PAN FACIAL TRAUMA- AN INSTITUTIONAL EXPERIENCE

[1] Dr. Bharath.B,[2] Mrs. Indumathi,[3] Dr. Madhan Mohan,[4] Dr. V. Deepak Reader

[1] Post Graduate Resident, Department Of Oral And Maxillofacial Surgery Karpaga Vinayaga Institute Of Dental Science.

[2] M.Sc Nursing Associatr Professor, Karpaga Vinayaga College Of Nursing

[3] MDS Dean And Professor, Department Of Oral And Maxillofacial Surgery Karpaga Vinayaga Institute Of Dental Science

[4] Department Of Maxillofacial Surgery Karpaga Vinayaga Institute Of Dental Science.

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INTRODUCTION

Maxillofacial injuries are seldom life-threatening

(Cowley et al., 1974; Champion et al., 1980). A significant number of victims fatally injured in traffic accidents however, have head and neck injuries (Bartley, 1975; Fox & Macleod, 1978; Hutchinson & Harris, 1978; Mackenzie et al., 1979). This also holds true for patients sustaining multiple injuries in traffic accidents (Oikarinen & Lindqvist, 1975).

The incidence and significance of facial trauma in victims with head trauma has not been a subject of great interest. One reason for this is probably that concomitant brain injuries gain more attention and are in general responsible for the fatal outcome. Another reason could be that most victims of fatal head injuries die before reaching hospital (Klauber et al., 1981; Simpson et al., 1981; Gilroy, 1985) and facial bone fractures perhaps remain overlooked and are also difficult to diagnose post-mortem.

The extraordinary structure of the facial skeleton acts as a cushion, preventing more serious brain injury in many instances. The maxilla in particular is, however, richly vascularised and aspiration of blood in trauma cases can be fatal (Zachariades et al., 1982; Grattan & Hobbs, 1985; Lindqvist et al., 1985). The obstruction of airways resulting from displacement of the maxilla or mandible especially in combination with brain concussion or contusion can also lead to hypoxia and suffocation. This may be, however, difficult to evaluate at autopsy. The purpose of this investigation was to study the incidence of maxillofacial trauma in victims with fatal injuries sustained in road traffic accidents.

In an earlier study we analysed fatalities in which the facial injury was considered to be the definitive cause of the fatal outcome. Since we had access to a large volume of carefully recorded material, we found it of general interest to report on (Received 27 September 1985; accepted 12

November 1985) maxillofacial injuries in fatal traffic accidents. Special interest was focused on the type of accident, the associated injuries, and the possibilities of preventing these types of fatalities.

Facial fractures are frequently complicated by injury to the eye and its adnexad (Petro et al., 1979; Steidler et al., 1980; Beirne et al., 1981; Culbertson, 1983; Holt et al., 1983; Holt & Holt, 1983). These injuries may result in loss of vision in one or both eyes (Gordon & Macrae, 1950; Gwyn et al., 1971; Ketchurn et al., 1976; Stcidler et al., 1980; Anderson et al., 1982; Babajews & Williams, 1986) or may compromise ocular function (Holt & Holt, 1983).

When these injuries are severe, they may be detected with ease by any medical or maxillofacial practitioner but many injuries appear minimal and may be missed by the non-ophthalmologist (Binder. 1978; Records, 1979; Holt et ul., lY83). Ocular injury may result in preventable severe dysfunction of the visual apparatus, if not detected shortly after injury. In one published study by Jabaley et ul. (1975), the difference in the rate of detection of such ocular injury between a prospective evaluation, where an opthalmologist was involved, and a retrospective evaluation, where only selective rcfcrral was made by the plastic surgeon, was 18% (29% and 11% respectively). Ideally, all patients with a facial or craniofacial fracture should be reviewed by an ophthalmologist (Miller & Tenzel, 1967; Gwyn et al., 1971; Holt et 291 _-.. al., 1983).

Defects in the field of vision, ocular structure and ocular motility may be permanent (Barclay, 1958; Jabaley et al., 1975; Turvey, 1977; Stcidler et al., 1980). It is important to define such functional defects in order to treat any preventable ocular dysfunction such as retinal detachment, tears or holes, or angle recession glaucoma (Jabeley et al., 1975; Holt et al., 1983) and to advise the patient appropriately.

