

# Clinical presentation and visual outcome of broomstick ocular injury in 120 eyes of children at a tertiary eye care in India

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## Research article

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# Abstract

## Background

Eye injuries are a serious health problem globally. Ocular trauma accounts for 5% of blindness cases. In India broomstick injury is very common. But only few studies are published regarding the nature and outcome of broomstick ocular injuries. The aim of this study is to determine the frequency, mode of presentation, complications and surgical results with a view to offering solutions to reduce this trend.

## Methods

This retrospective study was conducted at Regional Institute of Ophthalmology, Patna. The records of all patients presenting to the Eye OPD and Emergency clinic with ocular trauma from broomstick injury between March 2017 and April 2020 were reviewed. A total of 120 cases were identified. Patient's age, gender, interval between injury and presentation to eye OPD, mechanism of injury, activity at time of injury, visual acuity at presentation, anterior and posterior segment findings, diagnosis, complications, treatments offered and follow-up events were documented. Data were analysed statistically.

## Results

The mean age of presentation was  $8.10 \pm 4.93$  years. All were children < 15 years old. 80% patients sustained trauma from broomstick shot as an arrow. 70% had presenting vision < Hand movement. 90% of the cases were open globe injuries. Most of them had multiple complications such as corneal perforation (80%), traumatic cataract (27%), endophthalmitis (68%), retinal detachment (12.5%), panophthalmitis 8 (7%) and orbital cellulitis (6%). Culture was positive in 20%. Pseudomonas aeruginosa was the most common organism isolated. Therapeutic vitrectomy was performed in 67% eyes. Only 12% eyes gained ambulatory vision (VA > 3/60) after vitrectomy.

## Conclusion

Broomstick shot as an arrow causes devastating and multiple complications resulting in rapid and immediate loss of vision. Overall prognosis is bad and early presentation to the hospital does not appear to improve the prognosis. Such injuries often affect younger, male children. Primary prevention is the only way to control blindness occurring from such injuries. Primary health education should be given in school to highlight these risk factors.

## Background

Eye injuries are a serious health problem globally. Ocular trauma accounts for 5% of blindness cases<sup>1</sup>. Certain occupations and cultural practices are more prone. Therefore, the type and prognosis of injuries

differ between developed and developing countries<sup>2</sup>. Ocular trauma among children is a serious health concern. It is one of the major cause of monocular blindness.<sup>3-5</sup>. Vision loss in childhood retards the mental and physical development of the child. Thus it has significant psychosocial impact. Considering high frequency and severe vision loss it is a subject of major concern in children<sup>6-9</sup>. Many objects can cause penetrating ocular trauma. They are sharp objects such as pencil tips, knife, needles, sticks, twigs, toys, pellets, stone, metal rods and bricks. In India broomstick injury is very common. A broom is a common household agent used for sweeping floors and roasting grains (Fig. 1). It is made from a bundle of broomsticks, derived from a variety of materials like raffia palm, grasses, reeds, date palm and coconut leaves. In India children frequently play from bow and arrow made of broomsticks (Fig. 2). It is a popular game inspired from the mythological Gods depicted in the television serials and movies. Brooms are present in every household. Children often take them and cause accidental ocular injuries to their siblings or friends while playing. It can also become an intraocular foreign body (IOFB). The injury causes fulminant endophthalmitis because they are a reservoir of bacteria and fungi<sup>10</sup>. Broomstick injuries are very common but very few studies are published in literature. Few case reports have been published from India in 1968, Ghana and South Africa in 2005.<sup>11,12</sup> Sharma et al described the results of surgical treatment of 100 such cases in 1994<sup>10</sup>. Ukponmwan et al have described a case series of 20 patients from Nigeria<sup>13</sup>.

Broomstick ocular injury presents at our hospital throughout the year. But literature is quite limited. The aim of this study is to determine the frequency, mode of presentation, complications and surgical results of broomstick eye injury with a view to offering solutions to reduce this trend.

## Methods

This retrospective study was conducted at Regional Institute of Ophthalmology, Patna. The records of all patients presenting to the Eye Out patient department (OPD) and Emergency clinic with ocular trauma from broomstick injury between Sep 2017 and March 2020 were reviewed. A total of 120 cases were identified. Relevant information was retrieved that formed the database for analysis.

