

The Clinical Presentation and Management of Zygomatic Complex Fractures in a Nigeria Teaching Hospital.

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ABSTRACT

BACKGROUND: Fractures of the zygomatic complex occur worldwide and are a component part of injuries that can be sustained in the maxillofacial region. The objective was to analyze the clinical presentation and management of zygomatic complex fractures. **Methods:** This was a prospective study carried out over a period of five years at the University of Calabar Teaching Hospital, Nigeria. Data documented were patients' age, gender, time of presentation, cause and type of fracture, associated head and maxillofacial injuries, clinical features, types of plain radiographs, treatment methods, duration of follow-up and complications.

RESULTS: Majority of the patients (n=81, 63.3%) were in their third and fourth decades of life while the male to female ratio was 20.3:1. Road traffic accident (n=111, 86.7%) was the most common cause of fracture. Fractures of the zygomatic complex alone (n=105, 82.0%) were more common than isolated fractures of the arch (n=13, 10.2%) and combined fractures of the zygomatic complex and arch (n=10, 7.8%).

CONCLUSION: While multi-disciplinary approach to treatment is important, majority of the fractures were treated by simple elevation and transosseous wire osteosynthesis. Delay in presentation, associated injuries and non-availability of mini-plating technique contributed to the development of complications.

KEYWORDS: Zygomatic complex, fracture, presentation, management.

Fractures of the zygomatic complex is commoner in young adult males.^{6, 7} The common clinical features include limitation in mouth opening, inability to close the mouth, flattening of the cheek prominence, malocclusion, gradual or sudden blindness, diplopia, enophthalmos and sensory disturbances involving the infra-orbital nerve.^{3, 8, 9} Diagnosis of this condition is by clinical examination and radiographic finding.^{2, 10}

Fractures of the zygomatic complex are sometimes associated with other head and maxillofacial injuries.^{1, 2, 3} However, isolated zygomatic complex fractures also occur.^{3, 10} Following better understanding and technological advancement made in fracture management, many treatment methods have evolved over the years in the management of zygomatic complex fractures. However, the treatment options adopted for a particular case depend on the clinical presentation, cost-effectiveness, materials and facilities available. In our centre, the use of computerized tomography and mini-plate osteosynthesis is not yet a common place due to the problems of availability and affordability.

This study aims at analyzing the pattern of presentation and management of zygomatic complex fractures in our centre and to compare the results with those obtained elsewhere.

PATIENTS AND METHODS

This was a prospective study of fractures of the zygomatic complex which was carried out over a period of 5 years (January 2005 to December 2009) at the Accident and Emergency Centre and Dental and Maxillofacial Clinic of the University of Calabar Teaching Hospital (UCTH), Calabar Nigeria. The hospital is a referral centre with 400 beds that serves over three million people. Prior to the commencement of this study, approval was sought and obtained from the Ethics Committee of the hospital. Patients' whose consent were obtained and attended a minimum of four follow-up visits were included in the study. Pre- and post-trauma photographs were used when necessary to aid treatment planning and assess treatment outcome. Data documented were patients' age, gender, time of presentation and aetiology of fracture. Also recorded were the type and site of fracture (zygomatic complex or arch), associated head and maxillofacial injuries, clinical features, types of plain radiographs requested to confirm presence of fracture, method of treatment, duration of follow-up and complications.

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INTRODUCTION

Fractures of the zygomatic complex constitute part of the trauma cases encountered by practising oral and maxillofacial surgeons.^{1, 2} The zygomatic complex as a component of maxillofacial skeleton is partly responsible for mid-face contour and protection of the eye in the orbit. It gives origin to the masseter muscle and absorbs the force of mastication and forceful impacts before it reaches the brain.^{2, 3} The causes of zygomatic complex fractures as reported in the literature¹⁻³ include road traffic accident (RTA), assaults, disasters (including air mishap), missiles, sporting injuries, and falls. However, the relative contribution of these factors to the aetiology varies from one part of the world to another depending on the socio-economic and cultural characteristics of the population.^{2, 4, 5}

A minimum of four visits was scheduled for each patient with an interval of one week in the first two weeks, and fortnightly in the following eight weeks, and thereafter, one, three and six monthly appointments in the subsequent follow-up period. Treatment outcome was derived from post-operative complaints and clinical evaluation as they presented during follow-up. Successful treatment was defined as restoration of anatomical form of zygoma, and absence of pain at the fracture site during function. Complications were conditions arising in subjects that occurred during and after treatment and persisted beyond six weeks from the commencement of treatment. The data collated was analyzed using EPI Info software (2008 version).

