A RETROSPECTIVE AUDIT DETERMINING THE PREVALENCE OF HEAD INJURIES ASSOCIATED WITH MAXILLOFACIAL TRAUMA

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DECLARATION

I, Mahomed Ayoob Moolla, declare that this research report is my own work. It is submitted in partial fulfillment for the degree of Master of Dentistry in the branch of Maxillofacial and Oral Surgery at the University of the Witwatersrand, Johannesburg. It has not been submitted previously for any other degree or examination at this or any other University.

Date

ABSTRACT

Trauma in South Africa has been described as a "malignant epidemic" (Muckart DJ, 1991)[5]. Trauma is most acute in Sub-Saharan Africa, where deaths from trauma is higher than in any other region of the world where the risk of death from injury is greatest, especially for men aged 15-29 years (Murray CJL, in Bowley etal, 2002)[5].The recognition of concurrent life threatening injuries is critical, given that patients with facial fractures seldom die in the absence of airway problems, massive bleeding, aspiration of blood into the lungs and massive head injury[30].

There are several reports in the literature regarding multisystem trauma and facial fractures. Head injuries are commonly associated with facial fractures, and facial fractures can be markers for brain injury[16] .This study is aimed to identify the prevalence of head injuries associated with maxillofacial trauma in the Johannesburg General Hospital, Gauteng, South Africa.

The data was collected from 1st January 2003 to 30th June 2003. A total of 196 patients with maxillofacial injuries were treated and 176 were included in the study. The data was analyzed using SAS™ for Windows™. From the results it was found that of the 176 patients the majority were males comprising 88.07% of the study. Based on the GCS scores alone it was shown that 38.06% patients suffered head injuries. After reviewing patient records, it was found that of the whole sample only 31.25% of patients suffered true head

injuries based on CT scan and neurosurgery findings. It was also shown that the most frequent mechanism of injury with head injuries was gunshot wounds at 52.72% and the most common maxillofacial injury associated with head injury was panfacial fractures at 23.63%. In this study we also reviewed the outcome of the patients based on mortality rates. A total of 24 patients (13.63%) died from associated injuries. Of these patients 2 (1.13%) died from associated injuries due to polytrauma and 22 (12.5%) died due to severe head injury.

We found that severe maxillofacial injuries involving the midfacial region such as panfacial fractures, zygomatic complex fractures and Le Fort fractures are frequently seen in patients with significant head injury. This should alert trauma unit personnel during assessment of patients to the fact that if a patient presents with significant midfacial trauma, one might expect that an underlying head injury is present. It is important to make note, that of the associated injuries present with maxillofacial trauma, involvement of the central nervous system including concussion, is the most frequent[8].

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Abbreviations

ATLS®	=Advanced Trauma Life Support (American College of Surgeons)
BILFMAN	=Bilateral Fractured Mandible
BOS#	=Base of Skull Fracture
COMMFI	=Comminuted Facial Injuries
CSF	=Cerebrospinal Fluid
CT	=Computerised Tomography Scan
DAI	=Diffuse Axonal Injury
ETT	=Endotracheal Tube
GCS	=Glasgow Coma Scale
GSW	=Gunshot Wound
HI	=Head Injury
ICP	=Intracranial Pressure
IOD	=Injury on Duty
MVA	=Motor Vehicle Accident
NAD	=No Abnormalities Detected
NECK	=Neck/Cervical Spine
NIL	=None
NTT	=Nasotracheal Tube
ORBFRAC	=Orbital Fracture
PANFAC	=Panfacial Fracture

PVA	=Pedestrian Vehicle Accident
SO_2	=Oxygen Saturation
UNIFMAN	=Unilateral Fractured Mandible
ZYGOMA #	=Zygomatic Fractures

Chapter 1

1. Introduction and Review of the Literature

Trauma in South Africa has been described as a "malignant epidemic" (Muckart DJ, 1991)[5]. Trauma is most acute in Sub-Saharan Africa, where deaths from trauma is higher than in any other region of the world where the risk of death from injury is greatest, especially for men aged 15-29 years (Murray CJL, in Bowley etal, 2002)[5]. Trauma units countrywide continue to be flooded by patients with injuries caused by motor vehicle accidents (MVA), pedestrian vehicle accidents (PVA), bicycle accidents, Gunshot wounds (GSW), assaults including interpersonal violence, stab wounds, sporting injuries, fall from heights, injury on duty (IOD) and self inflicted injuries from attempted suicide.

Crime statistics for South Africa for the period 2003 to 2004 were issued by the South African Police Services. In Gauteng, there were 8664 reported cases of carjacking, 74322 cases of common assault and 1960 cases of indecent assault. The total number of cases reported for South Africa for the above mentioned crimes were 13793, 280942 and 9302 respectively[25]. In 2006, Statistics South Africa released information regarding mortality and causes of death in South Africa 2003 and 2004. They state that the causes of death, in order of relative importance and in both years, were: (1) events of undetermined intent; (2) transport accidents; (3) other external causes of accidental injury; (4) assault; (5) complications of medical and surgical care;

(6) intentional self-harm; (7) sequelae of external causes of morbidity and mortality; and; (8) legal intervention and operations of war[27].

