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Epidemiology of Paediatric Open Globe Injuries

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Abstract

Purpose: *To study the epidemiology of the paediatric open globe injuries (OGI) at tertiary care centre in central India in detail, such a way, that to reduce the incidences of OGI with the help of detailed epidemiological knowledge of the cause and the public education.*

Method: *This was the prospective analytical study in Tertiary care centre in central India from November 2014-October 2016. All the selected patients were under the age of 12 years. All the patients were under the records and tabulated. Statistical analysis was done using spss software.*

Results: *6912 children up to the age of 12 years attended the out-patient clinic in the department of ophthalmology at the Government Medical College and hospital Nagpur, Maharashtra, India, from November 2014 to October 2016. 56 patients found with OGI. Incidence of paediatric OGI is 0.81%. 36 (64.28%) were boys and 20 (35.72%) were girls. 43 patients (76.78%) belonged to 3-9 year age group. In 22(39.29%) injuries occurred indoor, 34(60.71%) injuries occurred outdoor. Wooden stick (Gulli-Danda, Bow and arrow) is the predominant object causing OGI in 22 children (39.29%).32(57.14%)injuries occurred in summer. 53(94.64%) patients were injured during day time. literate parents were only 20(35.71%),36(64.29%) were illiterate. 36(64.88%) patients were belonging to villages/ rural area. 38(67.85%) patients who belongs to below poverty line and only 18(32.15%) patients were above poverty line. There was no statistical significance in affected eye of patient and dexterity.*

Conclusion: *Community education is an essential part in prevention of OGI in paediatric age groups. Prevention of penetrating ocular injury requires greater education of community, parents and children and their care takers. A majority of ocular trauma in children is preventable. Effective and targeted preventive strategies will helps in reducing their incidence is possible with the help of the detailed understanding of the epidemiology of the OGI.*

Introduction

Open globe injury is defined as "any traumatic full-thickness break in the wall of eye."[1] It is well established that the leading cause of unilateral vision loss in childhood is trauma to the eye[2]. It is also the most common cause of acquired uniocular blindness in children. Trauma to the eye is a leading cause of monocular blindness worldwide, especially in developing countries[3]. Eye injuries account for approximately 8–14% of total injuries in children[4]and are the most common type requiring hospitalization (in up to 40% cases). Next to amblyopia, ocular injuries are the main reason for preventable monocular visual loss in childhood[5]

Paediatric ocular injuries are distinct from those in adults in many ways. Etiologically, such injuries are largely accidental, as opposed to those caused

by intentional violent assault in adults. Injuries have an age-specific pattern in children. It is well known that infants and children less than 3 years of age sustain lesser injuries due to close parental supervision. However, they generally suffer handler-related injuries like from the fingernail of siblings, mother or caretaker, sewing and knitting needles. Older children injure themselves accidentally by sharp edges and wooden sticks, spikes of toys, pencils, arrows, thorns and stones. Fall during swinging / sliding in parks is an important cause of the perforating ocular trauma.

In our study epidemiological factors in paediatric population and distribution of the patients such as according to age, gender, seasonal variation, place of an accident, object that causes trauma, dexterity, socio-economic status, festivals, seasonal variations, mental status of the patient, habits of patient, vision related ocular co-morbid conditions, literacy of parents, rural and urban difference among the numbers of patients. A marked preponderance of injuries is seen in the 6–10 years age group. Children in this age group are relatively immature and exposed to varying surroundings making them more vulnerable to injuries. Male children are affected more due to their adventurous and aggressive nature [6].

In our study we planned to analyse epidemiology which is defined as[1] the study of the distribution and determinants of health-related states or events in specified populations, and the application of this study to the control of health problems. The word epidemiology comes from the Greek words epi, meaning on or upon, demos, meaning people, and logos, meaning the study).

Methods

This was the prospective analytical study in Tertiary care centre in central India from November 2014-October 2016(Two years). All the selected patients were under the age of 12 years. In our study, epidemiological factors related information was collected from the patients and parents direct interview and history taking in detailed and categorised according to the following points such as age, gender, seasonal variation, place of an accident, object that causes trauma, affected eye of the patient i.e. dexterity , socio-economic status of patient, festivals, seasonal variations, mental status of the patient, habits of patient, vision related ocular co-morbid conditions, time interval between trauma and start of treatment, literacy of parents, rural and urban difference among the numbers of patients. All the patients were under the records and tabulated. Statistical analysis was done using spss software.

