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Clinical Spectrum and Treatment Patterns of Traumatic Cataract in a Western Maharashtra Hospital

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Abstract

Ocular trauma is a leading cause of preventable visual impairment and blindness, particularly in younger populations. Traumatic cataract, a frequent complication of such injuries, presents significant diagnostic and surgical challenges, particularly in resource-limited settings. Despite surgical advancements, outcomes can vary depending on injury type, patient factors, and management strategies. Objectives: The study aimed to determine the prevalence of cataract following ocular trauma, identify associated risk factors, evaluate different injury modes, analyze surgical management strategies, and assess visual outcomes post-surgery. Methods: A prospective interventional study was conducted from October 2023 to March 2025 at a tertiary care hospital in Western Maharashtra. A total of 63 patients with ocular trauma were enrolled. Data on demographic profiles, injury types, risk factors, and use of protective gear were collected using structured questionnaires. All participants underwent detailed ophthalmic examination and were managed surgically using appropriate techniques including small incision cataract surgery, phacoemulsification, corneal tear repair, or pars plana vitrectomy with Intraocular lens implantation. Visual acuity was assessed preoperatively and at defined postoperative intervals, including 6 months follow-up. Statistical analysis was done using SPSS v26.0. Results: Traumatic cataract was noted in (87.10%) 54 total patients. Males and individuals from rural backgrounds were more affected, though no significant associations with age, gender, or area of residence were found. The most common injury source was metallic objects (35.18%) for 19 patients. Closed globe injuries were more prevalent (61.90%). Most patients amongst 58 (92.06%) had not used protective gear. Preoperative visual acuity was <6/60 in 41 patients (75.92%) of cases. Postoperatively, a significant number achieved (best corrected visual acuity) BCVA>6/12 (7.40%) in 4 patients at 6 months. Posterior segment complications were infrequent but associated with poorer outcomes. Conclusion: Traumatic cataract is a common, yet preventable consequence of ocular trauma. This study highlights that early diagnosis and timely surgical intervention significantly improve visual outcomes in affected patients. Public education on eye safety remains crucial. Larger studies are needed to validate these findings and optimize care protocols.

Keywords: ***Traumatic cataract; Ocular trauma; Visual outcome; Eye injury; Cataract surgery; Western Maharashtra***

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1. Introduction

Ocular trauma remains a major cause of visual morbidity and preventable blindness worldwide [1, 2]. Often under reported due to its typically unilateral nature, ocular injuries disproportionately affect children and young adults. The World Health Organization (WHO) identifies cataract as the leading cause of global blindness, accounting for 47.8% of all cases and impacting approximately 17.7 million individuals [3]. Traumatic cataract, a lens opacity developing after blunt or penetrating ocular injury, is a significant yet treatable cause of vision loss. Its development depends on trauma severity and the integrity of the lens capsule, with variability in type and progression [3].

The incidence of traumatic cataract varies geographically and is influenced by factors such as age, gender, environment, and socioeconomic status. While males are more susceptible due to increased exposure to high-risk activities, visual outcomes are not significantly influenced by gender. Rural populations experience higher rates of ocular trauma, though outcomes are comparable to urban counterparts [4].

Traumatic cataracts often result from both open and closed globe injuries and may manifest immediately or years post-trauma. The clinical presentation includes lens opacification and potential zonular disruption, which can lead to lens subluxation even in the absence of visually significant cataract [5,6]. Damage mechanisms include direct capsule rupture, coup contrecoup injuries, and equatorial expansion from hydraulic forces [7]. These injuries may coexist with anterior or posterior segment damage, complicating the prognosis [7].

Epidemiological data on ocular trauma and traumatic cataract are scarce, particularly in low-income regions [6]. However, evidence indicates a bimodal age distribution, with high prevalence in the 5-25 and ≥ 70-year age groups. Cataracts develop in 27%-65% of ocular trauma cases and frequently necessitate surgical intervention [7]. Despite advancements in surgical techniques and intraocular lens (IOL) technology, some patients experience persistent visual impairment. Primary cataract extraction with IOL implantation is the standard approach, often yielding substantial visual improvement [8]. Given that many ocular injuries are preventable, increasing awareness and implementing safety measures are essential.

