 57114-57117.

INTRODUCTION

The literature suggests that maxillofacial fractures in children are not common injuries, and this is sequel to the observation that only 5% of all facial fractures in the general population occur in children. (Koltai *et al*., 1995; Shand and Heggiè, 2000; Anyanechi and Saheeb, 2011) The mechanisms of these injuries in children differs worldwide, but can be influenced by the life style, cultural and socio-economic life of the general population. (Gassner *et al*., 2004; Rahman *et al*., 2007) The treatment of the fractures includes conservative, closed reduction with or without inter-maxillary fixation (IMF) and open reduction with rigid internal fixation (RIF). (Posnick *et al*., 1993; Eppley, 2005; Muńante-Cárdenas *et al*., 2011) The management of the fractures is challenging because of the consideration that must be given to the fracture patterns, growth of the face, and dynamic changes in dentition which may differ from patient to patient. (McGraw and Cole, 1990; Hatef *et al*., 2009; Hoppe *et al*., 2014) In our environment, there are no documented evidence on the prevalence, pattern and management of maxillofacial bone fractures in children. This retrospective study therefore analyzes the pattern and management of these fractures in children aged one to 12 years over a 20-year period, and is intended to form a baseline for future studies in our environment.

Corresponding author:* **Dr. Charles E. Anyanechi,
Department of Dental Surgery, University of Calabar/University of Calabar Teaching Hospital, Calabar Eastern Highway, 540001 Calabar, Nigeria.

MATERIALS AND METHODS

The retrospective study of children, aged from one to 12 years who sustained fractures of the maxillofacial bone was undertaken. The subjects presented at the Oral and Maxillofacial Surgery Clinic of our hospital between January 1995 and December 2014. The study was exempted from ethical clearance by the Research Ethics Committee of our institution because of its retrospective nature. The diagnoses of the fractures were made clinically and confirmed by radiological examination. The radiographic views employed

were posterio-anterior (PA) of the jaws or skull, two oblique laterals of the mandible, submentovertex, Towne's view (axial) and occipito-mental 30^0. The radiographs were certified standardized by the Calabar branch of the Association of Radiologists in Nigeria. The images were evaluated by three examiners: oral and maxillofacial surgeon who regularly deals with pediatric trauma, senior resident in oral and maxillofacial surgery pediatric traumatology, and pediatric traumatology radiologist. For the diagnoses of maxillofacial fractures, the examiners were given three options to choose from: 1). Fracture: [displaced] [undisplaced], 2). No fracture and 3). Uncertain. Although computed tomography scan (CT scan) and magnetic resonance imaging (MRI) has become the gold standard in radiologic diagnosis of maxillofacial fractures particularly condylar and mid-facial fractures, non-availability, and affordability precluded its routine use in this centre, during the study period. Information obtained from the hospital register, case files and plain radiographs of the patients were documented in a pro-forma designed for the study. The information entered in the pro-forma were age, gender, etiology of fracture, type, site, side, number of fractures, and whether the fractures were displaced or not. Other factors recorded were the presence of concomitant injuries, time lag between injury and treatment, methods of treatment and complications. The data obtained were analyzed using EPI INFO 7, 0.2.0, 2012 version software (CDC, Atlanta, GA, USA). Simple frequency charts, descriptive statistics, and test of significance were used for analysis. P values <0.05 are considered significant.

