ORIGINAL ARTICLE

Pediatric maxillofacial injuries at a Nigerian teaching hospital: A three-year review

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Abstract

Aim: To determine the nature of pediatric maxillofacial injuries, according to etiology and characteristics of patients.
Materials and Methods: The records of patients aged 15 years and below who presented with maxillofacial trauma to the Maxillofacial Clinic of Aminu Kano Teaching Hospital, Kano, Nigeria over a 3-year period were retrospectively examined. Patients' demographic and etiologic factors were obtained and analyzed. A *P* value of <0.05 was considered significant.
Results: A total of 160 patients comprising males, 102 (63.8%) and females 58 (36.2%), were seen over the period of study. The age of patients range from 4 months to 15 years, mean 7.07 ± 4.52 years. There was no gender difference in terms of age ($P < 0.05$). Road traffic accident (RTA) was the most common etiologic factor accounting for 45.0% of cases. This was followed by fall (40.6%). Animal related injury and violence accounted equally for 3.8%. Soft tissue injuries in the form of abrasion, laceration and avulsion accounted for 70.0% of cases. Other anatomical sites included the mandible (16.3%), dento-alveolar fractures(12.5%), and midface (1.3%).
Conclusion: Road traffic accident and falls still remains the leading cause of maxillofacial injuries in children in this part of the globe. There is a need to reinforce existing traffic laws that aimed at minimizing the menace of RTA-related accidents.

Key words: Maxillofacial injuries, Nigeria, pediatric

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Introduction

The pattern of maxillofacial trauma varies from one country to another and within regions in the same country.[1] Social, cultural, and environmental factors have been linked to the pattern of presentation of maxillofacial trauma.[1,2] In the adult population, worldwide, motor vehicle accidents have been reported to be the most common etiologic factor whereas in children the etiologic factors vary with age-related activities and exposure. A survey in the United Kingdom has shown that trauma remains the leading cause of morbidity and mortality in children and affects one in three annually.[3,4]

Epidemiological data on pediatric maxillofacial trauma is important as it has obvious implications for improving care by its use in clinical audit, service management, planning of future services, and effective targeting of preventive measures.[5] A review of the literature showed very little information on epidemiological data for pediatric maxillofacial injury from Northern Nigeria.[6,7] The present study is aimed at determining the nature of pediatric maxillofacial injuries, at a Nigerian Teaching Hospital in North-West Nigeria, according to aetiology and characteristics of patients, and to compare the results with those from other parts of the world.

Materials and Methods

This was a retrospective analysis of maxillofacial injury in children over a three-year period. The case files of patients aged 15 years and below who presented with maxillofacial trauma to the Maxillofacial Clinic of our institution,

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from January 2008 to December 2010 were retrieved and examined. Details including characteristics of patients and etiologic factors were obtained and analyzed using SPSS version 13. A *P* value of less than 0.05 was considered significant.

Results

Of the 500 patients with maxillofacial injuries seen within the study period, 160 (32.0%) were children aged 15 and below. Males accounted for 102 (63.8%) while females were 58 (36.2%) giving a male to female ratio of approximately 2:1 [Table 1]. The age of patients range from 4 months to 15 years, mean 7.07 ± 4.52 years. The difference between mean age of males and females was statistically significant ($P < 0.05$). Majority of the children (95%) reside with both parents. About half of the injuries occurred in the streets (49.4%) while 46.3% occurred around the home environment. The remaining 4.3% of injuries occurred around the school environment.

Road traffic accident (RTA) was the most common etiologic factor accounting for 45.0% of cases, with vehicle and pedestrian related accidents comprising 24.4% and 20.6%, respectively. Fall was the next most prevalent etiologic factor accounting for 40.6% of cases, followed by violence (3.8%), animal related injury (3.8%), impalement injury (3.1%), epilepsy (1.2%), tetanus (1.2%), gunshot injury (0.6%), and sport injury (0.6%).