Previous research on traumatic cataract has primarily focused on its clinical presentation and surgical outcomes, often in isolated or demographically narrow populations. While several studies have documented the incidence and visual prognosis of traumatic cataracts, there is limited data specific to regional variations, particularly in Western Maharashtra. Furthermore, most available literature lacks comprehensive analysis of both risk factors and long-term management strategies in a single cohort. This study addresses these gaps by exploring the prevalence, risk factors, and management outcomes of traumatic cataract in a tertiary care center in Western Maharashtra [8].

The objectives of the study were to assess the prevalence of cataract following ocular trauma and to identify the associated risk factors contributing to its development. It aimed to evaluate the visual outcomes in patients diagnosed with traumatic cataract and to analyze the various modes of ocular injuries that led to its occurrence. Additionally, the study sought to examine the different treatment modalities employed in the management of traumatic cataract within the studied population.

2. Material and Methods

This prospective interventional study was conducted at a tertiary care hospital like Dr DY Patil medical college and hospital in Western Maharashtra from October 2023 to March 2025. The study included 63 patients of all age groups who presented with ocular trauma. The Institutional Ethics Committee Pune, approved the study protocol (Approval No. IESC/PGS/2023/309) on 25 September 2023. Ethical principles and informed consent procedures were strictly followed. All participants were informed about the study's objectives, methods, and potential risks in their native language, and written informed consent was obtained.

Inclusion criteria comprised patients of any age and gender presenting with ocular trauma (open or closed globe injuries) to the ophthalmology outpatient department.

Exclusion criteria included patients with pre-existing retinal, corneal, or glaucomatous pathology affecting vision, those treated elsewhere before presentation, and individuals unwilling to participate. Each participant underwent a detailed history and ophthalmic examination. The questionnaire collected demographic data, injury type, mode and object of injury, protective gear usage, alcohol intake at the time of injury, and systemic illness. Clinical assessment included uncorrected and best corrected visual acuity (UCVA and BCVA), adnexal and extraocular movement evaluation, slit-lamp examination for anterior segment assessment, and fundus evaluation using a 90D lens, indirect ophthalmoscope, and fundus camera. For cases where the posterior segment was not visible, B-scan ultrasonography was performed. Children and uncooperative patients were examined under sedation or general anesthesia.

Preoperative investigations included complete blood counts, bleeding/clotting time, urine analysis, systemic examination, chest X-ray, ECG, and B-scan where indicated. Pre-surgical preparation included obtaining informed consent, performing a xylocaine sensitivity test, administering topical antibiotics, trimming eyelashes, and dilating pupils with tropicamide 0.5% and phenylephrine 5%.

FIG. 1**. Indirect ophthalmoscope.**

FIG. 2. 90 D lens.

FIG. 3. **B Scan machine.**

Depending on the case, different surgical techniques were used. These included:

Small incision cataract surgery with intraocular lens implantation involved peribulbar/retrobulbar anesthesia, scleral tunnel incision, viscoelastic injection, capsulorhexis with trypan blue, hydrodissection, nucleus removal, cortical aspiration, intraocular lens implantation and conjunctival closure. Phacoemulsification with intraocular lens used topical/peribulbar block, corneal incision, anterior capsule staining, nucleus emulsification, cortical aspiration and foldable intraocular lens implantation. Corneal tear repair with intraocular lens involved corneal wound suturing, lens removal, anterior vitrectomy if needed and suitable intraocular lens placement. Pars plana vitrectomy with intraocular lens included sclerotomy, vitrectomy, lens removal and implantation of either a capsular-supported or scleral-fixated lens. Postoperatively, patients were followed up at day 1, week 1, week 6 and 6 months. Visual acuity was recorded at each visit and final BCVA (best corrected visual acuity) was documented at 6 months [8].

Data analysis was performed using SPSS version 26.0. Statistical significance was assessed using Fisher's exact test, with a p-value <0.05 considered significant. Microsoft Excel was used for tabulating and visualizing data to enhance clarity in results presentation.

