Substance abuse and maxillofacial injuries

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INTRODUCTION

Some of the major causes of maxillofacial injuries are assault/inter-personal violence (IPV), motor vehicle accidents (MVAs), work-related injuries, sporting accidents and falls. However, the epidemiological data for the different types of injury vary significantly and are influenced by geographic location, socioeconomic status, the time of year when patients are assessed and the type of facility where the study is conducted.[1-5]

The 2012 Statistics South Africa's release document on 'mortality and causes of death in South Africa' indicated that 9.8% of all deaths in South Africa were reported as non-natural. Transport accidents were the third most common (11.2%) reported cause of non-natural deaths followed by assaults at 10.2%.[6] According to a number of international studies, the face is the most common site affected by assault-related trauma.[7-10]

Substance abuse is a major public health concern in South Africa and has also been rated as the leading health problem in the United States.[11] Intoxication is also the most common denominator associated with violence and injury.[12] In a Swiss study, Eggensperger found that almost a quarter of assault-related facial fractures were caused by people intoxicated with alcohol, illicit drugs or a combination thereof.[13]

This article explores epidemiologic data and relevant information related to maxillofacial trauma, specifically associated with alcohol and substance abuse.

INCIDENCE OF ALCOHOL AND DRUG ABUSE IN TRAUMA PATIENTS

Patients under the influence of alcohol and/or drugs are seen in significant numbers at trauma centres globally.[14,15]

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ACRONYMS

ALAC:	Alcohol Advisory Council of New Zealand
ARF:	acute renal failure
BAC:	blood alcohol concentration
GSW:	gunshot wounds
IPV:	inter-personal violence
IVDA:	intravenous drug abusers
MMF:	maxilla-mandibular fixation
MVAs:	motor vehicle accidents
RML:	Rhabdomyolysis

A multi-centre study of more than 4000 patients conducted at six different trauma centres confirmed a positive blood alcohol concentration (BAC) level in 40.2% of the patients on admission. When poly-substance use was included, this figure rose to above 60%.[16] When McAllister (2013) studied urine samples from 93 patients with facial injuries, 37 (40%) tested positive for traces of alcohol. Almost half of these patients used illicit drugs in combination with alcohol.[17] A three-year survey of assault-related maxillofacial fractures in central Switzerland showed alcohol and/or illicit substances present in almost a quarter of all those surveyed.[13] Mathog and colleagues also identified assault as a major cause of mandibular fractures and pointed out that there is, frequently, a related substance abuse problem. The results from these multinational studies suggest that substance abuse is a major contributing factor in trauma injuries and can thus be considered a global health issue.[18]

A study conducted by Bowley (2004) in Johannesburg, South Africa, found that 60% of adult trauma patients tested positive for the presence of blood alcohol and the average BAC level was 37mmol/l (0.17g/dl). The latter is more than three times the legal BAC limit for South Africa i.e. 10.9mmol/l (0.05 g/dl). It was also noted that the urine samples of almost 50% of adult trauma patients tested positive for the presence of cannabis and other drugs such as mandrax and amphetamines.[12] Bowley further noted that a third of pedestrians involved in accidents had positive BAC levels and that a similar proportion tested positive for the presence of cannabis in urine samples.[12]

The interrelationship of alcohol abuse and trauma and its associated burden on the healthcare system cannot be overemphasized, especially when considering that 70 000 trauma-related deaths occur in South Africa annually, with a further 3.5 million people seeking healthcare following trauma.[19]

DEMOGRAPHIC PROFILE OF MAXILLOFACIAL PATIENTS AFFECTED BY SUBSTANCE ABUSE

Young adults are most affected by alcohol-related facial injuries. One study indicated that 61% of facial injuries were sustained by patients between the ages of 15 and 25 years.[20] Another study showed that 55% of adolescents presenting with facial injuries also presented with increased levels of substance abuse.[21]

These findings were supported by Lee (2008). He showed that the 16 to 30 year age group accounted for nearly two thirds of all patients who sustained facial injuries due to substance abuse. Lee also indicated that the male-to-female ratio for injuries sustained due to alcohol abuse is 9:1.[22]

Bowley (2004) also suggested that a high percentage of maxillofacial injuries coupled with substance abuse occurs in low socio-economic communities where there is a high unemployment rate and numerous poverty stricken areas.[12]

MECHANISM OF FACIAL TRAUMA

The mechanism by which facial trauma is sustained can be classified into blunt trauma (IPV and MVA), penetrating trauma (knife inflicted injury) or perforating trauma (gunshot wounds - GSWs).[23]

