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Original Research Article

Demographic pattern and visual outcome in patients with open globe injury

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ABSTRACT

Objectives: This study aimed to assess the demographic and clinical characteristics, prognostic factors, and visual outcomes of open globe injury on the repair.

Materials and Methods: This was a retrospective cross-sectional study including all patients who underwent repair surgery following open globe injury and are on regular follow-up visits postoperatively in a tertiary eye hospital from 1st July to 31st December 2021. Patients were divided into two groups. Group A include OGI patients undergoing repair within 24 hours, and Group B includes OGI patients who underwent repair after 24 hours of injury. All the study patients were studied in detail, including the Presenting features, mechanism of injury, preoperative and postoperative visual acuity, demographic data, and postoperative complications.

Results: This study studied a total of 100 patients (46 in group A and 54 in group B). Male predominance (>70%) was seen in both groups. In both groups, the highest number of patients (61% in group A and 52% in group B) were in ≤18 years of age. In both groups, the majority of OGI (52% in group A and 61% in group B) were Iron induced. In groups A and B, Zone I is affected chiefly, about 85% and 81%, respectively. Most OGI patients were admitted to the hospital with severe low vision on VA examination, about 54% and 63% in Group A and B, respectively. At three months of postoperative follow-up, BCVA was significantly improved In Group A than in Group B (p-value 0.05). 80% patients improved to normal vision in group A compared to 50% in group B.

Conclusion: Open globe injuries should be repaired as soon as possible, even within hours. Initial visual acuity remains the strongest predictor of outcome; however, delay to primary repair reduces final visual acuity.

1. Introduction

Open-globe injury (OGI) is an ocular emergency encountered by general practitioners and ophthalmologists.[1] OGI is defined as a full thickness wound of the eyewall due to either a laceration or an occult rupture. According to the Birmingham Eye Trauma Terminology System (BETTS), both rupture and laceration can lead to severe damage and visual impairment.[2] Though OGI is standard worldwide, with an annual global incidence rate of 3.5 per 100,000 persons.[3,4] Children

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suffer a higher percentage of open globe injuries than adults, comprising 19% –58.3% of all cases of ocular trauma. Ocular trauma is the leading cause of monocular blindness in children worldwide. A significant problem in the paediatric age group remains a delayed trauma diagnosis.[5,6] Open globe injuries should be repaired as early as possible. Initial presenting visual acuity remains the strongest predictor of outcome; however, delay to primary repair also reduces final visual acuity, and any significant delay from injury to repair is likely to negatively impact final visual outcome.[7] Complications of open globe injury include endophthalmitis, retinal detachment, cataract, corneal scarring, proliferative vitreoretinopathy, phthisis, and irreparable injury requiring evisceration or enucleation. The risk of endophthalmitis is increased when a primary repair is performed more than 24 hours after injury or more than 12 hours. This study was an attempt to assess the relationship between the visual outcome of repair and the time elapsed following OGI and assess the demographic and clinical pattern.

2. Materials and Methods

This retrospective comparative cross-sectional study includes all patients who underwent repair surgery following open globe injury and are on regular follow-up visits postoperatively in cornea clinic of Ispahani Islamia Eye Institute and Hospital from 1st July 2021 to 31st December 2021. All patients were divided into two groups depending on the injury's repair time. Group A included OGI patients who underwent repair within 24 hours and Group B included OGI patients who underwent repair after 24 hours of the injury. A Purposive sampling technique was maintained, and all patients with OGI who presented within seven days were studied in this study and fulfilled the selection criteria. We excluded all patients with OGI who came after seven days of the injury, previous repair, patients with polytrauma, chemical injury, and retinal detachment. Variables included in this study such as best-corrected visual acuity, presenting features, mechanism of injury, demographic data, and postoperative complications. We obtained written consent from all participants. All participants had undergone a general ophthalmic assessment and repair under general anesthesia. A clinical data sheet was maintained including all demographic profiles, clinical reports, and outcome measures. Visual outcome was the main predictor for this study. Visual acuity (VA) was recorded in Snellen units; the visual outcome was measured as normal vision (VA ≥ 6/18), Low vision (VA 6/18 to 3/60), and severe low vision (VA <3/60). Statistical analysis was conducted on SPSS version 16.0 for windows software. A significance test (chi-square test) was done, and the significance level was defined as a p-value.

