ANALYSIS OF OCULAR MANIFESTATIONS OF BLUNT TRAUMA TO THE EYE

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ABSTRACT

BACKGROUND

Ocular trauma remains one of the most significant sight threatening problems in the recent years. Changing life pattern, modernisation, rapid industrialisation and high-speed travel, wide and variable exposure to the surroundings are contributing factors in blunt trauma. Trauma to the eye and adjacent structures requires meticulous examination to determine the loss of vision, range of involvement of extraocular muscles, and extent of injury to the anterior and posterior segment of the eye and extent of injury to other orbital and adnexal tissues which result in suboptimal vision.

Objectives-

1. To determine the common effects of different types of injuries on the ocular structures.
2. To determine and identify the current causes, sites, mechanism and extent of injury to the eye in relation to different levels of trauma.

MATERIALS AND METHODS

A prospective, interventional study was conducted on 100 patients at KIMS, Hubli presenting with blunt ocular trauma from September 2016 to August 2017.

RESULTS

In our study, the M: F ratio was 5.25:1 (84:16) with clear male preponderance. Age incidence study showed that blunt ocular injuries were common in younger age group comprising of 66 patients (66%) i.e. below the age of 35 years (people who are very active and in productive age group). 52 patients (52%) had occupational injuries of which 70% were farmers. Object causing blunt injuries are stone (18%) and stick (12%). Ocular structure involved in blunt trauma mainly are: anterior segment injuries- 94 patients (94%); i.e. conjunctiva- 70 patients (70%), lid- 65 patients (65%), periorbital lesions- 56 patients (56%), ecchymosis of periorbital tissue- 42 patients (42%), lid oedema- 37 patients (37%), iris involvement- 20 patients (20%), lens involvement- 15 patients (15%), cornea involvement- 14 patients (14%), traumatic miosis- 6 patients (6%), traumatic mydriasis- 9 patients (9%); posterior segment- 18 patients (18%) were involved in which retinal detachment- 4 patients (4%), macular oedema- 3 patients (3%) vitreous haemorrhage- 3 patients (3%) and 2 cases with choroidal rupture were seen.

CONCLUSION

Our study indicates that ocular lesions with blunt injuries are fairly common. In our study, occupational injuries mainly agriculture related as the cases are from rural areas of North Karnataka. The ocular trauma is associated with varying degrees of loss of vision and earning capacity with social and economic consequences. Early referral, prompt evaluation and treatment will reduce the sight threatening complications in these cases.

KEYWORDS

Ocular Manifestations, Blunt Trauma, Anterior Segment, Hyphaema, Angle Recession, Retinal Detachment.

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BACKGROUND

Ocular injury is a major health problem in India, blunt trauma being one of the important causes of ocular morbidity and blindness.¹ Children at play, young men at work, in factories and construction sites, road side falls, high speed travel and Road Traffic Accident, sport injuries, fall on projecting blunt objects and in a rural setup like ours agriculture-based injuries are the causes of minor and severe blunt injuries.^{1,2}

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The majority of these injuries are sustained by active and productive individuals.¹ Unfortunately, these injuries may all be often vision threatening and the lifestyle and future of these injured individuals are irrevocably altered.

Looking at the present scenario of working pattern and visual demands of patients and the use of sophisticated instruments, it has become mandatory on the part of an ophthalmologist to identify the various ocular structures involved due to blunt trauma, which may vary in severity from a simple corneal abrasion to an extensive rupture of globe, and provide satisfactory vision at its earliest of blunt injuries in a total perspective. It is essential to study not only recent injuries but also study the eyes which have sustained an injury at variable time intervals earlier.

Eye injuries are avoidable, if prevention is quite effective at work place, on the sports field, and in home. Patients and ophthalmologist must be aware of activities that incur high risk of eye injury and must take advantage of a protective

eyewear that is available, which varies with the need of the patient and when used in proper manner can reduce eye injuries in most of the cases.