Patient's age, gender, interval between injury and presentation to eye OPD, mechanism of injury, activity at time of injury, visual acuity at presentation, anterior and posterior segment findings, diagnosis, complications, treatments offered and follow-up events were documented.

Ocular trauma from broomstick was classified using the Birmingham Eye Trauma Terminology system (BETTS)<sup>14</sup>. The children were treated promptly with systemic and topical antibiotics and antifungal. Surgical repair of corneal or scleral wound and removal of retained IOFB was carried out when indicated. In case of endophthalmitis or retinal detachment (RD) pars plana vitrectomy (PPV) and intravitreal antibiotics were injected. Vitreous biopsy was taken and sent for cytology and culture and sensitivity.

Data were analysed using SPSS, IBM, Chicago, USA. Ethics approval for this study was obtained from the Institutional Research Board of our hospital.

## Results

A total of 120 eyes in 120 patients were seen. All were children < 15 years old. The mean age was  $8.10 \pm 4.93$  years with a range of 2 to 14 years. Males were 6 times more affected than females (Table 1)

96 (80%) patients sustained trauma from broomstick shot as an arrow, often by a friend or sibling. 11 (9%) sustained injury from beating with a broom by their teacher or parent. 7 (6%) children were hit by their siblings with the broom while playing at home. 3 got injured from poor handling of the broom at chores and 3 children accidentally fell upon the broom. 50% of cases presented within 24 h of injury, 40% presented within 4 days and 10% presented after 1-week.

15 (13%) children presented with no light perception (NLP), 70 (58%) patients had visual acuities ranging from hand movement (HM) to light perception (LP). Vision could not be assessed in 5 children who were preverbal. Table 2 shows the visual acuities of the eyes at presentation and last follow-up visit. The last follow-up visit ranged from 3 weeks to 13 months with a mean follow-up of 21 weeks. 60% children were admitted through the emergency clinic, rest through OPD. Under the BETTS classification, 90% ( $n = 108$ ) of the cases were open globe injuries (OGI) ranging from penetrating (70%,  $n = 84$ ), perforating (15%,  $n = 18$ ) and retained IOFB (15%,  $n = 18$ ) injuries. Only 10% ( $n = 12$ ) were closed (lamellar) injuries (Table 3). Most of them had multiple complications such as corneal perforation (80%), traumatic cataract (27%), endophthalmitis (68%), RD (12.5%), panophthalmitis 8 (7%) and orbital cellulitis 7 (6%). Other complications are shown in Table 4. Vitreous biopsy was taken in 81 patients sample sent for staining, culture and sensitivity. Culture was positive in 20%. *Pseudomonas aeruginosa* was the most common organism isolated (Table 5). All patients were admitted. All received topical antibiotics moxifloxacin, tobramycin and natamycin. Injectable antibiotics vancomycin and ceftriaxone were started from day 1. If suspected inj Metronidazole was added to cover anaerobic organisms in cases of panophthalmitis or orbital cellulitis. Inj Tetanus toxoid was given. Thorough slit lamp and indirect ophthalmoscopic evaluation was done. Ultrasound B scan was gently performed to evaluate the lens status and posterior segment. Patients were immediately taken for globe exploration and repair under general anaesthesia. Corneal and scleral repair was done with 10/0 nylon and 8/0 polyglactin sutures respectively. IOFB, if present was removed. In cases of endophthalmitis core PPV was performed provided posterior segment was adequately visualised. If view was hazy then patients were taken up for surgery once the anterior segment cleared. RD was repaired either in same setting or later depending upon media clarity. Intravitreal vancomycin, ceftriaxone and voriconazole were injected in all cases of endophthalmitis. Therapeutic vitrectomy was performed in 80 (67%) eyes. Only 10 (12%) eyes gained ambulatory vision ( $VA > 3/60$ ) after vitrectomy.

## Discussion

Broomstick injury was 6 times more common in males than females. The mean age was  $8.10 \pm 4.93$  years. Majority (70%) were less than 10 years. Other studies have shown males to be more prone to injuries<sup>7,11,15</sup>. Young children are more prone because they have immature motor skills and unable to

protect themselves. They are unaware of the consequences of rough games. Previous studies reported a delay in presentation of more than 24 hours in 91% of cases<sup>7,9,11,16</sup>. Ukponwman et al<sup>13</sup> reported 50% cases presenting beyond 24 hours. In our study half of the cases presented within 24 hours, 40% within 4 days and rest after 1 week. The patients came from far off areas so they reached the hospital late after arranging travel and money logistics<sup>17,18</sup>. In few cases the primary ophthalmologist referred them late. Those who presented within 24 hours either lived in the same city or nearby districts. They were highly anxious as it involved young children and wanted immediate help.

