

## A CLINICAL STUDY OF PENETRATING INJURIES OF THE EYE

Deleekumar Kozhikkot Velayudhan<sup>1</sup>, Cyriac Kurian Pandarakkalam<sup>2</sup>, Govindan Shobhana<sup>3</sup>, Indu Vadakkoot Padmanabhan<sup>4</sup>

<sup>1</sup>Professor and HOD, Department of Ophthalmology, Government Medical College, Manjeri, Kerala.

<sup>2</sup>Professor and HOD, Department of Ophthalmology, SNIMS, Manjaly, Chalacka, Ernakulam, Kerala.

<sup>3</sup>Consultant, Department of Ophthalmology, Bharath Hospital, Kottayam, Kerala.

<sup>4</sup>Junior Consultant, Blood Bank, Government Medical College, Manjeri, Kerala.

### ABSTRACT

#### BACKGROUND

Ocular injuries are a major cause of worldwide visual impairment and the penetrating injury of eye is one of the major causes of unioocular and rarely binocular blindness. No matter how small such injuries are, never to be considered trivial and always to be treated as surgical emergencies.

Aims and Objectives of the study-

1. To study the incidence of penetrating injuries of the eye.
2. To study the percentage of occurrence of different types, their management and resultant visual outcome.

#### MATERIALS AND METHODS

This study was conducted at The Department of Ophthalmology, Medical College Kottayam from March 2000 to January 2003. Study participants include patients who attended Department of Ophthalmology, Medical College, Kottayam, with penetrating injury of the eye. Detailed History and Examination of eye is done with record of their vision, intraocular pressure, fundus examination, Radiological examination of the orbit and if needed ultrasound scan of eye. All cases which are admitted and given the necessary surgical management and then followed up in the OP for a varying period of 1-3 months.

#### RESULTS

In this study majority of patients were males. Higher number of injuries were occurred among 2-10 years and 31-40 years group. Injuries were caused by stick, glass piece, knife, stone and toys etc. As regarding occupation majority of patients were stone tillers working without any protection for their eyes. Left eye preponderance is seen in the study. Main site of injury was cornea, corneoscleral and sclera. In case of corneal wounds those which extended to centre cause much diminution of vision. As regarding the complications, Traumatic cataract stood first. Surgical management was directed towards optimal repair of wounds during primary suturing and prevention of secondary complications. The visual prognosis mainly depends on the initial visual acuity

#### CONCLUSION

According to this study, adults of working age group were found to have the highest risk. Males, especially manual labourers involved in stone tilling have the maximum risk. Children while playing are at particular risk. Most injuries are unilateral and anterior segment is commonly affected. The most common complication is traumatic cataract and with posterior segment involvement visual outcome is poor. Prognosis depends upon site of injury, initial visual acuity, Presence of cataract and intra ocular foreign body. Anterior segment injury carries better prognosis than posterior segment injury. Analysis of results showed that majority of patients retained good vision after treatment.

#### KEYWORDS

Penetrating Injury, Traumatic Cataract, Cornea, Intraocular Foreign Body, Endophthalmitis.

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#### BACKGROUND

Ocular injuries are a major cause of worldwide visual impairment and is of major socioeconomic importance. The penetrating injuries of eye is one of the major causes of unioocular and rarely binocular blindness. More than 1/3<sup>rd</sup> of unioocular blindness is caused by injuries worldwide.<sup>1</sup>

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*Corresponding Author:*

*Dr. Cyriac Kurian Pandarakkalam,*

*Ettumanoor, Kottayam, Kerala-686631.*

*E-mail: drcyriackurian1950@gmail.com*

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The eye ball is protected by nature anatomically by the bony walls of the orbit and its situation in the elastic fatty tissues within the orbit. Penetrating injuries of the eye are common, whether they are small punctures or extensive lacerations, they occur particularly among children<sup>2</sup> at play or adults engaged in work, or accidents incurred while traveling. Blast injuries also form one of the aetiological factors. No matter how small such injuries are, never to be considered trivial but are always to be treated as surgical emergencies.

Injuries to human eyes by pecking of a pet or wild bird are also seen, mostly caused by owls and roosters.



*Definition*

Penetrating injury is defined as single, full thickness wound of eye wall (corneoscleral) usually caused by sharp object in which no exit wound has occurred.<sup>3</sup> Intraocular foreign body is defined as the retained foreign object caused by a single entrance wound which is technically a penetrating injury but grouped separately because of different clinical implication<sup>3</sup>.