RESULTS

The result showed that 3996 cases with 4623 fractures presented within the study period, and 47/3996 (1.2%) cases with 58/4623 (1.3%) fractures occurred in patients between one to 12 years of age. The age of patients with fractures ranged from 5-12 years with mean age of 9.2±2.3 years. There were 33 boys and 14 girls giving a male to female ratio of 2.4:1. The males outnumbered the females in all the age categories (p=0.001), and as the age increased the frequency of patients increased (Table 1, p=0.001). RTA was the commonest cause of fractures in the patients (p=0.000, Table 2). Also, 31/47(66.0%) of the RTA victims were knocked down by motor vehicle while crossing tarred roads whereas 3(6.4%) were due to motor-cycle related accidents. All the fractures were compound intra-orally, non-comminuted; and predominantly mandibular (Table 3). The right side of the face was affected more than the left (Table 3, p=0.43). Furthermore, displaced fractures accounted for 15/58 (25.9%) while undisplaced were 43/58 (74.1%), and this was significant (p=0.01) in favor of the undisplaced. The distribution of number of fractures is as follows: 39 (83%) patients had single fractures, 5 (10.6%) two fractures while 3 fractures were diagnosed in each of the remaining 3 (6.4%) patients. Concomitant injuries were seen in 11/47 (23.4%) patients which were fractures of the nose 6 (37.5%), humerus 3 (18.8%), femur 2 (12.5%), cervical spine 2 (12.5%), tibia 1(6.2%), and 2 (12.5%) cases of haemothorax. Patients knocked down by motor vehicle had more multiple (n=6/8, 75%) and displaced (n=11/15, 73.3%, p=0.01) fractures, and concomitant injuries (n=8/11, 72.7%, p=0.01). The time lag between injury and treatment of fractures ranged from 3 to 7 days. Management of patients with undisplaced fractures (n=32/47, 68.1%) was by conservative treatment which consist of soft diet and jaw exercises; the condylar and Le Fort 1 fractures were among the undisplaced fractures. The displaced fractures of the mandible in 10/47 (21.3%) patients were treated by insertion of cold cured acrylic splint after reduction under local anaesthesia (2% xylocaine 1:80,000 adrenaline) and the rest (n=5/47, 10.6%) by circum-mandibular wiring using 0.5mm stainless steel wire and heat cured acrylic splint after reduction under general anaesthesia. The duration of the splinting was four weeks in all cases. The age of the patients treated by closed reduction ranged from 9 to 12 years (mean 10.8 years), and they were 11 boys and four girls. In all the patients, the hospital stay ranged from one to 7 days; but for those treated by closed reduction between 4 to 7 days. Most (n=31/47, 66%) patients were not admitted. The follow-up period ranged from 3.5 to 15.3 years (mean 9.2±1.8 years). The complications that developed following the fractures and after treatment are shown in table 4. Numbness of the lower lip and facial asymmetry resolved without treatment. Infection was controlled with antibiotics and antimicrobial agents while bleeding was arrested by packing with gauze and biting on it for a while. Except where permanent dentition was lost, the complications resolved without a permanent sequel.

Table 1. Distribution of patients according to age and gender

Age	Gender				Total	%
	Male		Female			
	n	%	n	%		
5-6	2	4.2	1	2.1	3	6.3
7-8	6	12.8	3	6.4	9	19.2
9-10	10	21.3	4	8.5	14	29.8
11-12	15	31.9	6	12.8	21	44.7
Total	33	70.2	14	29.8	47	100.0

Table 2. Etiology of fracture

Etiology	Frequency	%
RTA	39	83.0
Fall	6	12.8
Non-accidental injury	2	4.2
Total	47	100.0

Table 3. Distribution according to site, side and number of fractures

Site	Side		no. of fractures	%
	Right	Left		
Mandible				
Body	19	12	31	53.5
Parasymphysis	4	6	10	17.2
Subcondylar	4	4	8	13.8
Symphysis	-	-	4	6.9
Angle	1	2	3	5.2
Ramus	0	1	1	1.7
Middle third				
Le Fort 1	1	0	1	1.7
Total	29	25	58	100.0

Table 4. Distribution of complications of fractures in the patients

Complication	Frequency	%
Loss of permanent dentition	10	41.7
Numbness of lower lip/cheek	5	20.8
Facial asymmetry	4	16.7
Infection	3	12.5
Bleeding	2	8.3
Total	24	100.0

