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Evaluation of severity of maxillofacial injuries causing disturbance of ophthalmic apparatus requiring ophthalmic referral and review: a retrospective study

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ABSTRACT

AIM AND OBJECTIVE: The aim of the present study is to acquaint the maxillofacial surgeons with the many complicating intra and extra ocular lesions, which can occur following maxillofacial trauma.

MATERIAL AND METHODS: The clinical material for this study were 53 patients with maxillofacial injuries involving the ophthalmic apparatus irrespective of age and gender reporting to our Department of Oral and Maxillofacial Surgery. Patients who reported to the Department of Maxillofacial Surgery with clinically and radiographically proven maxillofacial fractures were assessed at the time of initial presentation. A detailed examination of eye structure and function was carried out by an ophthalmologist in all cases as a mandatory protocol. The acquired data was divided into

A. General- All routine information

B. Eye abnormalities- All ocular injuries sustained, their functional consequences, complications, treatment and recovery.

C. Motility disorders- Examination of ocular motility, assessment of movements in all directions of gaze and elicitation of diplopia. Each patient was examined by the attendant

maxillofacial surgeon and scored as per Al-Qurainy Scoring system from which the patients were categorized as requiring non-referral, routine referral, and early referral. In addition, the reason for referral, as elicited by the maxillofacial surgeon was appended to score sheet.

RESULTS: There was significant ($p<0.01$) difference in the evaluation by maxillofacial surgeon and ophthalmologist. Maxillofacial referral showed 100% sensitivity and 77.5% specificity with 100% negative predictive value and 0% false negative outcome and 22.5% false positivity.

CONCLUSION: The principal predictor of an adverse ophthalmic prognosis was impaired visual acuity. Our study reaffirms that the assessment of visual acuity should be performed in all patients sustaining maxillofacial injuries involving the ophthalmic apparatus. It is important for the maxillofacial surgeon to document these findings at the initial examination for the medico-legal purpose, as ocular trauma cases may account for all ophthalmology related litigation.

KEY WORDS: Al-Qurainy, Opthalmologists, Maxillofacial surgeon

INTRODUCTION

From ancient times history has it that eye for an eye is the dictum to settle one's score. End result of which could lead to traumatic injury affecting both soft and hard tissues.[1]

The literature reports incidence of ophthalmic injuries occurring with maxillofacial fracture spanning from as low as 0.8% in one study inclusive of all maxillofacial fractures, to as high as 30% in a study of blowout fractures. The visual outcomes of traumatic eye injuries vary from temporary blurred vision, as seen in traumatic mydriasis, to complete blindness, as seen in severe retinal detachment. Understanding the incidence of ocular injuries where ophthalmological management is needed, due care of these ophthalmic injuries are required till the patient is examined and opined by ophthalmologist.

Today, maxillofacial injuries are receiving greater attention because of the increase in the incidence, recognition of the direct involvement with the contents of orbital cavity particularly the involvement of the extra ocular muscles and periorbital tissues.[2]

The importance of a thorough ophthalmic examination need not be stressed in view of the fact, that inadequate care could result in blindness, with its associated social and medico legal implications. Hence it is mandatory to examine in detail eye and its surrounding structures. [3]

The aim of the present study is to acquaint the maxillofacial surgeons with the many complicating intra and extra ocular lesions, which can occur following maxillofacial trauma.[4]

To determine the efficacy of scoring system developed by Al-Qurainy A et al in patients with midfacial fractures involving the ophthalmic apparatus for referral to an ophthalmologist.[5,6]

Hence an attempt is made to determine optimum criteria for the referral of an appropriate patient to the ophthalmologist, further definite situations where maxillofacial surgeons are capable of handling specific ophthalmic injuries, as well as in association with ophthalmologist.

MATERIALS AND METHODS

The clinical material for this study were 53 patients with maxillofacial injuries involving the ophthalmic apparatus irrespective of age and gender reporting to our Department of Oral and Maxillofacial Surgery.

It was ensured that the reduced visual acuity, when it occurred, was sequelae to the maxillofacial trauma sustained and not to a previous ophthalmic disorder such as uncorrected errors of refraction (short or long sightedness), non-traumatic cataract or previous trauma affecting the eye or the visual pathway.