Ocular trauma is the most important preventable cause of blindness or partial loss of vision in more than half a million people worldwide, the commonest victim is young male.^{1,2}

With the knowledge of circumstances of injury, their nature and the damage caused, early appropriate management can be taken, and preventive measures may be advised.

Blunt Injuries Affecting Anterior Segment

Anterior segment structures are effectively attached to the scleral wall, Iris is attached to the Iris root, lens anchored by the Zonules and the Ciliary body attaches to the scleral spur anteriorly. As the globe is deformed the Mechanical energy is transformed into hydraulic pressure wave. These forces act on the anterior segment structures forcing their untethered ends posteriorly while this is occurring, the attached peripheral ends are directed more equatorially with the expansion of globe in this dimension and the combination of events creates shearing forces, this forceful expansion of tissue results in tears.

Dante J Pieramici, Leonard M Parver³ (1995) Stated that there are 7 Rings of Tissues Those Expand Resulting in Tears-

1. Sphincter pupillae.
2. Iris base to ciliary body.
3. Anterior face of ciliary body.
4. Attachment of ciliary body to scleral spur.
5. Trabecular mesh work.
6. Lens Zonules.
7. Attachment of vitreous and retina.

Recently adopted Classification	Kuhn F. et. al, ⁴ Standardized classification of Ocular trauma. Ophthalmology 1996 103-241.
Ocular Trauma Classification	

Closed globe Injury	The Eye wall does not have a full thickness wound.
Open Globe Injury	The Eye wall has a full thickness wound, a through and through injury.
Ruptures	Full thickness wound caused by blunt impact and an inside out mechanism.
Laceration	Full thickness wound by sharp objects
Penetrating Injury	Single Laceration, usually by a sharp object.
Perforating injury Perforating	Two full thickness lacerations (Entrance and exit) usually caused by sharp object or missile.

MATERIALS AND METHODS

Study Design

It is a prospective, interventional study. 100 cases of blunt trauma presented at Department of Ophthalmology, KIMS, Hubli, from September 2016 to August 2017 were prospectively studied. Visual acuity was recorded on

Snellen's chart, direct ophthalmoscopy, indirect ophthalmoscopy, slit-lamp examination were done. Relevant investigations were carried out such as X-ray orbit, fluorescein staining, lacrimal probing, syringing, gonioscopy, B-scan ultrasonography, CT scan and MRI scan in selected patients.

Inclusion Criteria

All Cases of Blunt Injury to the Eye

- Attending the outpatient department and
- Casualty department of KIMS Hospital are included.

Exclusion criteria

All Cases of

- Chemical injuries,
- Injuries with sharp instruments (penetrating, perforating) were excluded from the study.
- Patients who were having serious injuries which led them to life risk and needed priority management by other specialties were also excluded from the study.

Patients presenting with history of blunt injury to one or both eyes were selected from the out patients and in patients of ophthalmology Patients referred with blunt eye injury from the casualty department of KIMS, Hubli were selected.

The time interval between injury and consultation at these hospitals varied considerably. The earliest injury - consultation interval being 2 hours and the longest being 10 days.

When a patient presented with a history of blunt injury. A detailed history regarding age, sex, occupation, causative agents, duration of injury, direction of force, signs and symptoms occurring following the injury were taken.

A detailed torch light examination was performed. Vision was recorded on Snellen's chart. Ophthalmoscopy was performed in cases wherever possible. Slit-lamp examination was performed in all the cases.

Gonioscopy was performed in all patients except patients with purely subconjunctival haemorrhage and corneal injury and severe lid injury, oedema which prevented from doing gonioscopy.

Plain X-Ray

X-ray of the skull in anteroposterior view, Water's (nose-chin) position and parieto-orbital oblique projection were taken whenever necessary and in all medico-legal cases.

B Scan

Ultrasonography was performed in patients, where fundus could not be visualised and wherever suspected to have a vitreous haemorrhage, retinal detachment with or without media opacities.

