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Open Globe Injuries – A Devastating Cause of Paediatric Blindness

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Abstract: *Open Globe Injuries – A leading cause of childhood blindness*
Materials & Methods: *A retrospective study of hospital records was done for all patients under 18 years of age who underwent primary ocular repair surgery at Goa Medical College at a Tertiary Hospital from May 2016 to May 2017.*
The type and cause of injury, anterior and posterior segment findings, presenting and post-operative visual acuity were noted and evaluated.
Observations: *Out of 19 children presenting with open globe injury, 57.8% due to sharps, 31.5% were due to blunt trauma, 10.5% due to animal bites.According to WHO criteria, 4 had unilateral blindness, 7 had unilateral visual impairment and 5 had a visual acuity of more than 6/18 by Snellen's chart. It was noted that 63% of children were male and 37% were female.Children with zone 2 and 3 injuries with preoperative complications like Hyphaema and retinal detachment had a poorer visual outcome, post operatively.*
Conclusion: *Open Globe injuries are a devastating and potentially preventable cause of childhood blindness. The type and zone of injury as well as preoperative anterior and posterior segment findings greatly influence the post-operative visual recovery.*

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I. Introduction

Ocular trauma is a leading cause of non-congenital mono-ocular visual impairment and mono-ocular blindness in children.([1,2)] The impact caused by it is devastating in most cases and only a few studies have been done with proper follow up.

Klopfer et al.([3]) and Strahlman et al.([4]) reported an average annual hospitalization rate of children with diagnosis of ocular trauma of 15.2-15.8 per 100,000 in the USA. The rate of 29.1 per 100,000 per year was observed for patients of all ages with ocular trauma.

Out of all penetrating eye injuries, 27-48% affect children ([5,6,7,8,9,10,11])

This shows that children make up a large proportion of all ocular trauma.

Ocular trauma in children usually occurs at home or in school when the child is at play and the eye invariably gets injured with sharp or blunt objects, visually impairing the child.

A detailed ocular evaluation is difficult in children as

Our study aims to present and evaluate various causes, types and severity of Open globe injuries and compare their pre-operative condition with their post-operative visual outcome.

II. Materials and Methods

Hospital records of the patients of the Ophthalmology Deparment at a tertiary care Hospital from May 2016 to May 2017 were reviewed for patients under 18 years of age who had undergone primary repair of an Open Globe Injury or secondary surgery within 7 days after trauma.

The patient's age, gender, the cause, type and severity of injury were noted along with the patient's previous ocular history.

Ocular findings as well as complications secondary to the Open Globe injury were noted as well as pre and post-operative visual acuity.

The type of injury was classified into Zones based on Ocular Trauma Classification into three zones:

Zone 1: Wound involvement limited to cornea

Zone 2: Full thickness wound involving sclera and within 5mm of corneo-scleral limbus

Zone 3: Wound involvement posterior to anterior 5mm of the sclera.([12])

Patients were also classified according to WHO criteria as visual impairment in one eye or blindness in one eye. Blindness was defined as presenting distance visual acuity <3/60,
Visual Impairment as 3/60 to 6/18 with available correction according to WHO Vision 2020 Action Plan.

III. Results

Out of the 42 cases of Open Globe Injuries, 19 were children below the age of 18 years. It was found that there was a male preponderance, with 63% (n=12) being males and 37% (n=7) being females. The most common age group was found to be children between the ages of 4-9 years.
68% (n=13) were referred within 24 hours of injury, 21% (n=4) were referred within 24-48 hours of injury and 10.5% (n=2) were referred after 48 hours of injury. There was no significant relation between timing of surgery and visual outcome.
Based on the zones of injury, 57.8% (n=11) had Zone 1 injury, 36.8% (n=7) had Zone 2 injury and 5.2% (n=1) had Zone 3 injury.
57.8% (n=11) of injuries were caused due to sharp objects, 31.5% (n=6) were due to blunt objects and 10.5% (n=2) were due to animal bites.
On presentation, 15.7% (n = 3) of children had normal vision, 47.3% (n = 9) of children were visually impaired, and 21.0% (n = 4) of children presented with blindness. The initial visual acuity could not be assessed in 3 children. Final visual acuity at discharge showed that 5 children had normal vision, 7 children had uniocular visually impairment, and 4 children were uniocularly blind.
Out of the 19 cases, 3 were associated with a hyphema, 3 were associated with uveal prolapse, 3 were associated with a cataractous lens and 2 were associated with a retinal detachment.
68.4% (n=13) were penetrating injuries, 26.3% (n=5) were perforating injuries and 5.2% (n=1) were rupture.