Inclusion criteria:

The study included cases of facial trauma causing injuries to the facial skeleton resulting in disturbance in the integrity of the ophthalmic apparatus.

Trauma to facial skeleton resulting in cranio-orbital, frontal bone, naso-orbito-ethmoidal, comminuted zygomaticomaxillary complex, zygomatico-orbital complex, orbital blowout, Lefort II, Lefort III fractures and panfacial trauma involving the ophthalmic apparatus are included to evaluate the severity of injury requiring ophthalmological referral and review.

Exclusion criteria:

Trauma to the facial skeleton that do not have any direct impact on the ophthalmic apparatus like isolated mandibular fractures (subcondylar, body, parasymphyseal fractures), isolated zygomatic arch fracture, isolated Lefort-I fractures and isolated nasal septum fractures were excluded

METHODOLOGY

Patients who reported to the Department of Maxillofacial Surgery with clinically and radiographically proven maxillofacial fractures were assessed at the time of initial presentation.

A detailed examination of eye structure and function was carried out by an ophthalmologist in all cases as a mandatory protocol.

The acquired data was divided into

A. General- All routine information

B. **Eye abnormalities**- All ocular injuries sustained, their functional consequences, complications, treatment and recovery.

C. **Motility disorders**- Examination of ocular motility, assessment of movements in all directions of gaze and elicitation of diplopia.

Each patient was examined by the attendant maxillofacial surgeon and scored as per Al-Qurainy Scoring system from which the patients were categorized as requiring non-referral,

routine referral, and early referral. In addition, the reason for referral, as elicited by the maxillofacial surgeon was appended to score sheet.

SCORING SHEET USED BY THE MAXILLOFACIAL SURGEON TO DETERMINE WHICH PATIENTS WITH MAXILLO-FACIAL INJURIES WARRANT REFERRAL TO AN OPHTHALMOLOGIST

Clinical Feature	**Initial score** **score**	**Final**
Visual Acuity		
6/6 or better	0	
6/9-6/12	4	
6/18-6/24	8	
6/36 or less	12	
No light perception	16	( )
Zygomatic fracture type		
Comminuted	3	
Blow- out	3	
Other	0	( )
Motility Abnormality		
Present (Diplopia or squint)	3	
Absent	0	( )
Amnesia		
Retrograde + post traumatic	5	
Other	0	( )

Total Score:

Consider adding 1 point to total score if one of the following factors exist and total score is 11

- Patient is female
- Age between 30 and 39 years
- Cause of injury is road traffic injury

Referral to the ophthalmologist

- Do not refer if total score is less than 4
- Consider routine referral if total score is 5-11
- Consider urgent referral if total score is over 12

All the 53 patients were then evaluated by an ophthalmologist for an assessment of visual function, including the visual acuity as tested on the standard Snellen's chart, a detailed evaluation of ocular motility, pupillary dilatation and examination of the anterior and posterior segments of both eyes. Data acquired from that examination were then coded according to the score sheet appended.

All cases were sent for ophthalmologic evaluation to have an exact nature of injury and its ophthalmologic implications. The patients were categorized into non-referral, routine referral and early referral are described in Table 1, 2 and 3.[5]

Eye abnormality	Remarks
Post traumatic neuralgia/ anesthesia	Spontaneous recovery. No treatment required.
Coronal eye displacement	Should respond to facial fracture treatment
Orbital emphysema	Absorbs spontaneously
Eyelid swelling/bruises	Clears spontaneously
Conjunctival Chemosis	Clears spontaneously
Subconjunctival Haemorrhage	Clears spontaneously
Corneal abrasion	Heals spontaneously
Mild failure of accommodation	Usually recovers spontaneously
Mild reduction of visual acuity with recovery	May be due to corneal abrasion No treatment is usually needed
Mild commatio retinae	Spontaneous resolution

Table 1: List of the 'non- referral' category of ophthalmic injuries. For each type of category justification for the referral category is given.[7]