The age distribution of facial trauma showed a bimodal pattern. Injuries tend to rise as a child grows attaining its peak at the 6th year. It then begins to drop through ages 7-9 up to ages 10-12 and then rises with the onset of adolescence [Figure 1]. Overall, children within the age range 1-6 years had the highest number of injuries accounting for 77 (48.1%) and fall was responsible for majority of the injuries sustained [Table 2]. This was followed by children in the 13-15 years (20.6%) and 7-9 years (17.5%) age categories with RTA accounting for most of the injuries recorded among these age groups [Table 2]. An association was found between age and cause of injury. For children 0--6 years old, the main cause of injury was fall from a height, while for children 7-15 years old it was RTA ($\chi^2 = 102.4$, $P < 0.05$; Table 2).

Overall motorcycle related accidents accounted for about 33.3% of all road traffic accidents [Figure 2]. When considered separately 61.5% of vehicle and 78.8% of pedestrian-related accidents were due to motorcycle accidents alone. Pedestrian-related accident was observed to occur commonly in the 7-9 years age group and more in females but the difference was not significant. Males were significantly observed to have motorcycle induced vehicle related accidents and this was frequently seen among the 10-12 years and 13-15 years age categories [Table 3].

Injuries sustained by the nonwalking child (<1 years) were entirely due to a fall while it was partly but predominantly contributory among the 1-3 years and 4-6 years categories. Fall while at play accounted for about 64.6% and this was frequently seen among the 1-3 years and 4-6 years age groups. Maxillofacial injuries arising as a result of falls from

Table 1: Age and sex characteristics of subjects

Age (years)	Female	Male	Total
	n (%)	n (%)	n (%)
<1	6 (3.8)	1 (0.6)	7 (4.4)
1-3	12 (7.5)	25 (15.6)	37 (23.1)
4--6	20 (12.5)	20 (12.5)	40 (25.0)
7-9	8 (5.0)	20 (12.5)	28 (17.5)
10-12	4 (2.5)	11 (6.9)	15 (9.4)
13--15	8 (5.0)	25 (12.5)	33 (20.6)
Total	58 (36.2)	102 (63.8)	160 (100.0)

$\chi 2=14.29$, df=5. $P=0.014$

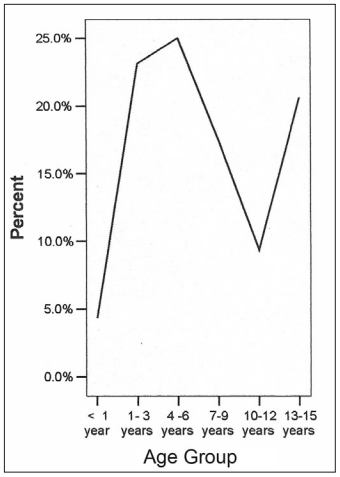

Figure 1: Age distribution of patients. Note the bimodal pattern

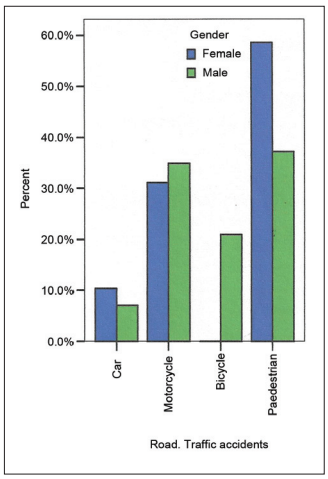

Figure 2: Gender distribution of maxillofacial trauma due to road traffic accident

