Original Research Paper
Volume - 7 | Issue - 8 | August - 2017 | ISSN - 2249-555X | IF : 4.894 | IC Value : 79.96
Ophthalmology

RETROSPECTIVE MULTIFACTORIAL ANALYSES OF FINAL VISUAL OUTCOME IN TRAUMATIC CATARACT: STUDY FROM TERTIARY EYE CARE HOSPITAL.

Sahil Bhandari	Fellow, Vitreo-retinal services, Aravind Eye Hospital, Thavalakuppam, Pondicherry – 605007 - Corresponding Author
Manas Nath	Consultant, Cataract and Refractive services, Aravind Eye Hospital, Thavalakuppam, Pondicherry – 605007
Kirandeep Kaur	DNB Resident, Aravind Eye Hospital, Thavalakuppam, Pondicherry, Tamil Nadu, India
Bharat Gurnani	DNB Resident, Aravind Eye Hospital, Thavalakuppam, Pondicherry, Tamil Nadu, India

ABSTRACT Traumatic cataract is a common sequel in ocular trauma and it would be imperative to understand the influence of various per-operative factors over final visual outcome. Aim of the study was to evaluate the influence of such factors on final visual outcome. Patient's diagnosed with traumatic cataract from January'12 to December'14 with a minimum of 3months follow up were included. Patients with <3months follow up, unclear lens status on presentation, cataract secondary to steroids or inflammation, operated elsewhere and incomplete diagnosis were excluded. Primary outcome was to analyze the factors responsible for better visual outcome(≤0.3 ogMAR). Fifty-three eyes had closed globe injury and 44 eyes had open globe injury with no difference in age or gender distribution(p=0.8). Significantly (p = 0.005) higher number of surgeries were performed in open globe injury patients but final visual recovery was similar to closed injury group. After adjusting for all the variable, it was observed that patients having better immediate and one-month visual recovery had significantly(p<0.05) higher chances of achieving final vision of ≤0.3LogMAR. Timing (primary vs secondary) of Intraocular lens placement did not affect visual outcome.

KEYWORDS : Multifactorial analyses, per-operative factors, Traumatic cataract, visual outcome

Introduction
Ocular trauma is one of the leading causes of monocular visual disability worldwide [1,2] and with the introduction of Birmingham Eye Trauma Terminology (BETT) classification and Ocular Trauma Score (OTS), the documentation has been standardized.[3] Traumatic cataract is a common sequel after ocular trauma which can result from direct injury to crystalline lens or contusion injury to the globe. Ocular trauma accounts for around 40% of monocular blindness [1,2] proportion of traumatic cataract being 27-65% cases.[3,4] Childhood trauma accounts for approximately 4 to 20% of all ocular injuries [5] and traumatic cataract accounts for approximately 29% of childhood cataract.[6] Visual acuity (VA) >20/60 or ≥20/40 has been kept as a reference mark for final visual outcome and the percentage of patients achieving the same has varied from 40 to 80%.[10,11,14,15]

Successful outcome of traumatic cataract depends on many factors like age,[9] gender,[10] type of injury,[9] duration of injury, timing of presentation, interval from presentation to surgical intervention, initial VA,[14] type and number of surgeries, postoperative visual gain, primary or secondary intraocular lens implantation,[15] surgical complications and traumatic sequel. Many landmark studies have been done to highlight the importance of these factors, but none has taken all the factors simultaneously.[9,10,14] Additionally, not much literature is available from Southern India.

Therefore, we did a multifactorial retrospective analyses of all traumatic cataract cases presenting to a tertiary eye care hospital. Our study aim was to highlight the predictors of final visual outcome following traumatic cataract surgery, associated ocular morbidity hampering final visual outcome along with special reference to demographic profile of the patients, mode of injury, type of trauma; time, type and number of surgeries.

Material and methods
We retrospectively analyzed all the cases of traumatic cataract presenting to tertiary eye care hospital in Southern India from January 2012 to December 2014. Ethical clearance was taken from Institutional Ethics Committee review board. All the case sheets were reviewed for the eligibility of inclusion into study and data was recorded into Microsoft Excel sheet (Microsoft Office 2010). Patients of all age group with minimum of 3 months follow up were included. Patients with incomplete medical records, <3 months follow up, unclear lens status on presentation, cataract secondary to steroids or inflammation, operated elsewhere and incomplete diagnosis were excluded.