Eye abnormality	Remarks
Enophthalmos	Usually responds to orbital wall reconstruction
Eyelid laceration	Can be treated by the maxillofacial surgeon

Conjunctival lacerations	May or may not need suturing depending on extent and involvement of underlying tissue
Traumatic Pupillary changes	May indicate other pathology. Observe and document.
Lens damage	May indicate underlying pathology requiring treatment or follow up, for example, angle recession.
Traumatic cataract	Indicate need for future treatment
Positive photo stress test	Macular edema. Self-limiting
Moderate failure of accommodation	No immediate treatment. May need refraction later
Severe failure of accommodation	No immediate treatment. May need refraction later
Moderate reduction of visual acuity	May be due to macular edema, corneal abrasion/ edema, corneal abrasion/ edema, traumatic mydriasis. Needs to be investigated
Severe commatio retinae	To be documented and observed. If involving the macula, may progress into macular cyst/hole
Choroidal tear: single	To be documented and observed
Choroidal tear: multiple	To be documented and observed
Viterous floater	Should be closely followed up. May indicate underlying pathology, but treatment is not immediately indicated
Traumatic pigmentary retinopathy	To be documented and observed
Nasolacrimal damage	If not repaired by the maxillofacial surgeon.

Table 2: List of the routine- referral category of ophthalmic injuries. For each type of injury, the justification for the referral category is given.[6]

Eye Abnormality	Remark
Proptosis	May be due to retrobulbar hemorrhage leading to optic nerve compression
Retrobulbar Haemorrhage	May be due to retrobulbar hemorrhage leading to optic nerve compression

Corneal damage: Puncture wound	Needs urgent repair under microscope
Corneal laceration	Needs urgent repair under microscope
Scleral injury	Needs careful repair
Hyphaema	May lead to rise of intraocular pressure
Angle recession	To be followed up closely for glaucoma. An acute pressure rise may occur.
Lens dislocation /subluxation	Treatment may be needed for post traumatic complications for e.g. glaucoma
Ruptured lens capsule	Indicates need for future treatment
Severe reduction in visual acuity	Optic nerve injury, retinal detachment, vitrous hemorrhage, etiology must be established immediately
Loss of vision	Optic nerve injury, retinal detachment, vitrous hemorrhage, etiology must be established immediately
Visual field loss	To be investigated soon for retinal detachment and/or damage to the visual pathway
Choroidal tear involving the macula	Document and observe prior to facial treatment for medico legal reasons
Vitrous hemorrhage	Needs urgent specialist examination
Flat retinal tear/hole	May need laser/cryotherapy
Retinal detachment with macula on	Needs urgent specialist examination
Retinal detachment with macula off	Needs urgent specialist examination
Optic nerve partial injury	Endangers sight. To be documented
Optic nerve injury: contusion	Endangers sight. To be documented
Optic nerve total damage/avulsion	To be documented for medico legal reasons

Table 3: List of early referral category of ophthalmic injuries. For each the justification for the referral category is given.[6]

RESULTS

In our study, 53 patients having maxillofacial injuries involving the ophthalmic apparatus were included. Nineteen patients (35%) were in the age group of 21 to 30 years, Fourteen (26.4%) were within 31 to 40 years age group, Ten (18.9%) patients were within 51 to 60 years age group, Two (3.8%) were in 61 to 70 years age group, while only one (1.9%) patient was less than 10 years of age.

50 (94.3%) were males and only 3 (5.7%) patients were females.

Of the 48 patients having facial injury due to road traffic accident (RTA), 1 (2.1%) was female and rest 47 (97.9%) were males. Out of the 5 patients with domestic fall, 2 (40%) were females and rest 3 (60%) were males. There was statistically highly significant difference in the etiology of facial fracture within the two sexes.

Out of the 53 patients, mild ophthalmic signs were noted in 27 (50.9%) patients, 17 (32.1%) had moderate ophthalmic signs and 9 (17%) patients had severe ophthalmic signs.

In our study signs of severe abnormality were proptosis, noted in 4 patients; loss of vision in 3 patients; retrobulbar haemorrhage in 1 patient, traumatic optic neuropathy in 1 patient, papilledema in 1 patient, traumatic cataract in 1 patient and lens displacement in 1 patient following maxillofacial injury.