The incidence of MVA-related facial injuries has decreased in many parts of the world. At the same time, less severe injuries are being sustained. This decline may be as a result of better driving conditions, improved car safety mechanisms, education, public awareness campaigns regarding alcohol-related accidents and stricter monitoring of the alcohol levels of drivers.[24] Depressingly, South Africa was ranked worst out of 36 countries in a global road safety report![25] It could be argued that this poor safety record is a contributing factor to the severity of injuries being sustained to the maxillofacial region of victims. Furthermore, unrestrained drivers who sustain facial injuries due to MVA are four times more likely to be under the influence of alcohol than those who are restrained. This correlation is due to a general reluctance among intoxicated drivers to comply with the use of protective devices such as seatbelts.[26]

A two-year retrospective audit of trauma victims in Kwa-Zulu Natal revealed that blunt trauma was predominant (70% of cases) over penetrating or perforating trauma (30% of cases). The most common causes of blunt trauma were assault and MVAs while penetrating/perforating injuries were mainly stab wounds and GSWs.[27]

Penetrating injuries inflicted by knives to the face are quite rare, due to attempts to protect the face by the hands in self-defence.[28] In a record-based study by Meer *et al*,[24] cases of penetrating knife wound injuries to the facial area were reported over a period of 11 years with almost two thirds of cases being seen over weekends. This is the largest known study on penetrating knife wound injuries to the maxillofacial region with the knife still *in situ*. It showed that 14 (57.3%) of the 24 patients were stabbed on the left side of the face. This could be ascribed to the fact that the majority of assailants are right-handed.[29] In another South African study by Daya and Liversage, the zygomatico-temporal area (54.2%) was found to be the most commonly affected anatomical region suffering penetrating knife wound injuries of the face.[30]

It should be noted here that a study by Nason found that 52 out of 130 patients with penetrating neck injuries were themselves intoxicated at the time of injury.[31]

CLASSIFICATION OF FACIAL INJURIES

Injuries to the maxillofacial region may be categorised as soft tissue injury, skeletal injury or injury to the dentition. These injuries may occur in combination with each other.

Soft tissue injuries include bruising, abrasions, lacerations and loss of tissue.

Skeletal injuries may involve the upper, middle and lower thirds of the face. The upper third facial injury may affect the frontal bone and frontal sinus. Injuries to the middle third of the facial skeleton include fractures to the nasal bone, ethmoid bone, lacrimal bone, zygomatic bone and maxilla. Fractures of the middle third of the facial skeleton are commonly known as Le Fort I – Guerin or low level fractures, while Le Fort II refers to pyramidal or subzygomatic fractures and Le Fort III describes high level or suprazygomatic fractures. Injuries to the lower facial skeleton include various types of fractures of the mandible.[32] According to Eggenberger, there is a predominance of 2:1 for the left side of the face in skeletal injuries. This could be explained by the role that IPV plays in the aetiology of facial injuries.[13]

Internationally, there has been a reduction in frontal and Le Fort fractures, due to a decline in MVA-related facial injuries. In contrast there has been an increase in isolated zygomatic injuries, due to a rise in IPV.[24] Haug 1 found a 6:2:1 ratio for the incidence of mandibular, zygomatic and maxillary fractures and Lee reported that the mandible was the most commonly injured site as a result of IPV.[24] This was supported by a study by Ogundare, which further revealed that more than half of patients presenting with IPV-related mandible fractures reported using an illicit substance within two hours preceding the injury.[33]

PATHOPHYSIOLOGICAL EFFECTS OF SUBSTANCE ABUSED IN TRAUMA PATIENTS

Physiological adverse effects may arise with surgical intervention on a patient with a history of substance abuse. A study by Senel reported a 28.6% infection rate following surgery on patients who habitually abused alcohol.[34]

Chronic alcohol abuse disrupts skeletal homeostasis and delays fracture repair through decreased bone formation caused by reduced serum osteocalcin levels. Osteocalcin is a protein secreted by the osteoblasts to stimulate bone formation and acts as a biochemical marker. The decrease in osteocalcin after ethanol intake suggests that there may be a direct toxic effect on osteoblast activity and proliferation. A reduction in osteoblast number and function results in decreased bone volume and strength.[18,35,36]

An increased rate of postoperative infection can occur among intravenous drug abusers (IVDA) with a higher risk of developing postoperative infection.[37]

Intoxicated patients are more likely to suffer from hypotension and are less likely to protect their airways when they are injured. Both acute and chronic alcohol abuse leads to compromised immunity.[15]