The results of ophthalmic examination may lend weight to medico-legal claims. Estimates of the incidence of ocular disorder following midfacial fracture vary considerably, being between 2.7% (Lute et al., 1979) and 67% (Holt et al., 1983). These estimates depend on referral practice, which

specialty carried out the evaluation, and whether minor injuries were included in addition to major ones.

The results also depend on whether the study was prospective (Miller & Tenzel. 1967; Jabaley et al., 1975) or retrospective (Gwyn et al., 1971; Morgan et al.. 1972; Jabaley et al., 1975; Turvcy, 1977; Lute et al., 1979; Steidler et al., 1980; Holt & Holt, 1983). Most studies which have been carried out have been rctrospcctivc and the details concerning the techniques of ophthalmic examination employed have not been described. Prospective studies have included only small numbers of patients (Miller & Tenzel, 1967).

DISCCUSION

This report is the largest prospcctivc survey of the ocular

scquelae of midfacial fracture currently available. Ocular injury of varying severity is a common sequel to midfacial fracture (Paton & Emery. 1973). The severity of the facial fractures is dependent upon the nature of the injury and is directly related to the likelihood and severity of trauma to the eye. Disruption of the orbital walls deprives the eye and its adnexae from the protection they arc normally afforded (Jabaley ef al., 1975).

In the present study, patients with the most severe head or facial injuries warranting neurosurgical intervention arc managed in a separate unit and have not been included in this report. It can be anticipated, however. that such individuals are highly susceptible to injury of the visual system. Disturbance of ocular motility was also a common .

The details of the motility disorders seen in this series of patients are described separately (Al-@rainy er al., 1991 a). The major cause of maxillofacial trauma in this study was alleged assault. The patients assessed were from a large industrialised area with a high rate of unemployment (Ellis et al., 1985). This may be related to the fact that the majority of injured patients were young adult males who sustained their injuries in alleged assaults. This cause of fracture and type of patient correspond to the results found in comparable studies (Lundin et ml., 1973: Altonen et al., 1976). Although alleged assaults were more common in males than in females, the difference

was not found to be statistically significant. Falls, however, were more common in females than in males.

In general, fractures were almost equally shared between both sides of the face. However, fractures sustained due to assaults were predominantly left-sided which relates with the fact that the majority of people arc right-handed. This finding is in agreement with the investigations of Hitchin and Shukcr (1973), Altoncn et al. (1976) and Muller and Schoeman (1977), who also found that assault victims displayed a predominance of leftsided fractures. June was the month in which the greatest incidence of injury occurred. This, probably, is expected in a summer month where most of the assaults, KTA and sporting events take place. It was interesting to find that patients who sustained a head injury severe enough to cause amnesia were more likely to suffer a disturbance to their visual system.

As expcetcd, amnesia was most common following RTA. The protective effect of seat belts is evidenced by the fact that all unrestrained patients developed concussion manifested by amnesia. Traumatic enophthalmos is usually due to enlargement of the orbital cavity subsequent to a floor or, less commonly, medial wall fracture (Converse 6t Smith. 1956); although dislocation of the trochlea, atrophy of orbital fat, cicatricial contraction of retrobulbar tissue and rupture of orbital ligaments or fascial bands have been previously incriminated (Benedict, 1936). Pfeiffer (1943) reviewed 53 patients with traumatic enophthalmos following facial bonefractures and noted orbital bone involvement in each case.

Of these, 24 patients sustained pure blow-out fractures which were due to assaults in 58% (n=14), and RTA in 17% (n=4) of cases. Our figures are closely in accordance with those of Pfeiffer. Enophthalmos following facial trauma should always raise suspicion of an orbital wall fracture and a CT scan is advisable when plain X-rays are negative. There is a number of

reports of large series of facial fractures in which associated injuries wcrc reported (Gwyn et al., 1971; Morgan et al., 1972; Steidler et al.,. 1980) but most of these reports only mentioned briefly or fail to characterise specific ocular complications. The very low incidence of ophthalmic injury reported by non-ophthalmic authors (McCoy et ul., 1962; Converse et cd., 1967; Schultz, 1967; Gwyn et-al., 1971; Morgan et al., 1972; Turvey, 1977; Iuce et al., .1979) probably indicates that significant ophthalmic pathology may have gone undetected.