Observations & Results of Epidemiology of Paediatric Open Globe Injuries

6912 children up to the age of 12 years from out-patient clinic in the department of ophthalmology at the Government Medical College and hospital Nagpur, Maharashtra, India, from November 2014 to October 2016. We studied total 56 eyes of the 56 numbers of the patient with OGI out of 6912 patients up to 12 years of age only. Our observations and results based mainly on epidemiological factors in paediatric open globe injuries.

The following observations were made:

Table No. 1: Incidence of Paediartic OGI

S.N.	Total patients <12 years	Patients with OGI	Incidence rate
1	6912	56	0.81%

Thus the incidence of paediatric OGI is 0.81% in our study.

Table No. 2: Gender Wise Distribution

S.N.	Gender	Number of patients	Percentage (%)
1.	Boys	36	64.28%
2.	Girls	20	35.72%
	Total	56	100

Among total number of patients <12 years, 56 children had OGI (0.81%). Among them 36 (64.28%) were boys and 20 (35.72%) were girls.

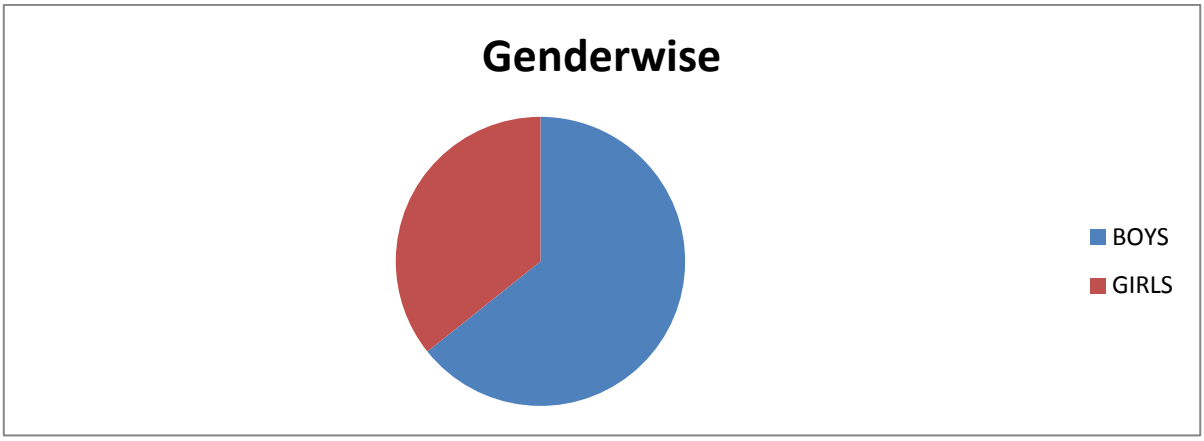


Table No. 3: Age Wise Distribution

S.N.	Age group (Years)	No. of Patients	Percentage
1.	0-3	2	3.57 %
2.	>3-6	16	28.57 %
3.	>6-9	27	48.21 %
4.	>9-12	11	19.65 %
	Total	56	100 %

We divided the patients into four groups as 0-3 ,>3-6 , >6-9 , >9-12 years. In >6-9 years age group we found the majority of the patient i.e. 27 (Table No.3). Majority of patients i.e. 43 children (76.78%) belonged to 3 to 9 year age group.