The parameters recorded were: demographic & clinical details, mode of injury, duration of defective vision (DV) and injury (DOI) at presentation, type of injury (open globe(OGI) or closed globe(CGI)), duration of DV before surgery, uncorrected and best corrected visual acuity (UCVA and BCVA) at presentation and all the postoperative visits (1,3,6,9,12 months and last visit) after primary surgery, primary(1°) or secondary(2°) IOL placement, number of surgeries, all surgical details and reasons for poor visual outcome. Since the duration of DV and DOI were based on history given by the patient, both were considered separately in order to account for the variability in recalling capability of patient. Primary surgery was defined as the first surgery performed after the presentation whether only cataract surgery, only open globe injury repair or combination of both. If the IOL was placed during the primary surgery, it was considered as primary IOL placement otherwise secondary.

Surgical protocol followed at the institution: All the injuries are evaluated for the extent of ocular and systemic injury. Diagrammatic depictions are made in case records. Anterior segment is evaluated by Cornea consultant and posterior segment by Vitreo-retinal consultant. Ultrasound B-scan is performed whenever the posterior segment is not visible. Appropriate cross specialty referral and management is done depending on the course of disease. Primary OGI repair is done as soon as the patient is systemically fit for surgery. Lens removal is done in case of visually significant traumatic cataract or subluxation or breached anterior lens capsule. Posterior capsule is preserved to the extent possible. Additional posterior segment intervention is performed as deemed fit by Vitreo-retinal consultant. Primary or secondary IOL placement decision is dependent on factors like extent of injury, capsular support, reliable IOL biometry and surgeon's discretion. All fresh OGI undergoing primary repair are planned for secondary IOL placement after a period of minimum 3 months. Primary IOL placement is preferred in CGI subjects, until otherwise contraindicated and secondary IOL is planned after a period of minimum 1 month post primary surgery. A preferable waiting period of 1 month in CGI and 3 month in OGI is considered to control inflammation and wait for refractive stability before secondary IOL intervention.

Statistical Analysis: STATA software 12.0 was used for statistical analysis. The parameters were divided into categorical and continuous variables. Chi square test was used to analyze two categorical variables, unpaired Student –t test to compare mean of two groups and Mann- Whitney test for comparing non parametric variable. Age group was divided into Pediatric (≤16 years) and adults (>16 years). Final BCVA was sub-grouped into group0: >0.3LogMAR unit; group1: ≤0.3 LogMAR units). Univariate and multivariate linear regression model was used for multifactorial analyses. Binomial logistic regression analysis was performed to compare the influence of variables in achieving final BCVA of better than 0.3 Log MAR units.

Results

Retrospectively 308 patients were diagnosed to have traumatic cataract but only 97 were included. Out of 97 eyes, 10 eyes were not operated for traumatic cataract. These 10 eyes were included in descriptive analysis only and not in the multifactorial analysis. Patient were excluded due to incomplete diagnosis, inadequate follow up and insufficient data. Mean age was 33.4 years with predominantly male patients. Twenty-six eyes (27%) belonged to pediatric age group (≤16 years). Mean age in pediatric group was 10.5±3.6 years and in adults was 41.7±15.5 years. All cases were unilateral in presentation with equal distribution between right and left eye (48 and 49 eyes respectively). Fifty-three eyes (54%) had CGI and 44 (45%) eyes had OGI with no difference in age or gender distribution (p=0.87 & p=0.71 respectively). Mean(±SD) follow up after primary surgery was 11.9 ± 9.33 months (1-41 months). Overall twenty different mode of injuries were noted with wooden stick being the most common (25 eyes) followed by vegetative matter (14 eyes) and iron material (12 eyes), but in pediatric age cracker burst was the most common form of injury followed by stick. Duration of injury (DOI) and defective vision (DV) at presentation were widely distributed over a range of 1 day to 2500 weeks [95% CI=84.8 – 272.2 weeks] and 1 day to 2080 weeks [95% CI=43.8 – 177.1 weeks] respectively, with a median value of 1.5 and 1 week respectively. Mean duration of DV at the time of surgery was 19.1 ± 12.4 days [range: 1 – 40 days; 95% CI=16.7 – 21.7 days]. Distribution of traumatic cataract morphology is given in Table 1