RESULTS

Table 1 shows the age and gender distribution of subjects. Majority (n=81, 63.3%) were in their third and fourth decades of life. The age of patients ranged from 17-80 years with a mean age of 35±2.3 years. There was male preponderance in all the age categories. There were 122 (95.4%) males and six (4.6%) females, giving a male to female ratio of 20.3:1.

Table 1: Age and gender distribution of subjects.

Age (years)	Male	%	Female	%	Total	%
11-20	6	4.7	0	0.0	6	4.7
21-30	45	35.2	0	0.0	45	35.2
31-40	33	25.8	3	2.3	36	28.1
41-50	17	13.3	2	1.5	19	14.8
51-60	11	8.6	1	0.8	12	9.4
61-70	7	5.5	0	0.0	7	5.5
71-80	3	2.3	0	0.0	3	2.3
Total	122	95.4	6	4.6	128	100.0

Most of the subjects (n=105, 82.0%) presented within two weeks of sustaining the fracture while 23 (18.0%) presented as old cases (Table 2). Road traffic accident (n=111, 86.7%) was the most common cause of fracture (Table 3). Vehicular RTAs accounted for 67 (60.4%) while others (n=44, 39.6%) were due to motorcycle RTAs. The total number of subjects sustaining maxillofacial fractures within the period under consideration was 827, while those of the zygomatic complex accounted for 125 (15.1%).

Table 2: Distribution of time lapse before presentation.

Duration	No	%
Within 48 hours	26	20.3
3-6 days	39	30.5
7-14 days	40	31.2
15-30 days	9	7.0
One- two months	8	6.3
> Two months	6	4.7
Total	128	100.0

Fractures of the zygomatic complex (n=105, 82.0%) were more common than isolated fractures of the arch (n=13, 10.2%) and combined fractures of the zygomatic complex and arch put together (n=10, 7.8%). Comminuted fractures (n=23, 18.0%) occurred less frequently than non-comminuted fractures (n=105, 82.0%). Also unilateral fractures were 115 (89.9%) while bilateral fractures accounted for 13 (10.1%). Likewise, fractures located on the left zygoma (n=71, 55.5%) were more than the right side (n=44, 34.4%).

Table 3: Distribution of aetiology.

Aetiology	No	%
Road traffic accident (RTA)	111	86.7
Assault	11	8.6
Gunshot	4	3.1
Fall	2	1.6
Total	128	100.0

Circumorbital ecchymosis and oedema with limitation of mandibular movements were the predominant clinical features of the fractures as shown in Table 4. The zygomatic complex was fractured in isolation in 25 (19.5%) cases while associated injuries were present in the rest (n=103, 80.5%), (Table 5). Single or multiple radiographic views were used to confirm the presence of fractures. These were, occipito-mental + posterior-anterior + submentovertex (n=71, 55.5%), occipito-mental + posterior-anterior (n=42, 32.8%), or occipito-mental (n=15, 11.7%) only.

Table 4: Clinical features of zygomatic complex fractures.

Clinical features	No	%
Circumorbital ecchymosis and oedema	120	19.2
Limitation of mandibular movements	118	18.9
Flattening of the cheek prominence	107	17.1
Subconjunctival ecchymosis without lateral border	94	15.0
Depression of the zygomatic arch	72	11.5
Paraesthesia/anaesthesia of cheek and upper lip	54	8.7
Diplopia	28	4.5
Epistaxis	23	3.7
Enophthalmos	9	1.4
Total	625	100.0

Table 6 shows the various treatment methods. Majority of the fractures (n=115, 78.2%) were treated by reduction through simple elevation and transosseous wire osteosynthesis. No active treatment was done in 21 (14.3%) of the cases. The anaesthetic methods used to manage the subjects were either local anaesthesia with conscious sedation (n=50, 46.7%) using 2% lignocaine with 1:80,000 adrenaline, pentazocine and diazepam or general anaesthesia (n=21, 19.6%) coupled with the use of 2% lignocaine with 1:80,000 adrenaline (n=36, 33.6%) under endotracheal intubation. Transosseous wire osteosynthesis were performed using 0.5mm diameter soft stainless steel wire while antral packing

was with ribbon gauze impregnated with tincture of benzoin compound.

Also, 108 (84.4%) of the subjects had successful and uncomplicated treatment outcome, while 20 (15.6%) had unsuccessful treatment as they presented with complications. The complications recorded are shown in Table 7. There was no gradual or sudden blindness. These complications were successfully managed during the follow-up period. The duration of follow-up ranged from six weeks to thirty months. In the patients without complications, follow-up period lasted between six to 10 weeks with a mean of 8.3 ± 2.4 , whereas in complicated cases follow-up was from 10- 132 weeks with mean of 36 ± 11.2 . However, 38 (29.7%) cases were lost to follow-up while those who had complications, kept follow-up appointments.