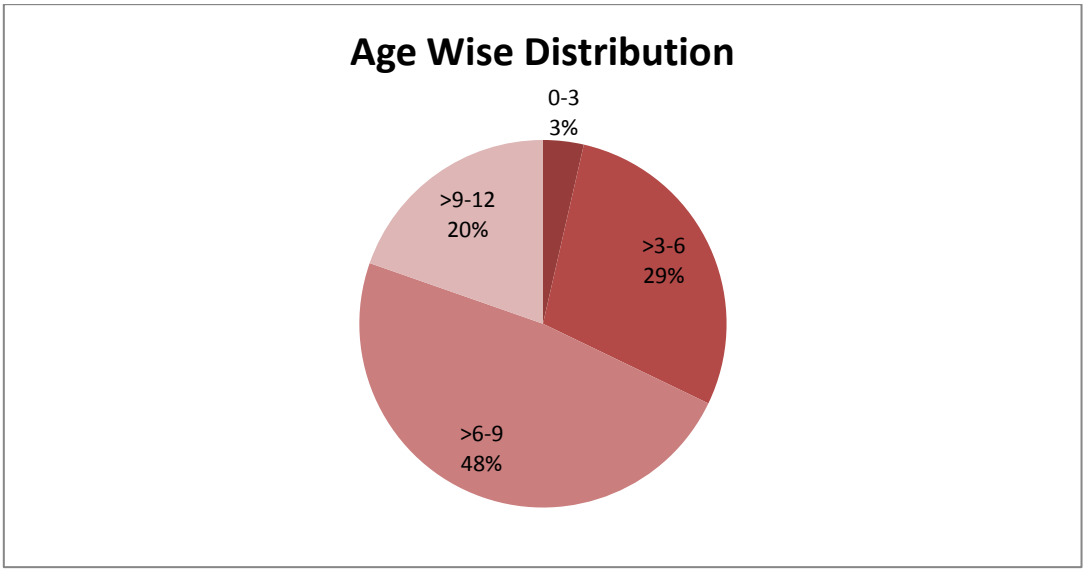


Table No. 4: Distribution as per place of Injury

S.N.	Indoor / Outdoor	Number of patients	Percentage
1.	Indoor	22	39.29%
2.	Outdoor	34	60.71%
	Total	56	100 %

From Table no.4we can say that the rate of occurrence of the injuries is more while playing outdoor owing to their increased activity while playing outdoor and less injuries while being indoor ($p<0.05$) due to more supervision of parents while being indoor.

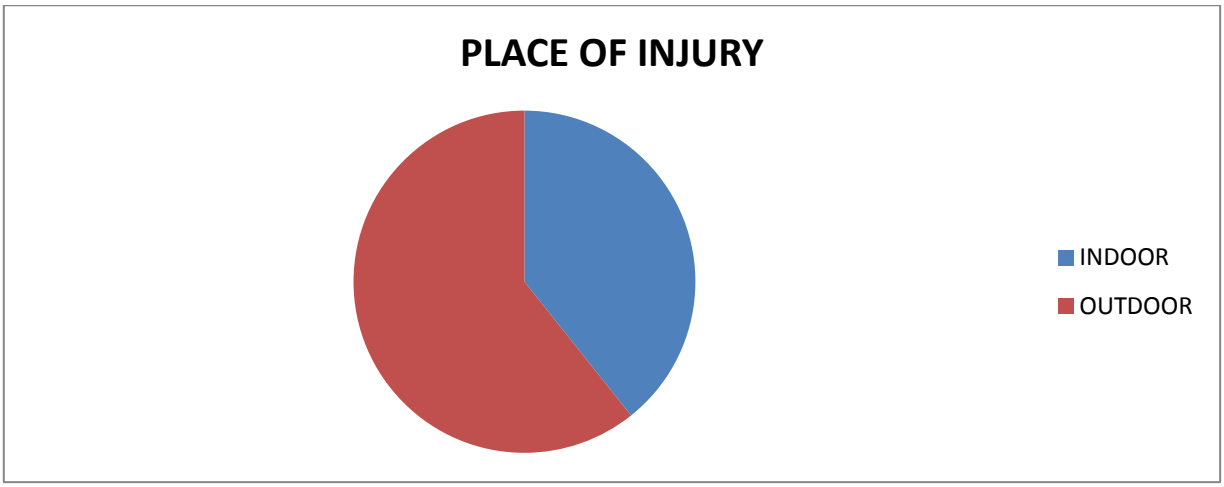
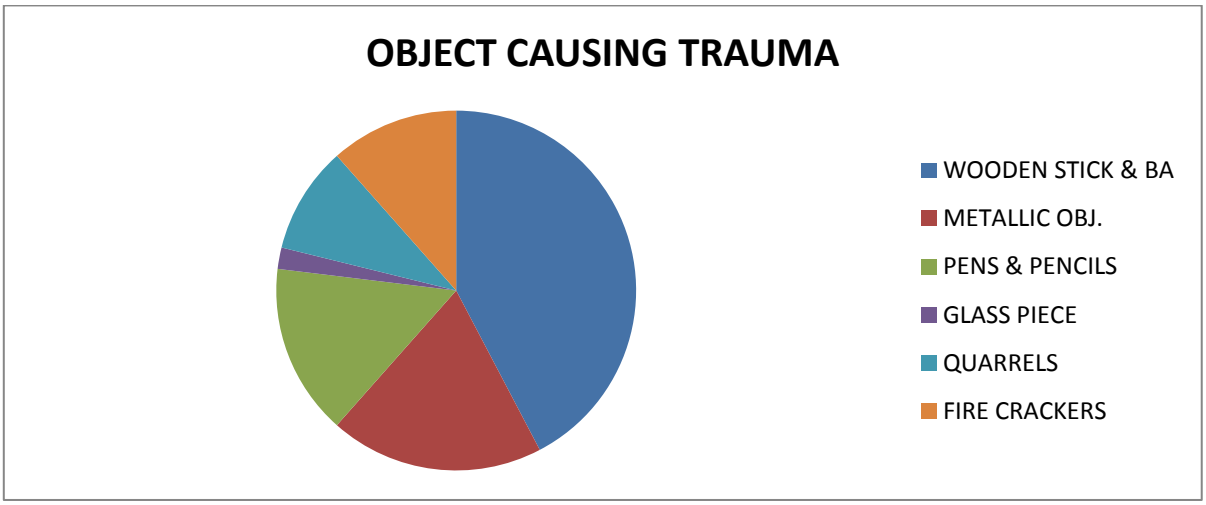