3. Results

TABLE 1. **Prevalence of Traumatic cataract.**

Cataract	N	%
Traumatic cataract	54	87.10%
No Cataract	9	12.90%
Total	63	100%

In the present study, the majority of subjects were diagnosed with traumatic cataract, accounting for 87.10% (n=54) of the total 63 participants. The remaining 12.90% (n=9) had no evidence of cataract. This highlights a high prevalence of traumatic cataract among the studied population. Among those diagnosed with traumatic cataract (n=54), the left eye (LE) was affected in 55.5% (n=30) of cases, while the right eye (RE) was involved in 44.5% (n=24). This suggests a slightly higher incidence of trauma to the left eye (TABLE 1).

The majority of cases were reported among 20 students (31.48%), followed by 12 farmers (18.52%), 6 company workers (9.68%), and 5 labourers (8.06%). Occupations with known ocular risk such as 4 welding (6.45%), 3 drivers (4.84%), and 1 factory worker (1.61%) were also represented, highlighting potential occupational hazards. Other occupations included 4 shopkeepers (6.46%), 2 housewives (3.23%), 1 health worker (1.61%), 1 staff in school (1.61%), and 1 engineer (1.61%). Among the total study population, 14.28% (n=9) had no cataract, indicating a higher burden of traumatic cataract among specific occupational groups. These cases either had corneal injuries, anterior chamber abnormalities, or vitreoretinal involvement without lenticular damage. These patients were managed accordingly with surgical intervention. In the present study 9.53% were alcoholic and 7.94% were using protective gear.

In the present study, closed globe injuries were more prevalent (61.90%) than open globe injuries (38.09%), indicating a predominance of blunt trauma. Metallic (35.18%) and organic (29.62%) materials were the leading causes of traumatic cataract, with ball/fist and glass. The most common diagnosis was traumatic total cataract (51.85%), followed by cases with corneal tears (37.03%) and other structural complications like scleral tears, iridodialysis and vitreous hemorrhage.

Corneal injuries (44.44%) and iris trauma (22%) were the most frequent associated ocular manifestations, underscoring the complexity and severity of trauma-related cataracts in this population (TABLE 2). In the study on B Scan, 3.17% had left eye Vitreous Haemorrhage and 1.58% had Right eye Retinal detachment.

TABLE 2. **Characteristics of Injury.**

		N	%
Type of injury (n=63)	Closed globe	39	61.90%
	Open globe	24	38.09%
Causative Agent for Traumatic Cataract (n=54)	Metallic	19	35.18%
	Organic	16	29.62%
	Ball/Fist	7	11.11%
	Glass	5	7.94%
	Firecracker	3	4.76%
	Stone	3	4.76%
	Blast Injury	1	1.59%
Diagnosis	Traumatic Total Cataract	28	51.85%
	Traumatic Cataract with Corneal Tear	20	37.03%
	Traumatic Cataract with Scleral Tear	2	3.7%
	Traumatic Cataract with Iridodialysis	2	3.7%
	Traumatic Cataract with Zonular Dehiscence	1	1.8%
	Traumatic Cataract with Vitreous Hemorrhage	1	1.8%
Other ocular trauma manifestation	Corneal injuries	27	44.44%
	Injury to Iris	14	22%
	Injury to Sclera	2	3.17%
	Lens subluxation or dislocation into vitreous	4	6.34%
	Secondary glaucoma	3	5.55%
	Hyphaema	2	3.70%
	Vitreous haemorrhage	2	3.70%

In the present study, none of the assessed factors showed a statistically significant association with traumatic cataract. The mean age was similar between those with and without cataract (33.13 ± 14.94 vs. 34.63 ± 14.46 years; $p=0.792$). Gender distribution showed a higher prevalence in males (84.90%) than females (90%), though not statistically significant ($p=0.756$). Similarly, rural residents (90.63%) had a slightly higher prevalence than urban residents (80%) without significant difference ($p=0.390$). The type of injury—closed globe (84.61%) vs. open globe (87.50%)—also showed no meaningful association ($p=0.315$). Systemic illnesses, alcohol consumption, and use of protective gear did not demonstrate significant relationships with cataract occurrence ($p>0.05$ for all), although protective gear use remained notably low, emphasizing an opportunity for targeted preventive strategies despite statistical insignificance (TABLE 3).