Table 1: Distribution of traumatic cataract morphology

Type of cataract	Rosette	PSCC [*]	Total cataract	Subluxated	Nuclear cataract	ASCC [†]	Focal	Liquefied
Eyes (n)	12	23	47	9	4	7	9	1

[*]PSCC – posterior subcapsular cataract; [†]ASCC – anterior subcapsular cataract

Thirty-four eyes (35%) had preoperative rupture of anterior lens capsule, majority belonged to OGI group (29 eyes). Mean(±SD) BCVA at presentation was LogMAR 1.98 ± 1.15. In total 138 surgeries were performed for 97 eyes including 10 eyes which didn't undergo any surgical intervention due to poor visual prognosis, cataract of localized extent and associated ocular morbidity limiting surgical success. Thirty-eight eyes (39%) underwent >1 surgery. Significantly (p = 0.005) higher number of surgeries were performed in OGI patients (mean ± SD: 1.81 ± 0.73) as compare to CGI group (mean ± SD: 1.36 ± 0.71). Comparison between OGI and CGI has been listed in table 2. BCVA improved significantly in both the groups (p<0.005) and the final BCVA was similar. Intraoperative complications were almost similar within the two groups though, posterior capsule rent and zonular dialysis were more common in CGI.

Table 2: Comparison of different variables between OGI[*] and CGI[†]

Demographic parameters	Open globe injury	Closed globe injury	P-value
Total eyes (n)	44	53	NA
Pediatric eyes (n)	11	15	NA
Adult eyes (n)	33	38	NA
Age [mean{years}]	30.25	36	0.15[§]
Pediatric age [mean{years}]	10.5	10.6	1.0[§]
Adult age [mean{years}]	36.8	46	0.01[§]
DOI[‡] at presentation (weeks)	75.9 ± 228.5	263.6±582.0	0.0002[‖]
Duration of DV[**] at presentation (weeks)	78.6 ± 226.9	136.8±396.9	0.006[‖]
Duration of DV[**] before surgery (days)	19.1 ± 12.2	19.2 ± 12.6	0.86[‖]
BCVA[††] at presentation (mean±SD)	2.36 ± 0.99	1.66 ± 1.19	0.002[‖]
BCVA[††] at final visit (mean±SD)	0.55 ± 0.99	0.49 ± 0.89	0.8[‖]
Change in BCVA[††] (mean±SD)	-1.81 ± 1.28	-1.16 ± 1.13	0.008[‖]

[*]OGI – Open Globe Injury; [†]CGI – Closed Globe Injury; [‡]DOI – Duration of Injury; [§]Unpaired Student T-test; [‖]Two-sample Wilcoxon rank-sum (Mann-Whitney) test; [**]DV – Defective vision; [††]BCVA – Best corrected visual acuity

Strabismus (5 eyes), corneal scarring (2 eyes) and amblyopia (3 eyes) were the pre-existing ocular co-morbidities. All the 10 eyes showed a significant improvement in final VA (p<0.05). Majority of the patient achieved a final BCVA better than 1.0 LogMAR. Postoperatively poor visual outcome (< 1.0 LogMAR) was observed in 18 eyes (18.5%) and the causes were macular scarring (4 eyes), retinal detachment (5 eyes), amblyopia (3 eyes), corneal scarring (3 eyes), advanced glaucoma (2 eyes) and endophthalmitis (1 eye). Seventy-four eyes (76%) achieved VA of ≤0.3 LogMAR. Age group wise 80% of pediatric eyes and 74.6% of adult eyes achieved VA of ≤0.3 LogMAR (p=0.21).

Independently BCVA at presentation, IOL placement (aphakia v/s 1° or 2°), UCVA on day 1 post op (POD1), BCVA at 1 month and 3 month post op were all found to be significantly associated with final BCVA (table 3). However, after adjusting for age, gender (male v/s female), type of injury (open v/s closed), DOI, duration of DV at the time of presentation and surgery; BCVA at presentation and all post op visits; UCVA POD1, IOL placement and total number of surgeries only UCVA POD1 and BCVA at 1 month post op were found to be significantly associated with final BCVA. IOL placement had a borderline significant value (table 3).