Table 5: Distribution of associated head and maxillofacial injuries.

Type of injury	No	%
Lefort 1 fracture	54	24.5
Lefort 2 fracture	51	23.2
Mandibular fracture	39	17.7
Palatal split	30	13.6
Lefort 3 fracture	15	6.8
Nasal fracture	15	6.8
Orbital	7	3.2
Facial nerve palsy	6	2.8
Head injury	3	1.4
Total	220	100.0

NB: Some subjects had more than one fracture combination.

Table 6: Surgical approaches and treatment of zygomatic complex fractures

Type	No	%
Reduction by upper buccal sulcus incision	68	46.2
Reduction by Gillies' approach	26	17.7
Lateral eyebrow approach with at FZ trans-osseous wiring	21	14.3
No treatment	21	14.3
Reduction by Caldwell Luc operation/ antral pack	11	7.5
Total	147	100.0

NB: FZ= Fronto-zygomatic

Some subjects had more than one type of treatment.

Table 7: Complications associated with zygomatic complex fracture.

Complication	No	%
Limitation in mouth opening	7	30.4
Numbness of the cheek and upper lip	6	26.1
Loss of prominence of the cheek (facial deformity)	3	13.0
Diplopia	3	13.0
Facial nerve (zygomatic branch) paralysis	3	13.0
Enophthalmos	1	4.3
Total	23	99.8

Table 7: Complications associated with zygomatic complex fracture.

Complication	No	%
Limitation in mouth opening	7	30.4
Numbness of the cheek and upper lip	6	26.1
Loss of prominence of the cheek (facial deformity)	3	13.0
Diplopia	3	13.0
Facial nerve (zygomatic branch) paralysis	3	13.0
Enophthalmos	1	4.3
Total	23	99.8

DISCUSSION

Fractures of the zygomatic complex are some of the maxillofacial skeletal injuries encountered in most Dental hospitals worldwide. The zygoma has been compared to a four-sided pyramid articulating with the frontal, sphenoidal, temporal and maxillary bones.^{1, 2} It accounted for 15.1% of all maxillofacial skeletal injuries in our centre during the period under consideration. This contrasts the reports of Zachariades et al¹¹ and Turvey¹² who recorded 0.45% and 69.0% respectively in their studies.

This study shows that the young age group presented more with zygomatic complex fracture. This is because road traffic accident (RTA) was the major aetiological factor, and this has been found to be common in this age category in previous studies.^{1, 13} The male preponderance seen in this study compares well with other reports.^{1, 2, 3} The reason for this is similar to that for increased RTA in males, as males are more exposed to traffic as drivers, and frequently travels for work, business and leisure activities.¹³ In Nigeria, due to the non-enforcement of the highway code, many drivers exceed the speed limit; do not use seat belts and sometimes drive under the influence of alcohol and psychoactive drugs.^{13, 14} Furthermore, because of the economic hardship in Nigeria, most vehicle and motorcycle owners fit fairly used tyres on their automobiles, and years of neglect have left the highways in a state of disrepair. All these factors have contributed to the increased prevalence of RTA as a leading aetiological factor of maxillofacial injuries in Nigeria.^{13, 14, 15}

Majority of the subjects (82.0%) presented within two weeks of sustaining the fracture. Reasons given for delay in presentation were delay in referral from other hospitals, distance to the maxillofacial clinic, financial constraints and the belief that injury was not serious. Fractures seen beyond two weeks were regarded as old fractures and these had adverse effect on prognosis of treatment.³

Fractures involving the middle third of the facial skeleton tend to follow the line of least resistance.^{1,2} The extent of the fracture, and its precise pattern, are dependent upon the direction and degree of the impact which, in turn, are determined by the relationship of the bone to the trajectory of the force and the kinetic energy which has to be absorbed.^{1,2,3} This study recorded more fractures of the zygomatic complex (82.0%) than those of the arch alone (10.2%) or combined zygomatic complex and arch (7.8%). This was because of the predominant role of RTA in most of the injuries; due to the frontal nature of the impacts.⁹

More fractures occurred on the left (55.5%) than on the right (34.4%) side. Grinker and Saks¹⁶ suggest that hemispherical cerebral dominance leads the victim to turn to the right in a reflexive manner to avoid being wounded, thus presenting the left side of the face to the injuring force. All the patients that had gunshot injuries (3.1%) and some of those with RTA (14.9%) presented with comminuted fractures which can be attributed to the high velocity nature of the impacting force.

