

## A CLINICAL STUDY ON THE AETIOPATHOGENESIS OF GLAUCOMA ASSOCIATED WITH TRAUMA

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### ABSTRACT

#### BACKGROUND

The aim of the study is to analyse the types of glaucoma associated with trauma and to study the causative mechanism of glaucoma associated with trauma.

#### MATERIAL AND METHODS

100 patients with glaucoma following trauma who attended the Regional Institute of Ophthalmology, Government Ophthalmic Hospital, Chennai, during the period of June 2005 to October 2007 were taken for this prospective study.

#### RESULTS

Of the 100 patients, number of patients with open angle (49%) and angle closure glaucoma (51%) were almost equal. Among the open angle glaucomas that caused by hyphaema contributed around 25%. This is followed by inflammation (15%), angle recession (6%) and lens particle glaucoma (3%). Among the angle closure glaucomas, lens-induced glaucomas contributed to 37%, which is followed by peripheral anterior synechiae (13%) and neovascular glaucoma (1%).

#### CONCLUSION

Injury to the eye leads to a chain of various complications of which glaucoma is the most dreadful one. Visual prognosis of ocular trauma depends on several factors. Examination and treatment should be carried out immediately following an eye injury to prevent visual loss.

#### KEYWORDS

Glaucoma, Open Angle, Angle Closure Glaucoma, Hyphaema, B Scan, UBM.

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#### BACKGROUND

Glaucoma is a chronic, progressive optic neuropathy caused by a group of ocular conditions, which lead to damage of optic nerve with loss of visual function.<sup>1</sup> The most common risk factor known is raised intraocular pressure. Traumatic glaucomas are secondary open or closed angle glaucomas, which represent a very heterogenous group of entities due to a variety of pathogenetic mechanisms, which increase the IOP in early or late phase of trauma due to blunt, penetrating, acid, thermal or radiation damage. Hyphaema, lens associated mechanisms, inflammation, angle recession and trauma to the trabecular meshwork are the most common causes of traumatic glaucoma after blunt trauma.<sup>2</sup> Peripheral anterior synechiae, inflammation, lens associated mechanisms, intraocular haemorrhage are the common

causes of glaucoma due to penetrating injuries. So, understanding the pathogenesis of intraocular pressure elevation is critical in selecting the appropriate management of glaucoma associated with ocular trauma. There are several systems by which the glaucomas can be classified. The two most commonly used are based on aetiology and mechanism. Based on aetiology, it can be classified into primary and secondary. Based on mechanism, it is classified into open angle glaucoma and angle closure glaucoma and developmental anomalies of the anterior chamber angle.<sup>3</sup> The types and aetiopathogenesis of glaucoma secondary to trauma will be analysed in this study.

#### MATERIALS AND METHODS

100 patients with glaucoma following trauma who attended Regional Institute of Ophthalmology, Chennai, during the period of June 2005 to October 2007 were included in this prospective study. The criteria for inclusion being all patients with raised intraocular pressure following trauma and all types of injuries causing raised intraocular pressure. The exclusion criteria being patients with pre-existing glaucoma and other pre-existing ocular disease with anterior segment infection or inflammation. All the patients were thoroughly evaluated by undertaking a detailed clinical history with regards to laterality (right or left), nature of injury like

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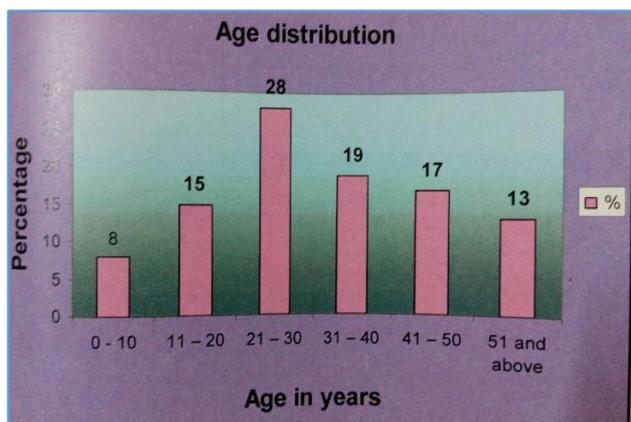