Ukponwman et al<sup>13</sup> presented a case series of 20 cases over 6 years. Essumann et al<sup>11</sup> reported 2 cases in 6 years and Omobolanle et al<sup>7</sup> reported 9 cases in 1 year. We saw 120 broom stick injury cases in 3 years. Broomstick injury at our centre is prevalent throughout the year. It is peculiar to Indian subcontinent<sup>19,20</sup>. A broom is a common household agent. Children frequently play from bow and arrow made of broomsticks. This game is quite popular in rural areas. But the incidence increased during the Covid19 pandemic lockdown period. At this time popular shows were retelecast on television. In these shows Gods were shown using bow and arrow upon their enemies. The children started playing with homemade arrows, inspired by the television shows. Also more number of cases were referred to our centre during the lockdown period because of limited healthcare facilities. That might have also contributed towards the increased incidence.

The most common mechanism (80%) of injury was broomstick used as an arrow with a rubber sling during games. Often the children were from lower socioeconomic strata and there was no parental supervision while playing.

90% injuries were OGI from penetrating and retained IOFB. The arrow is a pointed sharp object which travels at high speed and can easily penetrate the eye. Visual acuity at initial presentation was very poor, 80% being HM or worse. They did not improve even after adequate intervention till last follow up (Table 2). Their globe was salvaged though. 3 cases went into phthisis. This might be due to multiple injuries like corneal perforation, iris prolapse, hypopyon, severe endophthalmitis and corneal scar<sup>11</sup>. Those presenting with vision > 6/60 had better outcome. Their vision was salvaged. They had paracentral or limbal corneal perforation and mild endophthalmitis.

The initial presenting visual acuity was NLP in 15% and CF at 1 m to LP in 65%. Early presentation of patients to the hospital did not appear to improve visual outcome. This could be because of poor baseline vision, rapid, fulminant Gram negative endophthalmitis and severity of complications like RD. Published studies have shown that clinical features associated with good visual outcome in OGI were better baseline vision, culture of nonvirulent organism, lack of RD, absence of clinical endophthalmitis and shorter wound length<sup>21,22</sup>.

In this study 81 patients presented with endophthalmitis. All cases vitreous biopsy was taken and sent for cytology and culture. Culture positivity was 20% (n = 16). 63% (n = 10) had Gram negative infections. *Pseudomonas aeruginosa* was the most common organism isolated (n = 5), followed by *Bacillus cereus*

(n = 3) and Enterococcus (n = 2). Among Gram positive, Staphylococcus and Streptococcus were isolated in 2 eyes each. 2 cases had fungal growth, Aspergillus and Candida. Culture-positive rates have been reported from 27–75%<sup>19,20,23,24</sup>. The lower culture-positivity rates in our study could be because of prior use of antibiotics by the primary physician. Published reports on paediatric traumatic endophthalmitis have implicated Gram-positive organisms in 57–67% cases<sup>20,23,25</sup>, Staphylococcus aureus, Streptococcus epidermidis and Bacillus cereus being the most common organisms. Our study had predominantly Gram negative infections, Pseudomonas being the most common. This might be because a broom is a dirty object and harbours many bacteria and fungi. We also analysed the risk factors of penetrating traumatic endophthalmitis. Factors associated with increased risk were young age, delayed presentation, delayed primary repair, incomplete history regarding the exact nature of the injury, injury with a contaminated object, difficulty in undertaking a thorough initial and follow-up examination, rural setting, and retained IOFB<sup>19,26,27,28–38</sup>. Therapeutic vitrectomy was performed in 80 (67%) eyes. The indication was either endophthalmitis or RD. Only 10 out of 80 eyes (12%) gained ambulatory vision (VA > 3/60) after vitrectomy. Factors predictive of poor anatomical success were corneal abscess, injuries involving both anterior and posterior segment (P < .02), endophthalmitis (P < .05), and presence of RD with proliferative vitreoretinopathy (P < .05). Presence of either of these warrants an early and aggressive treatment. We did not find any impact of age on functional or anatomical outcome following treatment. This is in contrast to Alfaro et al<sup>39</sup> who reported poor visual outcomes in children younger than 10 years. This may be because potent antibiotics and advanced surgical instruments were not available in 1995 when their report came. Today many advances have been made in managing endophthalmitis cases in terms of availability of potent antibiotics and improvements in surgical instrumentation. Lens rupture has been reported to have poor outcomes<sup>40,41</sup>. We did not find any association between the two. Patients undergoing vitrectomy were more likely to have good anatomical outcome as it decreased the microbiological load and helped in diffusion of intravitreal and systemic antibiotics within the eye<sup>42–47</sup>.

