Original Article

Maximizing the visual outcome in traumatic cataract cases: The value of a primary posterior capsulotomy and anterior vitrectomy

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Objective: The objective was to provide evidence-based care for patients with traumatic cataracts, we assessed whether a posterior capsulotomy and anterior vitrectomy, as part of the primary surgical procedure, could be a positive predictor of final visual outcome. **Materials and Methods:** This is a prospective randomized control trial. Patients presenting at our hospital between January 2010 and December 2012 having ocular trauma and traumatic cataracts were enrolled, according to the inclusion criteria. We enrolled two groups: Those with and without primary posterior capsulotomy and vitrectomy. Information regarding demographic and ocular trauma were collected using the World Eye Trauma Registry form at the first visit and follow-up, and specific information was collected for both the group who underwent posterior capsulectomies and vitrectomies as a part of the primary procedure, and the control group. Data were analyzed to evaluate the predictive value of primary posterior capsulectomy and anterior vitrectomy. **Results:** We enrolled 120 cases, 60 in each group, comprising 31 females and 89 males. When all other variables were controlled for, the visual outcome (best corrected visual acuity) differed significantly ($P < 0.001$) between the groups. **Conclusion:** Performance of posterior capsulectomy and anterior vitrectomy as part of the primary procedure improves the final visual outcome.

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Trauma is a common cause of monocular blindness in the developed world, although few studies have assessed the issue of trauma in rural areas.[1] The etiology of ocular injury in rural areas is likely to differ from that in urban areas and so warrants investigation.[2-4] Any strategy for prevention requires knowledge of the cause (s) of injury, which may enable appropriate targeting of resources to preventing such injuries. There is a potentially large preventable burden for both eye trauma victims and society at large.[3]

Ocular trauma can cause cataracts.[1] The methods used to evaluate the visual outcome in eyes managed for traumatic cataracts and senile cataracts are similar,[5] but damage to other ocular tissues, due to trauma, may compromise the visual gain in eyes operated on for traumatic cataracts. Thus, the success rates of eyes with these two types of cataract may differ.

Introduction of the Birmingham Eye Trauma Terminology System (BETTS) has standardized the documentation of ocular trauma.[5]

Postoperative inflammation is a common complication following traumatic cataracts, hampering visual outcome.[6-10] Our objective was to investigate the effect of primary posterior capsulotomy and vitrectomy on the final visual outcome. We divided subjects into a group that underwent a posterior capsulectomy with anterior vitrectomy as part of the primary procedure.

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This study was conducted in a city located Central western India-Dahod at in India. Qualified ophthalmologists at our institution provide low-cost eye services to mainly the poor members of this area's tribal population of 4.2 million.

Materials and Methods

We obtained approval from the hospital administrators and research committee to conduct this study. Participants provided written informed consent. We have registered clinical trial with ref no REFCTRI - 2010 002825.

This was a prospective randomized control trial designed in 2010. All traumatic cataracts in either eye, diagnosed and managed between January 2010 and December 2012, were enrolled, and those consenting to participate and with no other serious bodily injury were included. We excluded patients who were found to have primary posterior capsule ruptures and infections.

For each patient enrolled, we obtained a detailed history, socioeconomic data,[11,12] details of the injury, and information on the eye treatment and surgery performed to manage past ocular trauma. Data for both the initial and follow-up reports were collected using the online BETTS format of the International Society of Ocular Trauma. Details of the surgery were collected using an online form.

Cases of traumatic cataract were grouped into those with open- and closed-globe injuries. Open globe injuries were further categorized into those with lacerations versus rupture. Lacerations of the eyeball were subcategorized into eyes with perforating injuries, penetrating injuries, or injuries involving an intraocular foreign body. The closed-globe group was subdivided into lamellar lacerations and contusion.

As our primary purpose was to investigate its predictive value, we classified cases into the following two groups: Those who underwent a primary posterior capsulectomy and anterior vitrectomy (Group A), and those who did not (Group B). We randomized these patients in a double-blind manner.