penetrating injury, blunt injury, chemical burns, thermal burns, nature of object, which caused injury like fist, ball, stone, metal, wood or glass, time interval between injury and admission to the hospital whether immediate or late and any pre-existing ocular diseases or surgeries. The injured eyes of the patients were examined for lid oedema, contusion or tear and anterior segment changes with slit lamp. Conjunctiva was examined for congestion, subconjunctival haemorrhage, chemosis and tear, cornea for oedema, foreign body, keratic precipitates, tear and tissue incarceration, anterior chamber for depth (normal, shallow, deep or irregular) and clarity (clear, turbid or with flare or cells, presence of hypopyon, hyphaema, foreign body, vitreous or lens matter); iris for normal pattern, hole, iridodialysis, anterior or posterior synechiae, incarceration in the wound, new vessels; pupil for normal, miotic, mydriatic, whether reacting to light, sphincter tear; lens for clear, cataractous, subluxation, dislocation, foreign body, pigments; vitreous for haemorrhage, incarceration in wound.

A complete glaucoma workup was done for all the cases, which included vision in right eye and left eye, tension was measured by Goldmann applanation tonometer and noncontact tonometer in selective cases. Gonioscopy was done with Goldmann single mirror indirect gonioscopes. Visual field was tested using automated perimetry in cases where it was possible. In fundus examination depending on the degree of visibility, direct ophthalmoscopy, slit lamp examination with 90D lens and indirect ophthalmoscopy were done in the patients and the following were looked for cup-to-disc ratio, retinal detachment, presence of vitreous haemorrhage or foreign body. All the cases were investigated with x-ray orbit to look for foreign body and USG done for posterior segment evaluation. Ultrasound biomicroscopy was done for selective cases suspected to have angle recession.

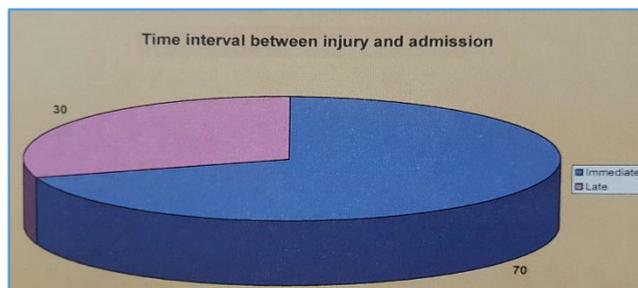
**RESULTS**

Of the 100 cases taken for the study, 78 cases were due to blunt trauma, 20 cases were due to penetrating injuries and 2 were caused by chemical injury. 70% cases were under less than 40 years age group (Chart 1). It is because of the reason that this group is actively involved in their occupation they are engaged.



**Chart 1. Age Distribution**

Sex distribution showed that 82% were males reflecting their work carrying a greater risk to occupational hazards. Involvement of right eye was more (62%) than the left eye (32%) in this study. There was no bilateral involvement. Place distribution showed that people from urban area were mostly affected. The reason for this regional variation could be due to the fact that this study was conducted in a tertiary eye care city hospital. About 70% patients presented in the immediate post traumatic period and 30% came late as the symptoms were very less in the early post traumatic period. (Chart 2).



**Chart 2. Time Interval between Injury and Admission**

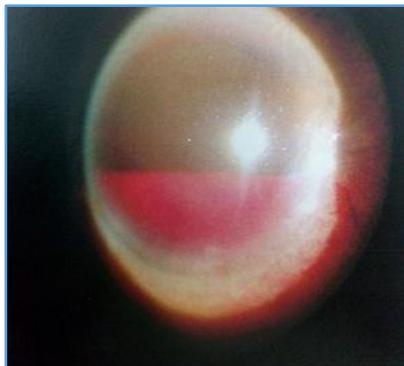
Industrial accidents were the commonest mode of injury (29%) followed by domestic (15%) and agricultural injuries (11%). The other modes of injuries were assault (10%), RTA (10%), cracker (11%), sports (8%) and quarry work (6%).