Table 2: Aetiology of maxillofacial injuries according to age group and gender

Age group (Years)	RTA	Falls	Animals	Violence	Sports	Gunshot	Impalement	Others	Total
<1	0 (0.0)	7 (4.4)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	7 (4.4)
1-3	11 (7.5)	24 (15.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.6)	36 (23.1)
4-6	9 (5.6)	21 (13.1)	3 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	5 (3.1)	2 (1.3)	41 (25.0)
7-9	23 (13.7)	3 (1.9)	0 (0.0)	3 (1.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	28 (17.5)
10-12	6 (3.8)	4 (2.5)	0 (0.0)	3 (1.9)	0 (0.0)	1 (0.6)	0 (0.0)	1 (0.6)	15 (9.4)
13-15	23 (14.4)	6 (3.8)	3 (1.9)	0 (0.0)	1 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	33 (20.6)
Total	72 (45.0)	65 (40.7)	6 (3.8)	6 (3.8)	1 (0.6)	1 (0.6)	5 (3.1)	4 (2.5)	160 (100.0)
$\chi 2=102.42$, df=35, $P=0.0001$*									
Gender									
Male	43 (26.9)	41 (25.6)	6 (13.8)	6 (3.8)	1 (0.6)	0 (0.0)	1 (0.6)	4 (2.5)	102 (63.8)
Female	29 (18.1)	24 (15.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.0)	4 (2.5)	0 (0.0)	58 (36.2)
Total	72 (45.0)	65 (40.6)	6 (13.8)	6 (3.8)	1 (0.6)	1 (0.6)	5 (3.1)	4 (2.5)	160 (100.0)

$\chi 2=16.09$, df = 7, $P = 0.024$*

Table 3: Distribution of road traffic accident according to age in 72 Patients. Data in frequency (%), except otherwise stated

Variable	Car	Motor bike	Bicycle	Pedestrian	Total
Age (years)					
1-3	3 (4.2)	0 (0.0)	0 (0.0)	9 (12.6)	12 (16.7)
4-6	0 (0.0)	3 (4.2)	0 (0.0)	5 (6.9)	8 (11.1)
7-9	0 (0.0)	3 (4.2)	3 (4.2)	17 (23.6)	23 (31.9)
10-12	0 (0.0)	6 (8.3)	0 (0.0)	0 (0.0)	6 (8.3)
13-15	3 (4.2)	12 (16.7)	6 (8.4)	2 (2.8)	23 (31.9)
Total	6 (8.4)	24 (33.4)	9 (12.6)	33 (45.8)	72 (100.0)

$\chi 2=48.02$, df=12, $P=0.001$

Table 4: Distribution of falls according to age and sex in 65 patients. Data is in frequency (%) except otherwise stated

Variable	Bed	Play	Tree	Total
Age (years)				
<1	7 (10.8)	0 (0.0)	0 (0.0)	7 (10.8)
1-3	7 (10.8)	19 (29.2)	0 (0.0)	26 (40.0)
4-6	0 (0.0)	21 (32.3)	0 (0.0)	21 (32.3)
7-9	0 (0.0)	1 (1.5)	0 (0.0)	1 (1.50
10-12	0 (0.0)	1 (1.5)	3 (4.6)	4 (6.2)
13-15	0 (0.0)	0 (0.0)	6 (9.2)	6 (9.2)
Total	14 (21.6)	42 (64.6)	9 (13.8)	65 (100.0)
$\chi 2=91.76$, df=10, $P=0.001$.				
Gender				
Female	6 (9.2)	18 (27.7)	0 (0.0)	24 (36.9)
Male	8 (12.3)	24 (36.9)	9 (13.8)	41 (63.1)
Total	14 (21.5)	42 (64.6)	9 (13.8)	65 (100.0)

$\chi 2=6.12$, df=2, $P=0.047$

tree was observed to be twice as common in the 13-15 years compared to the 10-12 years age categories and were seen only in males [Table 4].

Soft tissue injuries in the form of contusion, abrasion, laceration and avulsion accounted for 70.0% of cases. Other anatomical sites included the mandible (16.3%), dento-alveolar fractures (12.5%) and midface (1.3%) which was entirely limited to the zygoma. The upper lip and the tongue were the commonest injured soft tissues accounting for 30.4% and 24.1%, respectively [Figure 3]. These were followed by the forehead (8.9%), lower lip and cheek with equal prevalence of 7.1%. Graphical distribution of fracture of the mandible is presented in Figure 4. The body was the most frequently involved site (50.0%) followed by the condyle (19.2%) and parasymphyseal fractures (15.4%). The pattern of injury was observed to vary significantly with the age of the child. Thus soft tissue injuries occurred more in children aged 6 and below while older children, from 7 years and above had more of skeletal injuries ($P < 0.05$) [Table 5].