DISCUSSION

This study shows that the injuries occurred in 1.2% of patients and accounted for 1.3% of fractures in the general population. The fractures increased with increasing age, majority sustained the fractures by motor vehicle accidents (MVA), mandible was affected more than the bones of the mid-face; and those children knocked down by motor vehicle had more multiple and displaced fractures, concomitant injuries, longer hospital stay, and were more likely to undergo closed reduction. The literature shows that it is difficult to estimate the prevalence of maxillofacial fractures in children because different authors have defined the pediatric population upper age limit at different times to be 18 years, 16 years, 15 years and 12 years. In this study the upper age limit was 12 years and the prevalence was 1.2% of the general population. When this prevalence is compared with similar reports, (Posnick *et al*., 1993; Spring and Cote, 1996) it is lower. Although the present study was longer in duration than earlier reports, the variations in prevalence can also be due to the disparity in study designs. The low percentage of facial fractures in children has been attributed partly to their lesser involvement in outdoor activities and the lack of full pneumatization of the sinuses which occur much later in childhood. (Anyanechi and Saheeb, 2011; Spring and Cote, 1996) Also, the spectrum of maxillofacial injuries is directly related to the specific developmental stage of the cranio-facial bone. (Eggensperger Wymann *et al*., 2008) In conformity with the present study, previous reports have shown that boys are more commonly affected than girls, and that the majority of pediatric facial fractures occur in children between 6 and 12 years of age. (Posnick *et al*., 1993; Spring and Cote, 1996; Gassner *et al*., 2003; Boyette, 2014) In the present study, the most common cause of the fractures was RTA resulting from children crossing tarred roads unaccompanied by adults. RTA as a major etiological factor was reported by some earlier authors, (Rahman *et al*., 2007; Posnick *et al*., 1993; Hogg and Horswell, 2006) but these were not as a result of direct hit on the victims by motor vehicles. This is contrary to other reports that showed bicycle accidents, falls and interpersonal violence as the major mechanisms of these fractures. (Muńante-Cárdenas *et al*., 2011; Eggensperger Wymann *et al*., 2008; Boyette, 2014; Chrcanovic *et al*., 2010; Hoppe *et al*., 2015; Al Shetawi *et al*., 2016) In addition the fractures can also result from sporting activities and gunshots. (Posnick *et al*., 1993; Hoppe *et al*., 2014) Furthermore, the non-accidental injuries in this study were due to child abuse. The findings confirm the assertion that the mechanisms of the injuries in children can be influenced by the life styles, cultural and socio-economic characteristics of the general population under consideration. (Gassner *et al*., 2004; Rahman *et al*., 2007)

In this study, mandibular fractures occurred more frequently than the mid-facial fractures. This is similar to previous reports. (Koltai *et al*., 1995; Rahman *et al*., 2007; McGraw and Cole, 1990; Chrcanovic *et al*., 2010) On the contrary, Eggensperger Wymann *et al*. (2008) reported that the majority of the fractures in their study occurred in the middle one-third of the face. Also more fractures occurred in the body of the mandible, and right more than the left side of the face. The multiplicity, site and side of predilection of the fractures would depend on the site of impact and direction of the injuring force. (Hoppe *et al*., 2014; Hoppe *et al*., 2015) The force required to fracture bones of the maxillofacial region often produces concomitant injuries. In the present study, concomitant injuries occurred in 23.4% of the patients. Similar concomitant injuries have been reported by other researchers; (Eggensperger Wymann *et al*., 2008; Hoppe *et al*., 2015; Al Shetawi *et al*., 2016) but the result in this study is lower in frequency than the earlier reports. However, the prevalence and types of these associated injuries vary from study to study and may present management priorities that might include multi-disciplinary approach to treatment. (Posnick *et al*., 1993; Hoppe *et al*., 2014; Giuliani *et al*., 1997) The management of facial fractures in children is challenging and sometimes complex as there are no defined protocols. (Muńante-Cárdenas *et al*., 2011; Hatef *et al*., 2009; Hoppe *et al*., 2014) As these fractures occur during the period of growth and evolving dentition in the facial bone, it is necessary for the treating surgeon to have knowledge of the standard and the alternative treatment options in order to optimally manage the patients. (Alhumsi and Gilardino, 2014) Oftentimes conservative measures are favored over open reduction with rigid internal fixation in order to avoid disruption of blood supply to the bone and soft tissues. (Hoppe *et al*., 2014) Majority (68.1%) of the patients in this study were treated conservatively because they presented with undisplaced fractures. Similar conservative approach to the treatment of undisplaced and minimally displaced facial fractures was utilized by other researchers (Koltai *et al*., 1995; Rahman *et al*., 2007; Muńante-Cárdenas *et al*., 2011; McGraw and Cole, 1990; Hatef *et al*., 2009; Hoppe *et al*., 2014) in the majority of their cases as they found that it was effective and reliable, particularly in the younger age group, because of the unique remodeling potential of the pediatric facial bone. The displaced fractures were treated by closed reduction technique without IMF. However, those cases of displaced mandibular fractures that were not amenable to treatment with cold cured acrylic splint after reduction were treated with heat cured acrylic splint that was secured by circum-mandibular wiring. These treatment options have also been used successfully to manage displaced pediatric fractures. (Eppley, 2005; Chrcanovic *et al*., 2010) Some other researchers in well equipped centers advocate the use of rigid internal fixation (RIF) to treat displaced and complex fractures which have also given favorable results as they noted that the rapid healing of pediatric facial bones does not obviate the need for fracture reduction and fixation with titanium plates and screws since they are well tolerated, effective and reliable. (Koltai *et al*., 1995; Posnick *et al*., 1993; Eppley, 2005; Hogg and Horswell, 2006; Triana and Shockley, 1998; Wizenburg and Imola, 1998)