The leading cause of death from un-natural causes in 2003 and 2004 were due to unspecified firearm discharge (Table 1)

	2003	2004
Handgun Discharge	6	4
Rifle, shotgun and large firearm discharge	27	21
Other and unspecified firearm discharge	8015	6086
Contact with explosive material	11	10
Contact with sharp object	3218	1863
Contact with GSW object	1501	1778
Falling, jumping or pushed from a High place	14	23
Falling, lying or running before or into moving object	21	27
Crashing of motor vehicle	9	15
Total	12822	9827

Table 1: Causes of un-natural death by trauma between 2003 and 2004

An interim road traffic and fatal crash report for the year 2006 was issued by the Road Traffic Management Co-operation on 27 January 2007. They revealed the following statistics[24]:

1. The number of fatal crashes for the year 2006 increased by 718 (6, 12%) from 11,736 during the year 2005 to 12,454. (The increase from 2004 to 2005 was 10, 41%).
2. The estimated number of fatalities increased by 1,258 (8, 90%) from 14,135 during the year 2005 to 15,393 during 2006. (The increase from 2004 to 2005 was 10, 62%).
3. Driver fatalities increased by 599 (15, 49%) from 3,867 in 2005 to 4,466 in 2006.
4. Passenger fatalities increased by 793 (18, 20%) from 4,358 to 5,151 in 2006.
5. Pedestrian fatalities decreased by 134 (2, 26%) from 5,910 to 5,776. (RTMC, 2007)[24]

Although there is a reported decrease in the number of fatalities and crime related injuries[24,25], the numbers are still proportionally significant resulting in trauma units inundated with victims.

1.1 Maxillofacial Injuries

The spectrum of maxillofacial injuries presenting in the trauma unit at the Johannesburg Hospital, range from dento-alveolar fractures, nasal bone fractures, mandibular fractures, maxillary fractures, frontal bone fractures, naso-orbital ethmoid fractures, Panfacial fractures and penetrating injuries. All or some of these injuries present either as isolated maxillofacial injuries or associated with other concomitant injuries involving other organ systems viz; head injury, thoracic injury, abdominal injury and limb injuries.

As society has become completely mobile and urbanised, trauma has emerged as one of the leading health problems, with maxillofacial trauma being no exception. Injuries to the face and jaws are among the most frequent injuries seen in many emergency rooms[22]. Maxillofacial injuries, such as soft-tissue injuries, dental injuries, or maxillary, mandibular, and zygomatic fractures, are the most common injuries treated by maxillofacial and oral surgeons, and traffic accidents are the leading cause of these injuries [33]. There have been a number of studies to show the incidence of maxillofacial fractures in different countries, and it has been shown that mandibular fractures are twice as common as fractures in the midfacial region [2]. Fractures of the mandible are a common form of facial injuries, and have been reported to account for 36% to 59% of all maxillofacial fractures[1].

Beaumont (1985)[4], found in his study, that the mandible was the most common site of fracture, followed by the middle third of the face which included the zygomatico-maxillary complex. The mandible is the site of fracture most often diagnosed, this is the result of both its prominence and its selection as a target of intentional violence[4].

The main causes or mechanisms of injury worldwide are assaults and road traffic accidents, but the frequency varies from one country to another. Some studies have shown that assaults are more common in developing countries, whereas road traffic accidents occur more frequently in developed countries[26]. Fatal injuries caused by interpersonal violence and motor vehicle collisions are a major public health problem in South Africa[5]. In his study, Bowley (2002) reviewed the number of patients attending the Johannesburg hospital trauma unit from January 1985 to December 2001.

He found that the number of resuscitations for trauma in 1985 was 409 as compared to 1725 in 2001. Although the main reason for increase is due to the effects of interpersonal violence such as assault with a fist or GSW object i.e. victims assaulted with the butt of a handgun or rifle, the number of resuscitations for trauma due to accidents more than doubled during the study period (312 to 678)[5].

The severity of facial injury resulting from gunshot wounds varies, depending on the type of weapon used, calibre of weapon used, the type of ammunition used the distance from which the patient is shot. Close range, high velocity gunshot wounds and shotgun wounds can result in devastating functional and

aesthetic consequences for the patient [15]. Tsakiris (2002) noted an increase in the prevalence of maxillofacial gunshot injuries from 9% to 37% over the period 1987-1992. He reported that from gunshot wounds to the maxillofacial region, the mandible was more involved than the maxilla, 61% as opposed to 21%[29].