The zone of OGI was categorized into three zones. Zone 1 was defined by OGI limited to the cornea and limbus, zone 2 demarcated by injury extended up to 5 mm posterior to the limbus, may involve lens and zonule, and zone 3 by OGI which extended more than 5 mm posterior to the limbus, involving the posterior segment.[8]

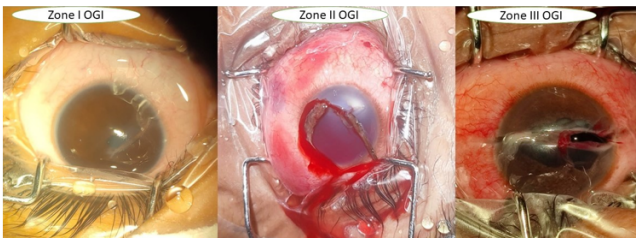

Fig. 1: Showing the preoperative zone of the OGI

3. Results

A total number of 100 patients of OGI undergoing surgical repair were evaluated for this study. According to the time of repair, all patients are divided into two groups, and according to age distribution, all patients are categorized into three groups (Table 1). In Group A, 72% patients were male, and 28% were female. In Group B, 76% patients were male, and 24% were female. Male (74%) were more predominant than females in both Group A and Group B ($P>0.05^{ns}$).

Table 1: The distribution of the age of the study subjects

Age	Group A	Group B	Results
≤18 years	28 (61%)	28 (52%)	
19-40 years	17 (37%)	17 (31%)	P Value= 0.97
>40 years	01 (02%)	09 (17%)	
Total	46	54	N=100

According to the occupation, most OGI patients are young students, about 60% and 50% in groups A & B, respectively. In group A, the second majority of patients are day labourers (20%), and in group B, housewives (13%) (P> 0.44ns). We studied the patients according to the mode of OGI. In Group A, most OGI was Iron induced (52%), and then wooden injury was common. In Group B, Iron induced OGI was 61%, and then wooden injury was 09%. In both groups, Iron and wooden-induced OGI were common. The groups had no statistically significant difference (P-value > 0.05). The right eye was involved in 48% of cases, and the left eye was involved in 52% of cases. There was no bilateral involvement of OGI. In group A, Male (25, 54%) was predominant, and female (31, 57%) were predominant in group B. All patients were also evaluated by the zone of OGI (Figures 1 and 2). In Group A, 85% of patients have Zone-I, 15% have zone-II, and none have Zone-III injury. In Group B, 81% of patients have Zone-I, 13% have Zone-II,

and 06% have Zone-III injury. In both groups, most patients have Zone-I injury (P-value > 0.05). According to the shape of the injury, most of the OGI was linear-shaped in both groups. In group A, 98% were linear, 02% were irregular where in group B, 80% were linear, 09% irregular, 11% shelving shaped (P-value > 0.05). The size of the injury was noted in this study. Minimum (2-4 mm) size of OGI was found in 25 (54.3%) cases in group A, and 26 (48%) cases in group B. Moderate (5-7 mm) size of OGI was in 15 (32.6%) cases of group A and 21 (38.8%) case of group B. Large size (8-14mm) OGI was observed in 7% cases in each group. According to preoperative risk factors. In Group A, 15% injury FB induced, 26% A\C exudate, 35% lens capsular tear and 43% with iris prolapse. In Group B, 17% FB induced OGI, 11% with A\C, 50% with lens capsular tear and 46% with Iris prolapse (P> 0.05). Table 2 shows the preoperative visual acuity in both groups of patients' injured eyes. No statistically significant difference (P-Value > 0.05%) was observed in the improvement of BCVA between the groups.

Table 2: Shows distribution of the patients according to pre-operative Visual acuity.

