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### RESEARCH ARTICLE

#### A STUDY OF PROGNOSTIC INDICATORS IN VISUAL OUTCOME OF ADULT TRAUMATIC CATARACT

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#### Abstract

**Introduction:** One of the most common consequences of blunt and penetrating ocular trauma is traumatic cataracts. It remains a significant cause of visual impairment.

**Aim:** This study aimed to investigate the analysis of prognostic indicators in the final visual outcome of adult traumatic cataracts.

**Methodology:** The study was conducted on a total of 60 patients including 46 males and 14 females above the age of 18 years were diagnosed with traumatic cataracts. Data regarding demographics, causative agent, type of trauma, and clinical course was recorded, and along with it, the OTS (ocular trauma score) was calculated. The outcome was measured with subsequent follow-up in the form of BCVA at 40 days of surgery. Appropriate statistical tests were applied.

**Results:** Penetrating injuries were sustained in 38 patients (63%) while 22 patients (37%) sustained blunt injuries to the eye. The most common affected age group was 30 – 60 years (60%) with male predilection (male to female ratio is 3.28:1). Commonest cause of trauma was road traffic accidents in 12 eyes (20%) followed by a thorn in 4 eyes (6.66%) and stone in 6 eyes (6.66%). In present study

lens implantation, visual acuity at presentation, the morphology of cataract, and OTS were found to significantly affect visual outcome while trauma-surgery duration did not affect visual outcome.

**Conclusion:** Traumatic cataracts mainly affected young males in our study. Better visual acuity at presentation, lens implantation after cataract extraction, and higher OTS correspond to higher visual acuity as recorded. Worse outcomes are seen with subluxated morphology. Trauma to surgery time interval is not a significant factor in the adult population.

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#### Introduction:-

Ocular trauma is a common reason of visual morbidity, which causes heavy psychological and economic burden to the victims and society<sup>1-3</sup>. Cases of traumatic cataract were grouped as those with open or closed globe injuries. The open globe injuries were further categorized into those with lacerations versus rupture. Lacerations of the eyeball were

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subcategorized into eyes with perforating injuries, penetrating injuries, or injuries involving an intraocular foreign body. Closed globe group was subdivided into lamellar laceration and contusion<sup>4</sup>.

The cause of traumatic cataract is complex since it may have been caused by rupture of lens capsule or zonular ligament, disorder of lens metabolism, or oscillation of lens cortex caused by collision. The onset of traumatic cataract may be immediate or several years after eye injury. The shape of traumatic cataract may be total, local, rosette or other irregular shape. The location of opacity may be at anterior or posterior cortex or the capsule. Any of these types of cataract will cause visual problems to the patient<sup>5</sup>.

The OTS (ocular trauma score) has been developed by Kuhn et al's study group that aims to predict the visual outcome of traumatic eyes, which has showed a predictable value for different types of ocular trauma. It has been reported that OTS can indicate the final vision for traumatic cataract patients<sup>6-8</sup>. In all patients undergoing corneal wound repair, the traumatic cataract is managed in a second procedure. Recurrent inflammation is more prominent in patients who had undergone previous surgery for trauma<sup>9-11</sup>. Posterior capsular rupture is much more common in traumatic cataract surgery than in conventional cataract surgery so lensectomy or vitrectomy is sometimes necessary<sup>12</sup>.

The possible factors which may influence the final visual outcome of adult traumatic cataract are initial visual acuity, injury type, wound location, cataract removal procedure and the way of IOL implantation. The initial visual acuity is positively associated with the final visual outcome and is also a predictor for visual outcome in open and closed globe injury. Visual outcomes were worse with open globe injuries than closed globe injuries. Location of wound in open globe injury will influence the final visual outcome<sup>13</sup>.

Injuries were classified according to the Birmingham Eye Trauma Terminology system (BETTS)<sup>14</sup>. The OTS was calculated and sorted into OTS score categories as follows: category 1 (0 to 44) category 2 (45 to 65) category 3 (66 to 80) category 4 (81 to 91) and category 5 (91 to 100)<sup>15</sup>.

The OTS (Ocular trauma score) has high sensitivity and specificity for predicting visual outcome of traumatic cataract patients in long term follow up. This study aims to study prognostic indicators in visual outcome of Adult Traumatic Cataract.