*Classification of Ocular Injuries<sup>4</sup>*

A new perspective has evolved for the classification of mechanical injuries of the eye. The new system always uses the entire globe as the tissue of reference. When a tissue is specified, it refers to wound laceration and not injury type. Thus, a corneal penetrating injury thus involves an open globe injury with the wound being in the cornea. The final version of the new ocular trauma terminology system subsequently was endorsed by the International society of ocular trauma, the United States Eye Injury Registry, the American Academy of Ophthalmology, the Hungarian Eye Injury Registry, the vitreous Society, the Retina Society and Ocular Trauma Classification Group in July 1995.

This classification system is limited to mechanical injuries of the globe – Open globe and closed globe injuries. This classification system is based on four specific variables of ocular trauma Anatomy or Physiology that have been shown to be prognosis of final visual outcome, type of injury based on mechanism of injury, grading of injury defined by visual activity, pupil defined as the presence or absence of relative afferent pupillary defect in injured eye and zone of injury based on antero-posterior extent of Injury. In case of multiple cornea-scleral openings, zones defined as the most posterior opening. In cases of intraocular foreign bodies, zone is defined at the entry site, when as in perforating injuries, zone is defined as the most posterior defect, generally the exit site.

*Open Globe Injury Classification*

*Type*

- A. Rupture
- B. Penetrating
- C. Intraocular FB
- D. Perforating
- E. Mixed

*Grade Visual acuity*

- 1) > 20/40
- 2) 20/50 to 20/100
- 3) 19/100 to 5/100
- 4) 4/200 to high perception
- 5) No light perception

*Pupil*

- Positive - RAPD present in affected eye
- Negative - RAPD absent in affected eye

*Zone*

- I. Isolated to cornea (including the corneoscleral limbus)
- II. Corneoscleral limbus to a point 5 mm posterior to sclera
- III. Posterior to the anterior 5 mm of sclera

*Aims and Objectives*

- To study the incidence of penetrating injuries of the eye
- To study the percentage of occurrence of different types, their management and resultant visual outcome

**MATERIALS AND METHODS**

*Study Period*

A study period from March 2000 to January 2003.

*Sample Size*

100 patients were included in the study.

*Settings*

Ophthalmology Department of Medical College, Kottayam, Kerala.

*Study Tool*

- Pretested semi structured objective questionnaire.
- Techniques to measure visual acuity and intra ocular pressure,
- Slit lamp examination and Radiological examination.

*Study Subject*

Patients, with Penetrating injury came to Medical College Kottayam.

*Methodology*

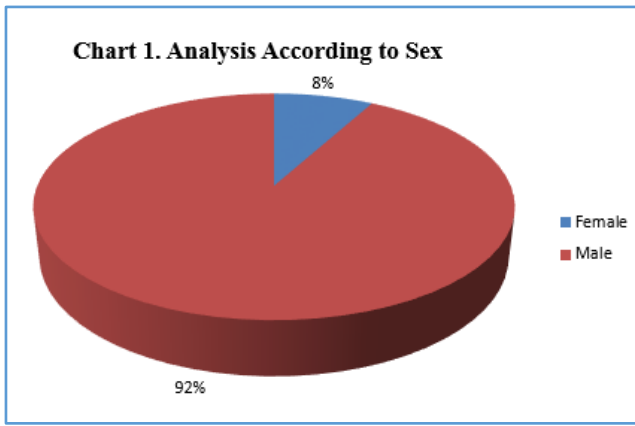
Detailed History and Examination of eye is done at the time of admission, with record of their vision, intraocular pressure and fundus examination of all possible cases, with record of extent of injury and tissues involved. Radiological examination of the orbit and ultrasound scan of eye taken to exclude the possibility of any intraocular foreign body and for detection of posterior segment changes when ophthalmoscopic visualisation is not possible. All cases which are admitted and given the necessary surgical management and then followed up in the OP for a varying period of 1-3 months.