BCVA	Group A	Group B	P Value
Severe Low Vision	25 (54%)	34 (63%)	
Low Vision	15 (33%)	16 (30%)	0.54^{NS}
Normal	06 (13%)	04 (07%)	
Grand Total	46	54	n=100

On 1st postoperative day, BCVA was recorded as severe low vision in 54% of patients, low vision in 37% of patients, and normal vision was only 9% of patients in Group A compared to severe low vision (67%), low vision (31%). Only 02% of patients had normal vision in group B. On the 7th postoperative day, In Group A, 35% of patients improved to normal vision in group A, and 11% had normal vision. A statistically significant difference was between the groups (p-value<0.05). After one month of the repair of the OGI, 45% of patients improved to normal vision in group A, and 26% of patients improved to normal vision in group B. The visual outcome of the injured eye after three months of OGI surgery are details mentioned in Table 3. In Group A, 7% of patients, 80%, have normal vision, whereas, in Group B, 50% have normal vision. A statistically significant difference was observed in the improvement of BCVA between the groups. Hyphaema (35 % in group A and 39% in group B) and cataracts (20% in group A and 28% in group B) were postoperative complications in this study. The two groups had statistically insignificant differences (P > 0.05).

Hyphaema (35 % in group A, and 39% in group B), Cataract (20% in group A, and 28% in group B) were observed as postoperative complications in this study. There was no statistically significant difference (P > 0.05) between two groups.

Table 3: Thedistribution of BCVA at 3 months post-operative follow-up of the patients

BCVA	Group A	Group B	P Value
Severe Low Vision	03 (07%)	05 (09%)	0.54^{NS}
Low Vision	06 (13%)	22 (41%)	
Normal	37 (80%)	27 (50%)	
Grand Total	46	54	n=100

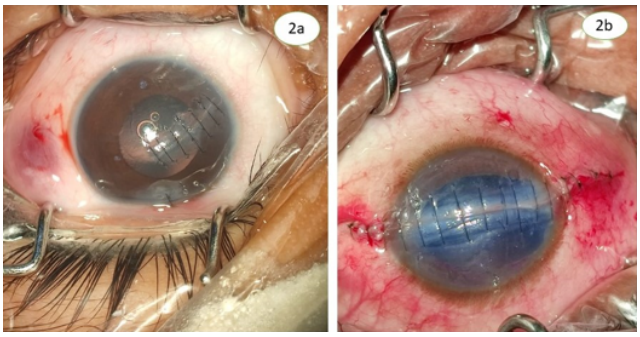

Fig. 2: Showing the eventful repair of the zone I and zone III OGI

4. Discussion

Open globe injury (OGI) is a total thickness wound of the globe. Four main types of OGI are defined: penetration, perforation, intraocular foreign body (IOFB), and rupture of the globe.[8] OGI may cause significant and irreversible damage to ocular structures,[9] one of the major causes of visual as well as the most common cause of monocular blindness, especially in urban populations.[9–14] The visual prognosis in eyes with OGI is often poor and depends on a few factors such as the zone and extent of the injury, the presence of infection, and the timing of the repair.[13,15,16] Primary repair of OGI should be performed preferably within 24 hours of the injury with a protective measure for preventing endophthalmitis.[9,17–19] Male children are most susceptible to ocular injury due to their aggressive nature and playing with risky tools. Male predominance was seen in both groups, 72% in group A and 76% in group B; like the study conducted by Ng HR et al.[20] Highest number of patients were under ≤ under 18 years age in both groups. OGI is common in pediatric and young children. About 61% and 52% of OGI occurred in those below 18 years of age, respectively, in Group A and B. Most of the patients were young adults about 21 to 30 years old.18 Female predominance with male to female ratio is 4:5.[21] In both groups, most of the OGI patients are young and about 60% and 50% in groups A and B respectively. In group A, the second majority of patients are day laborer (20%), and in group B, housewives (13%). A study showed most of the OGI occurred in young working adult using a motor vehicle.[20] In both groups, most of the OGI was linear shaped. In group A, 98% were linear, 02% were irregular whereas, in group B, 80% were linear, 09% irregular, and