### **Materials and Methods:-**

The prospective observational study was conducted in Ophthalmology Department of Government Medical College, Aurangabad from October 2020 to October 2022 after regional ethical committee approval. Total of 60 patients coming to a Tertiary healthcare center, including 46 males and 14 females above the age of 18 years were examined with traumatic cataract.

#### **Inclusion Criteria:**

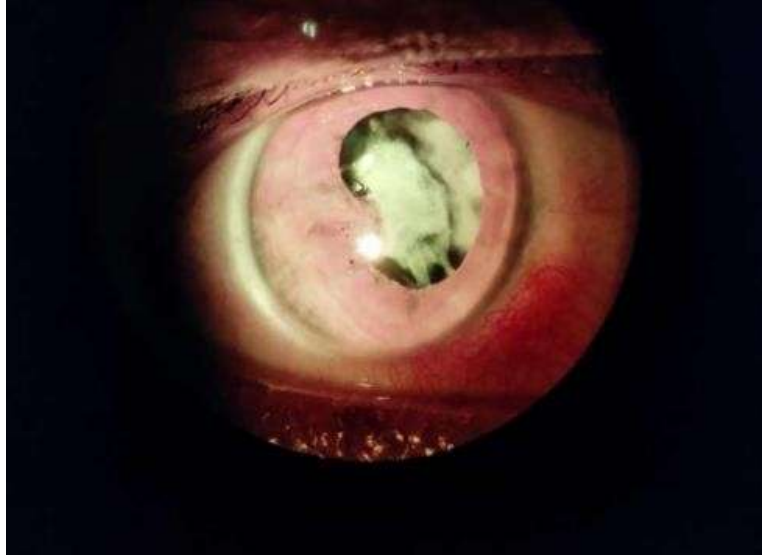
Patients of age 18 years and above diagnosed with traumatic cataract were included in the study

#### **Exclusion Criteria:**

Patients with lens induced glaucoma, pre-existing primary open angle/angle closure glaucoma, Pseudo-exfoliation Syndrome and with other ocular comorbidities like diabetic retinopathy, hypertensive retinopathy and vitreous degeneration were excluded from the study. Upon admission all the cases were evaluated according to the detailed history, type of trauma, duration between presentation and trauma, type of traumatic cataract, associated ocular injuries. Medical or surgical management was done accordingly. Intraoperative and postoperative complications were assessed. Visual acuity was recorded after surgery.

#### **Preoperative ocular assessment:**

1. Ocular examination using torchlight, slit-lamp examination, and indirect ophthalmoscopy was done (Fig. 1).
2. Visual acuity of both eyes was recorded.
3. Intraocular pressure assessment was done using a Schiottz tonometer.
4. B-scan ultrasonography was done to look for intraocular foreign bodies or any retinal detachment. Keratometry and A-scan biometry for intraocular lens power calculation was done. In cases of corneal opacities and/or scarring the other eye power was calculated.



**Fig.1:-** Traumatic cataract with adherent iris.

#### **Surgical techniques:**

Small incision cataract surgery with PCIOL was done under peribulbar anesthesia. In cases of posterior capsular rent with vitreous prolapse, anterior vitrectomy was done, patient was kept aphakic and secondary scleral fixated IOL implantation was done a few weeks later. Capsule tension ring was inserted in significant zonular damage with no overlying vitreous.

#### **Post-operative Protocol**

Eye pad was removed on post-operative day 1. Patients were restarted on Gatifloxacin and Prednisolone eye drops. Oral Ciprofloxacin 500 mg BD was given for 5 days. Patient followed up on Post-Operative Day 1, Day 7, Day 15, Day 30 and Day 40.

#### **Follow up examination includes:**

a) Best Corrected Visual Acuity, b) Anterior segment examination under Slit lamp examination, c) Posterior segment examination. The results were then analyzed statistically.

#### **Results:-**

##### **Demographic data**

A total of 60 patients were included in the study. Out of 60 cases, 46 were males and 14 were females (M: F- 3.28:1). A maximum number of cases were found in the age group of 30 to 60 years (60%) followed by 18-30 years (33%) and 60 years and above (7%). The mean age was  $37.7167 \pm 13.5047$  years (range-18-66 years).

Type and cause of injury. Various causes of injury are depicted in (Table 1).