Other demographic details collected included activity at the time of injury, object causing the injury, and previous examinations and treatments. After enrollment, all patients were examined using a standardized method. Visual acuity was assessed using the Snellen chart, and the anterior segment was examined using a slit lamp.

Based on lenticular opacity, cataracts were classified into total, membranous, white soft, and rosette types.[12] When no clear lens matter was observed between the capsule and nucleus by an ophthalmologist, the cataract was defined as total. When the capsule and organized matter were fused and formed a membrane of varying density, it was defined as a membranous cataract. When loose cortical material was found in the anterior chamber, together with a ruptured lens capsule, the cataract was defined as white soft. A lens with a rosette pattern of opacity was classified as a rosette-type cataract.

For lenses that were partially opaque, a posterior segment examination was carried out using an indirect ophthalmoscope and a + 20 D lens. When the optical medium was not clear, a B-scan was performed to evaluate the posterior segment.

The surgical technique was selected according to the morphology and the condition of tissues other than the lens. Phacoemulsification was used to operate on cataracts, and small-incision cataract surgery was performed for hard, large nuclei. For lenses with a white soft or rosette type of cataract, unimanual or bimanual aspiration was used. Membranectomy and anterior vitrectomy, via either the anterior or pars plana route, were performed when the cataract was membranous.

In all patients undergoing corneal wound repair, the traumatic cataract was managed in a second procedure. Recurrent inflammation was more prominent in patients who had undergone previous surgery for trauma.[6-10]

In children younger than 2 years, both lensectomies and vitrectomies via the pars plana route were performed, and the same surgical procedures were used to manage the traumatic cataract. Lens implantation as part of the primary procedure was avoided in all children younger than 2 years.

All patients with injuries and without infection were treated with topical and systemic corticosteroids and cycloplegics. The duration of medical treatment depended on the degree of inflammation in the anterior and posterior segments of the operated eye. The operated patients were re-examined after 24 h, 3 days, and 1, 2, and 6 weeks to enable refractive correction. Follow-up was scheduled for the 3rd day, weekly for 6 weeks, monthly for 3 months, and every 3 months for 1-year.

At each follow-up examination, visual acuity was tested using the Snellen chart. The anterior segment was examined with a slit lamp and the posterior segment with an indirect ophthalmoscope. Eyes with vision better than 20/60 at the glasses appointment (6 weeks) were defined as having a satisfactory grade of vision. Patients who developed after cataracts in the control group were treated Nd: YAG laser.

During the examination, data were entered online using a specific pretested format designed by the International Society of Ocular Trauma (initial and follow-up forms), which were then exported to a Microsoft Excel™ spreadsheet. The data were audited periodically to ensure completion. We used the SPSS software (version 17, IBM) to analyze the data. The univariate parametric method was used to calculate frequencies, percentages, proportions, and 95% confidence intervals. We used cross-tabulation to determine predictors of postoperative satisfactory vision (>20/60). The dependent variable was visual acuity > 20/60 at follow-up after cataract surgery. The independent variables were the age, gender, residence, time interval between injury and cataract surgery, primary posterior capsulectomy and vitrectomy procedure, and type of ocular injury. We converted vision in decimal-created categories and used Student's *t*-test to evaluate differences and $P < 0.05$ considered statically significant.

Results

We enrolled 120 patients, 60 in each group, of whom 31 (25.8%) were females and 89 (74.1) males [Table 1].

We classified injuries according to the BETTS distribution of cases. We found that (92, 76.6%) cataracts were caused by open-globe and (28, 23.3%) were caused by closed-globe injuries [Fig. 1], which were further subdivided into penetrating injury (86, 71.7%), globe rupture (6, 5%), lamellar lacerations (1, 0.8%), and contusion (27, 22.5%).

The demographic factors, age, gender, entry, habitat, socioeconomic status, and timing of intervention each had no significant effect on visual outcome. We found a significant improvement in visual acuity between before and after surgery [Table 2; $P < 0.001$].

The visual outcome (best corrected visual acuity) differed significantly between the groups ($P < 0.001$), suggesting that primary posterior capsulotomy and vitrectomy had a significant impact [Table 3]. Only 6 eyes in the control group had after cataract.