Signs of moderate ophthalmic abnormality like enophthalmos were found in 14 patients, telecanthus in 5, diplopia in 10, epiphora and lid ptosis in 3 patients each, pupils were not reacting to light in 7 patients, while lid laceration was found in 7 patients, 4 patients had pain during ocular movements and 5 patients had reduced vision.

Of the mild ophthalmic abnormalities, circumorbital ecchymosis was noted in 52 patients, periorbital edema in 47 patients, subconjunctival haemorrhage in 50 patients, chemosis in 8 and infraorbital paraesthesia was found in 10 patients.

Four of our patients had CNS abnormalities during the initial evaluation.

Out of the 5 patients with domestic fall, in 3 (60%) mild ophthalmic signs were noted and in 2 (40%) moderate ophthalmic signs were present. Out of the 48 patients with RTA, in 24 (50%) patients mild, in 15 (31.3%) patients moderate and in 9 (18.7%) patients severe ophthalmic signs were noted.

Following ophthalmological injuries would have gone unnoticed had we not referred patients for ophthalmological evaluations.

One case of traumatic optic neuropathy

One case of Traumatic cataract

One case of Papilledema

Following clinical findings were confirmed with concurrence of the ophthalmologist

As the ophthalmologic evaluation was evident in all cases, we were able to diagnose

One case of Lens displacement

One case of Retrobulbar haemorrhage

According to the scoring system developed by Al-Qurainy A et al, in patients with midfacial fractures involving the ophthalmic apparatus for referral to an ophthalmologist, as assessed by the maxillofacial surgeon, 31 (58.5%) patients were categorized into non-referral group,

14 (26.4%) patients into routine referral group and 8 (15.1%) patients into early referral group.

After evaluation by the ophthalmologist, 4 (7.5%) patients needed early referral, 9 (17%) patients needed routine referral and 40 (75.5%) patients needed no referral.

Out of the 8 patients evaluated for early referral by maxillofacial surgeon, 4 were categorized in early referral group and remaining 4 were considered for routine referral after ophthalmological evaluation. All the 31 patients were evaluated correctly for non referral by maxillofacial surgeon and ophthalmologist. Fourteen patients were evaluated for routine referral by maxillofacial surgeon and after ophthalmological evaluation, 5 patients were considered for routine-referral and 9 patients were categorized as non referral. There was significant ($p<0.01$) difference in the evaluation by maxillofacial surgeon and ophthalmologist.

Maxillofacial referral showed 100% sensitivity and 77.5% specificity with 100% negative predictive value and 0% false negative outcome and 22.5% false positivity.

DISCUSSION

Maxillofacial fractures involving midface and zygoma are commonly complicated by injuries to the visual system (Holt and Holt[7] 1983). According to Al-Qurainy and co-workers[8] 63% of patients who had mid facial fractures had also minor or transient ocular injuries, 16% suffered moderately severe ocular injuries and 12% experienced severe ocular injuries[2]. According to Poon A[9] 55% of patients with injuries involving the face had ocular or orbital injuries.

In our study majority of patients with maxillofacial injuries involving the ophthalmic apparatus were males, with high number of patients in the age group of 21 to 30 years (35%) and 31 to 40 years (26.4%) age group. This shows that the more commonly involved population are the one's having an active lifestyle who are more prone to such injuries.

Our data suggests a highly significant number of patients with etiology of maxillofacial trauma as road traffic accident. Among the road traffic accidents majority of them were riding two wheelers. Hence we emphasize the use of adequate protective measures while driving.