**Table No.1:-** Object of injury.

Iron rod	2	Compass needle	1	Brick	3
Thorn	4	Screwdriver	1	Sewing needle	2
Cricket ball	2	Pencil	1	Tile	2
Wooden stick	1	Metal wire	2	Spoon	2
RTA	12	Branch	2	Shelf corner	1
		ee	oftr		
Stone	4	Knife	2	Metal ruler	1
Bullhorn	3	Fist	3	Cardboard box	1
Rope	1	Pen	3	Comb	1
Fingernail	1				

1. About 22 patients (36.7%) sustained blunt trauma, 38 patients (63.35%) had penetrating injury. Most common mode of injury has been road traffic accidents accounting for 12 patients (20%) cases.
2. Almost half of the patients presented with corneal tear. 17 patients (46%) had corneal wounds, 12 patients (32%) had corneo-scleral wounds, while 8 patients (22%) had scleral wounds, among those who suffered from penetrating trauma. Other associated injuries include (Table 2)

**Table No.2:-** Associated ocular injury.

Associated ocular injury	No. of patients	Percentage	Associated ocular injury	No. of patients	Percentage
Nil	7	11.6%	Phacodonesis	12	20%
Epithelial defect	21	35%	Iridodonesis	4	6.6%
Corneal tear	32	53.3%	Posterior synechiae	0	0%
Corneal opacity	3	5%	Sealed corneal tear	2	3.3%
Hyphaema	21	35%	Iris prolapse	12	20%
Iridodialysis	17	28.3%	Cortex/lens matter in AC	8	13.3%
Sphincter tear	4	6.6%	Vitreous strands in AC	4	6.6%

1. Mean of duration between trauma and presentation (days) was  $3.0333 \pm 3.5652$ . Almost half of the patients presented to hospital within 2 days.
2. 26 patients (43%) had posterior vitreous detachment on USG B Scan while minimal vitreous hemorrhage and vitreous hemorrhage were found in 4 patients (7%) and 2 patients (3%) respectively.
3. Morphology of traumatic cataract was studied and was found that the maximum number of patients, 33 (55%) had total cataract, followed by rosette type in 14 (23%) and subluxated cataract was found in 13 patients (22%).
4. Trauma and surgery duration varied from 1 day and 41 days post presentation to the hospital with a mean of 21.1833 ( $\pm 11.9668$ ) days. Maximum number of patients i.e. 11 (53%) were operated between 15-20 days of trauma.
5. Of the 60 patients, Corneal tear repair was done in 20 patients (33%), scleral and corneal tear repair was done in 13 patients (22%) followed by Manual Small Incision Cataract surgery in 58 (96.66%) patients and Intra Capsular Cataract Extraction in 2 patients (3.33%). Intraocular lens was implanted in 43 patients (71.66%) while in 17 patients (28.33%) intraocular lens was not implanted.
6. During the intra-operative period, 24 patients (40%) had posterior capsular tear, while zonular dialysis, premature entry and mid dilating pupil occurred in 6 (10%), 4 (6.66%) and 2 (3.33%) patients respectively. In post-operative period, 12 patients (20%) had iritis, 12 patients (20%) zonular dialysis, secondary glaucoma occurred in 7 patients (11.66%), 2 patients (3.33%) had hypopyon, 2 patients (3.33%) had vitreous haemorrhage and retinal detachment occurred in 2 patients (3.33%) while only 3 patients (5%) did not have post-operative complications.
7. OTS, the type of injury, Morphology of cataract, BCVA at presentation and lens implantation were found to be statistically significant in affecting the BCVA at 40 days i.e.  $p$  value  $< 0.05$  (Table No.3).

**Table No.3 :-** Variables affecting BCVA at 40 days in 60 patients and their statistical significance.

Variables affecting BCVA at 40 days	R	R <sup>2</sup>	P value	Significance at 5% level
BCVA VS OTS	0.8372	0.7009	$< 0.05$	Significant
Type of injury	0.7112	0.5058	$< 0.05$	Significant
BCVA at 40 days vs morphology	-0.3740	0.14	$< 0.05$	Significant
BCVA at 40 days vs wound location	0.32	0.10	$> 0.05$	Not Significant
BCVA at 40 days vs trauma to surgery time	0.2124	0.04	$> 0.05$	Not Significant
BCVA at 40 days vs BCVA at presentation	0.6215	0.3863	$< 0.05$	Significant
BCVA at 40 days vs lens implantation	0.8310	0.6905	$< 0.05$	Significant