Table No. 5: Object Causing Trauma Wise Distribution

S.N.	Number of patients	Percentage %
Wooden stick including Bow & Arrow	22	39.29 %
Metallic objects	10	17.86 %
Pen & Pencil	8	14.29 %
Glass Piece	1	1.79 %
Quarrels	5	8.93 %
Fire crackers	6	10.71 %
Fall on vegetative matter	3	5.35 %
Fall from bed	1	1.79 %
total	56	100%

Wooden stick (mainly Gulli-Danda & Bow and arrow) is the predominant object causing open globe injuries in 22 children (39.29%). Gulli-Danda is a type of a game in in rural India with two type of wooden sticks are used and small stick i.e. Gulli is being hit by the Danda which carries the high risk injury to other player when being hit. This game is generally played in villages and during this play, there is generally no observation of the parents. Next is the Bow and Arrow, followed by metallic object in 10 children (17.85%) like table spoon, tea spoon , sharp kitchen appliances etc. pens and pencils in 8 children (14.28) while playing or studying, fire crackers in 6 children (10.71%) during festive seasons and quarrels in 5 children (8.92%). A single case of fall from the bed while sleeping (1.78%) in which patient falls on the ground while sleeping.



Abbreviations- BA-Bow and Arrow, OBJ-Objects.

Table No. 6: Season Wise Distribution

S.N.	Season	Number of patients	Percentage
1	Rainy Season	10	17.86%
2	Winter	14	25 %
3	summer	32	57.14 %
	Total	56	100 %

Most of the injuries i.e. 32 occurred in summer (i.e. from March to June) of which 22 occurred in month of May and Juneowing to their increased activity during this vacation period . Rest 14 in Winter out of it 9 mainly in Diwali vacations (Table no.6).