Different ophthalmic signs seen in maxillofacial injuries

According to Al-Qurainy and co-workers[8] the overall incidence of ophthalmic injury of any severity (including subconjunctival haemorrahage) following maxillofacial trauma was 90.6%. This figure was much higher than the previous reports published in the literature, including the 67% rate reported by Holt et al[7] (1983). Most patients (63.4%) suffered only minor or transient ocular injuries such as lid bruise, subconjunctival hemorrhage and mild impairment of accommodation.[8]

Moderately severe ocular injuries were noted in 15.7% which were unlikely to have permanent visual or physiological sequelae. Examples include minor eyelid and conjunctival lacerations and enophthalmos.[8]

Severe eye injuries were noted in 11.6% such as angle recession, retinal or vitreous injury or optic nerve damage, 2.5% lost vision in the affected eye. 28.4% suffered from amnesia as patients who sustained a head injury severe enough to cause amnesia were more likely to suffer a disturbance to their visual system.[8]

Shere et al [10] in 2004 reported that contusion of the eye and adnexa was the most common ocular injury seen in 2.5 percent and 7.1 percent of patients with zygomaticomaxillary complex and orbital blowout fractures, respectively. Ruptured globes (0.83 and 2.6 percent, respectively) and enucleations (0.22 and 0.17 percent, respectively) were other associated traumatic sequelae.

Guly et al [11] in 2006 reported that, among 4082 patients with facial fractures (e.g., zygoma, periorbital, maxilla), 398 (9.8 percent) suffered a concomitant eye injury and concluded that the risk of an eye injury for a patient sustaining a facial fracture is 6.7 times greater compared with a patient without facial fractures.

Jamal et al[12] in 2009 reported that retinal hemorrhage (4 percent), retinal detachment (2 percent) and ruptured globe (2 percent) were the most frequent major ocular injuries that complicated facial fractures.

Now as regards to our experience of eliciting clinical features in cases where ophthalmic apparatus involvement is present the following features were noted:

Of the mild ophthalmic abnormality, the signs noted were circumorbital ecchymosis in 52 patients, periorbital edema in 47 patients, subconjunctival haemorrhage in 50 patients, chemosis in 8 and paraesthesia was found in 10 patients.

Signs of moderate ophthalmic abnormality like enophthalmos were found in 14 patients, telecanthus in 5, diplopia in 10, epiphora and lid ptosis in 3 patients each, lid laceration was found in 7 patients, 4 patients had pain during ocular movement and 5 had reduced vision.

Sign of severe abnormality like retrobulbar haemorrhage was found in 1 patient, traumatic optic neuropathy in 1, papilledema in 1, traumatic cataract in 1 and lens displacement was found in 1 patient. Proptosis was noted in 4 patients and 3 patients had loss of vision following maxillofacial trauma.

In our study loss of vision was seen in 3 cases, causes being traumatic optic neuropathy, retrobulbar haemorrhage and papilledema as in accordance with the studies published in the literature.

The literature varies widely on mechanisms leading to visual loss. Ansari[13] reported that almost 50 percent and 40 percent of patients in their series lost their vision secondary to retrobulbar hemorrhage and ruptured globe, respectively; whereas Dancey et al[49] found that

traumatic optic neuropathy was the primary mechanism of ensuing blindness. Ugboko et al[15] reported that ruptured globe was the primary mechanism of visual loss.

The majority of patients described by Ansari[11] and Ugboko et al[15] were involved in high-speed motor vehicle accidents or sustained gunshot wounds. Not surprisingly, ruptured globe was found to be a major cause of blindness in both series. In contrast, Dancey et al[14] found traumatic optic neuropathy to be the leading cause of visual impairment.

Following ophthalmological injuries would have gone unnoticed had we not referred patients for ophthalmological evaluations.

One case of traumatic optic neuropathy

One case of traumatic cataract

One case of Papilledema

"Our data suggests that ophthalmologists are able to detect ocular injury that is not apparent to the non-ophthalmologist". Hence need for an ophthalmologic consultation and examination has to be emphasized.

Following clinical findings were confirmed with concurrence of the ophthalmologist.

As the ophthalmologic evaluation was evident in all cases, we were able to diagnose One case of Lens displacement**,** one case of Retrobulbar haemorrhage This was due to the fact that Funduscopic examination was not included in our study and due to the fact that maxillofacial surgeons are not trained in detecting these ocular injuries.

All of these eye abnormalities which we failed to detect were associated with decrease in visual acuity, hence we would like to emphasize that all patients with maxillofacial injury involving ophthalmic apparatus should be initially examined for visual acuity test (Snellen's Test).