1.2 Head Injury

In the United States there are approximately 500 000 cases of head injury occurring each year, and of these about 10% die prior to reaching the hospital[6]. It is estimated in the USA that 95 per 100 000 inhabitants sustain a fatal or severe enough injury to require hospital admission each year[31]. Traumatic brain injury is a heterogenous disease involving a wide range of pathologies, including diffuse axonal injury, focal contusions and space occupying intra and extradural haematomas[31] .

A decrease in the level of consciousness is the single most reliable indicator that the patient has a serious head injury or secondary insult to the brain (Trunkey D, 1993)[7]. Patients with head injury may be classified according to (1) Mechanism of Injury, (2) Severity of Injury, and (3) Morphology of Injury [6,31].

1.2.1 Mechanism of Injury

Patients in this group are classified into either closed or penetrating head injury. In closed head injury, acceleration and deceleration forces seen in road traffic accidents, cause diffuse injuries and more local impact forces contusions. In penetrating, usually from gunshot or stab wounds, the object causes local destruction, and depending on the kinetic energy transmitted to the tissue, more widespread devastating injuries can result[31] . Dural penetration determines whether the injury is penetrating or not[6] . The outcome in penetrating injury is poorer, and outcome is primarily determined by mortality[31].

1.2.2 Severity of Injury

The Glasgow Coma Scale score is used to quantify neurologic findings and allows uniformity in description of patients with head injury[6] Table 2. It is widely accepted and a standardised method for evaluating level of conscious[31]. The severity of the head injury can be classified as mild, moderate or severe depending on the scores of the Glasgow Coma Scale. Mild head injury patients have a score of 14-15, moderate 9-13 and severe 3-8. Coma has been defined as having a score of 8 or less[6] Table 3.

Assessment Area	Score
Eye Opening (E)	
Spontaneous	4
To speech	3
To pain	2
None	1
Best Motor Response (M)	
Obeys commands	6
Localises pain	5
Normal flexion (withdrawal)	4
Abnormal flexion (decorticate)	3
Extension (decerebrate)	2
None (flaccid)	1
Verbal Response (V)	
Orientated	5
Confused conversation	4
Inappropriate words	3
Incomprehensible sounds	2
None	1

GCS score = (E+M+V), best possible score=15, worst possible score=3

Table 2: Glasgow Coma Scale adapted from the ATLS® Student Manual 7th Edition 2003

1.2.3 Morphology of Injury

Assessing the clinical severity of injury according to the GCS is impaired by the fact that many patients arrive in the hospital sedated, paralysed and ventilated. For these reasons interest has focused on more technical examination such as Computerised Tomography Scans (CT scans) and

Magnetic Resonance Imaging (MRI)[31] . CT scans permit the evaluation of structural damage, detection of mass lesions, traumatic subarachnoid haemorrhage and may show evidence of raised Intracranial pressure (ICP)[31]. Morphologically, head injuries may be broadly considered under two headings: (1) Skull Fractures, (2) Intracranial lesions[6] Table 3.

Mechanism	GSW		-High velocity (automobile collision) -low velocity (fall, assault)
	Penetrating		-gunshot wounds -other penetrating injuries
Severity	-mild -moderate -severe		-GCS score 14-15 -GCS score 9-13 -GCS score 3-8
Morphology	-Skull Fractures	-Vault	-linear vs stellate -depressed/nondepressed -open/closed
		-Basilar	-with/without CSF Leak -with/without VII nerve palsy
		-Focal	-epidural -subdural -intracerebral
		-diffuse	-mild concussion -classic concussion -diffuse axonal injury

Table 3: Classification of head injury from ATLS®

The predictive value of the GCS score has been reported by several investigators[7] . Patients with a high GCS score, have a greater likelihood of good neurologic recovery. A patient with a low score has a low probability of good neurologic recovery.

1.3 Head Injury and Maxillofacial trauma

The recognition of concurrent life threatening injuries is critical, given that patients with facial fractures seldom die in the absence of airway problems, massive bleeding, aspiration of blood into the lungs and massive head injury [30]. Head injury in the form of cerebral trauma is relatively low among facial trauma patients in a study by Tung-Chain Tung in 2000. This may support the theory that the air filled, impact absorbing facial bones in front of the cranial structures serves as a cushion to protect the brain.

Gwynn et al (1971), found in their study of facial fractures and associated injuries, that life-threatening injuries such as cerebral concussions were frequently associated with facial fractures (14,2%)[10]. Previous studies have shown that 17,5% of patients with facial fractures sustained some form of closed head injury, and that almost 10% sustained severe intracranial injury [7]. They also mention that intracranial hypertension (intracranial pressure high enough to impair the normal flow of the cerebral circulation) is the single most common cause of morbidity and mortality in the patient with severe closed head injury, and a sustained pressure of 60mmHg has a mortality rate of 100%.