All the patients underwent primary repair and during their follow-up underwent further surgeries as required.
The primary repair consisted of primary suturing of scleral laceration with 8-0 vicryl sutures and corneal tear with 10-0 nylon sutures.
In addition, the 2 patients with uveal prolapse underwent iris reposition and 1 patient underwent iris abscission.
B-Scan ultrasonography was performed in all patients postoperatively and two patients were seen to have a retinal detachment.
3 patients had a secondary procedure with extraction of the cataractous lens with an anterior vitrectomy and intraocular lens implantation.
Out of the 4 children who had uniocular blindness, two were due to retinal detachment, one developed phthisis bulbi and one had a corneal scar.

Table 1: Sharp objects causing Open Globe Injuries

Object	Number	Percentage
Wooden stick	2	18.1%
Toy Dart	1	9.0%
Pencil	3	27.2%
Umbrella spoke	2	18.1%
Fish hook	1	9.0%
Animal bite	2	18.1%

Table 2: Relationship of associated ocular findings with final visual acuity

Associated Ocular Finding	Number	<6/60	6/18-6/60	>6/18
Hyphema	3		1	2
Retinal Detachment	2	2		
Cataract	3	-	3	
Uveal Prolapse	3	-	2	1

IV. Discussion

We have seen that Ocular trauma is a leading cause of preventable blindness and visual impairment in children which may greatly influence the quality of life and cause serious morbidity.
There are variable factors influencing the visual outcome following trauma. The mechanism of injury, extent of injury, presenting visual acuity, associated hyphema, vitreous haemorrhage, retina detachment, endophthalmitis or a relative afferent pupillary defect are among the factors investigated([13-18])
Some studies have shown that injury to the lens carries a poor prognosis while other studies show that it does not affect the visual outcome if appropriate management is carried out.(15)
Our study showed that appropriate management of a cataractous lens leads to a visual outcome better than otherwise expected.

A study conducted in Iran reported that 48.9% of children had an initial visual acuity of <6/60 and 28.3% had final visual acuity of <6/60.([19])

A study from Nigeria shows that 64.1-100% of Open Globe Injuries present with with an initial visual acuity of <6/60([20,21]). Their study has shown that 79.4% of these children finally become visually impaired out of which 39.7% were visually blind.

A Canadian study involving 131 Pediatric open globe injuries identified various risk factors for final visual acuity <6/60 as wound length, rupture, vitreous hemorrhage and retinal detachment([22])

A study conducted in Australia reported that wound length, site of injury, and lens injury were factors for a poor visual outcome. They showed that 27% of open globe injuries had a final visual acuity of <6/60([23])

Presenting visual acuity is difficult to assess in children as most of them even older children are uncooperative due to the pain and discomfort caused by the open globe injury. So the reliability of visual acuity remains questionable. Hence it has a limited role in predicting the final visual outcome in children.

Studies have shown that the ratio of males to females presenting with Open Globe Injuries range from 1.9:1 to 5:1.([24-31])

This was consistent with our study as well which showed a male predominance, probably due to the fact that male children tend to be more adventurous and playful, as compared to female children.

Penetrating trauma is the most common form of paediatric OGIs all over the world, with a range from 48.4% to 83% of all OGIs, followed by rupture; 9.9-34% and Intra Ocular Foreign Body presence; 4.0-16.1% with perforation being the least common type;1.2-4% ([25-29])

Our study differed from this study as we found that penetrating injuries were the commonest, followed by perforation and then by rupture.

It has been shown that Zone 1 injuries are the most common form of OGIs in children (44-79%) ([25-29]) whereas Zone 3 injuries have the worst visual prognosis.

This was consistent with our study which showed that zone 1 injuries were the commonest, followed by zone 2 and zone 3.

Zone 3 injuries because of their greater extent tend to have poorer visual outcomes.

Our study showed that the more severe and obvious the injury to the unprotected eye, the earlier the presentation. This delay can be attributed to use of home remedies, lack of recognition of the severity of the injury by parents, and inexperience of the staff at primary health care centers and other socio-economic and educational factors.

In conclusion, we see that Open Globes Injuries are devastating and visually incapacitating to a child and are a largely preventable cause of blindness.

Hence,dangerous objects should be kept out of reach of children and more importantly better awareness should be created amongst parents and caregivers for greater vigilance to prevent open globe injuries.

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