Chronic alcohol abusers experience compromised recovery because alcohol use suppresses T-cells by affecting cell migration, adhesion, and signal transduction. In addition, the production of T-cells is reduced, making the body more susceptible to bacterial colonisation and subsequent infection. Alcohol consumption also negatively affects protein production, particularly collagen, and ultimately this affects wound repair.[36]

Rhabdomyolysis (RML) is a clinical syndrome characterised by the release of muscle cell contents into the plasma[38] and is associated with acute cocaine intoxication after blunt injuries to skeletal muscle. Cocaine is metabolised by cholinesterases to form benzolecgonine which is a potent arterial vasoconstrictor, leading to reduced re-uptake of norepinephrine and dopamine resulting in increased sympathetic activity, skeletal muscle ischaemia and muscle injury which can cause RML.[39] A rare case was reported wherein a patient presented with acute renal failure (ARF) secondary to RML after being acutely cocaine-intoxicated whilst simultaneously sustaining oro-facial trauma.[40]

CLINICAL CONSEQUENCES OF FACIAL TRAUMA

Injuries affecting the middle and lower facial skeleton can result in occlusal disturbances. The immediate clinical presentation of injury includes swelling, ecchymosis, pain, step deformities, asymmetry, anterior open bite and sensory or motor nerve disturbances.

Injury to deep structures of the face may occur as a result of penetrating trauma. Five percent of all facial nerve disorders are due to traumatic injuries.[41] Parotid gland and/or parotid duct injuries are usually not immediately diagnosed and therefore are sometimes overlooked. Common post-traumatic complications that arise from parotid duct injury are sialoceles and parotid fistulae.[41]

Maxillofacial injuries caused by gunshots lead to long term disabilities and morbidity after survival. GSWs are amongst the most complex clinical scenarios to deal with.[42] Immediate management involves haemorrhage control and the establishment of a definitive airway. Patients that have suffered GSW may present with an expanding haematoma and severe neurological impairment. Tooth and bone fragments can cause injury distant to the entry wound due to gross comminution of skeletal and dental structures.[43-45]

Nausea and vomiting are often associated with substance abuse. The use of maxilla-mandibular fixation (MMF) in mandibular fractures may therefore be contraindicated in these patients as there could be a relatively high risk of possible aspiration and or upper airway obstruction with MMF. Other issues that might be problematic are relying on the patient's ability to carefully follow postoperative instructions and to maintain adequate oral hygiene.[21] Shetty reported a significantly higher non-attendance rate among patients with facial injuries who had reported regular alcohol use at the time of hospital admission.[46]

PSYCHOLOGICAL CONSEQUENCES OF FACIAL TRAUMA

A patient suffering from facial injury undergoes a traumatic event that may influence his/her psychological well-being. Symptoms of depression, anxiety and hostility may be reported.[47] These are related to concerns about possible permanent disfigurement, which may intensify the abuse of substances.[48] Other short and long term sequelae include functional impairment with an effect on everyday matters such as eating or conversing in public.

FINANCIAL IMPLICATIONS OF FACIAL TRAUMA

The Alcohol Advisory Council of New Zealand (ALAC) has estimated that injury contributed to more than 70% of the life-years lost due to alcohol abuse. This is five times more likely for men than women.[49] Easton estimated in 2002 that New Zealand's social financial burden due to alcohol-related trauma ranged from NZ$ 1 billion to NZ$ 4 billion per year. This burden affects not only the public health sector but also precipitates crime and results in a loss of productivity.[50]

The majority of patients who present at a trauma unit with assault-related facial fractures require surgery. This is usually associated with hospitalisation for several days[13] which has a major impact on health care costs. When it is an intoxicated trauma patient who is being evaluated and managed, these costs escalate even further. Due to the pathophysiological consequences of treating alcohol and substance abuse patients, financial expenditure can escalate even further in surgical ICU because the care of an intoxicated patient may fall outside the domain of standard care.[15]

CONCLUSION AND RECOMMENDATIONS

Alcohol abuse is common among patients who sustain maxillofacial injuries. It is of utmost importance that national prevention programmes for alcohol and other illicit substance abuse should be established in an attempt to reduce the incidence of assault-related maxillofacial injuries. Healthcare providers can play a key role in addressing potential consequences related to abuse when consulting patients. The visit of a patient to a trauma centre or dental practice provides a unique opportunity to incorporate alcohol screening, intervention and referral as a part of standard care.

Dentists have a responsibility to highlight the relationship between substance abuse and trauma to their patients and in light of this relationship, to discourage the abuse of alcohol and illicit substances.

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