CT Scan Plain was done for the following cases:

Orbital fracture, Road Traffic accident cases, in patients with history of fall and medicolegal cases with badly injured globe and adnexa and in desirable cases.

MRI

Magnetic Resonance Imaging Scans were done in all medico-legal cases and in other cases wherever it was necessary.

RESULTS

Age Wise Distribution of Patients

Age Group	No. of Cases	Percent
Birth to 15	15	15
16-25	15	15
26-35	36	36
36-45	18	18
46-55	8	8
Above 55	8	8
Total	100	100

Table 1. Age Incidence

Sex	No. of Cases	Percent
Male	84	84.0
Female	16	16.0
Total	100	100.00

Table 2. Sex wise Distribution of Patients

Source of Injury	No. of Cases	Percent
Occupational injuries	52	52
Sports & Play	23	22
RTA & Assault	22	22
Others	3	3
Total	100	100.0

Table 3. Distribution of Cases According to Source of Injury

Object	No. of Cases	Percent
Stone	18	18.0
Stick	12	12.0
Iron rod	7	7.0
Ball	5	5.0
Fist	12	12.0
Metallic/Wooden extraocular FB	4	4.0
Branch of tree	4	4.0
Bull gore	6	6.0
Knob of door, Cup board	4	4.0
Whip lash	4	4.0
Cycle/Scooter handle	4	4.0
Handle of handloom/lathe/Silk	3	3.0
Reeling machine		
Finger nail	2	2.0
Pencil/Pen blunt end	2	2.0
Racquet	2	2.0
Tooth brush	2	2.0
Others (RTA etc.)	9	9.0
Total	100	100.0

Table 4. Objects Causing Blunt Injury

Ocular Involvement	No. of Cases	Percent
Periorbital region	56	56.0
Lids	65	65.0
Conjunctiva	70	70.0
Cornea	14	14.0
Hyphaema (AC)	6	6.0
Iris	20	20.0
Angle Recession	6	6.0
Lens	15	15.0
Posterior segment	18	18.0

Table 5. Ocular Structures Involvement

Periorbital Lesions	No. of Cases	Percent
Ecchymosis	42	42
Lid oedema	37	37
Laceration	8	8
Emphysema	4	4
Fracture	9	9

Table 6. Distribution According to Periorbital Involvement

Conjunctiva	No. of Cases	Percent
Subconjunctival haemorrhage	44	44
Chemosis	20	20
Laceration	6	6
Total	70	70.0

Table 7. Distribution of Cases According to Conjunctival Involvement

Cornea	No. of Cases	Percent
Abrasion	5	5
Partial laceration	2	2
Descemet's tear	1	1
Oedema	3	3
Ulcer	1	1
Blood staining of cornea	2	2
Total	14	14.0

Table 8. Corneal Lesions

Iris	No. of Cases	Percent
Iridodonesis	3	3.0
Iridodialysis	8	8.0
Synechiae	3	3.0
Total	14	14.0

Table 9. Distribution of Cases According to Iris Involvement

Pupil	No. of Cases	Percent
Miosis	6	6
Mydriasis	9	9
Total	15	15

Table 10. Pupil Involvement

Lens involvement	No. of Cases	Percent
Subluxation of lens with and without lenticular opacity	2	2
Dislocation of lens	1	1
Partial opacity	7	7
Total opacity	2	2
Pure lenticular opacity (Rosette)	3	3
Total	15	15

Table 11. Pattern of Lens Involvement

Clinical Findings	No. of Cases	Percent
Vitreous		
Vitreous herniation in to anterior Chamber	2	2
Vitreous haemorrhage	3	3
Retina		
Berlin's oedema	3	3
Retinal oedema	3	3
Retinal detachment	4	4
Choroid		
Choroidal haemorrhage	1	1
Choroidal rupture	2	2
Total	18	18