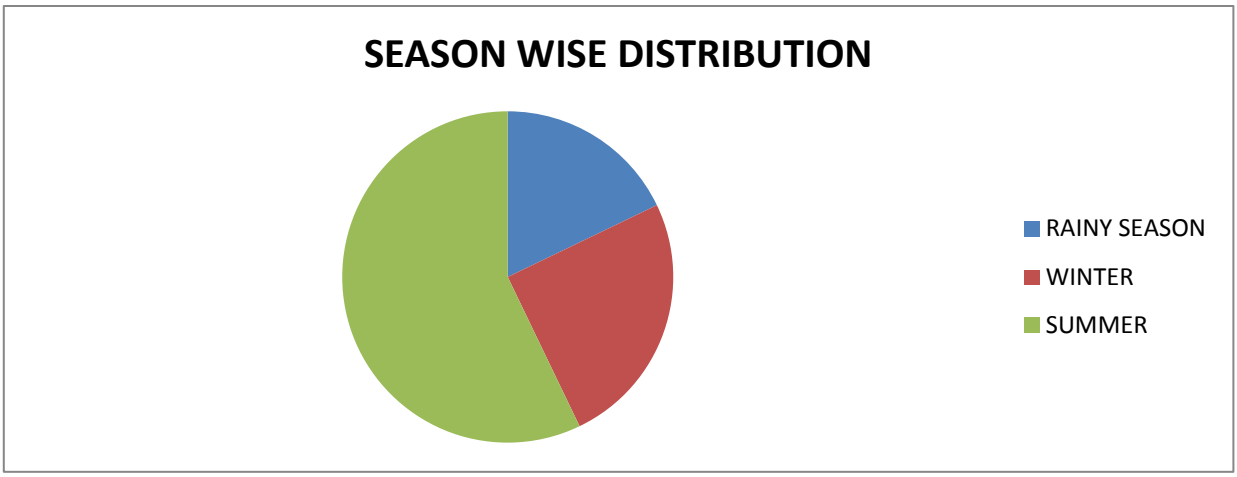


Table No. 7: Time Wise Distribution

S.N.	Time	Number of the patients	Percentage
1.	Day	53	94.65 %
2	Night	3	5.35 %
	total	56	100 %

Only 3 patients were injured in night of which 1 was fall from bed while sleeping and rest 2 was firecrackers related injuries. Rest 53 patients were injured during day time ($p<0.05$) (Table no.7). This can be attributed to their increased activity during the day period.

Table No. 8: Literacy of the parents wise Distribution

S.N.	Literacy of parents	Number of patients	Percentage
1.	Literate	20	35.71%
2.	illiterate	36	64.29.%
		56	100

The literate parents of the patients were only 20, rest 36 were illiterate $p<0.05$ (Table no.8).

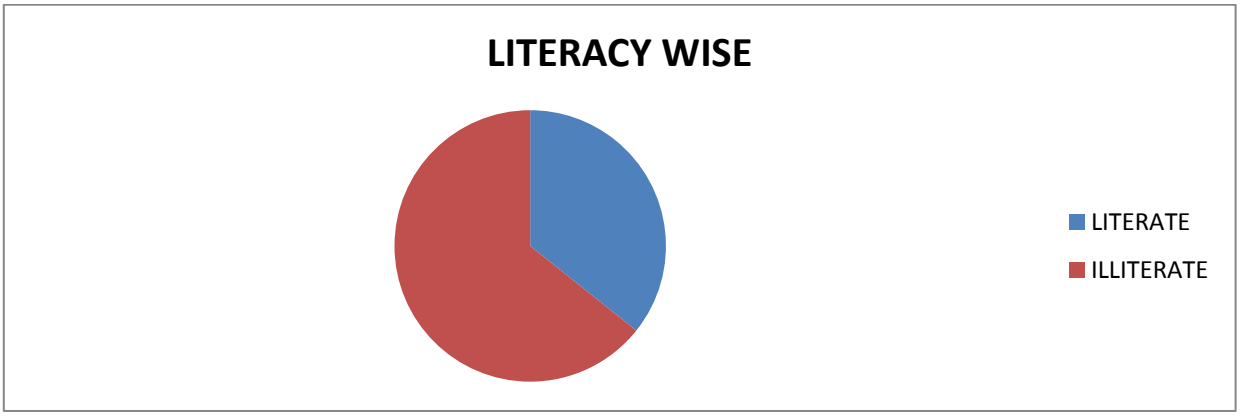


Table No. 9: Rural, Urban Difference

S.N.	Rural / Urban	Number of patients	Percentage
1.	Rural	36	64.29%
2.	Urban	20	35.71%
		56	100%

36 patients were belonging to villages/ rural area and only 20 patients urban area. ($p<0.05$)

