AFRICAN JOURNAL OF MEDICINE
and medical sciences

VOLUME 31, NUMBER 2 JUNE 2002

EDITOR:
B. O. OSOTIMEHIN

ASSISTANT EDITOR:
A. O. UWAIFO

ISSN 1116 — 4077

Afr. J. Med. med. Sci. (2002) 31, 101-105

Concomitant injuries in 531 patients with maxillofacial fractures

AO Fasola, AE Obiechina and JT Arotiba

Department of Oral & Maxillofacial Surgery, College of Medicine, University of Ibadan, Nigeria

Summary

A ten-year review of five hundred and thirty one patients with facial fractures who sustained six hundred and forty eight associated injuries was presented. The male to female ratio was 2.7:1 and the highest incidence was in the 21-30 years age group. Road traffic accident was the commonest aetiology while the most frequently associated injury was soft tissue lacerations (71.0%). Neurological injuries constituted 9.9% of the total number of concomitant injuries. Other associated injuries seen were orthopaedic injuries 9.5%, ophthalmologic injuries 6.6%, chest injuries 1.9%, abdominal injuries 0.6% and urological injuries 0.5%. It is mandatory that the surgical team should be organised in the treatment of patients with concomitant injuries coexisting with maxillofacial fractures.

Keywords: *Concomitant, injuries, maxillofacial, fracture*

Résumé

Un examen pendant dix ans de cinq cents trente un (531) malades avec les fractures faciales qui ont eu six cents quarante-huit blessures associé était présenté. La proportion du sexe masculin au sexe féminin était dans le groupe âgé de 21 à 30 ans. L'étiologie le plus commun était l'accident de circulation routière tandis que la blessure la plus fréquemment associé 'était la déchirure de tissu tendre (71%). Les blessures neurologiques constituent 9,9% du nombre total des blessures concomitant. Les autres blessures associées qui étaient remarqué étaient les blessures orthopédique 9,5%, blessure ophtalmologiques 6,6%, blessures de poitrine 1,9%, blessures abdominales 0,6% et blessures urologicales 0,5%. C'est obligatoire que l'équipe chirurgienne devrait être organisé à ce qui concerne le traitement des malades avec les blessures concomitant qui coexistent avec les fractures maxillo-faciales.

Introduction

Fractures of the facial bones may occur in isolation or in conjunction with injuries to other parts of the maxillofacial region and the body. When these concomitant injuries occur, they may be of genuinely serious and life-threatening nature [1].

The timely diagnosis and immediate management of these concomitant injuries are important to reduce the morbidity and mortality associated with these conditions. Despite the abundant studies done on maxillofacial fractures all over the world, injuries associated with facial fractures have received only passing comments in oral and maxillofacial surgery literatures.

The purpose of the study was to determine the incidence, sex, age of the patients, the cause of concomitant injuries associated with maxillofacial fractures and the relationship of the associated injuries with maxillofacial fractures.

Materials and methods

This study gathered data from 1203 patients seen and treated at the Oral and Maxillofacial Surgery department of the University College Hospital, Ibadan, between 1 January 1989 and 31 December 1998. The review protocol incorporated age, sex, aetiology, maxillofacial fractures and concomitant injuries. The concomitant injuries are divided into the following categories according to Haug *et al* [2].

(a) Facial lacerations which ranged from small to large ones (Hussain *et al*) [3]
(b) Orthopaedic injuries represented fractures of the limbs/extremities.
(c) Neurological injuries ranged from cranial injuries, to loss of consciousness, skull fractures and spinal injuries which included fractures and compression of the spine.
(d) Abdominal injuries incorporated trauma to the liver, spleen and the bowels.
(e) Chest injuries included fractures of the ribs, flail chest, diaphragmatic injury, tracheobronchial injuries, pneumothorax and haemothorax.
(f) Urological injuries which incorporated kidneys and ureters
(g) Ophthalmic injuries which vary from mild ophthalmic disorders such as coronal eye displacements to severe ones like optic nerve injury.

Results

Prevalence

A total number of 1203 patients who sustained maxillofacial fractures were seen over the 10-year period. Out of this number, concomitant injuries occurred in 531 (44.1%) patients.