Table 12. Distribution of Cases as per the Clinical Findings of Posterior Segment Damage

Cranial Nerve Injury	No. of Cases	Percent
Total 3 rd nerve paralysis	1	1
4 th nerve paralysis	1	1
6 th nerve paralysis	2	2
Combined 3 rd and 6 th nerve paralysis	2	2

Table 13. Cranial Nerve Injuries

Visual Acuity	No. of Cases	Percent
6/6	42	42
6/9	20	20.0
6/12	17	17
6/18	5	5.0
6/24	2	2.0
6/36	1	1
6/60	1	1.0
1/60	2	2
Cf2mt	2	2
Cf/CF	2	2
Hm/Cf	1	1
Pl ⁺ +PR ⁺	2	2
Following light	1	1
No PL	2	2
Total	100	100.0

Table 14. Percent of Final Visual Acuity

Figure 1. Traumatic Cataract

Figure 2. Subluxation of Lens

Figure 3. Blunt Trauma Globe Rupture

Figure 4. Hyphaema

DISCUSSION

Age Incidence

In this study consisting of 100 cases, the age range was from 3 months old child to 80 years old woman. Incidence of ocular injuries were found to be highest in the younger age group and children of 16 to 35 years (51%).

Maximum cases were below the age group of 35 years. It has been observed that children and young adults are more prone to injuries, this may be due to more exposure to risk of blunt injuries, exposure and lack of awareness, regarding injuries among children.

According to Jain BS, Sony SR⁵ (1993), the maximum incidence of ocular injuries was seen in the age group of 16 to 30 years (63%) and in children below 16 years (23.2%). This is because children left to play unsupervised by their parents.

Sex Incidence

There were 84% males and 16% females in this study, the male female ratio was 5.25:1, this nearly coincides with the study conducted by Eagling EM⁶ (1974), the male female ratio was 6.5:1.

Occupational injuries

Agriculture, the major bulk of our study which was followed by Sports and then Road Traffic Accidents and assault.

Causative Agents/ Source of Injury

The commonest causative agents were stones and sticks followed by injuries with cricket ball, rubber ball and fist. In this study, most common object causing blunt trauma to the eye was stone (18%) followed by stick (12%), fist (12%), road traffic accident (9%), iron rod (7%), bull gore (6%), ball (5%), branch of tree (4%), etc. The commonest mode of injuries was by stones.⁵

Periorbital and Lid Involvement

In this study, black eye or periorbital contusion was the most common clinical finding seen in 56 cases (56%). This involved ecchymosis to the eye lid and or periorbital region. This is in accordance with the study conducted by Orlando and Doty JH (1996) in which they evaluated 125 patients with sports related ocular injuries and reported an incidence of 36% of lids of periorbital contusion injuries. Other findings included periorbital oedema (36.5 to 39%), periorbital laceration 16 cases (8%), crepitus (emphysema) (2 to 2.5%), lid oedema (39%), lid abrasion (7%) and lid laceration (8%). There were 44 patients with purely subconjunctival haemorrhage. 36 patients had subconjunctival haemorrhage associated with other findings.

Corneal Findings

After excluding 44 cases (eyes) of subconjunctival haemorrhage out of 100 cases, 14 eyes (14%) had corneal findings, out of which 5 eyes had corneal abrasion, 3 eyes had corneal oedema, and 2 cases had blood staining of cornea. There were 2 patients with a partial thickness corneal tear of which 1 was in the superotemporal area just away from the limbus. In this study, there were 2 patients with blood staining of the cornea. 6 cases of hyphaema were present, most involved 1/3 to 1/2 of the anterior chamber, 2 cases had only marginal increase in IOP but none of them had significant raise in IOP.

Iris and Pupillary Involvement

Involvement of the iris and pupil constituted major number of clinical findings. Out of total cases, traumatic mydriasis was present in 9 eyes (9%) which was the commonest followed by miosis in 6 eyes (6%), synechiae in 3 cases (2%). Our study corresponds to the study of 205 cases by Canavan and Archer⁷ in which 79 cases had iris and pupillary injuries.