Haug (1992), found a 17,5% incidence of closed head injury associated with facial fractures, and the predominant cause of injury was motor vehicle accidents (61%). He states that patients with the most severe intracranial injuries, were those associated with a combination of mandibular/zygomatic fractures or maxillary/zygomatic fractures, and the least amount of close head injuries were associated with isolated maxillary fractures[12]. Patients with severe head injury often have coma as a sequelae of their injury. As a result, functional deficits in the upper aerodigestive tract often occur, necessitating the need for definitive airway management[32].

There are several reports in the literature regarding multisystem trauma and facial fractures. Head injuries are commonly associated with facial fractures, and facial fractures can be markers for brain injury [16].

Chapter 2

Materials and Methods

2.1 General

Prior to undertaking the research, ethical clearance was obtained from the Committee for Research on Human Subjects (medical) of the University of the Witwatersrand (Clearance M050716). Permission was also obtained from Dr CB Pearl to use some of the data collected for his research report in 2003. The study included all patients who presented with maxillofacial injuries to the Trauma Unit (163) at the Johannesburg General Hospital between the period January 2003 to July 2003. All patients were informed about the study, and written consent by either the subject themselves or a family member was obtained prior to their participation in the study (appendix 1)

The focus of Dr Pearl's study was on Airway management in Maxillofacial and Oral Surgery. However, certain domains were not included in this study, such as gender, morphology of head injury and patient outcome, necessitating the need to utilize the subject's hospital number to call up all patients records in order to obtain information about the domains which were not included.

A total of 176 patients were included in the study, all of whom presented to the Trauma unit with some form of maxillofacial trauma. A total of 20 patients were excluded due to some data being omitted on the questionnaire. Unfortunately, one of the limitations of the data collection

was that the age of the patient was not always obtainable since many patients were either intubated, unconscious or with a low Glasgow coma scale, not enabling adequate questioning. The data was collated and statistically analysed using the SAS Windows^{TM} based software.

Chapter 3

Results

3.1 Gender

Of the total sample size of 176 patients, 155 were male and 21 were female (Table 4)

Sex	**N value**	**%**
M	155	88.07
F	21	11.93
Total	176	100

Table 4: Total number of males and females

3.2 Mechanism of Injury

The most frequent mechanism of injury was blunt trauma (N=74) followed by Gunshot wounds (N=47). Table 5 shows the different mechanisms of injury and their frequencies.

Mechanism of Injury	**N Value**	**%**
Blunt	74	42.05
GSW	47	26.07
PVA	25	14.2
MVA	24	13.64
Pen	6	3.41
Total	176	100

Table 5: Frequency of Mechanism of Injury

3.3 Maxillofacial Injuries

The most frequent maxillofacial injury was bilateral fracture of the mandible, 21.02%(N=37), followed by unilateral fracture of the mandible and zygoma fracture 19.89%(N=35) and soft tissue injury 17.05%(N=30). The remainder of the patients was distributed among the various maxillofacial injury categories as shown in Table 6.

Maxillofacial Injury	**N value**	**%**
Bilat # mand	37	21.02
Zygoma #	35	19.89
Uni # mand	35	19.89
Soft tissue	30	17.05
Panfac #	14	7.95
orbital #	10	5.68
le fort I	8	4.55
le fort III	4	2.27
le fort II	3	1.70
Total	176	100

Table 6: Distribution of maxillofacial injuries in the whole sample

3.4 Glasgow Coma Scale Scores and Head Injury

Of the 176 patients in total, 109 patients presented with a score of 15 and 67 patients had a score of 14 or less. Of the 67 patients, 1 patient had a score of 2 as the patient arrived at the trauma unit intubated (Table 7).

GCS Score	N value	%
2	1	0.57
3	23	12.5
4	1	0.57
5	4	2.27
6	3	1.70
7	15	8.52
8	4	2.27
9	3	1.70
10	2	1.14
11	4	2.27
12	5	3.41
13	1	0.57
14	1	0.57
15	109	61.93
Total	176	100

Table 7: Distribution of Glasgow Coma Scale Scores

3.5 Patient Outcome

In this study outcome is based on mortality instead of disability of head injured patients.86.37% (N=152) of patients in this study survived the trauma and were discharged. The remaining 13.63% (N=24) patients died either in the casualty department, operating theatre or in the wards (Table 8).

Patient Outcome	N value	%
Survived	152	86.37
Died	24	13.63
Total	176	100

Table 8: Patient outcome based on mortality

3.6 Morphology of Head Injury

Of the total number of patients included in the study (N=176), there were a total of 67 patients (38.07%) who presented with a GCS score of 14 or less indicating varying degrees of head injury. The remaining 111 patients had a GCS score of 15 (Table 7). Table 9 shows the different morphologies of head injury, GCS scores, maxillofacial injuries, mechanism of injury and patient outcome that are present in these patients. All of the patients with head injury received a neurosurgical consult. However, some did not have a CT scan since they might have been unstable for CT scan or they died prior to receiving a scan.