Age and sex distribution

The highest incidence was in the 21-30 year age group (208 cases, 39.2%) while the lowest incidence was in the age range of 71-80 years (3 cases, 0.5%) (Table 1). These were 389 males and 142 females giving a ratio of 2.7:1.

Aetiology

The most common aetiology of concomitant injuries in patients with maxillofacial fractures was road traffic accidents. This represented 401 (75.5%) of the total number of patients. The next most common causes were assaults and falls which accounted for 48 cases (9.0%) and 39 cases (7.3%). Other aetiological factors are as indicated in Table 1.

Distribution of concomitant injuries

Out of 648 injuries in 531 patients, the associated injuries were predominantly facial lacerations comprising 71.0% of the total number of injuries. Next most common were neurological injuries (9.9%) and orthopaedic injuries (9.5%). Less commonly seen associated injuries were ophthalmic (6.6%), chest (1.9%), abdominal (0.6%) and urological injuries (0.5%) (Table 2)

Number of concomitant injuries per patient

Of the 531 patients, 436 (82.1%) had one associated injury, 74 (13.9%) sustained two injuries while 20 (3.8%) had three injuries. One (0.2%) patient sustained four concomitant injuries.

Correspondence: Dr. AO Fasola, Department of Oral & Maxillofacial Surgery, University College Hospital, P.M.B. 5116, Ibadan, Nigeria.

Table 1: Sex and age distribution of patients and the aetiology of concomitant injuries in 531 patients

Sex		Age distribution		
Female	Male	Age in yrs.	No. of patients	%
389	142	<10	27	5.1
M: F = 2.7:1		11 - 20	63	11.9
		21 - 30	208	39.2
		31 - 40	113	21.3
		41 - 50	61	11.5
		51 - 60	32	6.0
		61 - 70	24	4.5
		71 - 80	3	0.5
		Total	531	100.0

Aetiology of concomitant injuries in 531 patrients

Aetiology	No. of patients	%
Road traffic accidents	401	75.5
Assaults	48	9.0
Falls	39	7.3
Sports	22	4.2
Industrial accidents	11	2.1
Misellaneous causes (gunshots, fits)	10	1.9
Total	531	100.0

Table 2: Distribution of 648 concomitant injuries in 531 patients with maxillofacial fractures.

Concomitant injury	No. of injuries	%
Facial lacerations	460	71.0
Neurological	64	9.9
Orthopaedic	62	9.5
Ophthalmic	43	6.6
Chest	12	1.9
Abdominal	4	0.6
Urological	3	0.5
Total	648	100.0

Specific types of concomitant injuries

The commonest facial laceration seen was the moderate type which comprised 51.3% of the total number. The small lacerations constituted 28.3% of the lacerations while the large lacerations made up 19.8% of the total number of the facial lacerations. (Table 3).

Table 3: Types of facial lacerations associated with maxillofacial fractures

Facial lacerations	No. of injuries	%
Moderate (2-4cm)	236	51.3
Small (< 2cm)	133	28.9
Large (> 4cm)	91	19.8
Total	460	100.0

Closed head injuries constituted 60.9% of the neurological injuries. Cervical spine injuries comprised 17.2%, skull fractures 14.1% while intracranial haematoma made up 7.8% of the total number of neurological injuries. (Table 4).

Table 4: Frequency of neurological injuries associated with maxillofacial fractures

Neurological injury	No. of injuries	%
Closed head injury	39	60.9
Cervical spine	11	17.2
*Skull fracture	9	14.1
Intracranial haematoma	5	7.8
Total	64	100.0

**Skull fractures - frontal bone 5, sphenoid 3, temporal bone 1.*

Fractures of the upper extremity were the most frequently associated orthopaedic injury (59.7%). This was followed by fractures of the lower extremity (37.1%) and fractures of the pelvis (3.2%) (Table 5).

Conjunctival injuries of the eye constituted 41.8% of the total number of ophthalmological injuries. This was followed by eyelid injuries (21.0%), reduced visual acuity (14.0%) and blindness (11.6%). Other ophthalmological injuries were as stated in Table 5.