- Ocular trauma score (OTS) was calculated and analyzed as per table no. 4

**TableNo.4:-** DistributionofpatientsbasedonOcularTrauma Score(OTS).

OTS	No.ofpatients
35-40	1 (1.66%)
40-45	0 (0%)
45-50	2 (3.33%)
50-55	0 (0%)
55-60	23 (38.33%)
60-65	0 (0%)
65-70	12 (20%)
70-75	5 (8.33%)
75andover	17 (28.33%)

- Patient followed upon post-operative Day1, Day7, Day15, Day30andDay40(Table 4)

**Table no. 5:-** Trend of visualacuityfromdayof presentationto post-operative day40.

BCVA	BCVA ATPR ESENTATION	BCVAATD AY1	BCVAATD AY7	BCVA AT DAY15	BCVA AT DAY30	BCVAAT 40 DAYS
NO PL	0	2 (3.33%)	2(3.33%)	2(3.33 %)	2(3.33 %)	2(3.33%)
PL+PRACCUR ATE	12 (20%)	10 (16.6%)	10(16.6%)	7(11.6 %)	6(10%)	2(3.33%)
HMCF	19 (31.6%)	5 (8.3%)	3(5%)	6 (10%)	7 (11.6%)	0
FCCF	14 (23.3%)	1 (1.6%)	2(3.33%)	2(3.33 %)	2(3.33 %)	0
FC1M	6(10%)	4 (6.6%)	4(6.6%)	0	0	3(5%)
FC2M	2(3.33%)	9 (15%)	9(15%)	2(3.33 %)	0	7(11.6%)
FC3M	4(6.6%)	5(8.3%)	1(1.6%)	1(1.6%)	1(1.6%)	0
FC4M	0	10(16.6%)	8	7 (11.6%)	6(10%)	0
FC5M	0	8(13.3%)	2 (3.33%)	9(15%)	6(10%)	3 (5%)
6/60P	2 (3.33%)	0	1(1.6%)	3(5%)	0	3(5%)
6/60	1(1.6%)	4(6.6%)	11 (18.3%)	11 (18.3%)	8 (13.3%)	4(6.6%)
6/36P	0	0	2 (3.33%)	0	0	1(1.6%)
6/36	0	2(3.33%)	5(8.3%)	7(11.6 %)	14 (23.3%)	3(5%)
6/24P	0	0	0	0	0	2 (3.33%)
6/24	0	0	0	3(5%)	6(10%)	1(1.6%)
6/18P	0	0	0	0	0	2 (3.33%)
6/18	0	0	0	0	2 (3.33%)	5(8.3%)
6/12P	0	0	0	0	0	4(6.6%)
6/12	0	0	0	0	0	5(8.3%)
6/9P	0	0	0	0	0	9(15%)
6/9	0	0	0	0	0	3(5%)
6/6P	0	0	0	0	0	1(1.6%)
6/6	0	0	0	0	0	0
Total	60	60	60	60	60	60

**Discussion:-**

The present study depicted 60 % affected population to be in the age group of 30 to 60 yearsand33%affectedpopulationtobeintheagegroupof18-30yearswithaverageagebeing37.7167±13.5047 years with

male preponderance may be mainly because of the increased exposure to ocular trauma because of the occupation. Exclusion criterion of the study was individuals below the age of 18 years and hence that age group was not included here. Compared to present study where there is 77 % male preponderance, Singh D showed similar age and gender distribution. He found approximately 50% of the affected population in the age group of 11 to 30 years and an 85 % male preponderance<sup>17</sup>. Mangane M et al showed 52% of the affected population in the age group of 11 to 30 years and a 72% male preponderance<sup>18</sup>. Murmu S et al showed 60% affected population in the age group 11 to 30 years and a preponderance of 89 % of the male population<sup>19</sup>.

In present study, trauma with penetrating injury was found as a common mode of injury i.e., in 63 % of cases. Blunt type of injury was found as a mode of injury in 37% of cases. Mode of injury was found to be significant factor affecting visual outcome (p value < 0.05). Penetrating trauma was found to have worse final visual outcome. The study population consisted of patients from the urban as well as rural areas.