Patient	Morphology of head Injury	GCS score	Maxillofacial Injury	Mechanism of Injury	Patient Outcome
1	No HI	13	Bilat # mand	PVA	
2	Diffuse HI	3	Panfac	GSW	Died
3	Severe HI	3	Panfac	GSW	
4	Severe HI	3	Panfac	PVA	
5	Moderate HI, polytrauma	12	Bilat # mand	PVA	Died
6	Base of skull fracture,	7	Zygoma #	GSW	Died
7	Base of skull fracture, secondary meningitis	10	le fort III	MVA	Died
8	DAI	3	soft tissue	MVA	
9	Multiple intracerebral haematomas,	3	Soft tissue	PVA	
10	Subarachnoid haemorrhage, DAI	7	Soft tissue	MVA	
11	DAI, chronic vegetative state	7	Soft tissue	GSW	
12	Posterior fossa extra dural haematoma, brain stem compression	6	Zygoma #	GSW	
13	Base of skull fracture, extradural haematoma,	6	Zygoma #	GSW	
14	Posterior fossa extradural bleed, base of skull fracture	7	Zygoma #	GSW	
15	No CT, severe hi and polytrauma	3	Zygoma #	GSW	Died
16	Massive HI, brain matter protruding	3	Soft tissue	GSW	Died
17	Base of skull fracture, severe HI	7	Zygoma #	GSW	Died
18	Severe HI	3	Zygoma #	GSW	

19	Pneumocephalus, frontal bone fracture	5	Orbit #	GSW	
20	Frontal bone fracture, No HI	15	Zygoma #	GSW	
21	No HI, CT brain-NAD	11	Unilat # mand	GSW	
22	CT brain-NAD	7	Bilat # mand	PVA	
23	Subarachnoid haemorrhage	7	Bilat # mand	PVA	
24	Base of skull fracture, polytrauma	12	Bilat # mand	GSW	Died
25	Subarachnoid haemorrhage small subdural haematoma	7	Panfac	GSW	
26	No HI, polytrauma	3	Bilat # mand	MVA	Died
27	CT brain-NAD polytrauma	8	Bilat # mand	PVA	Died
28	multiple skull fractures, no bleed	7	Zygoma #	MVA	
29	severe HI, intracerebral bleed, midline shift	3	Zygoma #	GSW	Died
30	Midline shift, Basal cisterns closed, cerebral contusion	7	Zygoma #	GSW	
31	Brain contusion	11	Le fortI	PVA	
32	HI	7	Unilat # mand	MVA	
33	No HI	12	Unilat # mand	GSW	
34	HI	9	le fort III	MVA	
35	Temp bone fracture, DAI	5	Panfac	PVA	
36	Subarachnoid haemorrhage,	11	Orbital#	GSW	Died

	extradural haematoma, frontal contusion				
37	no CT, fixed dilated pupils, massive HI	3	Le fort I	PVA	Died
38	Small pneumocephalus, raised ICP	3	Bilat # mand	PVA	
39	Base of skull fracture, Subarachnoid haemorrhage pneumocephalus, DAI	3	Le fort II	PVA	Died
40	Base of skull fracture, severe HI	3	Le fort III	PVA	
41	No HI	12	Le fort I	MVA	
42	Base of skull fracture, CSF leak	5	Soft tissue	GSW	
43	Concussion, CT brain-NAD	7	Orbital #	GSW	
44	Fractured skull with brain matter herniating	6	Orbital #	GSW	Died
45	Fractured skull, brain contusion	7	Orbital #	GSW	
46	CTbrain-NAD polytrauma	5	Soft tissue	pen	
47	CT brain-NAD, No HI, neck trauma	9	Soft tissue	GSW	
48	No HI	14	Unilat # mand	GSW	
49	Diffuse closed HI, cerebral oedema	4	Soft tissue	PVA	Died
50	DAI	3	Soft tissue	MVA	
51	Subarachnoid haemorrhage, frontal lobe contusion	7	Soft tissue	PVA	
52	Severe HI,	3	Soft tissue	MVA	Died

	polytrauma				
53	CT brain NAD	11	Panfac	GSW	
54	Subarachnoid haemorrhage, aqueduct bleed	12	Le fort II	GSW	
55	Intracerebral haematoma, raised ICP, diffuse head injury	10	Panfac	GSW	
56	DAI, Subarachnoid haemorrhage	9	Panfac	GSW	Died
57	Subarachnoid haemorrhage, intracerebral haematoma	8	Orbit #	GSW	
58	Extradural haematoma haematoma, surface collections, pneumocephalus, base of skull fracture	8	Panfac	MVA	
59	Frontal haematoma, Subarachnoid haemorrhage, cerebral contusion	2	Soft tissue	GSW	Died
60	Raised ICP, base of skull fracture, temporal contusions	3	Zygoma #	PVA	
61	DAI, midline shift	5	Panfac	GSW	Died
62	large subdural haematoma and polytrauma	3	Panfac	MVA	Died
63	Base of skull fracture, temporal contusion	8	Panfac	GSW	
64	Subdural haematoma	5	Soft tissue	GSW	
65	Subarachnoid haemorrhage, raised	3	Le fort III	MVA	Died