Fractured ribs (33.0%) and pneumothorax (25.0%) were the most frequently associated chest injuries; followed closely by haemothorax (16.7%), stove in chest (16.7%) and flail chest (8.3%). Injuries to the liver (75.0%) and the spleen (25.0%) were the abdominal injuries seen in this study while injuries to the kidney (66.7%) and the bladder (33.3%) were the urological injuries encountered (Table 6).

Treatment of concomitant injuries

Operative treatment was done in 497 patients (93.6%). General anaesthesia was administered in 418 (78.7%) patients while local anaesthesia was used in 79 (14.9%) patients (Table 7).

Four hundred and thirteen (89.8%) lacerations out of the total number of 460 lacerations were sutured while 47 (10.2%) lacerations were treated conservatively. Conservative treatment of head injuries was the commonest treatment done for head injuries (39.1%). This was followed by treatment of head injuries by osmotic diuretics (21.9%). Twenty-one (33.9%) orthopaedic injuries were treated by closed reduction and plaster of Paris casts while open reduction and internal fixation was done for 19 (30.6%) orthopaedic injuries. The other neurological and orthopaedic treatment methods were as shown in Table 8.

Twenty-five (58.1%) ophthalmological injuries were treated conservatively while suturing of eyelid lacerations was done for 9(21.0%) injuries. Intercostal tube drainage was used to treat 5 (41.7%) chest injuries while conservative treatment of chest injuries was done for 4 (33.3%) injuries. Two (66.7%) abdominal injuries were treated by hepatic lobectomy while conservative treatment was utilized in 2 (66.7%) urological injuries (Table 9).

Thirty-five (6.6%) patients underwent multiple general anaesthesia. More than one surgical team (neurosurgeons, orthopaedic surgeons, ophthalmologists, cardiothoracic surgeons, general surgeons, and urologists) operated during the same anaesthestic in 69 (12.9%) patients. Tracheostomy was performed in 11 (2.1%) patients.

Table 5: Types of orthopaedic and ophthalmological injuries associated with maxillofacial fractures

Orthopaedic			Ophthalmological		
Types of injuries	Number	- %	Types of injuries	Number	%
Fracture of upper extremity	(37)	(59.7)	Conjunctival injury	18	41.8
-fractures of the ulna	12	19.4	Eyelid injury/laceration	9	21.0
-fractures of the radius	10	16.1	Reduced visual acuity	6	14.0
-fractures of the humerus	10	16.1	Blindness	5	11.6
-Fracture of the clavicle	3	4.9	Enophthalmos	3	7.0
-Fractures of the metacarpals	2	3.2	Coronal eye displacement	2	4.6
Fractures of lower extremity	(23)	(37.1)			
-Fractures of the fibula	10	16.1			
-Fractures of the tibia	7	11.3			
-Fractures of the femur	6	9.7			
Fractures of the pelvis	(2)	(3.2)			
Total	62	100.0	Total	43	100.0

Table 6: Types of chest, abdominal and urological injuries associated with maxillofacial fractures

Chest			Abdominal			Urological		
Types of injuries	Number	%	Types of injuries	Number	%	Types of injuries	Number	%
Fractured ribs	4	33.3	Rupture of the liver	3	75.0	Subcapsular haematoma of the kidney	2	66.7
Pneumothorax	3	25.0	Rupture of the spleen	1	25.0	Rupture of the bladder	1	33.3
Pneumo/haemothorax	2	16.7						
Stove in chest	2	16.7						
Flail chest	1	8.3						
Total	12	100.0		4	100.0-		3	100.0

Table 7: Type of anaesthesia used in 497 patients who underwent surgical operations

Type of anaesthesia	No. of patients	%
General anaesthesia	418	78.7
Local anaesthesia	79	14.9
Total	497	93.6

Outcome of management

The median length of hospital stay was fifteen days. Nine patients died in the hospital as a result of associated cranial injuries.

