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Zygomatic complex fractures in a suburban Nigerian population

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Abstract – A retrospective analysis of 128 zygomatic complex fractures was undertaken. There were 109 males (85.2%) and 19 females (14.8%), aged 3–74 years (mean ± SD, 33 ± 12.6 years). Patients in the third decade of life (38.3%) recorded the highest incidence. Road traffic accidents (74.2%) mainly from automobile (61.7%) and motorcycle (9.4%) involvement were the predominant etiology. While 38.8% of them presented within the first 24 h, males were relatively earlier than their female counterparts, although this was not statistically significant ($P > 0.05$).Class 3 fractures were the commonest (50%), followed by classes 2 (zygomatic arch) and 4, respectively. Most class 6 fractures (6.3%) resulted from gunshot injuries. There were 116 unilateral (left 63, right 53) and 12 bilateral fractures with the right side of the face recording more zygomatic arch fractures. In addition, statistical significance was observed between etiology, class and type of fracture ($P < 0.05$). One hundred and twenty-four (136 fractures) patients were available for treatment as four declined. Twelve cases did not require treatment while others were managed by either closed or open reduction under general anesthesia. Gillies' temporal approach was the commonest (57.1%) surgical technique employed. However the unstable nature of the fractures necessitated open reduction and transosseous wiring in 33 cases. The high prevalence of zygomatic complex fractures arising from vehicular accidents reflects the poor status of the road network in rural and suburban Nigerian communities. Hence government should improve on existing infrastructures, decongest the highways and enforce traffic laws amongst road users. In addition, the need to encourage massive investments in safer alternative transport systems is emphasized.

Vincent Ugboko[1], Christopher Udoye[2], Kizito Ndukwe[1], Adewumi Amole[2], Stephen Aregbesola[1]

[1]Departments of Oral and Maxillofacial surgery, Faculty of Dentistry, Obafemi Awolowo University, Ile – Ife; [2]Radiology, Faculty of Health Sciences, University of Ilorin, Ilorin, Nigeria

Key words: zygomatic complex fracture; suburban population

Dr Vi Ugboko, Departments of Oral and Maxillofacial Surgery, Faculty of dentistry, Obafemi Awolowo University, Ile – Ife, Nigeria
E-mail: vugboko@yahoo.com

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Fractures of the zygomatic complex with its accompanying functional and esthetic deficits are a fairly common phenomenon in the practice of oral and maxillofacial surgery. The zygomatic complex contributes to the formation of the lateral wall and floor of the orbit as well as to the walls of the temporal and infratemporal fossa because of its articulations with the frontal, temporal, maxillary bones and greater wing of the sphenoid.

While it is generally agreed that they are the most common of the midface fractures (1–3), statistics show that the incidence figures quoted in the literature vary. Previous African studies by Adekeye (4), Moorehouse and Chimimba (5), and Khan (6) reported 23.3, 13.8 and 9.3%, respectively. In addition, Cook and Rowe (7), Gassner et al. (2) and Iida et al. (3) found 64, 28.1 and 20%, respectively amongst their cases. These differences can be ascribed to peculiarities in study design and data collection, age of patients, etiology, cultural and geopolitical factors (2, 8).

Zygomatic complex fractures can occur in isolation or in combination with other facial bone fractures. Similarly, earlier workers (2–6) have

highlighted various etiological factors such as road traffic accidents, altercations, falls and gunshot injuries but most cases arise from direct and blunt impacts to the lateral aspect of the face.

Although there is abundant literature on maxillofacial fractures (2, 3, 9–11), few from Sub-Saharan Africa have provided detailed information on the zygomatic complex (1, 4). Besides previous reports (1, 4) have emanated from maxillofacial units located mainly in urban centers. Thus the present investigation examines the etiology, pattern and management of zygomatic complex fractures in a suburban Nigerian population.

Patients and methods

This is a retrospective study of all patients who presented with fractures of the zygomatic complex between January 1990 and July 2003 at the Maxillofacial Unit of the Obafemi Awolowo University Teaching Hospital, Ile-Ife, Nigeria. Data was retrieved from the hospital case records and radiographs on the patients' demographics, cause, and duration of injury, classification, treatment given and complications.

In the present study, zygomatic complex fractures were classified into six classes as described by Knight and North (12) using the Water's radiographic projection. Class 1, undisplaced fractures; class 2, arch fractures including the v-shaped deformity; class 3, unrotated body fractures; class 4, medially rotated body fractures; class 5, laterally rotated body fractures; and class 6, complex fractures. In addition, we sought to know if the fractures were simple, compound, comminuted or compound and comminuted.