	ICP, mass effect, pneumocephalus				
66	Raised ICP, Midline shift, Subarachnoid haemorrhage	3	Panfac	MVA	Died
67	subdural bleed causing midline shift and mass effect	3	Panfac	PVA	Died

Table 9: Morphology of Head Injury

3.7 Mechanism of Injury and Head Injury

There were a total of 67 head injured patients (Table 9).Of these, 31.34% (N=21) were caused by GSW trauma. A further 25.37% (N=17) by pedestrian vehicle accidents, and 20.89% (N=14) by gunshot wounds and motor vehicle accidents and finally 1.49% (N=1) by penetrating trauma.

3.8 Maxillofacial Injury and Head Injury

The most frequent maxillofacial injury associated with head injured patients is fracture of the zygomatic complex 22.38% (N=15), (Table 10). Soft tissue injuries and panfacial fractures were equally significant with percentages of 20.89% and 19.40% respectively. Bilateral fractured mandibles had a frequency of 11.94%, and unilateral fractured mandibles a frequency of 5.97%. The combined frequency for fractured mandibles associated with head injuries being 17.91%.

	N Value	**%**
Zygoma #	15	22.38
Soft Tissue	14	20.89
Panfacial #	13	19.40
Le Fort Fractures	10	14.92
Bilateral # Mandible	8	11.94
Unilateral # Mandible	4	5.97
Orbital #	3	4.47
Total	67	100

Table 10: Maxillofacial Injuries associated with Head Injury

Chapter 4

4.1 Discussion

The total sample size during the study period of 6 months was 196. However, 20 subjects were excluded due to insufficient information recorded relating to this study. Thus 176 subjects were included for data analysis. Males comprised the majority of patients (88.07%), with females only comprising 11.93%. The male to female ratio was 7.38:1. This significant gender distribution seems to correlate with other studies reviewed in the literature showing male predominance of 79.68%[30], 83.3%[28], 85%[17], 74.12%[14] and 82%[15].

The most significant mechanism of injury for this study was blunt trauma including assault 42.05% and gunshot wounds 26.07%. There was a much lower incidence of trauma induced by pedestrian vehicle accidents and motor vehicle accidents (14.2% and 13.64% respectively). These figures indicate an alarmingly higher rate of violent crimes with an intention to cause grievous bodily harm and malicious injury to person resulting in significant injury and mortality.

The main causes of injury worldwide are assaults and traffic accidents, but the most frequent cause varies from one country to another[26]. Some studies have shown that assault is more common in developing countries, whereas traffic accidents are more common in developed areas.

In a review of 567 patients by Gwynn etal 1971, they found 35.27% of the injuries were caused by motor vehicle accidents[10]. Luce in 1979, found in there study of 1020 patients, 65% were caused by motor vehicle accidents[22]. These figures compared to the figures in this study, justify the above statement by Simsek (2007)[26].

In this study, the most frequent maxillofacial injury represented was the bilateral fractured mandible 21.02% followed by fractured zygoma and unilateral fractured mandible 19.89% each. Combining the fractured mandibles, results in a 40.92% frequency. In a survey by Haug etal in 1990, they found in 402 patients that 67% suffered mandibular fractures, 21% zygomatic fractures and 11% maxillary fractures[11]. Beaumont (1985), found in his study, that the mandible was the most common site of fracture, followed by the middle third of the face which included the zygomatico-maxillary complex[4]. Tsakiris (2002) reported that from gunshot wounds to the maxillofacial region, the mandible (61%) was more often affected than the maxilla (21%)[29]. The results of this study therefore correlate with previous literature, that fractures of the mandible represent the most common maxillofacial injury.

According to the GCS scores of the patients, it was found that 38.06% (N=67) were classified as having head injury. The vast majority of patients with head injury according to their GCS scores were classified as having severe head injury 74.62% (N=50), 22.38% (N=15) with

moderate head injury and 2.98% (N=2) with mild head injury. However, after reviewing the morphology of the head injuries from the patient files, it was discovered that in fact 12 of the 67 patients with a decreased GCS did not have a head injury but did suffer polytrauma. This results in 31.25% (N=55) of patients in the whole sample having confirmed head injury based on morphology of head injury and not GCS levels alone.