Type	Number of Cases	%
Blunt	78	78
Penetrating	20	20
Chemical	2	2

**Table 1. Type of Injury**

Blunt injuries constituted 78%. This could be due to careless handling of blunt objects. Penetrating injuries accounted for 20% and chemical injury was least common constituting (2%) (Table 1). Metal is the commonest agent causing injury (30%) mainly in industrial accidents. In industrial works, metal pieces are driven with a tremendous force, which on impinging on the eye produce severe ocular damage. This is followed by wood (25%), which is the common agent in domestic and agricultural injuries. They include stick, thorn, wood piece, etc. Injury with stone (24%) is mainly seen in trauma due to RTA, cracker and quarry injuries. Ball is the main agent in sports injuries (5%). Chemical injuries were least common (2%) and were caused by alkali. Number of patients with open angle (49%) and angle closure glaucoma (51%) were almost equal (Table 2). Among the open angle glaucomas that caused by hyphaema contributed around 25%. (Figure 1)

**Hyphaema**



**Figure. 1**

Type of Glaucoma	Number of Cases	%
Open angle glaucoma	49	49
Angle closure glaucoma	51	51

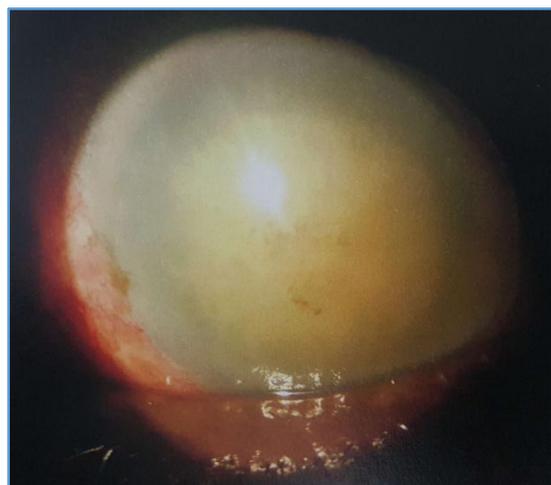
**Table 2. Type of Glaucoma**

These patients present early due to defective vision. Of these 25 cases, 8 had grade II, 11 had grade III and 6 patients had grade IV (total) hyphaema on presentation. This is followed by inflammation (15%). Of these 15 cases with anterior chamber inflammation, 2 cases had grade 2+ cells, 8 had grade 3+ and 5 cases had grade 4+ on slit lamp examination. Less common causes were angle recession (6%) and lens particle glaucoma (3%) (Table 3). In the post traumatic angle closure glaucomas, lens-induced glaucomas contributed to (37%).

Mechanism of Open Angle Glaucoma	Number of Cases	%
Hyphaema	25	25
Inflammation	15	15
Angle recession	6	6
Lens particle	3	3

**Table 3. Mechanism of Open Angle Glaucoma**

**Anterior Dislocation of Lens**



**Figure 2**

Majority of cases with angle closure were contributed by lens-induced glaucomas.

Of these, pupillary block due to anterior dislocation was around (13%) (Figure 2), intumescent lens (15%) and subluxated lens (9%). The next common cause was due to peripheral anterior synechiae (13%) due to inflammation in blunt trauma. In penetrating injury, it was due to a shallow anterior chamber resulting in synechial closure. There was one case of neovascular glaucoma, which was due to chronic inflammation following trauma (Table 4)

Mechanism of Angle Closure	Number of Cases	%
Anterior dislocation of lens with pupillary block	13	13
Peripheral anterior synechiae	13	13
Intumescent lens	15	15
Subluxated lens with pupillary block	9	9
Neovascular glaucoma	1	1

**Table 4. Mechanism of Angle Closure Glaucoma**

B-scan was useful in evaluating the posterior segment status in these eyes. 75% of eyes had a normal posterior segment. In the rest of the cases, there were important posterior segment findings like vitreous haemorrhage (20%) and retinal detachment (7%). The other associated findings in a few cases were IOFB, PVD and lens dislocation.