Table 3: Linear regression analysis of factors significantly associated with final BCVA[*]

Final BCVA[*]	Coefficient	Standard Error	P-value	95% Confidence Interval
UNIVARIATE				
BCVA[*] at presentation	0.25	0.078	0.002	0.095 - 0.41
Primary IOL[†] placement	-0.72	0.26	0.007	-1.25 to -.207
Secondary IOL[†] placement	-0.99	0.28	0.001	-1.57 to -0.43
UCVA[‡] on POD[§] 1day	0.099	0.027	0.001	0.044 - 0.154
BCVA[*]1month	0.10	0.031	0.001	0.043 - 0.166
BCVA[*]3month	0.076	0.033	0.026	0.01 - 0.144
MULTIVARIATE				
UCVA[‡] on POD[§] 1day	0.10	0.027	0.000	0.050 - 0.158
BCVA[*] at 1month	0.12	0.027	0.000	0.070 - 0.179
IOL[†] placement (aphakia versus primary of secondary)	-0.28	0.13	0.039	-0.55 to -0.014

[*]BCVA – best corrected distance visual acuity; [†]IOL – Intraocular lens; [‡]UCVA – uncorrected distance visual acuity; [§]POD – post op day

Univariate and multivariate (table 4) logistic regression model was used to analyze the odds of achieving final BCVA of ≤0.3 LogMAR. After adjusting for all the variable, it was observed that patients having better post op day 1 UCVA and 1 month BCVA had significantly higher chances of achieving final BCVA of ≤0.3 LogMAR. Though type of injury appears to be significant in multivariate logistic analysis, cross tabulation revealed no significant difference (Chi-square test; p=0.50).

Table 4: Binomial logistic regression analysis for final BCVA[*]

Final BCVA[*] (>0.3 versus ≤0.3 LogMAR unit)	Odds Ratio	P-value	95% confidence interval (CI)
UNIVARIATE			
IOL[†] placement (aphakia versus primary or secondary)	3.89	0.004	1.54 – 9.81
BCVA[*] presentation	0.48	0.008	0.28 – 0.82
UCVA[‡] POD[§] 1 day	0.73	0.0001	0.61 - 0.86
BCVA[*] 1 month	0.76	0.003	0.63 - 0.91
MULTIVARIATE			
Type of injury (OGI[‖] versus CGI[**])	0.03	0.033	0.001 - 0.75
UCVA[‡] on POD[§] 1day	0.39	0.010	0.19 - 0.79
BCVA[*] at 1month	0.60	0.033	0.37 - 0.96

[*]BCVA – best corrected distance visual acuity; [†]IOL – Intraocular lens;

‡UCVA – uncorrected distance visual acuity; §POD – post op day; ||OGI – open globe injury; **CGI – closed globe injury

Discussion

Visual outcome and its prognostic variables in traumatic cataract have been previously reported.[9-16] Factors influencing final visual outcome are age,[9] gender,[10] OGI,[9] initial VA[14] and type of surgery.[10,14] Limited literature is available on the role of IOL implantation,[15] duration of injury, early or late presentation, timing of primary surgery[15] and early post-operative visual recovery. Except for few[12,14,16] most studies have traumatic cases managed before 2010. Literature search on PubMed did not reveal any study which has evaluated visual outcome and its prognostic factors from Southern India and none have analyzed multiple factors simultaneously. Therefore, we aimed to address this lacuna.