Lens

15 eyes had lenticular involvement in the form of subluxation, dislocation, lenticular opacities with or without rupture of anterior capsule as opposed to the 52 eyes out of 212 in a study by Canavan and Archer.⁷ In this study, in 67 (33.5%) eyes with lens and pupillary damages, 31 eyes had simultaneous lenticular damage as opposed to 44 and 79 eyes

with lens or pupillary abnormalities in the study conducted by Canavan and Archer.⁷

Posterior Segment Damage

There were a total of 18 cases of posterior segment involvement. 3 eyes in this study had vitreous haemorrhage, 3 had Berlin's oedema. Siegfried found 167 cases (12.5%) had Berlin's oedema. There were 4 cases of retinal detachment which could be appreciated on indirect ophthalmoscopy and was confirmed by B-Scan

A total of 3 cases of retinal oedema were observed, the vision returned to normal in most of the cases as the oedema subsided over a period of 1-2 months. 2 cases of choroidal rupture, 1 case of choroidal haemorrhage.

Vision

Out of total 100 cases, 42 eyes of subconjunctival haemorrhage had a best corrected visual acuity of 6/6. The other two had pre-existing retinal pathology. Of the remaining 66 eyes, 20 eyes had a final visual acuity of 6/9, 17 eyes had a final visual acuity of 6/12, and 5 eyes had a final visual acuity of 6/18, 2 cases had 6/24, 1 case had 6/36. 1 had less than 1/60, 2 had counting fingers to 2 metres, 1 had hand movement close to the face, 2 had PL+ +PR, 1 had 'following light movement' PL+, and 2 had no PL-.

Extraocular Muscles and Nerves

1 case (1%) of traumatic total 3rd nerve paralysis was seen, 1 case (1%) of 4th nerve paralysis was seen, 2 cases of combined 3rd and 6th nerve paralysis and 2 cases of isolated 6th nerve paralysis were reported.

In traumatic 3rd nerve paralysis, ocular movements were restricted in all the directions except abduction. Pupil in the affected eye was dilated and fixed.

Corneoscleral Rupture

There were 3 cases (1.5%) of corneoscleral rupture starting from extreme periphery of the cornea and running through the sclera, these were associated with prolapse of the iris tissue. Suturing was done using 10.0 Vicryl after iris abscission/reposition.

This finding almost coincides with the study conducted by Kylstra JA, Lamkin JC, Runyan DK⁸ (1995) who have reported an incidence of 3.5% corneoscleral rupture.

CONCLUSION

It is clear from this study as well as other epidemiological studies conducted over past 15 years that ocular trauma is associated with varying degrees of loss of vision and earning capacity with social and economic consequences. This is an area for further research; additional investigation is also needed to develop and evaluate new interventions for prevention and management of all types of eye injuries.

Interdisciplinary approaches and community-based strategies will be important to make progress in this area of study to save and salvage vision.

From this study, we can infer that children and young adults are more prone to blunt ocular trauma, occupational injuries, and road traffic accidents constitute the main bulk of injuries.

Injury with stone was the most common (18 cases, 18%), next comes stick injuries (12 cases, 12%; agriculture related

injuries) in causation of blunt ocular trauma.

In this study, anterior segment was more often affected (94 cases, 94%).

Many of the injuries could have been prevented, if the patients had used protective eyewear during work or play.

We need to stress more on the importance of preventive measures by which incidence of these cases can be reduced.

In an unfortunate event of trauma, the patient must be seen as early as possible, referred to an ophthalmologist for adequate management.

Early referral, prompt evaluation and treatment will reduce the sight threatening complications in these cases.

Patients should be explained about the importance of protective measures like protective glass, helmets, etc. in occupations such as sports and travel.

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