The present study noted that the common modes of injury are road traffic accidents (20%) and trauma with stones (6.66%) and thorn prick (6.66%) Road traffic accidents were seen among young urban population while injury by thorn prick was seen in rural individuals working on fields. Vegetative trauma in this study comprises injury by thorn and branch of tree which was found in 6 patients (10%). 3 patients (5%) suffered injury with fist blow, 3 patients (5%) suffered injury with pen and 3 patients (5%) suffered injury with brick. 2 patients (3.33%) suffered injury with iron rod, 2 patients (3.33%) suffered injury with cricket ball, 2 patients (3.33%) suffered injury with sewing needle and 2 patients (3.33%) suffered injury with tile. Wooden stick, rope, compass needle, screwdriver, pencil, shelf corner, metal ruler, cardboard box, comb and finger nail were other objects of injury showing a distribution of 1 patient (1.66%) in every category. Shah M et al found that most of the injuries were caused by a stick (56.4%) and stone (8%)<sup>20</sup>. In a study by Mangane M et al results depicted 78% injuries by stick, 18% by stone, and 40% by a metal rod<sup>18</sup>. Present study showed 26 different objects of injury hence showing a wide range of distribution of injuries among every category.

Duration between trauma and surgery varied from 1 day i.e. patients getting operated on the same day as trauma and 41 days post presentation to the hospital with a mean of 21.1833 ( $\pm 11.9668$ ) days. Maximum number of patients i.e. 11 (53%) were operated between 15-20 days of trauma. In the present study, the duration between trauma and surgery did not significantly (p value < 0.05) the visual outcome because all of the patients were not in the amblyopia age group, exclusion criterion of the study being age. Blum et al showed a short interval between trauma and cataract surgery in cases of penetrating trauma and some cases with a history of two decades between injury and cataract surgery<sup>21</sup>. Krishnamacharya et al noted that patients presented at various intervals following trauma (mean 6.48 months, range 1 day to 9 years)<sup>22</sup>.

Majority patients i.e. 19 (31.66%) had BCVA of HMCF at the time of presentation. The pre-operative visual acuity in the present study was as follows – 12 patients (20%) had visual acuity of PL+ PR Accurate. 19 patients (31.66%) had visual acuity of HMCF. 14 patients (23.33%) had visual acuity of FCCF. 4 patients (6.66%) had visual acuity of FC 3M. 2 patients (3.33%) had visual acuity of FC 2M. 6 patients (10%) had visual acuity of FC 1M. 1 patient (1.66%) had visual acuity of 6/60P. 2 patients (3.33%) had visual acuity of 6/60. The study by Ying Qi showed similar pre-operative visual acuity – 35.6% cases had vision of hand movements, 27.1% cases had vision of counting fingers 1 meter (FC 1m) to 5 meters (FC 5m), and 5 % cases had a vision of 6/60 to 6/12<sup>23</sup>. Shah M et al showed 87.74% of patients to have pre-operative visual acuity of PL+ or HMCF / FCCF, 10 % patients with visual acuity of FC 1m to FC 5m<sup>20</sup>.

Wound location was studied. 46% (17) patients had corneal wounds, 32% (12) had corneo-scleral wounds, while 22% (8) patients had scleral wounds, among those who suffered from penetrating trauma. Wound location was found to not affect final visual outcome (p value > 0.05).

#### **Intraoperative complications:**

In present study, PC tear occurred in 24 patients (40%), zonular dialysis occurred in 6 patients (10%), premature entry occurred in 4 patients (7%), 2 patients (3%) had mid-dilated pupils while 24 patients (40%) had an uneventful surgery. Lt Col J K S Parihar et al noted posterior capsular rupture in 36.66% of cases<sup>24</sup>.

**Postoperative complications:**

12 patients (20%) had iritis, 12 patients (20%) had zonular dialysis, secondary glaucoma occurred in 7 patients (11.66%), 2 patients (3.33%) had hypopyon, 2 patients (3.33%) had vitreous haemorrhage and retinal detachment occurred in 2 patients (3.33%). Only 3 patients (5%) did not have post-operative complications. Blum et al noted secondary glaucoma in 3% of cases<sup>21</sup>. Lt Col JKS Parihar et al noted secondary glaucoma in 21.66% of cases<sup>24</sup>. Shah M et al noted glaucoma in 2% of cases<sup>20</sup>. Blum et al noted intraocular hemorrhage in 3% of cases<sup>21</sup>. Krishnamachary et al noted vitreous hemorrhage in 2% of cases<sup>22</sup>.

Morphology of traumatic cataract was studied and was found that the maximum number of patients, 33 (55%) had total cataract, followed by rosette type in 14 (23%) and subluxated cataract was found in 13 patients (22%). We found that morphology significantly affected visual outcome. Total cataract had better outcomes with worse outcomes occurring in patients with lens subluxation. 76.9% (10) patients with subluxation were aphakic while 22.9% were implanted with IOL. Shah M et al in their study studied morphology and classified it as Membranous 84 (12.2%) Rosette 8 (1.2%) White soft 412 (60.0%) Total 183 (26.6%). Similar to our study they found that morphology affected final visual outcome<sup>25</sup>.