**RESULTS**

*Total Number of cases 100.*

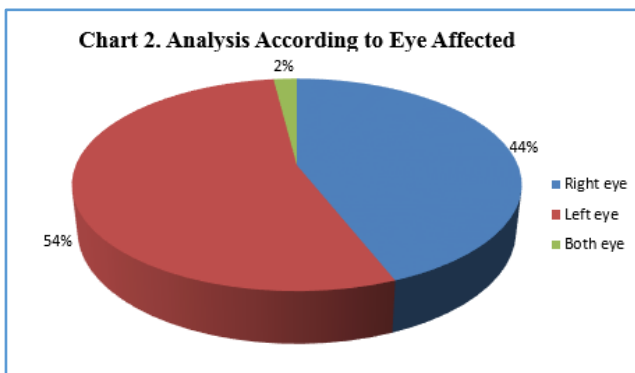
Age Group (Yrs.)	No. of Cases	Percentage
1-10	18	18%
11-20	16	16%
21-30	16	16%
31-40	18	18%
41-50	16	16%
>51 years	16	16%

**Table 1. Age Wise Analysis of Cases**



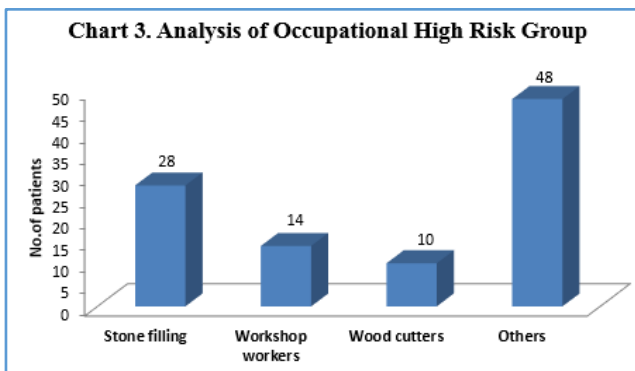
Eye Affected	No. of Cases	Percentage
Right eye	44	44%
Left eye	54	54%
Both eye	2	2%

**Table 2. Analysis According to Eye Affected**



Mode of Injury	No. of Cases	Percentage
Occupational	52	52%
Assault	1	1%
RTA	7	7%
Children playing (<4 years)	6	6%
Others	34	34%

**Table 3. Analysis According to Mode of Injury**



Objects	No. of Cases	Percentage
Stone	32	32%
Glass piece	13	13%
Sharp stick	12	12%
Flying wooden piece	9	9%
Metal wire	7	7%
Metal piece	6	6%
Knife	5	5%

Brook stick	5	5%
Pen tip	3	3%
Nail piece	3	3%
Soda bottle cap	2	2%
Bird peck	2	2%
Chisel tip	1	1%

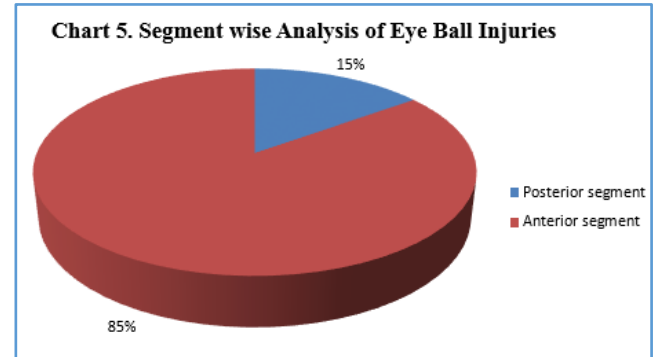
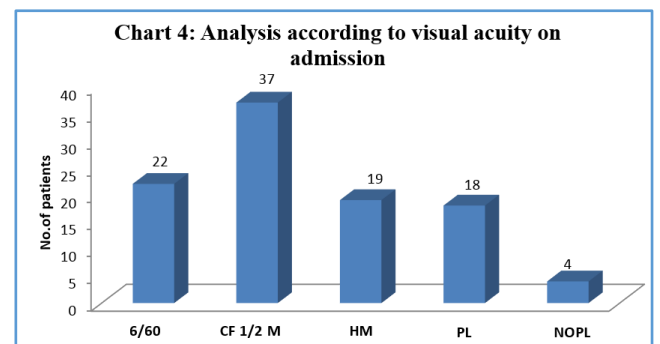
**Table 4. Analysis According to the Type of Objects Involved**

Object	No. of Objects	Percentage
Stone	5	5%
Iron	4	4%

**Table 5. Analysis of Objects as IOFB**

Site	No. of Objects	Percentage
Vitreous	5	5%
AG angle	3	3%
Lens	1	1%

**Table 6. Analysis of IOFB Site**



Site	No. of Cases	Percentage
Cornea	77	77%
Corneoscleral	20	20%
Scleral	3	3%

**Table 7. Analysis According to Site of Entry of Wound**

Structure	No. of Cases	Percentage
Cornea	97	97%
Sclera	3	3%
Corneoscleral	20	20%
Iris	66	66%
Lens	43	43%
Vitreous	15	15%
Retina	2	2%