UBM confirmed angle recession in 6 cases where it was suspected (Figure 3). On gonioscopy, all the 6 cases had angle recession involving 180 degree or more.

**UBM - Angle Recession**



**Figure 3**

**DISCUSSION**

On analysing the age distribution, there is a preponderance of traumatic glaucoma in less than 40 yrs. age group (70%), which is in accordance with other studies, that show a similar distribution.<sup>4</sup> Sex distribution showed a preponderance in males (82%), which is in accordance with other studies,

reflecting greater risk of occupational hazards in males.<sup>5</sup> In females, the commonest cause of injury was found to be domestic and agricultural. In this study, right eye is involved more than left eye (62%) and no cases had bilateral involvement. Place distribution showed urban people are more affected than rural (74%) probably due to the study being conducted in a tertiary eye care centre in the city. Also, the most common cause of injury in the urban sector was industrial accidents and in the rural population the commonest causes were agricultural and domestic injuries.<sup>6</sup> Early presentation was seen in majority (70%), reason being defective vision and severe pain. Among this group, the patients with hyphaema and lens-associated injuries presented in the immediate post traumatic period. Few patients, in spite of poor vision came late as there was not much symptoms immediately. Industrial accidents were more common (29%) than domestic, agricultural, assault, RTA and crackers. Trauma due to sports and quarry work are the other modes of injuries. In this study, blunt injury is the major type of injury followed by penetrating injury.

This may be due to the careless handling of blunt objects without knowing that they are also as dangerous as sharp objects. Chemical injuries producing rise in intraocular pressure were less commonly seen.

Metal is the commonest agent causing injury mainly in the industrial accidents. This is followed by wood, which is the agent involved in domestic and agricultural injuries. Wood injuries include stick, thorn, wood pieces, etc. Injury with stone is mainly seen in trauma due to crackers, quarry work and RTA. Ball is the main agent among sports injuries as their impact on the globe is more due to their convex surface. Fist was the common cause in medicolegal cases. In this study, number of patients with open angle (49) and angle closure (51) glaucoma were almost equal.

The commonest cause of open angle glaucoma following trauma is hyphaema. These patients present in the immediate post traumatic period due to defective vision. This is followed by traumatic glaucoma due to inflammation. Angle recession and lens particle glaucoma are other less common causes.

Majority of cases with angle closure were contributed by lens-induced glaucomas.<sup>7</sup> They include anteriorly dislocated and subluxated lens causing pupillary block and intumescent lens.

All these cases presented early due to severe pain. The next common cause was formation of peripheral anterior synechiae due to inflammation following blunt trauma. In penetrating injury, the cause for synechial closure was a shallow anterior chamber.<sup>8</sup> There was one case of post traumatic neovascular glaucoma, which presented very late after the injury. It was due to chronic inflammation and associated with retinal detachment.

All patients in this study underwent B scan of which 25% had significant posterior segment findings. The commonest

problem was vitreous haemorrhage followed by retinal detachment, which accounted for the very poor vision in the early post traumatic period.<sup>9</sup> Angle recession was confirmed by Ultrasound Biomicroscopy (UBM) in 6 patients in whom it was suspected.

All those patients presented late after injury ranging from 4 to 8 weeks. Among those 6 cases, 3 cases had recession involving 180 degrees (2 quadrants), 2 cases had recession with slightly more than 180 degrees and one case had a 270 degrees recession. The reason for angle recession was blunt injury.<sup>10</sup>

## CONCLUSION

Injury to the eye leads to a chain of various complications, of which glaucoma is the most dreadful one. Visual prognosis of ocular trauma depends on several factors. More emphasis should be laid out on preventive measures by educating the population regarding eye injuries and the importance of protective measures. Using protective goggles by people working in industries and while bursting crackers must be stressed upon. Examination and treatment should be carried out immediately following an eye injury to prevent visual loss.

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