When we compared all variables, ranging from sociodemographic to visual outcome, between the two

Table 1: Age and sex distribution

Age group	Sex		Total
	Female	Male	
0-10	6	19	25
11-20	11	28	39
21-30	6	19	25
31-40	2	11	13
41-50	3	5	8
51-60	2	6	8
71-80	1	1	2
Total	31	89	120

Table 2: Comparative study of vision presurgery and postsurgery

Postoperative vision	Preoperative vision		Total
	<1/60	1/60-3/60	
<1/60	0	1	1
1/60-3/60	9	2	11
20/200-20/120	18	4	22
20/80-20/60	28	6	34
20/40-20/30	34	5	39
20/20-20/15	11	2	13
Total	100	20	120

f=0.000 ANOVA

Table 3: Comparative study of postsurgical visual outcome among two groups

Postoperative vision	PPC		Total
	Yes	No	
<1/60	0	1	1
1/60-3/60	1	10	11
20/200-20/120	5	17	22
20/80-20/60	12	22	34
20/40-20/30	31	8	39
20/20-20/15	11	2	13
Total	60	60	120

P=0.000. PPC: Primary posterior capsulotomy

groups, we found no significant associations; only the variable being assessed – primary posterior capsulotomy and vitrectomy – improved visual outcome significantly [Table 4, $P < 0.001$].

Discussion

Visual gain following surgery for traumatic cataracts is a complex issue. Electrophysiological[13] and radio-imaging[14,15] investigations are important tools for assessing comorbidities associated with an opaque lens. Postoperative intraocular inflammation is a major complication following surgical procedures for traumatic cataracts.[6-10]

We perform primary poster capsulectomy (PPC) and anterior vitrectomy as a primary procedure in all age groups. The performance of these procedures was assessed and found to have a significant effect on visual outcome; no significant difference in any other variable was identified [Table 4]. A similar procedure was performed for treatment of traumatic cataracts by and Kumar *et al*.[16] and Rastogi *et al*.[17] They reported similar results, but only in pediatric subjects; furthermore, no control group was included. Shah *et al*. assessed PPC as a tool for visual outcome and reported results similar to ours; however, again no control group was evaluated.[18-20] These techniques have been reported to be useful for the treatment of cataracts in pediatric patients.[21-23] Shah *et al*. and Brar *et al*. reported comparative study among open and closed globe injuries.[24]

Table 4: Comparative study of groups with or without PPC and anterior vitrectomy

Parameter	Group A		Group B		*P*
	No	%	No	%	
Socioeconomic status					
Poor	36	60	39	65	0.136
Rich	14	23.33	21	35	
Very poor	10	16.67	10	16.67	
Total	60	100	60	100	
Entry					
Camp	23	38.33	24	40	0.031
Other	6	10	2	3.33	
Referral	8	13.33	3	5	
Self	23	38.33	31	51.67	
Total	60	100	60	100	
Previous surgical treatment					
No	53	88.33	52	86.67	0.401
Yes	7	11.67	8	13.33	
Total	60	100	60	100	
Age distribution					
0-10	15	25	10	16.67	0.849
11-20	18	30	21	35	
21-30	11	18.33	14	23.33	
31-40	7	11.67	6	10	
41-50	3	5	5	8.33	
51-60	5	8.33	3	5	
61-70	0	0	0	0	
71-80	1	1.67	1	1.67	
Total	60	100	60	100	
Gender					
Female	17	28.33	14	23.33	0.339
Male	43	71.67	46	76.67	
Total	60	100	60	100	
Object of injury					
Cattle horn	0	0	1	1.67	0.211
Firework	0	0	1	1.67	
Sharp object	18	30	11	18.33	
Stone	5	8.33	3	5	
Wooden stick	24	40	34	56.67	
Thorn	13	21.67	10	16.67	
Total	60	100	60	100	
Reporting					
0-1	1	1.67	1	1.67	0.984
2-4	8	13.33	9	15	
5-30	25	41.67	26	43.33	
More	26	43.33	24	40	
Total	60	100	60	100	
Type of injury according to BETTS					
Open globe	44	73.3	48	80	0.259
Closed globe	16	26.60	12	20	
Total	60	100	60	100	

Contd...