Discussion

Patients with facial fractures frequently have associated injuries as a result of intense injuring force which is focussed towards the whole body which results in multiple injuries which vary in gravity and intricacy [4]. The incidence of 44.13% of associated injuries among patients who sustained facial fractures compares favourably with previous studies [5,6]. However, the incidence is lower than 81.3% recorded by Ugboko *et al* [7] and greater than 29.9% reported by Nakamura and Gross [8]. The high value observed by Ugboko *et al* [7] was due to the large number of facial lacerations seen in their study while the low value recorded by Nakamura and Gross [8] was as a result of the small number of automobile injuries in their study.

The dominant casualties in this study were young adults. This is consistent with the findings of previous studies [9,10,11]. This is not surprising since they are the ones usually involved in high speed transportation which is likely to result in road traffic accidents. The gender ratio was similar to a study by Gywn *et al* [10] who stated that males are more involved in more violent altercations, more hazardous occupations and have higher incidence of road traffic accidents.

Most of the patients seen in this study were involved in road traffic accidents. This conforms with the findings of previous studies [2,4] but differs from the studies done by Nakamura and Gross [8] and Gywn *et al.* [10] where altercation was the commonest cause. A combination of factors such as poor condition of roads, disregard for traffic rules and regulations and lack of vehicular seat belts are responsible for the high value of road traffic accidents in this study. We found that altercations, falls and sport injuries are seldom serious enough to cause severe associated injuries.

The most common concomitant injury was facial lacerations. This finding parallels those of previous studies [2,5,11]. This is not unexpected since the selection of patients for this study was based on presence of facial fractures. Neurological injuries ranked second as associated injuries. This corresponds to the findings of previous studies [2,5,6] but lacks comparison with the study by Lim *et al.* [12] which ranked orthopaedic injuries above neurological injuries in order of frequency of occurrence of associated injuries.

Closed head injury (CHI) was the commonest neurological injury seen in this study (Table 4). CHI can be defined as a "documented evidence of loss of consciousness and/or post-traumatic amnesia" in a patient with a non-penetrating injury [13]. The impact on the head gives rise to the displacement and

Table 8: Treatment of facial lacerations, neurological and orthopaedic injuries

Facial lacerations			Neurological injuries			Orthopaedic injuries		
Treatment	Number	%	Treatment	Number	%	Treatment	Number	%
Suturing	413	89.8	Conservative treatment of *HI	25	39.1	Closed reduction and POP casts	21	33.9
Conservative treatment	47	10.2	Treatment of *HI by osmotic diuretics	14	21.9	Open reduction with internal fixation	19	30.6
			Skull traction for cervical injuries	11	17.2	Conservative treatment	12	19.4
			Conservative treatment of skull fractures	7	10.9	Skeletal traction	10	16.1
			Craniectomy	3	4.7			
			Cranioctomy	2	3.1			
			Open reduction of skull fractures	2	3.1			
Total	460	100.0	Total	64	100.0	Total	62	100.0

**HI = Head injury*

Table 9: Treatment of ophthalmological, chest, abdominal and urological injuries

Ophthalmological injuries			Chest injuries			Abdominal injuries			Urological injuries		
Treatment	No.	%	Treatment	No.	%	Treatment	No.	%	Treatment	No.	%
Conservative treatment	25	58.1	Intercostal tube drainage	5	41.7	Hepatic lobectomy	2	66.7	Conservative treatment	2	66.7
Suturing of lid lacerations	9	21.0	Conservative treatment	4	33.3	Splenectomy	1	33.3	Repair of bladder	1	33.3
Treatment of facial fractures	5	11.6	Elevation of depressed ribs	3	25.0						
Enucleation of eye	3	7.0									
Evisceration of eye	1	2.3									
Total	43	100.0	Total	12	100.0	Total	3	100.0	Total	3	100.0

distortion of cerebral tissues which later results in concussion, contusion, laceration of brain and loss of consciousness [14]. Although, the midface is designed to absorb impact and protect the cranial structures, the observation by Haug *et al* [15] that bones of the middle third of the face appear to transmit forces to the cranium is valid in this study.