Data were then entered into an IBM compatible computer and analyzed using the software SPSS version 11.0 (SPSS Inc., Chicago, IL, USA). Simple frequency charts, chi-squared statistics, Fisher's exact test and Students *t*-tests were used as appropriate. Statistical significance was inferred at *P*-levels <0.05.

Results

A total of 196 patients presented with various midface fractures during the study period. Of these, 128 (65.3%) sustained 140 fractures of the zygomatic complex. There were 109 males (85.2%) and 19 females (14.8%) whose ages ranged from 3 to 74 years (mean ± SD, 33 ± 12.6 years; median 30.5 years). No statistically significant difference was observed in the mean age of both males and females ($P > 0.05$). Patients in the third decade of life (38.3%) recorded the highest number of fractures, while those in the third and fourth decades accounted for 64.8% of cases (Table 1).

Table 1. Age and gender distribution of 128 patients with zygomatic complex fractures

Age distribution (years)	Number of patient's		Total (%)
	Males (%)	Females (%)	
0–10	3 (2.3)	0 (0)	3 (2.3)
11–20	9 (7)	3 (2.3)	12 (9.4)
21–30	41 (32)	8 (6.3)	49 (38.3)
31–40	32 (25)	2 (1.6)	34 (26.6)
41–50	15 (11.7)	3 (2.4)	18 (14.1)
51–60	6 (4.7)	2 (1.6)	8 (6.3)
61–70	2 (1.6)	1 (0.8)	3 (2.3)
71–80	1 (0.8)	0 (0)	1 (0.8)
Total (%)	109 (85.2)	19 (14.8)	128 (100)

Table 2. Etiology of fractures in 128 patients according to gender distribution

Etiology	Number of patients		Total (%)
	Males (%)	Females (%)	
Road traffic accidents			
Automobile	62 (48.4)	17 (13.3)	79 (61.7)
Motorcycle	12 (9.4)	0 (0)	12 (9.4)
Pedestrian	4 (3.1)	0 (0)	4 (3.1)
Sports	9 (7)	0 (0)	9 (7)
Fights and Assaults	7 (5.5)	2 (1.6)	9 (7)
Gunshots	9 (7)	0 (0)	9 (7)
Falls	5 (3.9)	0 (0)	5 (3.9)
Industrial accidents	1 (0.8)	0 (0)	1 (0.8)
Total (%)	109 (85.2)	19 (14.8)	128 (100)

Road traffic accidents (74.2%) mainly from automobile (61.7%) and motorcycle (9.4%) involvement were the predominant causes of zygomatic complex fractures. Sports, fights and assaults and gunshot injuries recorded nine patients (7.%) each (Table 2). Three cases (2.3%) of zygomatic complex fractures seen in the first decade of life were because of automobile related accidents (Fig. 1).

All patients presented for treatment between 3 h and 90 days of sustaining injury (mean ± SD, 6.5 ± 11.2 days; median 3 days). While 38.8 and 41.1% of them presented within the first 24 and 48 h, respectively, at least eight of every 10 presented within a week. Overall, male patients presented relatively earlier than their female counterparts, although this was not statistically significant ($P > 0.05$).

Table 3 shows the classification of zygomatic complex fractures according to the etiological agents implicated. Class 3 fractures caused predominantly by automobile accidents were the commonest (50%), followed by classes 2 (zygomatic arch) and 4, respectively. Most class 6 fractures (6.3%) resulted from gunshot injuries. Regarding fracture types,

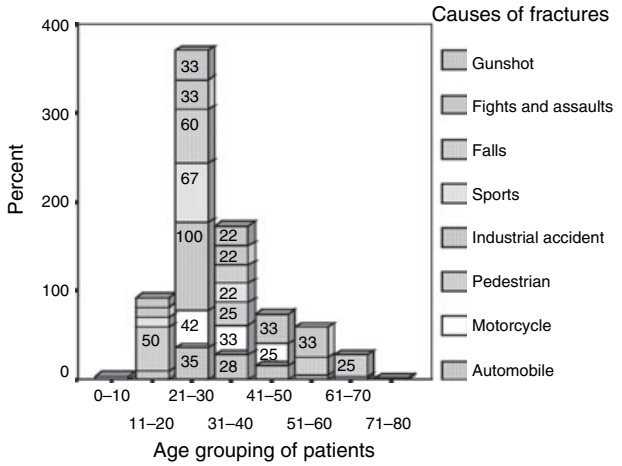

Fig. 1. Etiology of fractures according to age distribution.