**Table 8. Structure Wise Analysis of Injury of Eye Ball**

Complication	No. of Cases	Percentage
Traumatic cataract	43	43%
Hyphaema	5	5%
Secondary glaucoma	4	4%
Endophthalmitis	7	7%
Phthisis bulbi	1	1%
Retinal detachment	2	2%

**Table 9. Analysis of Complication Noted**

Visual Outcome	No. of Cases	Percentage
6/6	5	5%
6/9	15	15%
6/12	10	10%
6/18	7	7%
6/24	12	12%
6/36	7	7%
6/60	11	11%
CF ½ - CF5M	23	23%
HM+	3	3%
PL+	5	5%
NO PL	2	2%

**Table 10. Analysis of Visual Outcome**

## DISCUSSION

As seen in various studies, sex incidence showed that majority of patients were males. Out of 100 cases 92 cases (92%) were found to be males, and 8 cases (8%) were found to be females. This is comparable to other studies,<sup>5,6</sup> like S.P.Perceival Scarborough (1972) and P.Desai, Mac Ewen C, Baines P (1996)

The age of the patients in our study ranged from 2 to 71 yrs. and higher number of injuries occurred among 2-10 years and 31-40 years group. In our study, both these groups showed 18% incidence. Injuries among children were caused by stick, glass piece, knife, stone and toys etc.

Majority of patients were stone tillers working without any protection for their eyes. Another common thing causing penetrating injury in our series is sharp stick, flying wooden piece and glass piece. Wood cutters, Iron rod cutters, and workshop men get injuries with Iron pieces. Wood cutters using sharp iron piece over the wood. Other causes of injury were glass piece, nail piece, and chisel tip in occupational set up.

Left eye preponderance is seen in our study. 44% for right eye and 54% for left eye and 2% for both eyes. This is in concordance with other studies. Left eye is usually near the area of danger and right eye tends to be somewhat protected by the nose.<sup>7</sup>

Main site of injury in our series, was cornea 77%, corneoscleral 20% and sclera 3%. In case of corneal wounds, those which extended to centre cause much diminution of vision.

Intra ocular foreign bodies were seen in this series. Commonest culprit is stone accounting for 5% cases and iron 4% cases. Vitreous showed 5% cases. AC angle 3% and lens 1%.

As regarding the complications, Traumatic cataract stood first 43%, then hyphaema 5%, secondary glaucoma 4%. Endophthalmitis 7%, retinal detachment 2% and Phthisis bulbi 1%.

## Management

Management starts with detailed history of how the injury occurred. Detailed examination of penetrating injuries including slit lamp and fundus examination of all admitted cases and necessary investigations are done and submitted for surgery as soon as possible after taking consent. Surgical management was directed towards optimal repair of wounds during primary suturing and prevention of secondary complications. Suturing is done under GA in children and under local anaesthesia in adults (Peribulbar anaesthesia or retro bulbar anaesthesia with facial block is given). 64% cases had iris prolapse. Iris tissue was excised or repositioned depending on the condition of iris. Iris tissue is gently released from wound edges and return to its place to obtain a normal iris diaphragm, and a round pupil especially if the wound is fresh and not soiled. AC was filled with normal saline/ringer lactate.

Systemic broad-spectrum antibiotics, local antibiotics, Atropine, s/c cortisone and antibiotics, topical steroids, Pad and bandage was given. Systemic steroids also given in all cases.

Traumatic cataract is dealt with, after the uveitis is subsided, and the corneal wound is healed, but in certain circumstances, if the lens capsule is torn and lens floccules protruding into the anterior chamber causing uveitis and secondary glaucoma, it was removed along with primary suturing through a limbal incision. In our study 23 patients under gone cataract surgery with intra ocular lens implantation, and all of them achieved fairly good vision.

Uveitis treated with Prednisolone eye drops and Atropine topically, Antibiotics and steroids systemically.

Scleral ruptures are sutured with 8/0 virgin silk after release or abscission of uvea and vitrectomy is done if vitreous is present in wound site. No specific treatment was given for iridodialysis.

In cases with secondary glaucoma, the raised intra ocular tension was first brought down by I/V Mannitol and Carbonic anhydrase inhibitors and topical medications and treated accordingly.

For hyphema, we usually advocate bed rest including haemostatics antibiotic + steroid eye drops pad and bandage. Mydriatic was put if there was iritis.