The complications recorded in this study were a direct consequence of the trauma, but resolved without a permanent sequel except for those who lost permanent dentition that were in the fracture lines. As stated in an earlier study, (Anyanechi and Saheeb, 2014) infections occurred in some patients in the present study because the fractures were compound intra-orally. Also, some earlier researchers have shown that patients who have sustained maxillofacial fractures were likely to have dental injury. (Gassner *et al*., 1999; Lieger *et al*., 2009) On the contrary, Eppley (2005) recorded no complication in his study while on the other hand, some authors documented varying complications. (Koltai *et al*., 1995; Posnick *et al*., 1993; Giuliani *et al*., 1997) Posnick *et al*. (1993), Spring and Cote (1996) noted that the long term effects of the fractures and the treatment given on facial growth still remain undetermined. However, in this series, the early presentation of the patients for treatment, with less displaced, complex fractures and the long duration of follow-up partly contributed to the successful treatment outcome. This study was limited by the use of only plain radiographic views, without CT scans and MRI

techniques especially for the diagnosis of the condylar and middle third fractures. Although these fractures were few and treatment outcome was good, the plain radiographic x-rays are drawbacks as mandibular condyle is difficult to visualize on these views due to the overlapping of adjoining anatomical structures. (Banks and Brown, 2001; Malik, 2008) Consequently, there was no distinction between dislocation and sagittal fractures of the condyle, extent of injury to the meniscus and its position and relation to condyle and glenoid fossa which are very important criteria for detecting which of the fractures might be prone to complications. Furthermore, rigid internal fixations were not utilized for the treatment of the displaced fractures because this method of treatment was not available in this centre during the period of the study.

Conclusion

This study shows that the prevalence of maxillofacial fractures was low in the patients aged one to 12 years. However, there are management challenges of these fracture cases in children necessitating putting in place preventive measures. Since majority of them were knocked down by motor vehicle, preventive program if instituted will have a positive effect in further reducing the prevalence of fractures in children.

REFERENCES

Al Shetawi AH, Lim CA, Singh YK, Portnof JE, Blumberg SM. 2016. Pediatric maxillofacial trauma: A review of 156 patients. *J Oral Maxillofac Surg*., 74: 1420 e1-e4.

Alhumsi TR, Gilardino MS. 2014. Current management of facial fractures in the pre-adolescent. *Curr Opin Otolaryngol Head Neck Surg*., 22: 336-341.

Anyanechi CE, Saheeb BD. 2011. Mandibular sites prone to fracture: Analysis of 174 cases in a Nigerian Tertiary Hospital. *Ghana Med J*., 47: 111-114.

Anyanechi CE, Saheeb BD. 2014. Complications of mandibular fracture: Study of the treatment methods in Calabar, Nigeria. *West Indian Med J*., 63: 349-353.

Banks P, Brown A. 2001. Fractures of the facial skeleton. 2nd ed. Oxford, Woburn: Butterworth-Heinemann., 171-185.

Boyette JR. 2014. Facial fractures in children. *Otolaryngol Clin North Am*., 47: 47-61.

Chrcanovic BR, Abreu MH, Freire-Maia B, Souza LN. 2010. Facial fractures in children and adolescents: a retrospective study of 3 years in a hospital in Belo Horizonte, Brazil. *Dent Traumatol*., 26: 262-270.

Eggensperger Wymann NM, Hölzle A, Zachariou Z, Iizuka T. 2008. Pediatric Craniofacial Trauma. *J Oral Maxillofac Surg*., 66: 58-64.