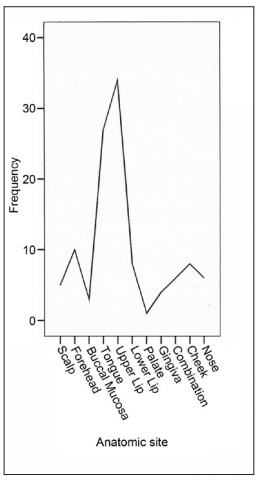

Figure 3: Distribution of soft tissue injuries

Concomitant injuries were recorded in 28 (17.5%) of cases with injuries to the upper limb (35.7%) and lower limb (32.1%) accounting for majority of cases. These were followed by head injury (21.4%), ocular (3.6%), facial nerve (3.6%), and cervical fracture (3.6%).

Table 5: Distribution of injuries according to age. Data is in frequency (%) except otherwise stated.

Age (years)	Soft tissue	Dentoalveolar	Mandibular	Midface	Total
<1	7 (4.4)	0 (0.0)	0 (0.0)	0 (0.0)	7 (4.4)
1-3	32 (20.0)	4 (2.5)	1 (0.6)	0 (0.0)	37 (23.1)
4-6	29 (18.1)	4 (2.5)	7 (4.4)	0 (0.0)	40 (25.0)
7-9	16 (10.0)	7 (4.4)	5 (3.1)	0 (0.0)	28 (17.5)
10-12	9 (5.6)	1 (0.6)	5 (3.1)	0 (0.0)	15 (9.4)
13-15	19 (11.9)	4 (2.5)	8 (5.0)	2 (1.25)	33 (20.6)
Total	112 (70.0)	20 (12.5)	26 (16.2)	2 (1.3)	160 (100.0)

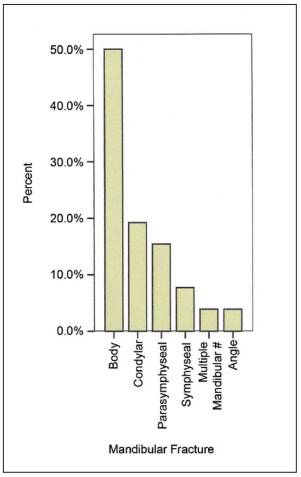

Figure 4: Distribution of mandibular fracture

Discussion

There are several published reports on the epidemiology of maxillofacial injuries in the pediatric population. The overall incidence of 32.0% observed in the present study is higher than the previously reported value of less than 15.0%, in a retrospective analysis, by several authors from different parts of the world,[1,8,9] including Adekeye[6] from Nigeria. Thus indicating a clear rise in the rate of maxillofacial trauma in children and is consistent with recent reports by Scariot *et al.*[10] from Brazil and Okoje *et al.*[11] from Ibadan, Nigeria.

Our results confirm that boys are more prone to injuries than girls and the approximate ratio of 2:1 obtained in the present study is consistent with existing publications.[1,3,12-14] The reason usually adduced for the observed differences is that girls mature earlier than boys, who also tend to be more involved in outdoor activities and contact sports.[2,15,16]

In this study, RTA and fall were the main etiologic factors accounting for 45.0% and 40.6%, respectively, with RTA responsible for more of the cases. The result agreed with earlier reports, from Nigeria, that found RTA as the most common cause of injuries in children[11,17-19] Majority of the injuries occurred in the 1-6 years age group and were mainly soft tissue injuries sustained as a result of a fall in the home environment which lend credence to earlier published reports.[1,20-22] Pedestrian accidents were commonly seen in the 7-9 years while vehicle related accidents mainly due to motorcycles were frequent among the adolescents. A possible explanation for the observed high prevalence of pedestrian related accidents in the present study could be due to the increase in the number of vehicles especially motorcycles in the Kano metropolis. The operators of these motorcycles are predominantly illiterates who neither have in-depth knowledge of the automobiles they are operating nor the traffic rules and road sign. In addition, Kano is an urban city with high level of commercial activities, including street hawking which has been reported to expose children to the hazards of RTA.[11]

The pattern of distribution of injuries across the age groups was bimodal lending support to other published reports on the epidemiology of paediatric maxillofacial trauma.[23-25,27] As a child learns to walk and run, the incidence of fall increases because co-ordination and motor skills are poorly developed at this stage.[13,27] In older children, high impact injuries arising from sports, interpersonal violence and RTA especially pedestrian and vehicle related accidents are dominant injury mechanisms.[1,6,28,29]