Management of fractures of the dentofacial skeleton was centered around the dental occlusion, and man aged initially with intermaxillary fixation and latterly by intraoral placement of mandibular miniplates. It is therefore logical to assume that surgeons performing this surgery should either have a dental qualification, or have access to a team member that does. These fractures, although common, are part of a trauma continuum which rapidly changes as the

On the other hand, the low incidence of ophthalmic injury reported by some ophthalmic surgeons (Milauskas & Fueger, 1966; Miller & Tcnzel, 1967) may indicate that only the more serious ocular injuries had been reported while mild and less serious injuries were not mentioned. The overall incidcncc of ophthalmic injury of any severity (including sub-conjunctival hacmorrhage) following maxillofacial trauma in the present series is 90.6% (329/365). This figure is much higher than those previously published in the literature, including the 67% rate reported by Holt et uf. (1983). However, Holt’s series was retrospective.

Included only 51% of facial fracture patients potentially available for assessment and provided limited follow-up documentation. It was therefore selective on the part of the attending maxillofacial surgeon and allowed no definite conclusions to be drawn concerning the possibility of undetected eye injuries in the patients who did not have formal eye examination.

The results of this study reinforce the contention that RTA cause more severe ocular injuries than any other cause of facial trauma (Petro et al., 1979; Holt et al., 1983). Similarly, comminuted malar fractures were associated with the highest incidence of visual dysfunction. Fortunately, many of the ocular injuries were transient and of no permanent consequence.

Howcvcr, the incidence of 11.6% (42/363) of patients with serious or blinding injuries is significant. Of particular importance are those cases of optic nerve contusion or compression (2.5%).

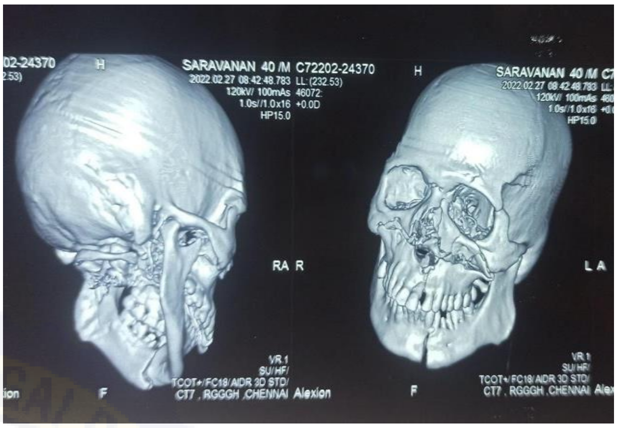
Total loss of vision in quite healthy looking eyes is not uncommon following facial trauma. Kctchum et al. (1976) prescntcd 2 cases of bilateral blindness without direct injury to the globe and postulated that a haematoma. ischacmia, or direct bone fragment penetration of the optic nerve may have been the cause. In the light of the more recent study by Anderson et

al. (1982) illustrating the proper timing of surgical decompression of the optic nerve and response to high dose corticosteroid therapy, such injuries may deserve immediate and aggressive management especially if the initial examination demonstrates some vision immediately following the injury.

The results of the eye examination, while they do not often alter the type of fracture repair, may influence the indications and timing of the repair because treatment of certain ocular injuries. such as optic nerve compression, must be instituted at once. The proper time for an eye examination. especially visual acuity testing, is at the time of initial assessment of the patient’s trauma.

We suggest that all patients sustaining midfacial fracture associated with a significant decrease in visual acuity either prc- or postoperatively should have an early ophthalmological review. Many patients sustaining facial injury make recourse to legal or insurance claims. The results of detailed ophthalmic assessment often add weight to such cases and affect levels of compensation paid. The data accruing from this study have been subjected to discriminant function analysis and has resulted in the development of a scoring system which allows the maxillofacial surgeon to determine which patients warrant ophthalmic referral and with what urgency (Al-Qurainy et al., 1991b.).