"The principle predictor of an adverse ophthalmic prognosis was impaired visual acuity. Our study reaffirms that the assessment of visual acuity should be performed in all patients sustaining midfacial fractures".

"From our experience we would suggest that Funduscopic examination is of immense help for better treatment planning for patients with ophthalmic injuries. Maxillofacial surgeons should be trained in Funduscopic examination".

"In our study we would like to suggest that the Ophthalmological consultation should be carried as soon as possible after initial examination done by the maxillofacial surgeon".

In this present study the ophthalmologist was able to identify 1 case of traumatic optic neuropathy, 1 case of retrobulbar haemorrhage and 1 case of papilledema within 1 hour of ophthalmological referral. If ophthalmological referral would have been delayed, the patient would have undergone severe ocular damage.

Moreover, it is important for the maxillofacial surgeon to document these findings at the initial examination for the medico-legal purpose, as ocular trauma cases may account for 6-9% of all ophthalmology related litigation.[16]

		After ophthalmological evaluation			Total
		Early-Ref	Non-Ref	Routine-Ref	
After evaluation by maxillofacial surgeon	Early-Ref	4		4	8
	Non-Ref		31		31
	Routine-Ref		9	5	14
Total		4	40	9	53

Table No 4: Comparison of evaluation by maxillofacial surgeon with ophthalmological evaluation

A total of 53 patients with maxillofacial trauma involving the ophthalmic apparatus were assessed for the purpose of evaluating the validity of the scoring system. Out of 8 patients evaluated for early referral by maxillofacial surgeon, 4 were evaluated for early referral and remaining 4 were considered for routine referral after ophthalmological evaluation. All 31 patients were evaluated correctly for non-referral by maxillofacial surgeon and ophthalmologist. 14 patients were evaluated for routine referral by maxillofacial surgeon and after ophthalmological evaluation 5 patients were considered for routine-referral and 9 patients were categorized as non-referral. There was significant ($p<0.01$) difference in the evaluation by maxillofacial surgeon and ophthalmologist.

Maxillofacial referral showed 100% sensitivity and 77.5% specificity with 100% negative predictive value and 0% false negative outcome. 22.5% false positivity was also noted by maxillofacial reference.

An ideal screening test would be 100% sensitive and 100% specific. The application of the scoring system described, when taken in conjunction with a detailed clinical appraisal of the patient, is likely to result in a large proportion of 'appropriate' referrals to the ophthalmologist and will lessen the likelihood of significant ophthalmic pathology being missed. This scoring system requires to be time tested upon a new population of individuals in order to determine its efficacy.

CONCLUSION

1. Our data suggests that ophthalmologists are able to detect ocular injury that is not apparent to the non-ophthalmologist.

2. From our experience we would suggest that Funduscopic examination would be of immense help for better treatment planning for patients with ophthalmic injuries. Maxillofacial surgeons should be trained in Funduscopic examination

3. The principle predictor of an adverse ophthalmic prognosis was impaired visual acuity. Our study reaffirms that the assessment of visual acuity should be performed in all patients sustaining maxillofacial injuries involving the ophthalmic apparatus.

4. It is important for the maxillofacial surgeon to document these findings at the initial examination for the medico-legal purpose, as ocular trauma cases may account for all ophthalmology related litigation. Thorough documentation is frequently the physician's best defence and can actually prevent seemingly frivolous litigation.

5. "In our study we would like to suggest that the Ophthalmological consultation should be carried as soon as possible after initial examination done by the maxillofacial surgeon".

6. From our study we conclude that circumorbital ecchymosis, periorbital edema and subconjunctival haemorrhage are the mild signs most commonly observed in maxillofacial trauma involving the ophthalmic apparatus.

7. Our study shows that the causes of loss of vision were traumatic optic neuropathy, retrobulbar haemorrhage and papilloedema.

8. The application of the scoring system described, when taken in conjunction with a detailed clinical appraisal of the patient, is likely to result in a large proportion of appropriate' referrals to the ophthalmologist and will lessen the likelihood of significant ophthalmic pathology being missed. This scoring system requires to be time tested upon a new population of individuals in order to determine its efficacy.

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