Presence of intraocular foreign body plays a major role in determining the final visual acuity.<sup>8</sup> 1 Iron foreign body was removed by magnet and the other was in the lens which was removed along with lens removal. The rest of the foreign body in the vitreous was stone and it was referred to higher centre where vitreoretinal facilities are available. Remaining foreign body was stone in the anterior chamber, which was removed.

Traumatic Endophthalmitis constituted 7%, which was treated after taking aqueous and vitreous samples for culture and sensitivity. Intra vitreal vancomycin and broad spectrum systemic antibiotics and steroid were given to all patients.

The resultant visual acuity of our patients was analysed. 5% had 6/6 vision. They all had corneal wounds of less than 3 mm size. They were all full thickness corneal wound and

four of them without iris incarceration, or other structure involvement. One of these patients had iris incarceration in the wound site and traumatic cataract, iris abscission and extra capsular extraction and posterior chamber intra ocular lens implantation was done to that patient.

Of these, one patient had endophthalmitis due to iron foreign body in vitreous and vision was not improved even after removal of foreign body and active medical management. Another patient who had involved in blast injury and the eye was severely injured and became phthisical. Eyes with initial good vision resulted in good resultant visual acuity.

Presence of posterior segment involvement denotes poor visual outcome.<sup>9</sup> Other things are complications like uveitis, secondary glaucoma, retinal detachment etc.

Sympathetic ophthalmia is not seen in our study. This shows rarity of such complications due to prompt treatment of penetrating injuries including good surgical management and the use of steroids.<sup>10</sup>

### CONCLUSION

- According to this study, adults of working age group have the highest risk. Males, especially manual labourers involved in stone tilling have the maximum risk. Children while playing are at particular risk. Most injuries are unilateral and anterior segment is commonly affected.
- The commonest material involved is stone and cornea is the commonest site of injury. Among IOFB, stone and metal are the commonest culprits and vitreous is the commonest site for metallic foreign body. The most common complication is traumatic cataract and with posterior segment changes, visual outcome is poor.
- The main feature of this study shows that the visual prognosis mainly depends on the initial visual acuity. Those with better visual acuity showed better prognosis for vision. Laceration limited to cornea alone in young patients showed better prognosis. Shorter average length of the laceration also carries better prognosis. Prognosis varies with the location of RIOFB.
- Anterior chamber, iris and lens foreign body carried good prognosis. Posterior segment foreign body in the

vitreous showed poor prognosis. Anterior segment injury carries better prognosis than posterior segment injury. Analysis of results showed that majority of patients retained good vision after treatment.

- Considering the risk factors, importance of prevention of such injuries is to be emphasized here. Appropriate safety measures have to be adopted in manual labourers especially involved in stone tilling. Protective goggles made up of polycarbonate can be advised.

### REFERENCES

- [1] Ajamian PC. Traumatic cataract. *Optom Clin* 1993;3(2):49-56.
- [2] Parihar JK, Dash RG, Vats DP, et al. Management of anterior segment penetrating injuries with traumatic cataract by Pentagon approach in paediatric age group: constraints and outcome. *Indian J Ophthalmol* 2000;48(3):227-230.
- [3] Sorby A. *Modern ophthalmology*. Vol 4. Lippincott 1972.
- [4] Greven CM, Engelbrecht NE, Slusher MM, et al. Intraocular foreign bodies: management, prognostic factors, and visual outcomes. *Ophthalmology* 2000;107(3):608-612.
- [5] Percival SPB. A decade of intraocular foreign bodies. *Br J Ophthalmol* 1972;56:454-461.
- [6] Percival SP. Late complications from posterior segment intraocular foreign bodies with particular reference to retinal detachment. *Br J Ophthalmol* 1972;56(6):462-468.
- [7] McCormack P. Penetrating injury of the eye. *Br J Ophthalmol* 1999;83(10):1101-1102.
- [8] Bullock JD, Warwar RE, Bartley GB, et al. Unusual orbital foreign bodies. *Ophthal Plast Reconstr Surg* 1999;15(1):44-51.
- [9] Sternberg P, de Juan E, Michels RG, et al. Multivariate analysis of prognostic factors in penetrating ocular injuries. *Am J Ophthalmol* 1984;98(4):467-472.
- [10] Hutton WL, Fuller DG. Factors influencing final visual results in severely injured eyes. *Am J Ophthalmol* 1984;97(6):715-722.