As a result of the intimate association of the zygomatic complex with the rest of the skull and facial skeleton, associated head and maxillofacial fractures are common.^{2, 9} The associated injuries recorded in this study are similar to those reported by earlier authors.^{2, 3} These authors reported that Lefort type of fractures were most commonly associated with zygomatic complex fractures.^{2,3}

Many signs and symptoms usually accompany zygomatic complex fractures.¹⁻³ Circumorbital ecchymosis and oedema, limitation in mandibular movements, and flattening of the cheek prominence leading to facial deformity were the most common. The persistence of bright red blood in subconjunctival ecchymosis without lateral boundary is believed to be due to the direct diffusion of oxygen through the overlying membrane.¹ Both circumorbital ecchymosis and oedema, and subconjunctival ecchymosis are usually self-limiting.¹⁻³ Flattening of the cheek prominence is usually seen in tripod fractures that are most often displaced inwards.² Limitation in mandibular movements is a result of the fractured zygomatic complex impinging on the coronoid process of the mandible.^{2,3} Paraesthesia or anaesthesia of the cheek and upper lip recorded was due to direct injury to the

infraorbital nerve. As recorded in this study, several authors have noted that the occurrence of zygomatic complex fractures were important risk factors to the development of diplopia and enophthalmos.¹⁻³

Radiographic examination in the present study was limited to the use of plain radiographs due to the unavailability of sophisticated imaging techniques in our centre. However, there is still a controversy on the number of radiographs required for diagnosis. In the study by Mcloughlin et al⁸, 93.3% of the respondents used two or more radiographs for diagnosis of zygomatic complex fractures while only 6.7% of surgeons relied on a single radiograph. This study corroborated this earlier report since single radiographic view was relied upon for diagnosis in 11.7% of cases, and the rest (88.3%) depended on two or three different views. However, Ogden et al¹⁷ suggested that in some cases of fractured zygoma, clinical criteria alone were adequate for post-operative assessment.

A review of the literature¹⁻³ suggests that about half of those patients presenting with radiological evidence of fracture may not require operative treatment. However, minor degrees of displacement can be accepted in many cases, especially in the elderly, provided that a permanent disturbance of binocular stereoscopic vision will not result.¹ Also, the number of patients for whom operation is not advised tends to increase with the surgeon's experience.¹ In the present study 14.3% of the patients did not have any active treatment and were placed on observation during the follow-up period.

The predominant methods of reduction in this study were by simple elevation through upper buccal sulcus (46.2%), and Gillies' (17.7%) approaches. This is consistent with the reports of De Giovanni et al¹⁸ but differs with that of Mcloughlin et al⁸. Direct fixation by transosseous wire osteosynthesis and packing in the maxillary sinus was indicated in those cases considered likely to remain unstable following reduction. This is consistent with the report of Fashola et al.⁴ For stable fractures, simple elevation is sufficient due to the integrity of temporal fascia and interdigitation of the fracture lines.^{1,3}

Mcloughlin et al⁸ found that the use of bone plating was not significantly greater than the use of transosseous wiring among British Oral and Maxillofacial surgeons. Contrary to this report, O'Sullivan et al¹⁹ found that bone plating was the most frequently employed fixation to achieve a better fracture healing.

In this study, most of our patients (70.3%) kept to follow-up appointments except 29.7% that were lost to follow-up. As is common with patients in our environment, once the acute phase of a health condition is resolved, they

tend to default on appointments.⁹ This study found post-operative complications among 15.6% of the subjects. Tadj and Kimble²⁰ reported a complication rate of 20.7% while Covington et al²¹ reported a rate of 1.5%. The patients that had complications were successfully managed during the follow-up period, and some (30.3%) in collaboration with the ophthalmic and neuro-surgeons. Some of these complications were thought to have arisen partly as a result of late presentation, not being able to use mini-plate osteosynthesis and consequently, inadequate initial treatment.

CONCLUSION

This study revealed that RTA was responsible for most of the fractures. While multi-disciplinary approach to treatment is important, majority were treated by simple elevation and transosseous wire osteosynthesis. Associated injuries and delay in presentation contributed to the development of complications. Although, there are conflicting reports in the literature on the benefits of newer technique over the older methods of treatment, the use of mini-plate osteosynthesis in those subjects that presented late would have enhanced treatment outcome. This paper also call for a more proactive and pragmatic approach toward reduction of automobile accidents by the relevant government agencies in order to bring the burden of trauma to the barest minimum.

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