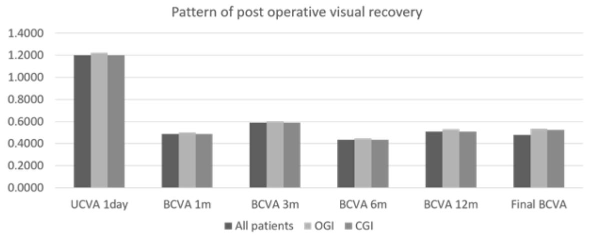
We studied a heterogeneous sample of 97 eyes with male predominance. A little more than half of the eyes were classified as CGI which was similar to Krishnatreya et al[12] but in contrary with other studies.[14,16] Overall stick was the most common mode of injury[10,12] but in pediatric age cracker burst injury was the most common. Mean values of duration of DV and DOI were highly skewed due to the wide distribution from days to years, which indirectly points towards the possibility of long quiescent period between injury and patient's presentation. However, median value of DV and DOI justifies that majority of the cases presented with a recent history of trauma. There was no age or gender predilection towards a particular type of injury (open versus closed globe), but in the subset of adult population, young adults were at higher risk of OGI. This is in contrary to previous studies where males were found to be at high risk for OGI and female at CGI.[12,16] This discordance could be attributed to difference in demographics of the study population.

Two out of every 5 eyes required >1 surgery (mean 1.5/eye). Though the number of surgeries were higher in OGI patients, final visual outcome was not different in either group (OGI v/s CGI). This result, though very perspective, supports the benefit of step wise surgical approach in OGI patients. In our study the IOL implantation rate was on a lower side (73% and 81% for OGI and CGI respectively) as compare to other studies,[10,11] probably due to shorter duration of post-surgical follow up.

Clinical endpoint for all traumatic cataract patients is the final visual acuity. Almost 76% of our study population achieved a BCVA of ≤0.3 LogMAR which was similar across pediatric and adult patients and higher than earlier reported.[10,13,14,16] Also, in comparison to study done by Ram et al[11] the percentage of patients achieving final BCVA ≤0.3 LogMAR in our study is higher in OGI group. With regards to visual outcome, Shah et al[17] and Brar et al[18] have reported a significant difference among OGI and CGI groups but we couldn't find any difference, which is similar to Wos et al[19] Such a variability could be the outcome of different practice guidelines.

As per our results, factors which could independently influence visual outcome were better initial VA, IOL placement, better immediate and 1month postoperative visual recovery. However, after multivariate analysis immediate and 1month post-op visual recovery were the two most important prognostic variables. The above result is of paramount practical importance. As an Ophthalmologist, one would like to predict the visual recovery pattern in post-operative phase of any ocular surgery, especially the complicated ones. In addition, a red tag associated with traumatic aphakia cases is when to do the secondary IOL implantation? As per our study, majority of patients achieved VA similar to final BCVA by the end of 1 month (figure 1). Similar course was better observed in OGI patients than CGI (figure 1). Though mean BCVA at 12th month appears to be closer to final BCVA, it was observed that variable follow up duration acted as a major confounding factor. Thus, 1 month is an adequate waiting period to plan secondary IOL in CGI cases. Although according to our results this equally holds good in OGI cases but practically planning secondary IOL at 1 month is not always possible. However, this is a retrospective study and therefore it would be imperative to confirm the above results with a prospective randomized study.

Fig 1: Illustrates the course of visual recovery from day 1 post-op. *UCVA – Uncorrected visual acuity; BCVA – Best corrected visual acuity; OGI – Open globe injury; CGI – Closed globe injury; m – month



Primary or secondary placement of IOL has always been the question of interest in traumatic cataract. In our study we did not find any significant difference between primary or secondary IOL placement either in pediatric or adult population, similar to Rumelt et al (15). However, a very important observation was that patient who were left aphakic had a significantly lower chances of better visual outcome. Thus, it is recommended that as per the clinical scenario either primary or secondary IOL placement should be planned.

In conclusion ocular trauma is relatively common in young males and wooden stick is the most common cause of trauma in South India population. Thirty-nine percentage of trauma patients may require more than one surgery and 76% of all achieve VA of ≤0.3 LogMAR. Final visual recovery was similar in traumatic cataract cases of either open or closed globe injury. Instead of age, gender, type of injury, initial BCVA and timing of surgical intervention; the two major prognostic factors for final visual outcome were immediate and one-month post-op visual acuity. Since majority of the patient's achieved a stable vision after one month of primary surgery, secondary IOL placement can be safely planned in CGI cases at 1 month post-op but due to practical limitations it would be better to plan secondary IOL after 3 months post-op in OGI cases.