## Conclusion

Broomstick shot as an arrow causes devastating and multiple complications resulting in rapid and immediate loss of vision. Overall prognosis is bad and early presentation to the hospital does not appear to improve the prognosis. Such injuries often affect younger, male children during misguided and unsupervised play. Primary prevention is the only way to control blindness occurring from such injuries. It is recommended that primary health education should be given in school to highlight these risk factors. School teachers should also educate the parents in parents teacher meeting about its danger and the need to monitor their children while playing. Broom kept at home should be away from the reach of children. Loose pieces should be immediately picked up and discarded safely. Bow and arrow games should be prohibited. Governments can broadcast messages in the media to raise awareness about these risks to reduce the incidence of injuries.

## Abbreviations

OPD- Out patient department

IOFB- Intraocular foreign body

BETTS- Birmingham Eye Trauma Terminology system

RD- Retinal detachment

PPV- Pars plana vitrectomy

OGI- Open globe injury

## **Declarations**

### **Ethics declaration, Ethics approval and consent to participate**

This study followed the tenets of the Declaration of Helsinki and was approved by the ethical committee of the hospital, IGIMS Ethical Committee, Indira Gandhi Institute of Medical Sciences, Patna. Verbal informed consent from each patient was taken before the study. Parental consent was obtained.

### **Consent to publish**

Not applicable

### **Availability of data and materials**

All data and materials generated or analysed during the study are submitted in the manuscript.

### **Competing interests**

The authors declare that they have no competing interests.

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No funding was received for this study.

### **Authors Contributions**

Dr. Abhishek Gupta wrote the paper. Dr. Richa Gupta designed the research. Dr. Prabhakar Singh collected the data. Dr. Shivani Sinha analysed the data. Dr. Vidya Bhushan revised the paper. Dr. Bibhuti P Sinha monitored and supported the research. All authors have read and approved the manuscript

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## Tables

Table 1. Sex and age distribution		
Profile	Frequency	Percentage
Sex		
Male	103	86
Female	17	14
Age (years)		
0-5	50	42
6-10	34	28
11-15	36	30

Table 2: Visual acuity at presentation in the eye clinic and follow-up		
Visual acuity (affected eye)	At presentation n (%)	At last follow up n (%)
NLP	15 (13)	18 (15)
LP-HM	70 (58)	78 (65)
CF-5/60	20 (17)	10 (8)
6/18-6/60	10 (8)	12 (10)
Not assessed	5 (4)	2 (2)

Type of injury	Frequency (n) (%)
Open globe	108 (90)
Closed globe	12 (10)
Penetrating	84 (70)
Perforating	18 (15)
Retained IOFB	18 (15)
Rupture	0

Anterior segment	Frequency	Percentage
Lid laceration	12	10
Corneal perforation	96	80
Scleral perforation	32	27
Uveal prolapse	77	64
Traumatic cataract	32	27
Subluxated lens	6	5
Hyphaema	12	10
Hypopyon	36	30
<b>Posterior Segment</b>		
Endophthalmitis	81	68
Retinal detachment	26	22
Vitreous haemorrhage	5	4
Panophthalmitis	8	7
Orbital cellulitis	7	6

Table 5: Microbial spectrum of endophthalmitis	
Microorganism	n (%)
Gram negative	10 (63%)
Pseudomonas	5
Bacillus cereus	3
Enterococcus	2
Gram positive	4 (25%)
Staphylococcus aureus	2
Streptococcus pneumoniae	2
Fungi	2 (12%)
Aspergillus fumigatus	1
Candida albicans	1

## Figures



**Figure 1**

Broom



**Figure 2**

Bow and arrow made from broomstick