Based on CT scan and neurosurgery findings, of the 67 patients with a decreased GCS score, 82.08% (N=55) have a confirmed head injury and 17.91% (N=12) have had no head injury The results from this study show a significantly higher incidence of head injuries associated with maxillofacial injuries as compared to other reports in the English literature. Gwynn[10], found in their study of facial fractures and associated injuries, that life-threatening injuries such as cerebral concussions were frequently associated with facial fractures (14,2%)[10].

Steidler and co-workers in 1980 found that 62% of patients suffered loss of consciousness when sustaining trauma to the middle third of the face[28]. Previous studies have shown that 17, 5% of patients with facial fractures sustained some form of closed head injury, and that almost 10% sustained severe intracranial injury[7]. In a study by Hung et al 2004, which investigated the correlation between mandible fractures and loss of consciousness, it was found that the incidence of loss of consciousness in patients sustaining mandible fractures was 17.6%[17].

In the group with confirmed head injuries, of the 55 patients the most frequent mechanism of injury was gunshot wounds 52.72% (N=29), pedestrian vehicle accidents 25.45% (N=14) and motor vehicle accidents 21.81% (N=12). These 3 mechanisms of injury can be classified as high velocity, whereas assaults and blunt trauma can be classified as low velocity. None of the other mechanism of injury featured as a cause for injury.

Haug (1992), found that motor vehicle accidents were the predominant cause of injury 61%, and produced an equal distribution between simple loss of consciousness and severe intracranial injury. However, he also stated that motorcycle accidents caused a disproportionately higher rate of severe intracranial injury 78% with a lower GCS score than any other cause[12]. In a review of 1000 major facial fractures and associated injuries, Luce et al (1979) showed that 64.80% of patients were injured in a high velocity circumstance[22].

Panfacial fractures, isolated soft tissue injuries and zygomatic complex fractures feature as the predominant maxillofacial injuries associated with head injured patients, with frequencies of 23.63%, 21.81% and 20% respectively. Le fort fractures and orbital fractures present much less with a frequency of 15.54% and 10.90% respectively. From the results above, it can be said that trauma to the midfacial region has a higher incidence of head injuries as compared to the lower facial third (9.09%). As stated

previously, in all the head injured patients the mechanism of injury could be classified as high velocity injuries. Therefore, as the injuring force becomes more violent and directed more towards the body as a whole, the injuries multiply in complexity and severity[22].

In a study by Heuston and Cook in 1956, 2200 patients with facial fractures were analyzed and it was concluded that patients who sustained facial fractures in a motor vehicle accident (45%), the incidence of head injury was 50%[22]. Haug and co-workers in 1990, assessed concomitant injuries with facial fractures and found that close to 60% of maxillary fractures, about 30% of zygomatic fractures and around 25% of mandible fractures were associated with associated neurologic injuries[11].

The nature of motor vehicle accidents has changed from the past with high velocity travel[20]. Unusual facial fracture combinations have now become increasingly common. The most important among these combinations are frontomaxillary fractures, which is characterized by disjunction of parts of the frontal bone so that the midface and anterior base of skull are separated from the main body of the cranium. This is unlike a Le Fort III fracture, which is a dislocation of the midface from the base of skull [20]. Injuries of sufficient force and magnitude to produce a Le Fort III fracture usually result in fractures of the Le Fort II and I distribution as well, this is termed total facial smash[20].

From the entire sample in this study, we find that 13.63% (N=24) of the patients had died from associated injuries. Of the 24 patients who died, 22 patients (12.5%) died of severe head injury, and only 2 (1.13%) died from injuries due to severe polytrauma. In a study in 2000 by Tung etal who reviewed acute life threatening injuries in facial fracture patients, it was found, there was a mortality rate of 7.81% (N=5) and of the five patients who died three died from neurologic injuries[30]. The most prevalent maxillofacial injuries associated with patients who died with significant head injuries were panfacial fractures 27.27% (N=6). Le Fort fractures, zygoma fractures and soft tissue injuries occurred with an individual frequency score of 18.18% (N=4). Fractured mandibles and isolated orbital fractures resulted in a frequency of 9.09% (N=2).

From these figures and the literature discussed previously, it is evident that severe midfacial trauma has a higher prevalence of head injuries resulting in significant mortality figures

Chapter 5

5.1 Conclusion

Facial trauma is a common injury pattern with the face being the target during intentional assault and the head and face being the first part of the body acting as a secondary missile during ejection from a motor vehicle. In motor vehicle accidents the head is often subject to forces many times that of gravity [20]. From this study there exists a significant association between severe maxillofacial trauma and head injuries.

We find that severe maxillofacial injuries involving the midfacial region such as panfacial fractures, zygomatic complex fractures and Le Fort fractures are frequently seen in patients with significant head injury. This should alert trauma unit personnel during assessment of patients to the fact that if a patient presents with significant midfacial trauma, one should be alerted that an underlying head injury is present. It is important to make note, that of the associated injuries associated with maxillofacial trauma, involvement of the central nervous system including concussion is the most frequent[8].