The mean age among patients with traumatic cataract was 33.13 years (SD=14.94), while for non-cataract patients it was 34.63 years (SD=14.46). The p-value of 0.792 from the Student's t-test indicates no statistically significant difference in mean age between the two groups. This suggests that age is not a significant factor in determining whether ocular trauma results in cataract formation in this population.

TABLE 3. **Association of Factors with Traumatic Cataract.**

		Traumatic cataract (n=54)		No Cataract (n= 9)		Total	P value
		n	%	n	%	N	
Age	**Mean ± SD**	33.13 ± 14.94		34.63 ± 14.46			0.792
Gender	**Male**	45	84.90%	8	16.10%	53	0.756
	Female	9	90%	1	10%	10	
Area	**Rural**	30	90.63%	3	9.09%	33	0.390
	Urban	24	80%	6	20%	30	
Type of injury	**Closed globe injury**	33	84.61%	6	15.38%	39	0.315
	Open globe injury	21	87.50%	3	12.5%	24	
Systemic Illness	**Hypertension and Diabetes Mellitus**	1	1.85%	0	0%	1	0.292
	Diabetes Mellitus	1	1.85%	0	0%	1	
	Hypertension	3	5.55%	3	33.33%	6	
	Nil	49	90.74%	6	66.66%	55	
Alcohol consumption	**No**	49	90.74%	8	85.71%	57	0.694
	Yes	5	9.26%	1	14.29%	6	
Use of protective gear use	**No**	49	90.74%	9	100%	58	0.490
	Yes	5	9.10%	0	0%	5	

Chi-square test, # Fisher's Exact Test

TABLE 4. **Distribution of Surgical Procedures Performed for Traumatic Cataract (n = 54).**

Surgical Procedure	Frequency (n)	Percentage (%)
Small Incision Cataract Surgery (SICS) with PCIOL implantation	20	37.0%
Corneal tear repair with lens aspiration and PCIOL implantation	20	37.0%
Phacoemulsification with PCIOL implantation	7	13.0%
Pars plana vitrectomy with PCIOL implantation	3	5.6%
Scleral tear repair with lens aspiration and PCIOL implantation	2	3.7%
Lens aspiration with PCIOL implantation + Capsular Tension Ring (CTR)	1	1.9%
Iridodialysis repair with lens aspiration and PCIOL implantation	1	1.9%

In the present study, pre-operative visual acuity was severely impaired in the majority of patients, with 75.92% (n=41) having vision worse than 6/60. A smaller proportion had moderate visual acuity between 6/60 to 6/18 (16.66%), and only 7.40% (n=4) had visual acuity better than 6/12 before surgery. On the first post-operative day, visual outcomes varied: 1.9% achieved 6/9, 25.9% had 6/12, 24.1% reached 6/18, and 13.0% had 6/24. Others had reduced acuity, including 6/36 (16.7%), 6/60 (14.8%), with 1.9% each seeing only finger count at 1ft and perception of light with accurate projection. At 6 months post-operatively,

visual outcomes significantly improved: 57.4% (n=31) attained best corrected visual acuity (BCVA) better than 6/12, 33.3% (n=18) had vision between 6/60 to 6/18, and only 9.3% (n=5) remained with vision worse than 6/60, indicating a favourable long-term surgical outcome for most patients (TABLE 5).

TABLE 5. **Visual acuity findings pre and post operative.**

		N	%
Pre-Operative visual acuity (n=54)	<6/60	41	75.92%
	6/60-6/18	9	16.66%
	>6/12	4	7.40%
Post operative visual acuity on day 1 (n=54)	6/9	1	1.9%
	6/12	14	25.9%
	6/18	13	24.1%
	6/24	7	13.0%
	6/36	9	16.7%
	6/60	8	14.8%
	FC at 1ft	1	1.9%
	PL+PR accurate	1	1.9%
BCVA at 6 months (n=54)	<6/60	5	9.3%
	6/60 to 6/18	18	33.3%
	>6/12	31	57.4%