Maxillofacial injuries as a result of interpersonal violence accounted for 3.8% of cases and were seen among males in the 7-9 years and the 10-12 year age categories which is contrary to reports that it occurred in children over 12 years old.[2,21,25,30,31] This differences may be due to the peculiar ethno-religious practices in the northern part of Nigeria were male children are left to roam on the streets at a very early age without parental care and guidance. This may readily expose them to societal vices and they may also develop violent tendencies. Our result was comparable to the prevalence of 3.6% obtained from a recent Nigerian study.[11] The observed prevalence of 3.8% is much lower than those reported in most developed countries,[12,32] except that from Austria where 3.9% was reported by Gassner *et al.*[3] The main weapons of assault observed in the present study were knives. In the northern part of Nigeria, especially among the Hausas and Fulanis, knives and cutlasses are used as common means of defence.[33]

All sporting activities have an associated risk of orofacial injuries due to falls, collusions, and contact with hard surface.[34] Injuries arising from sporting activities did not

play any significant role in the aetiology of maxillofacial trauma in this series partly because traumatic dental injuries (TDIs), which is highly associated with sport related activities, were excluded from our data collections. In the study by Adekoya–Sofowora *et al.*[35] sporting activities accounted for about 14.9% of TDIs. Another reason for the low prevalence of maxillofacial injuries secondary to sporting activities observed in this study may be due to the low ebb of such activities as suggested by our data. Bulk of the observed injuries occurred around the home and streets environment with less than 5% of injuries occurring around the school vicinity where lots of sporting activities presumably goes on.

Contrary to the recent report from Nigeria, by Okoje *et al.*,[11] of a rise in the incidence of pediatric gunshot injuries only 1 (0.6%) case of gunshot injury was observed. Our result was consistent with that of Ugboko *et al.*[34] who also reported 1 gunshot injury about a decade earlier from South Western Nigeria. The observed differences may be due to a rise in the spate of criminal activities and influx of arms into the southern part of Nigeria from where the authors' work was carried out.

Soft tissue injuries were observed in 70.0% of cases and were seen more in younger age groups which lend credence to existing publications.[3,11,12,27] Our study found an overall incidence of 5.0% in children ages 6 and below, with a value of 4.4% in those below 5 years of age, which support earlier published reports that facial fracture is rare before the fifth year of life.[1,6,8] The reason for the relatively uncommon incidence of maxillofacial fractures in children includes a higher cranial to facial skeletal size, softer and more elastic bones, protective thick, soft tissues and lack of pnuematization of the paranasal sinuses.[26,35]

Mandibular and dento-alveolar fractures were the most common skeletal injuries which have been widely substantiated in other reports.[1,2,3,6,7,11] In most published reports, the condyle is the most common site of mandibular fracture.[18,19,21,36] Our study found the body of the mandible as the most common fractured site. The result of this study also differs from that of Ogunlewe *et al.*[7] who found the parasymphyseal region as the most frequently fractured mandibular site. The observed differences may be due to varying injury mechanisms and kinetics which may differ from place to place.[1] There were no sharp differences between the pattern of skeletal injuries in younger children and older ones except for fractures of the mid-facial skeleton which was limited to the zygoma and was seen only in the adolescents.

Associated injuries are seen in 25-75% of children with facial fractures.[2,30,37] We observed a lower prevalence of 17.5% for concomitant injuries but the pattern remains the same, with orthopaedic and head injuries[11,18] taking the lead. In general, high impact injuries such as RTA and gunshot injuries have been observed to be more associated with trauma to other parts of the body than fall.[30,38]

Road traffic accident and fall still remain the leading cause of maxillofacial injuries in children in this part of the globe. There is a need to reinforce existing traffic laws that aimed at minimizing the menace of RTA-related accidents. In addition, the government must enforce minimum educational requirement for operating automobiles on our roads to reduce the carnage. There is also need for parents, guardian and school teachers to monitor the activities of children at home or school.

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