Strength of our study resides in the exhaustive nature of data collection, multifactorial analyses, heterogeneous population, standard treatment guidelines and clinically reproducible results. Limitation of our study is the retrospective nature, variability in presentation, multiple surgeons, small sample size and limited duration of follow up.

References

1. Thylefors B. Epidemiological patterns of ocular trauma. Aust N Z J Ophthalmol. 1992;20:95-8.
2. Négrel AD, Massembo-Yako B, Botaka E, Minassian DC, Coddy-Zitsamélé R. Prevalence and causes of blindness in the Congo. Bull World Health Organ. 1990;68:237-43.
3. Kuhn F, Morris R, Witherspoon CD, Mester V. The Birmingham Eye Trauma Terminology system (BETT). J Fr Ophtalmol. 2004;27:206-10.
4. Dannenberg AL, Parver LM, Brechner RJ, Khoo L. Penetration eye injuries in the workplace. The National Eye Trauma System Registry. Arch Ophthalmol. 1992;110:843-8.
5. Lambert SR, Drack AV. Infantile cataracts. Surv Ophthalmol. 1996;40:427-58.
6. Eckstein M, Vijayalakshmi P, Killedar M, Gilbert C, Foster A. Aetiology of childhood cataract in south India. Br J Ophthalmol. 1996;80:628-32.
7. Shah MA, Shah SM, Shah SB, Patel CG, Patel UA. Morphology of traumatic cataract: does it play a role in final visual outcome? BMJ Open. 2011;29:1(1).
8. Verma N, Ram J, Sukhija J, Pandav SS, Gupta A. Outcome of in-the-bag implanted square-edge polymethyl methacrylate intraocular lenses with and without primary posterior capsulotomy in pediatric traumatic cataract. Indian J Ophthalmol. 2011;59:347-51.
9. Shah M, Shah S, Shah S, Prasad V, Parikh . Visual recovery and predictors of visual prognosis after managing traumatic cataracts in 555 patients. Indian J Ophthalmol. 2011;59:217-22.
10. Gogate P, Sahasrabudhe M, Shah M, Patil S, Kulkarni A. Causes, epidemiology, and long-term outcome of traumatic cataracts in children in rural India. Indian J Ophthalmol. 2012;60:481-6.
11. Ram J, Verma N, Gupta N, Chaudhary M. Effect of penetrating and blunt ocular trauma on the outcome of traumatic cataract in children in northern India. J Trauma Acute Care Surg. 2012;73:726-30.
12. Krishnatreya M, Sarma KD. Clinicoepidemiological Study on Traumatic Cataract. International Journal of Contemporary Medical Research. 2016;3:1539-41.
13. Adlina AR, Chong YJ, Shatriah I. Clinical profile and visual outcome of traumatic paediatric cataract in suburban Malaysia: a ten-year experience. Singapore Med J. 2014;55:253-6.
14. Qi Y, Zhang YF, Zhu Y, Wan MG, Du SS, Yue ZZ. Prognostic Factors for Visual Outcome in Traumatic Cataract Patients. J Ophthalmol. 2016;1748583.
15. Rumelt S, Rehany U. The influence of surgery and intraocular lens implantation timing on visual outcome in traumatic cataract. Graefes Arch Clin Exp Ophthalmol. 2010;248:1293-7.
16. Sharma AK, Aslami AN, Srivastava JP, Iqbal J. Visual Outcome of Traumatic Cataract at a Tertiary Eye Care Centre in North India: A Prospective Study. J Clin Diagn Res. 2016;10:NC05-8.
17. Shah MA1, Shah SM, Shah SB, Patel CG, Patel UA, Appleware A et al. Comparative study of final visual outcome between open- and closed-globe injuries following surgical treatment of traumatic cataract. Graefes Arch Clin Exp Ophthalmol. 2011;249:1775-81.
18. Brar GS, Ram J, Pandav SS, Reddy GS, Singh U, Gupta A. Postoperative complications and visual results in uniocular pediatric traumatic cataract. Ophthalmic Surg Lasers. 2001;32:233-8.
19. Woś M, Mirkiewicz SB. [Traumatic cataract--treatment results]. Klin Oczna. 2004;106:31-4.