4. Discussion

In the present study conducted in Dr DY Patil medical college and hospital in Western Maharashtra, the prevalence of traumatic cataract following ocular trauma was remarkably high at 87.10% (n=54 out of 63 patients) (TABLE 1). This figure underscores the burden of cataract as a frequent sequela of ocular trauma, in line with the findings of Okoye et al., who reported a 65% incidence post-trauma [1]. The slightly higher rate in this cohort study may be attributed to differences in injury severity or diagnostic thresholds. Traumatic cataracts affected the left eye in 55.5% of cases (n=30) and the right eye in 44.5% (n=24), suggesting a marginal left eye predominance, a trend previously noted by Okoye et al. [1]. However, this difference did not reach statistical significance, consistent with the bilateral risk profile reported in earlier studies [9]. Demographic and Occupational Risk: The most commonly affected age group was 21-30 years, with a mean age of 33.13 years among patients with traumatic cataract. No significant association between age and cataract development was observed (p=0.792), corroborating the findings of Singh et al. [10]. A marked male preponderance (84.90%) was observed, aligning with global trends reported by Bohra et al. and Chua et al. [11,12]. This gender disparity likely reflects greater exposure to trauma-prone activities. Occupational analysis showed that students (31.48%) and farmers (18.52%) were the most affected, followed by industrial workers and manual laborers, indicating high-risk environments due to lack of protective measures. These trends parallel those reported by Négrel and Thylefors, who highlighted children and manual laborers as vulnerable populations in low-resource settings [13].

Injury Patterns and Mechanisms Closed globe injuries were more common (61.90%) than open globe injuries (38.09%) (TABLE 2). This is consistent with data from Baker et al., who reported a near equal split but with a slight predominance of closed globe injuries [14]. Metallic (35.18%) and organic materials (29.62%) were the most frequent causative agents, aligning with rural exposure patterns and findings by Gogate et al. [11]. Traumatic total cataract (51.85%) was the most common diagnosis, often resulting from blunt or penetrating trauma that disrupts the lens capsule. Corneal tears were observed in 37.03% of cases, suggesting frequent anterior segment involvement (TABLE 2). These findings echo those of Yorston & Foster and Thylefors [15]. B-scan ultrasonography identified vitreous haemorrhage in 3.17% and retinal detachment in 1.58%, signifying posterior segment involvement in a minority of cases. These rates are slightly lower than the 5%-10% range reported by Wong et al. [16,17].

Risk Factor Analysis No significant associations were found between traumatic cataract and systemic illness (p=0.292), alcohol use (p=0.694), or protective gear usage (p=0.490) (TABLE 3). Despite low usage (7.94%), protective equipment remains a critical preventive measure. Therefore, emphasized that the majority of global ocular injuries are preventable with proper protective gear [13]. Surgical Management Surgical intervention primarily involved SICS with PCIOL implantation and corneal tear repair with lens aspiration and PCIOL, each performed in 37% of cases. Phacoemulsification was utilized in 13%, often in less severe cases. Complex surgeries such as pars plana vitrectomy and scleral tear repair were reserved for posterior segment complications and extensive trauma. These trends match the surgical approaches endorsed by Kumar et al. and Lalitha et al. for trauma cases in low-resource settings [10].

Visual Outcomes: Preoperative vision was severely impaired improvement in many cases, with 25.9% reaching 6/12 and 24.1% reaching 6/18. However, a subset had minimal improvement initially. At 6 months, visual acuity improved significantly: 57.4% achieved >6/12, and 33.3% had 6/60 to 6/18, leaving only 9.3% with <6/60.These results mirror those of Sharma et al. (2014) and Agrawal et al. (2010), who reported similar visual recovery trajectories in traumatic cataract surgery [18-21].

5. Limitations of the Study

The present study was conducted in a single tertiary care centre. The relatively small sample size may have limited the statistical power to detect significant association between various risk factors and development of traumatic cataract. The short duration of follow-up did not allow for assessment of long-term visual outcomes. Surgery was performed by different surgeons.

6. Conclusion

From the above study it can be concluded that Traumatic cataract is common following ocular trauma. Demographic factors like age, sex and area of living did not have significant association with development of traumatic cataract. Occupational and environmental hazards contributed to a large percentage of ocular trauma emphasizing importance of prevention. Surgery for traumatic cataract was successful. Some patients had posterior segment complication and poor vision post-surgery. Larger studies are required to refine treatment protocol and improve outcomes for those presenting with this avoidable but serious health condition.

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