Table 4: *Contd...*

Parameter	Group A		Group B		Total
	No	%	No	%	
Habitat					
Rural	45	75	38	63.33	0.118
Urban	15	25	22	36.67	
Total	60	100	60	100	
Morphology					
Membranous	8	13.33	3	5	0.340
Rosette	3	5	2	3.33	
Soft fluffy	24	40	23	38.33	
Total cataract	25	41.67	32	53.33	
Total	60	100	60	100	
Surgical technique					
Phacoemulcification	40	66.67	39	65	0.761
Small incision cataract surgery	20	33.33	21	35	
Total	60	100	60	100	
Preoperative vision					
<1/60	53	83.33	47	78.33	0.110
1/60-3/60	7	11.67	13	21.67	
Total	60	100	60	100	
Number of surgeries					
1.00	53	83.33	54	90	0.500
2.00	7	11.67	6	10	
3.00	0	0	0	0	
Total	60	100	60	100	
Final visual outcome					
<1/60	0	0	1	1.67	0.000
1/60-3/60	1	1.67	10	16.67	
20/200-20/80	5	8.33	17	23.33	
20/60-20/40	12	20	22	36.67	
20/40-20/30	31	51.67	8	13.33	
20/20-20/15	11	18.33	2	3.33	
Total	60	100	60	100	

PPC: Primary posterior capsulotomy, BETTS: Birmingham Eye Trauma Terminology System

Ram *et al*. reported randomized controlled trial in cases of pediatric cataract to study the incidence of posterior capsular opacification.[25] Verma *et al*. reported lower incidence of capsular opacification following primary posterior capsular opacity and anterior vitrectomy.[26] We tried to study similar finding for an adult population also. To our knowledge, no study of these procedures for treatment of traumatic cataracts has been reported.

The frequency of complications was significantly lower in the treatment group ($P = 0.002$); however, we were unable to find a similar study in the literature for comparison. The incidence of retinal detachment was also lower in the treatment group. Brar *et al*. reported incidence of postoperative complications.[24]

We enrolled adult and pediatric cases which may be considered as weakness of the study.

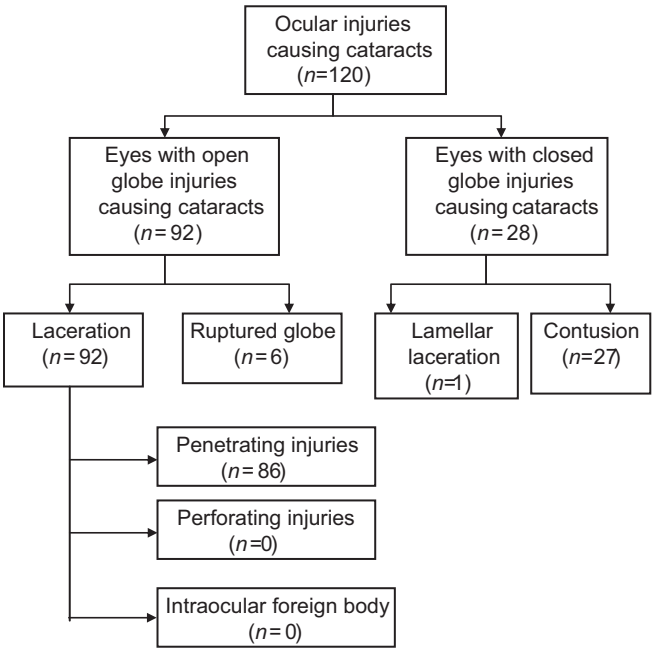

Figure 1: Distribution of injuries causing traumatic cataract according to Birmingham Eye Trauma Terminology System

Conclusions

Primary posterior capsulectomy with anterior vitrectomy may improve the final visual outcome in cases of traumatic cataract. These findings should be confirmed in a study of a larger population that includes multiple centers.

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