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 capsulotomies and vitrectomies as a part of the primary procedure, and the control group. Data were analyzed to evaluate the predictive value of primary posterior capsulotomy 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 capsulotomy and anterior vitrectomy as part of the primary procedure improves the final visual outcome.

Key words: Factors affecting visual outcome in traumatic cataracts, primary posterior capsulotomy, traumatic cataract, visual outcome

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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. When no clear lens matter was observed between the capsule and nuclei 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 no clear lens matter was observed between the capsule and nuclei, 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.

In children younger than 2 years, both lensectomies and vitrectomies via the pars plana route, were performed 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.

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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 posterior capsulotomy (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 2: Comparative study of vision presurgery and postsurgery |
|---|---|---|
| Postoperative vision | Preoperative vision | Total |
| | <1/60 | 1/60-3/60 |
| <1/60 | 0 | 1 |
| 1/60-3/60 | 9 | 2 |
| 20/200-20/120 | 18 | 4 |
| 20/80-20/60 | 28 | 6 |
| 20/40-20/30 | 34 | 5 |
| 20/20-20/15 | 11 | 2 |
| Total | 100 | 20 |

\( f=0.000 \) ANOVA

| Table 3: Comparative study of postsurgical visual outcome among two groups |
|---|---|---|
| Postoperative vision | PPC | Total |
| | Yes | No |
| <1/60 | 0 | 1 |
| 1/60-3/60 | 1 | 10 |
| 20/200-20/120 | 5 | 17 |
| 20/80-20/60 | 12 | 22 |
| 20/40-20/30 | 31 | 8 |
| 20/20-20/15 | 11 | 2 |
| Total | 60 | 60 |

\( P=0.000 \). PPC: Primary posterior capsulotomy

| Table 4: Comparative study of groups with or without PPC and anterior vitrectomy |
|---|---|---|---|
| Parameter | Group A | Group B | \( P \) |
| Socioeconomic status | | | |
| Poor | 36 | 60 | 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 | 26.6 | 12 | 20 |
| Total | 60 | 100 | 60 | 100 |

Contd...
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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Table 4: Contd...

| Parameter                      | Group A | Group B | Total |
|--------------------------------|---------|---------|-------|
| 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.[28] 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

Ocular injuries causing cataracts (n=120)

Eyes with open globe injuries causing cataracts (n=92)

Laceration (n=92)

Ruptured globe (n=6)

Penetrating injuries (n=86)

Perforating injuries (n=0)

Intraocular foreign body (n=0)

Eyes with closed globe injuries causing cataracts (n=28)

Lamellar laceration (n=1)

Contusion (n=27)
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