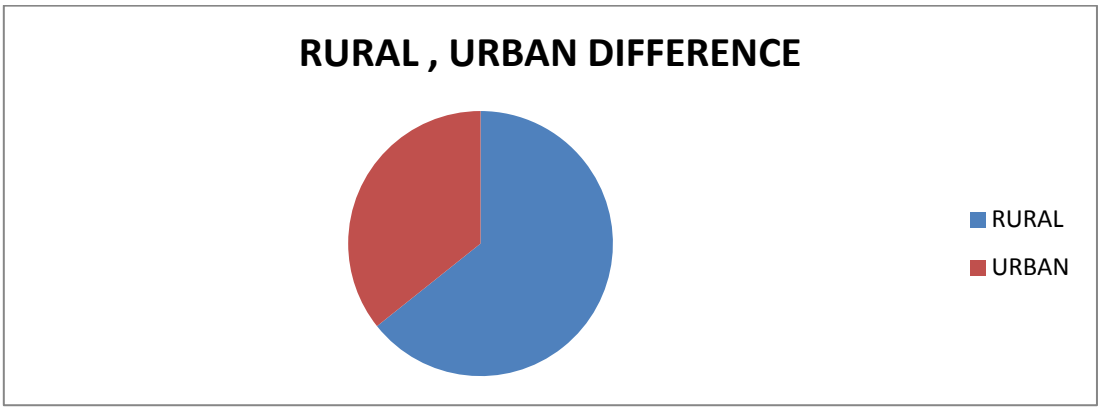
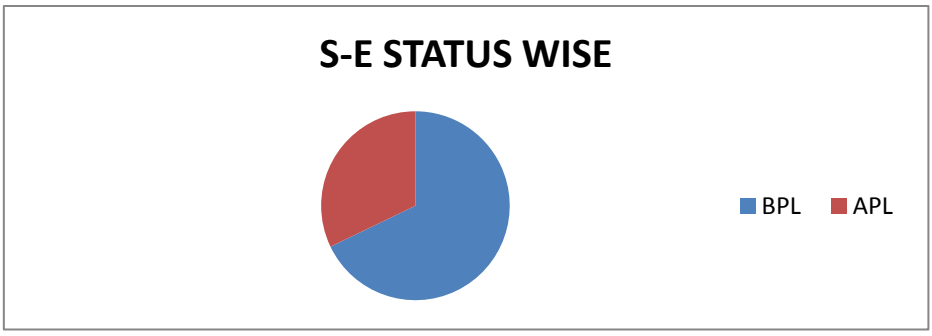


Table No. 10: Socioeconomic status wise Difference

S.N.	S-E Status	Number of patients	Percentage
1	BPL	38	67.86%
2	APL	18	32.14%
	Total	56	100 %

S-E-Socioeconomic, BPL-Below poverty line, APL- Above poverty line.

There were 38 patients who belongs to below poverty line and only 18 patients who doesn't belongs to below poverty line (Table no.10).($p<0.05$)



There was no statistical significance in affected eye of patient and dexterity or among the laterality i.e. left vs. right eye.

Considering the mental status of the patient, all the patients were mentally normal according to their age and as informed by parents and according to the history of their performance in the school and no significant habits were found that will affects the epidemiology such as history of any addiction in form of tobacco or alcohol. There were no vision related ocular co-morbid conditions.

Discussion

In general, children are more susceptible to eye injuries because they have immature motor skills and limited common sense. They have a natural curiosity and are often seen imitating without regard to the risks and outcomes. Although most eye injuries are avoidable by simple preventive measures, many children suffer visual impairment that can affect their psychosocial development.

Age Wise Distribution

From Table No.3

S.N.	Comparison with age group	Age in years
1.	Our study (up to 12 years)	7.06 Years
2.	Baxter RJ, Hodgkins PR, Calder I, et al[7] (up to 16 years)	9 Years, 4 Months
3.	Farr AK, Wilmer Eye Institute, The John Hopkins Hospital, Baltimore[8].(up to 14 years)	8.2 Years
4.	National Cheng Kung University, in Taiwan by Liu M L et al[9] (up to 15 years)	7.1+/-4.4 Years

A retrospective study done by SG Jaison et al in Northern India[10] included 80 children below 15 years of age. 40% of the children belonged to the 6 to 10 years age group.

The study conducted at Birmingham by Baxter RJ, Hodgkins PR, Calder I, et al[7].The mean age in their study was 9 years and 4 months.