Cervical spine injury was responsible for 2.07% of the total number of concomitant injuries. This is greater than values between 0.9% and 1.2% recorded in previous studies [4,12] but less than values of 3.6% and 4.0% reported by Olson *et al* [6] and Schultz [11]. However, no cervical spine injury was found in Gywn *et al*'s study [10]. Most of the cervical spinal injury were as a result of transmission of indirect forces from the facial injuries which resulted in dislocations at sites of maximum mobility between the cervical spines. The relationship noted between the fractures of the mandible and upper cervical spine injuries and soft tissue lower cervical spine injuries by Lewis *et al* [9] was also seen in our study. Frontal bone fractures was the most frequently seen cranial bone fracture accounting for five out of the total number of nine. This is consistent with the finding of Haug *et al.* [15].

Orthopaedic injuries accounted for 9.5% of the total number of concomitant injuries (Table 2). This is less than 18.1% recorded by Olson *et al* [6] but greater than 4.3% reported by Lim *et al* [12] and 7.4% by Ugboko *et al.* [7]. It is very important to note that the most common orthopaedic injury in this study was fractures of the upper extremity which differs from the study by Schultz [11] who noted fractures of the lower extremity as the most common orthopaedic injury. There was a rupture of the bladder in one of the two fractures of the pelvis seen.

Table 2 showed that ophthalmological injuries were seen in 6.6% of associated injuries. Ocular injuries commonly occur in patients with facial fractures [16]. Holt *et al* [17] stated that minimal ocular injuries may be missed by the non-ophthalmologist while severe ones may be easily detected by any medical practitioner or maxillofacial surgeon. Five cases of blindness were seen; four cases were due to optic nerve injuries while one was as a result of rupture of the globe and the cause in all the cases was road traffic accidents.

Chest, abdominal and urological injuries were less commonly seen associated injuries accounting for 1.9%. 0.6% and 0.5%, respectively. Although these injuries are fairly uncommon, missed diagnosis of these injuries could lead to a fatal consequence. It is therefore important that thorough physical examination and diagnostic studies such as peritoneal tap, radiographs, computerised tomography scan, blood studies and intravenous pyelogram be done so that injuries to the abdominal organs are not missed.

Almost one fifth of the patients with associated injuries had more than one concomitant injury. Irby [18] stated that the rise in automobile transportation had led to an increase in

multisystem injuries; the head, face, spinal cord and torso are prone to injury in high speed collision and usually two or more of these areas are involved. Road traffic accidents are responsible for more causes of polytrauma than any other mechanism.

About four-fifths of the patients underwent surgical operations under general anaesthesia. This was because of the extensive nature of the facial injuries and the need to operate on some other areas of the body. The commonest surgical procedure done for associated injuries was suturing of facial lacerations. It is very important that exploration of fractured bone, teeth and foreign bodies is done before closure. Careful closure was accomplished to achieve good aesthetic result.

Most of our head injury patients were managed conservatively using closed observation of the neurological status since the head injuries were mild. The Glasgow coma scale [19] is a universally valuable method of assessing the state and improvement in the level of consciousness.

Skull traction for cervical fractures was done in 17.2% of neurological injuries. The relative restrictions skull traction poses in the management of facial injuries are well documented by Schultz [11]. Similar restrictions were encountered in this study.

Conservative management was done in the majority of ophthalmological injuries as most of these injuries were subconjunctival haemorrhages which cleared spontaneously. Suturing of laceration was done in about one-fifths of ocular injuries. It is very important that minimal debridement of eyelids and preservation of viable tissue are done since tissues survive in a large percentage of cases [18]. Enucleation of the eyes was done in three cases after repeated checks of vision showed that the eyes could not perceive light to prevent sympathetic ophthalmia.

Intercostal tube drainage was done in five chest injuries to expel air and blood from the pleural cavity. In management of chest injuries, it is very important to obtain a clear tracheobronchial tree, obtain maximum pulmonary expansion and evaluate all possible blood and air from the pleural cavity. Also, the lost blood should be replaced.

The renal injuries were managed conservatively since these injuries consisted of subcapsular haemorrhage. However, it is important that the patient must rest flat in bed until macroscopic haematuria has been absent for one week.

The average of stay in the hospital of the patients in this study was fifteen days. This is longer than 9.6 days recorded in Gywn *et al*'s study [10]. The higher number of patients with cranial and orthopaedic injuries who required prolonged immobilization could have been responsible for this.