11% shelving shaped. The two groups have statistically significant differences (P- value > 0.05). In both groups, the injury size is commonly within 4 mm, about 26% and 28% in groups A and B, respectively. There was no statistically significant difference (P>0.05%) between the two groups. In Group A, 15% injury FB induced 26% exudate in anterior chamber (A/C), 35% lens capsular tear and 43% with iris prolapse. In Group B, 17% FB induced OGI, 11% with A/C, 50% with lens capsular tear and 46% with Iris prolapse. There was no statistically significant difference (P> 0.05) between these two groups. Agarwal et al. showed RD occurred in 13% of cases, lens tear in 73% cases in 669 cases.[22] Bhagat N et al. study showed that endophthalmitis occurred in 03%, and retinal detachment was evaluated in 22% of 36 cases with IOFB after 5 to 7 days following OGI.[23]

In Group A, most OGI was Iron induced (52%), and then wooden injury was common. In Group B, Iron induced OGI was 61%; then wooden injury was 09%. Iron and wooden-induced OGI were shared in both groups, like in the Tirakunwichcha study, where metallic and wooden machinery-induced OGI were common at about 53%.[24] In Group A, OGI is more common in the right eye (54%), whereas in Group B, more common in the left eye (57%). The groups had no statistically significant difference (P-Value > 0.05). Tirakunwichcha's study shows that OGI is expected in the left eye in about 52%, performed on 78 patients.[24] In Both Group A and B, Zone I is mainly affected, about 85% and 81% respectively, which is consistent with the Puodžiuvien E study where Zone I was affected in 48% of patients.[25] Outcomes varied in the zone from zone II and zone III, all Zone I cases achieved the final vision of 6/6 to 6/12 (p=0.022).[26] In Group A, 15% and in Group B, 13% cases, Zone-II, were affected. Zone III was less commonly affected.

Most OGI patients were admitted to the hospital with severe low vision on VA examination, about 54% and 63% in Group A and B, respectively. After that, most patients presented with low vision, about 33% and 30%, respectively, which was consistent with the Tirakunwichcha study, where the majority of the patients presented with severe low vision, about 77%.[24] Following trauma, 18% reported low vision, severe low vision and no perception of light 10.7% and 6%, respectively, in a Bangladesh study.[21] After surgical repair, on the 1st postoperative day follow-up with BCVA, most patients have severe low vision and low vision in both groups. No significant improvement in visual acuity observed in both groups. This result is like the Tirakunwichcha study.[24]

On the 7th POD follow-up BCVA, In Group A, 35% of patients improved to normal vision, 28% improved to low vision, and 37% had severe low vision. In Group B, 11% of patients improved to normal vision, 41% to low vision, and 48% to severe low vision. In both groups, most patients have severe low vision. Still, in group A, 2nd majority of patients have normal vision, whereas, in Group B, only 11% of patients have normal vision. A statistically significant difference was observed in the two groups (p-value<0.05). On postoperative 1st month follow-up BCVA, in Group A, most of the patients improved to normal vision (45%), whereas in Group B, most of the patients improved to low vision (46%), which is not consistent with a study[24] shows most of the patients improved to low vision on postoperative 1st month follow up. BCVA improved to normal vision in about 80% of patients in group A and 50% in Group B after three months of surgery. But in group A, there was a statistically significant improvement in group B. This result is consistent with Blanch RJ et al. study.[7] In group A, 35% patients have developed hyphaema and 20% cataracts, whereas 39% hyphaema and 28% cataracts in group B. Hyphaema was resolved within few weeks. Dogan et al. showed no difference in final BCVA and complication rate according to the injury type (laceration or rupture).[27] There was not needed any evisceration and enucleation in this study. Limitations of this include limited sample size and limited follow-up time. We found significant differences in visual outcome after repair of the Open Globe Injury within 24 hours and after 24 hours. We recommend health education and awareness buildup on the safety of the workplace to reduce the occurrence of ocular injury.

5. Conclusion

Open globe injuries should be repaired promptly. Early repair and zone I OGI are essential predictors of visual outcome. An expert ocular trauma surgeon should repair all injuries. Any significant delay in primary repair will likely negatively impact the final visual outcome. Ophthalmic trauma management should be included in the residency and fellowship program.

6. Ethical Approval

The study received ethical clearance from the Ispahani Islamia Eye Institute & Hospital, Dhaka, Bangladesh.

7. Conflict of Interest

The authors declare that they have no conflict of interest.

8. Source of Funding

None.

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