In our study, Intraocular lens was implanted in 43 patients (71.66%) while in 17 patients (28.33%) intraocular lens was not implanted. Lens implantation was a significant factor affecting visual outcome, with aphakic patients having poorer outcomes (p value < 0.05). Similarly in a study by Smith et al, 61% patients were implanted with IOL and 39% were aphakic<sup>26</sup>. Shah M et al, in their study implanted lens in 82% of the cases<sup>20</sup>. Our results are similar to previous studies by Eckstein et al<sup>27</sup>, Gupta et al<sup>28</sup>, Smith et al<sup>26</sup> and Shah et al<sup>25</sup>, that an IOL improves visual outcomes.

**Ocular Trauma Score: In our study**

The OTS was calculated and sorted into OTS score categories as follows: category 1 (0 to 44), category 2 (45 to 65), category 3 (66 to 80), category 4 (81 to 91) and category 5 (91 to 100). 1.6% patients were in OTS category 1, 41.6% were OTS category 2, 56.8% were OTS category 3, with no patients in OTS category 4 and OTS category 5. We found statistical significance (p value < 0.05) between the OTS and BCVA at 40 days. Higher OTS correlated with better visual outcomes. Similar studies have been shown by Smith et al and Shah et al which have demonstrated that the OTS is a useful tool to predict the visual outcome<sup>25, 26</sup>. Gupta et al reported the prognostic value of the OTS in open-globe injuries<sup>28</sup>. Post-operative Visual Acuity The final visual acuity was assessed in all the 60 cases that underwent cataract surgery. The assessment of visual acuity was done on post-operative day 1, 7, 15, 30 and BCVA was assessed at post-operative day 40. Out of the 60 cases, 40 cases (66.66%) had a visual outcome between 6/60 to 6/6, 16 cases (26.66%) had an outcome between FC 1 meter to FC 5 meters, whereas in 14 cases (23.33%) the outcome was HMCF/FCCF. Patients who had post-operative complications like vitreous hemorrhage (3.33%), vitritis (20%) and secondary glaucoma (11.66%) showed poorer visual outcomes. 2 patients suffered retinal detachment (3.33%) and were PL negative by the end of 40 days post-surgery. 17 Patients (28.33%) were kept aphakic and their BCVA at post-operative day 40 was recorded ranging from PL negative to 6/60P, PL negative being recorded in patients with retinal detachment. Lt Col JKS Parihar et al reported that 46 (76.67%) cases had attained good corrected visual acuity of 6/12 or more. 10 cases (16.67%) could attain visual acuity ranging between 6/36 to 6/18 and 4 (6.66%) cases had a poor visual outcome<sup>24</sup>. Blum et al reported that 69 patients (82.1%) with IOLs had a mean visual acuity of 20/30. Nine patients (77%) with aphakia reached 20/40. Seven patients (8.2%) remained at hand movements and light perception because of severe post-traumatic retinal pathology, optic nerve atrophy, or both<sup>21</sup>. Daljit Singh et al reported that 60.4% of patients had corrected visual acuity better than 6/12 and 83.3% of the patients had acuity better than 6/24<sup>17</sup>.

The factors which affected visual outcome in our study were type of injury, IOL implantation, morphology of cataract and visual acuity at presentation. We found that the ocular trauma score correlated with visual outcome at 40 days and can be useful as a predictor of the same. In our study Wound location and Trauma to surgery interval were found not to affect visual outcome. The presence of intra and post-operative complications also leads to poorer visual outcome; however, complications like secondary glaucoma, iritis, hyphaema have a tendency to improve beyond our study period of 40 days.

**Conclusion:-**

Ocular trauma is one of the most important and complex aspects of trauma to the head or face. Traumatic cataracts in these scenarios tend to behave differently and are more complex to treat than other types of cataract, as associated other injuries often complicate and prevent ideal management of the cataract. Visual acuity at presentation and Ocular trauma score can act as good predictors of

final visual outcome. Penetrating injury, aphakia, subluxated cataract tend to have worse outcomes. Multicentric and long term studies will help add more data and protocols in the management of this complex problem.

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