The incidence of mandibular fractures at the hospital from 2011 to 2013 was about 37 each year, which was only slightly higher than the incidence from 1993 to 1999, which were 36 each year.



The age range of patients who presented with fractures had also not changed significantly, and the most common age group was from 20 to 30 years. This had not changed at the hospital in the last 15 years, and remained consistent with other centres. The male:female ratio in our study was 7.5:1. This correlated well with other studies, but showed an increase in male predominance from the previous study, which showed a male:female ratio of 4.5:1. January remained the most common time for mandibular fractures, which may relate to both an increase in nightlife and alcohol intake during the summer months.

Summer has been quoted in other studies as a more common time for fractures.15 A small increase in May could be the result of the Australian Rules Football season, which accounted for an increase in sports- related fractures during this time. Assault remained the most common mode of injury in Hobart, and increased slightly from 55% in 1999 to 60% in 2013. This was significantly higher than the incidence of assault-related mandibular fractures in New Zealand, which was 44%. Most other papers have quoted road crashes as the most common cause of injury, but in our study they accounted for only 5% of all mandibular fractures. This may be explained by the emphasis on road safety in Australia. The incidence of fractures after road crashes has decreased between 1999 and 2013 from 18% to 5%, despite an increase in population. The second most common cause that we found was sport. This remained relatively stable between 1999 and the present.

In 1999, 17% of fractures resulted from sport, nearly half of which involved Australian Rules Football. Now, 17% of fractures result from sport, over half of which are footballrelated. The increase in the part played by alcohol in the incidence of mandibular fractures increased from 41% in 1999 to 60% in 2013, which may correspond to the increased number of assaults. Alcohol-related violence among men seems to be becoming a bigger issue, as the incidence of drunken men with mandibular fractures increased from 85% in 1999 to 97% in 2013. Efforts must be made to reduce the level of interpersonal violence associated with male drunkenness in Tasmania.

The distribution between unilateral and bilateral mandibular fractures did not change much between the 2 time periods, and the number of unilateral fractures increased slightly from 53% to 59%. This may be related to the shift away from road crashes, which are often associated with multiple fractures. In 1999 the number of fractures on the left and right sides of

the mandible were roughly equal. We found a predominance of left-sided mandibular fractures, which may be related to being hit by a right-handed assailant.

The angle remains the most common site of mandibular fracture. This differs from most of the other published data, which describe the mandibular parasymphysis as the most common site. The two international papers that also featured the angle as the most common site were from Nigeria17 and Tunisia,18 so there does not seem to be a geographical explanation for the difference. These 2 papers, however, also show assault as the most common cause of fracture. It may be, therefore, that assault is associated with mandibular angle fractures more than with other fracture patterns.

Open reduction and internal fixation remains the most common management for mandibular fractures.

This is also in keeping with most other centres, except those from Tunisia18 and Malaysia,22 which quoted closed reduction as their treatment of choice. This study has shown that there have been several changes in patterns of mandibular fracture in Hobart since 1999. First, the incidence of affected men has increased. There has also been a shift from road crashes to assault as the main cause of the fractures, and an increase in the involvement of alcohol in patients with fractured mandibles, particularly among men.

The large number of assaults was related to a higher incidence of fractures of the mandibular angle in this study and in others, implying that assault involving the facial bones commonly results in a fracture of the mandibular angle. These findings suggest that there has been an improvement in motor vehicle safety with regards to the aetiology of fractured mandibles. There has also been an increase in fractures as a result of alcohol- related interpersonal violence amongst men in Tasmania, with an increased number of fractures of the mandibular angle.

The percentage of significant maxillofacial injuries among traffic accident victims seems to be low in various studies (Huelke & Compton, 1983; Grattan & Hobbs, 1985). The annual incidence of facial injuries from vehicle collisions has been estimated as 278 per lo5 residents in the United States (Karlson, 1982). However, it has been suggested that some facial injuries occur in as many as 80% of automobile occupant fatalities (Karlson, 1982).