Eppley BL. 2005. Use of resorbable plates and screws in pediatric facial fractures. *J Oral Maxillofac Surg*., 63: 385-391.

Gassner R, Bösch R, Tuli T, Emshoff R. 1999. Prevalence of dental trauma in 6000 patients with facial injuries: implications for prevention. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*., 87: 27-33.

Gassner R, Tuli T, Hächl O, Moreira R, Ulmer H. 2004. Craniomaxillofacial trauma in children: a review of 3,385 cases with 6,060 injuries in 10 years. *J Oral maxillofac Surg*., 62: 399-407.

Gassner R, Tuli T, Hächl O, Rudisch A, Ulmer H. 2003. Cranio-maxillofacial trauma: A 10 year review of 9, 543 cases with 21,067 injuries. *J Craniomaxillofac Surg*., 31: 51-61.

Giuliani G, anile C, Massarelli M, Maira G. 1997. Management of complex craniofacial traumas. *Rev Stomatol Chir Maxillofac*., 98(Suppl): 100-102.

Hatef DA, Cole PD, Hollier LH Jr. 2009. Contemporary management of pediatric facial trauma. *Curr Opin Otolaryngol Head Neck Surg*., 17: 308-314.

Hogg NJ, Horswell BB. 2006. Hard tissue pediatric trauma: A review. *J Can Dent Assoc*., 72: 555-558.

Hoppe IC, Kordahi AM, Lee ES, Granick MS. 2015. Pediatric facial fractures: Interpersonal violence as a mechanism of injury. *J Craniofac Surg*., 26: 1446-1449.

Hoppe IC, Kordahi AM, Paik AM, Lee ES, Granick MS. 2014. Examination of life threatening injuries in 431 pediatric facial fractures at a level 1 trauma center. *J Craniofac Surg*., 25: 1825-1828.

Hoppe IC, Kordahi AM, Paik MM, Lee ES, Granick MS. 2014. Pediatric facial fractures as a result of gunshot injuries: an examination of associated injuries and trends in management. *J Craniofac Surg*., 25: 400-405.

Koltai PJ, Rabkin D, Hoehn J. 1995. Rigid fixation of facial fractures in children. *J Craniomaxillofac Trauma*, 1: 32-42.

Lieger O, Zix J, Kruse A, Iizuka T. 2009. Dental injuries in association with facial fractures. *J Oral Maxillofac Surg*., 67: 1680-1684.

Malik NA. 2008. Textbook of oral and maxillofacial surgery. 2nd ed. New Delhi: Jaypee Brothers. 315-413.

McGraw BL, Cole RR. 1990. Pediatric maxillofacial trauma age-related variations in injury. *Arch Otolaryngol Head Neck Surg*., 116: 41-45.

Muńante-Cárdenas JL, Olate S, Asprino L, de Albergaria Barbosa JR, de Moraes M, Moreira RW. 2011. Pattern and treatment of facial trauma in pediatric and adolescent patients. *J Craniofac Surg*., 22: 1251-1255.

Posnick JC, Wells M, Pron GE. 1993. Pediatric facial fractures: evolving patterns of treatment. *J Oral Maxillofac Surg*., 51: 836-844.

Rahman RA, Ramli R, Rahman NA, Hussaini HM, Idrus SM, Hamid AL. 2007. Maxillofacial trauma of pediatric patients in Malaysia: a retrospective study from 1999 to 2001 in three hospitals. *Int J Pediatr Otorhinolaryngol*., 71: 929-936.

Shand JM, Heggiè AA. 2000. Maxillofacial injuries at the Royal children's hospital of Melbourne: a five year review. *Ann R Australas Coll Dent Surg*., 15: 166-169.

Spring PM, Cote DN. 1996. Pediatric maxillofacial fractures. *J La State Med Soc*., 148: 199-203.

Triana RJ Jr, Shockley WW. 1998. Zygomatico-orbital complex fractures: the use of resorbable plating systems. A case report. *J Craniomaxillofac Surg*., 4: 32-36.

WizenburgSM, Imola MJ. 1998. Internal fixation in pediatric maxillofacial fractures. *Facial Plast Surg*., 14: 45-58.

****