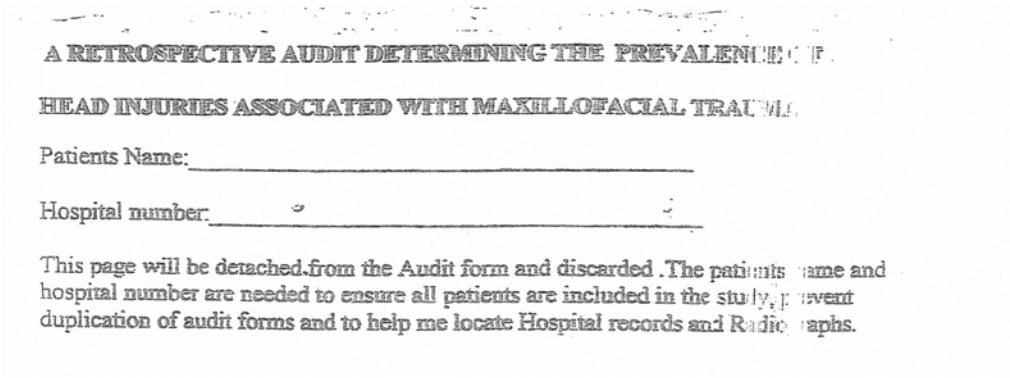
If patients present to the trauma unit with either severe maxillofacial trauma or suspected head injuries, when requesting CT scans, the doctor should request both CT brain and CT facial bones in order to prevent

missed injuries. In view of the high association of closed head injury in the facial fracture population, as well as the potential for mortality and neurologic morbidity, the maxillofacial and oral surgeon should be cognizant of this condition and its management[7]. There are several reports in the literature regarding multisystem trauma and facial fractures. Head injuries are commonly associated with facial fractures, and facial fractures can be markers for brain injury[16].

Treatment of facial fractures in the patient with multisystem injuries can not be isolated from the total management of the patient. Without exception, the management of neurologic trauma takes precedence over facial injuries[19]. Under these situations, repair of facial injuries may be compromised because of treatment delays, metabolic factors and lack of patient cooperation[19]. The influence of these and other factors on repair of facial fractures have not been studied widely and is therefore an area for further research.

APPENDICES

Appendix 1: Data Collection Form



A RETROSPECTIVE AUDIT DETERMINING THE PREVALENCE OF

HEAD INJURIES ASSOCIATED WITH MAXILLOFACIAL TRAUMA

Patients Name:_____

Hospital number:_____

This page will be detached from the Audit form and discarded .The patients name and hospital number are needed to ensure all patients are included in the study, prevent duplication of audit forms and to help me locate Hospital records and Radiographs.

A RETROSPECTIVE AUDIT DETERMINING THE PREVALENCE OF

HEAD INJURIES ASSOCIATED WITH MAXILLOFACIAL TRAUMA

To be completed by the attending Doctor on any patient they treat with any suspected maxillo facial injuries. These include simple mandibular fractures, midfacial fractures, panfacial fractures and penetrating injuries to the face region (GSW's and stab wounds)

Mechanism of Injury: MVA ☐ PVA ☐ Blunt trauma ☐

GSW ☐ Penetrating injury ☐

Suspected MaxilloFacial Injury: Unilateral Fractured mandible ☐

Bilateral Fractured Mandible ☐

Isolated Zygoma Fracture ☐ Le Fort 1 Fracture ☐

Le Fort 2 Fracture ☐ Le Fort 3 Fracture ☐

Pan Facial Fractures ☐ Soft Tissue injury ☐

Isolated Orbital Fracture ☐

If GSW: Entry ☐ Exit ☐

Associated Injuries: Yes ☐ No ☐

If yes please specify:_____

_____

Is a base of skull injury suspected: Yes ☐ No ☐

Is there a suspected CSF Rhinorrhea: Yes ☐ No ☐

CSF Otorrhea: Yes ☐ No ☐

Special Investigations: Panoramic Radiograph ☐ PA Mandible ☐

Occipitomental ☐ SMV ☐ CT Scans ☐

Other ☐

Findings of special investigations: _____

_____

Was airway intervention required prehospital? Yes ☐ No ☐

If yes specify type._____

Was airway management intervention required in the trauma unit? Yes ☐ No ☐

If yes please specify

(1) Reasons why a definitive airway was needed. _____

_____

_____

(2) Type of definitive airway . ET tube ☐ NT tube ☐ Tracheotomy ☐

Needle Cricothyroidotomy ☐

Surgical Cricothyroidotomy ☐ Other ☐

(3) Reasons why you specifically chose that technique to secure the airway. _____

_____

_____

Thank you very much for taking the time to complete this questionnaire, please leave the form in the folder at the front desk. Your time and support is greatly appreciated. If you need to contact me, please do so on 083 555 6995

Regards

DR. Mahomed A. Moolla

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