Accurate analyses of fatal maxillofacial injuries resulting from road traffic accidents have not previously been reported, but it appears that about 7-11% of persons injured in traffic accidents have either fractures or severe soft tissue lacerations of the face (Braunstein, 1957; Rowe & Killey, 1970; Oikarinen & Lindqvist, 1975). This percentage is very similar to modern statistics concerning war injuries (Tinder et al., 1969).

Autopsy reports of multiply injured victims, however, are probably inaccurate in cases of zygomatic fractures or condylar fractures of the mandible. Since our numbers are based on autopsy findings, they probably underestimate the actual incidence. These fractures are, however, hardly life-threatening and we can thus assume that in all the cases in our material, there were major facial injuries that had a significant detrimental effect. In our earlier study of 20 cases with fatal facial trauma, it was concluded that all victims immediately killed in the accidents had aspirated blood (Lindqvist et al., 1985). There was no evidence of obstruction of the upper airways by either a crushed maxilla or a retropositioned tongue in any of the cases, but it was considered that almost all had died of asphyxia caused by aspiration of blood.

It is probable also that in the present 84 cases the immediate deaths (73 cases) were a result of a combined effect of the head injury and the facial injury, also associated with a chest injury in most cases.

Major brain injuries were in fact seen in only a quarter of the cases. As pointed out by Grattan & Hobbs (1985) maxillofacial injuries, especially bleeding, together with brain concussion or contusion probably lead to asphyxia without the typical mandibular or maxillary fractures, which in general are blamed for respiratory distress (Bailey & Gaskill, 1967; Killey, 1974; Killey, 1977; Binns, 1984). The medical prevention of these deaths is, however, difficult because of the fact that the majority are killed immediately. Preventing death must, therefore, lie in the prevention of the injuries themselves.

It seems that 256 BRITISH JOURNAL OF ORAL & MAXILLOFACIAL SURGERY

the use of seat-belts, also in the case of rear seat passengers, is the most important single measure that can prevent these fatalities in motor car occupants (Tolonen et al., 1983). This view is supported by the observations that the majority of the victims had not used a seat-belt, and that the fatalities have been significantly reduced since 1975, when seat-belt wearing became compulsory in Finland. In the same way the risk of fatal injuries is increased significantly among motor-cyclists neglecting to use helmets. The positive effect of the helmet has been reported in a number of studies

(Watson et al., 1980; Cannel1 et al., 1982; Krantz, 1985).

The Finnish system of investigating all fatal traffic accidents by Boards of Investigation consisting of different experts who also have access to autopsy findings, makes it possible scientifically to analyse traffic injuries. Data gained from these analyses complement the studies that have been performed under experimental conditions in traffic laboratories. Fatal maxillofacial injuries resulting from road traffic accidents are few, but little has been done to investigate them with more exact information on the injuries.

Their characteristics. however, appear to differ from other types of road traffic fatalities. We conclude that the use of seat-belts by every car and commercial vehicle occupant, is the most important measure for the prevention of fatal head injuries. This also holds true for helrnets for motor- cycle and moped riders. In addition, modified speed reglulations could also prevent many maxillofacial fatalities.

MULTIDISCIPLINARY MANAGEMENT:

These injuries present a significant management challenge. Low energy mechanisms produce stereotypical injuries, usually limited to a single bone anatomical region. High energy injury patterns typically involve multiple hard and soft tissue regions of the face with cranial extension, together with disruption of tendons, ducts and motor nerves.

Whilst monospecialty maxillofacial trauma clinics enable close follow-up and audit of outcome for low energy mechanisms, it is our belief that high energy patterns, both in the acute setting and in later revision, are best managed in S. Holmes / British Journal of Oral and Maxillofacial Surgery 47 (2009) 179–181 181 Proposed model. a multidisciplinary environment. This provides a true team management of these injuries, but in addition allows development of existing team members to extend their role beyond their specialty. This is crucial in the modern NHS, where other commitments may conflict with availability for acute medical care.

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