Table 3. Classification of fractures in 128 patients according to the etiological factors

	Classification of fractures						
Etiology	1	2	3	4	5	6	Total (%)
Automobile	7	11	43	12	5	1	79 (61.7)
Motorcycle	0	4	6	1	1	0	12 (9.4)
Pedestrian	1	1	2	0	0	0	4 (3.1)
Sports	3	1	4	0	1	0	9 (7)
Fights and Assaults	0	2	7	0	0	0	9 (7)
Falls	1	1	2	1	0	0	5 (3.9)
Gunshots	0	0	0	1	0	8	9 (7)
Industrial accidents	0	0	0	0	1	0	1 (0.8)
Total (%)	12(9.4)	20 (15.6)	64 (50)	15 (11.7)	8 6.3)	9 (7)	128 (100)

Table 4. Location of zygomatic fractures in 128 patients according to gender distribution

	Number of patients (%)		
Location	Males	Females	Total (%)
Left	54 (42.2)	9 (7)	63 (49.2)
Right	45 (35.2)	8 (6.3)	53 (41.4)
Both	10 (7.8)	2 (1.6)	12 (9.4)
Total (%)	109 (85.2)	19 (14.8)	128 (100)

simple ones accounted for 74.2%, compound 14.1%, and comminuted 4.7%. Concomitant compound and comminuted cases constituted 7% of the sample population. Furthermore, the etiological agent influenced the class and type of fracture sustained by the patients. These differences were statistically significant ($P < 0.05$). There were 116 (left 63, right 53) and 12 unilateral and bilateral fractures, respectively (Table 4). The right side of the face recorded more zygomatic arch and class 3 fractures. Although more cases of either unilateral or bilateral fractures were seen in males, the difference was not statistically significant ($P > 0.05$).

The different treatment modalities of zygomatic complex fractures are displayed in Table 5. Of the 128 patients, 124 (136 fractures) were available for treatment as four declined for personal reasons. Twelve fractures that were predominantly of class 1 variety were treated conservatively. Others were managed by either closed or open reduction under general anesthesia using nitrous oxide/halothane for orotracheal intubations or intravenous ketamine hydrochloride. Gillies' temporal approach was the commonest (57.1%) surgical technique employed in all patients, and was found to be effective for 16 (11.4%) and 63 (45%) classes 2 and 3 fracture respectively. However the unstable nature of the fractures necessitated open reduction and transosseous wiring in five (four class 3 and one class 2) cases. Six fractures were reduced with the lateral coronoid approach. Patients who sustained classes 4 and 5 fractures had open reduction and transosseous wiring. This treatment option was also applicable for majority of the class 6 fractures. Overlying soft tissue wounds in patients with compound fractures were managed by primary closure or use of local flaps (Figs 2 and 3) where direct apposition could not be achieved.

Eleven patients (8.6%) reported with complications (Fig. 4) and these include facial scar (4), limited mouth opening (2) and ocular involvement (5). Loss of vision (3) and one each of enopthalmus and ptosis made up the ocular complications. The scars were observed in those who sustained compound fractures from gunshot injuries while optic nerve avulsion and rupture of the globe were responsible for the loss of vision.

Discussion

The prominence of zygomatic complex as well as its multiple articulations with other bones of the facial skeleton renders it exceptionally vulnerable to fracture when injuries affect the maxillofacial region. In the present study, zygomatic complex fracture occurred more frequently (65.3%) than any other fracture of the midface. This finding is similar to those reported by Zacharides et al. (13) (65%), Cook and Rowe (7) (64%), Turvey (14) (69.0%) and Fasola (1) (62.0%). However, some earlier studies (10, 15) have reported much lower incidence figures.

Males sustained more fractures than females with a male to female ratio of 6:1. This ratio compares favorably with that of Fasola (1) (5.4:1) in a similar study from western Nigeria but lower than 23:1 reported by Adekeye (4) from Northern Nigeria. Adekeye (4) ascribed the low prevalence in females'

Table 5. Treatment modalities for 140 zygomatic complex fractures in 128 patients

Treatment given	Classification of fractures 1	2	3	4	5	6	Total (%)
Conservative treatment							
Leave alone	12	0	0	0	0	0	12 (8.6)
Gillies' approach	0	16	63	0	0	1	80 (57.1)
Lateral coronoid approach	0	1	5	0	0	0	6 (4.3)
Antral packing	0	0	4	0	0	1	5 (3.8)
Open reduction and transosseous wiring	0	1	4	15	6	7	33 (23.6)
Refused treatment	0	2	0	0	2	0	4 (2.9)
Total (%)	12	20	76	15	8	9	140 (100)

Fig. 2. Compound and comminuted zygomatic complex fracture from gunshot injuries.

Fig. 3. Same patient as in Fig. 2 (side view).