A retrospective study done at Wilmer Eye Institute, The Johns Hopkins Hospital, Baltimore[8] included 218 children aged less than or equal to 14 years. Overall mean age was 8.2 years.

Study done at National Cheng Kung University, Hospital in Taiwan by Liu ML et al[9] includes children of 15 years or younger. The mean age of 7.1+/- 0.3 years, for boys was 7.3+/- 4.4 years and for girls was 6.7+/- 4.3 years.

In our study; the mean age was 7.06 years. The mean age among boys was 7.33 years and girl was 6.80 years. 43 (76.78 %) of children were from 3-9 years among them 27 children i.e. 48.21% were from 6 to 9 years age group.

Gender Wise Distribution

Table No.2 gives us gender wise distribution of the patients

S.N.	Studies	Boys	Girls	Ratio
1	National Cheng Kung University, inTaiwan by Liu M L et al[9] A) 6-10 Years B) > 11 Years	106 2.3 : 1 2.5 : 1	50	2.1:1
2	Tejas Desai, Chinmayi Vyas, Suhani Desai et al[11]	145	72	2.08:1
3	Our study C) 6-9 Years D) > 9Years	36 2 : 1 1.75 : 1	20	1.8:1

The study done at National Cheng Kung University, in Taiwan by Liu M L et al[9] had boy: girl ratio of 1.8:1 for children from 0 to 5 years, 2.3:1 for those who were 6 to 10 years, and 2.5:1 for those who were 11 to 15 years old. The overall ratio was 2.1:1.1 for boys and girls respectively. The study done by Tejas Desai, Chinmayi Vyas, Suhani Desai et al[11]found boys:girls ratio of 2.08:1. The predominance of boys was seen in our study. Out of total 56 patients 36 were boys and 20 were girls thus boys to girls ratio is 1.8:1. In 0-3 years we found 1:1 ratio Similar to other studies, most eye injuries occurred among boys, which could be attributed to their more active behaviour and their tendency to spend more time outdoors compared to the girls.

Indoor and Outdoor Wise Distribution

Table No.4 gives us indoor, outdoor wise distribution of the patients

S.N.	Study	Outdoor	Indoor
1	SG Jaison, SE Silas et al[10]	>53%	<47%
2	Mary Esther, John B et al[12]	>59%	<41%
3	Sertaç,Argun Kıvanç et al[13]	>60%	<40%
4	Tejas Desai, Chinmayi Vyas[11]	>54%	<46%
5	Our study	60.71%	39.29%

In our study outdoor injuries were 34, with 23 boys and 11 girls with ratio is 1.9:1. Indoor injuries was 22. Thus the indoor to outdoor injury ratio was 1.6:1.

Object Causing Trauma Wise Distribution

Table No.5

S.N.	Studies	Wooden stick including Bow-Arrow	Other common objects
1	Mary Esther, John B et al[12]	41.6%	Metallic object
2	Tejas Desai, Chinmayi Vyas[11]	33%	Metallic wire
3	SG Jaison, SE Silas et al[10]	47.2%	Domestic accidents
4	Our study	39.29%	Metallic objects

Our study showed that wooden stick, Bow and Arrow is the predominant object resulting in open globe injuries in 22 patients (39.28%), second most common object causing trauma was metal in 10 patients (17.85%) followed by Pen and Pencils in 8 patients (14.28), and fire crackers in 5 patients (8.92%), quarrels in 5 patients (8.92%), glass objects in 1 patient (1.78%), fall on vegetative matter/object accounted for 3 patients (5.35%) of injuries and 1 patient who fall from bed in night while sleeping with her mother (1.78%). The study done by SG Jaison et al[10] in Northern India showed sports was the most common mechanism (52.8%) resulting in open globe injuries. Main sports resulting in trauma were playing with bow and arrow and gulli-danda (47.2%). Domestic accidents resulted in 31.5% of injuries. Fire crackers caused 15.7% of injuries.

The study done by Rohit Saxena et al[14] included 204 children, showed that the most common object causing injury was bow and arrow(15.2%).Liu ML et al in Taiwan[15] unspecified sharp object caused 16.7% of injuries followed by scissors which caused 13.5% of injuries. Children playing with Wooden-sticks is a common scenario in developing countries, which can result in blindness. Parents literacy also found to important factor amongst the injuries.