Although maxillofacial injuries are seldom life threatening, nine cases of death were recorded in our study. All the nine patients had associated cranial injuries. Arajarvi *et al* [20] stated that fatal outcome after maxillofacial injuries was due to bleeding and a massive aspiration of blood together with brain concussion and chest injuries.

In view of the severe injuries seen in association with facial fractures, which could lead to high morbidity and death, there is a need for careful, timely diagnosis and prompt treatment of the concomitant injuries. Also, combined surgical team approach is very important in the total care of patients with concomitant injuries.

References

1. Killey HC Fractures of the middle third of the facial skeleton. Second Edition. Bristol John Wright and Sons Ltd 1977
2. Haug RH, Prather J and Indresano AT. An epidemiologic survey of facial fractures and concomitant injuries. J Oral Maxillofac Surg 1990; 48:926-932.
3. Hussan K, Wijetunge DB, Grubnic S and Jackson IT, A comprehensive analysis of craniofacial trauma. J. Trauma 1994; 36:34-47.
4. Luce EA, Tubb TD and Moore AM. Review of 1,000 major facial fractures and associated injuries. Plas Reconstr Surg 1979; 63:26-30.
5. Adekeye EO. The pattern of fractures of the facial skeleton in Kaduna, Nigeria. A survey of 1,447 cases. Oral Surg 1980; 6:491-495.
6. Olson RA, Fonseca RJ, Zeitter PL *et al*. Fractures of the mandible. J. Oral Surg 1982:40; 23.
7. Ugboko VI, Odusanya SA and Fagade OO. Maxillofacial fractures in a semi-urban Nigerian teaching hospital. A review of 442 cases. Int J Oral Maxillofac Surg. 1998; 27:286-289.
8. Nakamura T and Gross CW. Facial fractures: analysis of five years of experience, Arch Otolaryngol 1973; 97:288-290.
9. Lewis VL, Manson PN, Morgan RF, Cerullo LJ and Mejer PR. Facial injuries associated with cervical fractures: recognition, patterns and management. J. Trauma 1985; 25: 90-93.
10. Gywn PP, Carraway JH, Horton CE, Adamson JE and Lladick RA. Facial fractures, associated injuries and complications. Plast Reconstr Surg. 1971; 47:225-230.
11. Schultz RC. Facial injuries from automobile accidents, a study of 400 consecutive cases Plast Reconstr Surg 1967; 40:415-425.
12. Lim LH, Lam LK, Moore MH *et al*. Associated injuries in facial fractures. Review of 839 patients. Br J Plast Surg 1993: 46:635.
13. Davidoff G, Jakubowski M, Thomas D *et al*. The spectrum of closed head injuries in facial trauma victims. Incidence and impact. Ann Emerg Med 1998: 17:6.
14. Rains AJH and Ritchie HD. Bailey and Love's short practice of surgery. English Language Book Society & H.K. Lewis & Co. Ltd. 1981; 18th Edition.
15. Haug RH, Adams JM, Conforti PJ and Likavec MJ. Cranial fractures associated with facial fractures. A review of mechanism, type and severity of injury. J Oral Maxillofac Surg 1994; 52:729-733.
16. Al-Quirainy IA, Titterington DM, Dutton GN, Stassen LFA, Moos KF and El-Attar A. Midfacial fractures and the eye: the development of a system for detecting patients at risk of eye injury. Br. J. Oral Maxillofac Surg 1991; 29:363-367.
17. Holt JE, Holt GR and Blodgett JM. Ocular injuries sustained during blunt facial trauma. Ophthalmol 1983:90:14.
18. Irby WB. Facial trauma and concomitant problems. Evaluation and treatment. St Louis, CV Mosby, 1979.
19. Tesdale G and Jennet B. Assessment of coma and impaired consciousness: a practical scale. Lancet 1974; 1:81-84.
20. Arajarvi E, Lindqvist C, Santavirta S, Tolonen J and Kiviluoto O. Maxillofacial trauma in fatally injured victims of motor vehicle accidents. Br. J Oral Maxillofac Surg 1986:24-251-257.