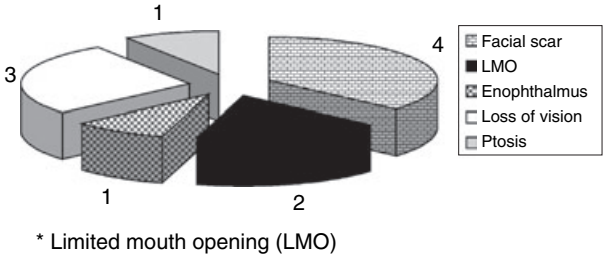

Fig. 4. Complications of zygomatic complex fractures.

to two main reasons. First, the number of women in Nigeria who own cars, motorcycles and bicycles is negligible compared with their male counterparts and vehicular accidents accounted for approximately 82% of the fractures in their series. Secondly, most Nigerian women are housewives participating occasionally in trading or farming, hence they are less exposed to traumatic hazards that may be associated with fights, industrial work and sports. However, Adekeye's (4) study was carried out in northern Nigeria where most women are restricted for cultural and religious reasons and may not be as vulnerable to vehicular accidents as females from Southern Nigeria.

The highest incidence of zygomatic complex fractures was observed amongst patients in the third decade of life. This is consistent with the findings of other workers (1, 4, 16) and similar reasons have been suggested for the predominance of young adults in these studies. Furthermore, it is generally believed that they are more actively involved in high-speed transportation, fights, industrial work and sports, which increases their susceptibility to such injuries.

In the present report, road traffic accidents were the commonest cause of zygomatic complex fractures, accounting for 74.2% cases. Although, this figure is relatively high, it is lower than 82.2 and 81.6% reported by others (1, 4) whose practices are located in urban centers with a large population density and high volume of traffic. In general, most Nigerian studies (1, 4, 11, 15, 17) have implicated road traffic accidents as the leading cause of maxillofacial injuries with figures remarkably higher than those reported by Rowe and Killey (18) (35.6%), Haidar (16) (19.4%), Hutchin and Shuker (19) (35.6%) and Moorhouse and Chimimba (5) (26.7%). This has been attributed to the downturn in the economy that has led to massive importation of fairly used vehicles from Europe (11). Inadequate maintenance of these vehicles plying poorly maintained rural and suburban roads as well as reckless driving have immensely contributed to these high figures. In addition, the volume of traffic on most intercity/interstate routes is unusually high because of non-functional transport alternatives like rail and water transport while air transport is not readily affordable. However, in countries where the volume of traffic is comparatively low, vehicular accidents were second to assaults amongst the causes of maxillofacial fractures (5). In spite of the recurrent episodes of communal and ethnic clashes in this locality in recent times, a low prevalence of violence related fractures were recorded in this series when compared with figures quoted by Haidar (16) and Hitchin and Shuker (19) in their studies.

Unlike previous reports (1, 4), a considerable proportion of the patients in this study presented for treatment within the first 24–48 h of injury. This relatively early presentation might be because of the esthetic and functional deficits often associated with such fractures.

The most common anatomic type of zygomatic complex fractures was type 3. This is in agreement with most studies where road traffic accident was the main etiological agent (1, 4, 20).

Various closed and open reduction procedures are available as treatment options for zygomatic complex fractures. However, the choice of technique depends on the clinician's evaluation of the fracture, experience and preference as well as availability of equipment and facilities. In the present study, Gillies' temporal approach was the commonest surgical procedure employed compared with 40.9 and 41% reported by Adekeye (4) and Moorhouse and Chimimba (5) but this was found to be adequate for all the stable fractures. Furthermore, the 11.5% of cases who did not receive treatment in this series also contrasts sharply with 46.9 and 34.9% recorded by Adekeye (4) and Moorhouse and Chimimba (5). Patients who did not receive treatment were those who outrightly refused treatment or did not require elevation of the fractured zygoma because of the absence of either esthetic or functional impairment. It is note worthy that in the present era of rigid internal fixation (2, 3) reasonably satisfactory results were obtained in about a quarter of our patients who had open reduction and transosseous wiring of the fractures. Presently, the full compliment of equipment and materials for rigid internal fixation is not readily available in this locality and the cost of treatment is usually quite prohibitive.

There are accounts in the literature highlighting blindness, retrobulbar hemorrhage, infections and limited mandibular movement (4, 8, 21) as complications associated with zygomatic complex fractures. The 8.6% obtained in the present study compares favorably with 8.9% in Adekeye's (4) series. While majority of the patients in the present study had ocular complications, malunion was the commonest recorded in northern Nigeria where they were mainly attributed to delay in seeking treatment.

The high prevalence of zygomatic complex fractures arising from vehicular accidents reflects the poor status of the road network in rural and suburban Nigerian communities. Hence government should improve on existing infrastructures, decongest the highways and enforce traffic laws amongst road users in order to reduce the carnage on the highways. In addition, there is a need to encourage massive investments in safer alternative transport systems.

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