Season and Festival Wise Distribution

Table No.6 gives us season wise distribution of the patients

S.N.		Festive season % of injuries	Vacations
1	Mac Ewen CJ, Baines PS et al[17]	14%	Yes
2	Mansouri MR, Mohammadi SF et al[16]	14.8%	Yes
3	Our study	16.07%	Yes

In India, during Diwali festival season have more chances of fire-cracker injuries (8%) and chemical injuries by colored water balloons and lime during Holi. Mostly lack of eye protection is responsible for this[78]. In our study we also came to know that festive seasons and vacations also play important role in causation of the paediatric OGI.

Distribution of ocular trauma in study of Jaun C. Serrano, Patricia Challela, Jaun D.Arias[18]showsin the 5-year study shows the clusters in November, December, and January and in August and September stand out with the highest number of eye injuries, especially in boys, suggesting a seasonal variation. A possible explanation for the first identified cluster is that children are generally out of school during November, December, and January. In addition, during this quarter and owing to Christmas and New Year's holidays, access to fireworks for private use is common and unrestricted, a situation that has gradually changed after the study period. Children also spend more time outside playing with friends and neighbours, with less adult supervision. Although schools also have a mid-year vacation period during June and July.[18]

In our study 32 patients were injured during the summer amongst them 22 were injured in the period of summer vacation . 14 patients were injured during winter season of which 9 were injured during Diwali vacation, of which 6 were related to injury due to the fire crackers which are commonly used in India during this festival.

Literacy and poverty of parents wise Distribution

Table No.8 and 10

S.N.	More Illiteracy and Poverty of parents	Yes / No
1	Pradeep Addagadde, Venkataramana et al[19]	Yes
2	Yu Meng and Hua Yan[20]	Yes
3	Our study	Yes

A study done by Pradeep Addagadde, Venkataramana et al[19]and Yu Meng and Hua Yan[20]found that literacy of the parents and the socioeconomic status of the parents has association in paediatric OGI. In our study we also found that the poverty has epidemiological impact on occurrence of open globe injuries[20]. Out of 56 patients 38 patients were belonging to the below poverty line and 18 were above poverty line.

Majority of the trauma cases were accidental in nature as a result of natural curiosity and clumsiness in children. A small percentage was due to quarrels amongst the children. Reported cases of trauma due to assault were found in older children who were involved in group fights.

BCVA at presentation

Table No.13showing BCVA at presentation:

Study	Mary Esther, John B et al[12]	Cecilia O, Ojabo et al[14]	Our study
>6/18	25.6%	28.7%	28.57%
Rest of the patients	74.4%	71.30%	71.43%

In most of the studies the BCVA at presentation is <6/18, a study by Mary Esther, John B et al[12]shows that 25.6% of the patients presented with VA>6/18 at presentation. A study by Cecilia O, Ojabo et al[14] shows that 28.7% of the patients presented with VA>6/36 at presentation and thus our study with 28.57% patients with >6/18 at presentation is comparable.

Thus from above discussion we can say that, most of the paediatric OGI are vision threatening and blinding in nature but are preventable in nature. Thus the thorough understanding in the cause by mean of the epidemiology, we can develop the preventive safety measures, community education, literacy and awareness programs which will help to decrease this types of the injuries in the future.

Conclusion

Open globe injuries that are suffered in childhood generally occur either at home, in the yard, or on the street, with wooden sticks/objects being the most common cause of injury. The initial visual acuity is one of the most important determinants of the final visual acuity. Open globe injuries are the common cause of monocular preventable blindness world-wide in paediatric population. This study was able to provide a better understanding of epidemiology of Open globe injuries in paediatric patients in tertiary care centre. The recommendation is that community education is an essential part in prevention. Efforts to prevent ocular injuries should particularly be directed toward improving established habits and taking care during playing outdoor and at home. The necessity of seeking professional medical

help immediately after injury and the danger of delaying treatment should also be stressed. Adult supervision is an important factor in the prevention of eye injury in paediatric group. Public education and use of protective safety measures are recommended to alleviate the problem.

Thus we can say that the most common cause of injuries found to be wooden sticks, while playing outdoor, during daytime, more in boys than girls with mean age 7.06 years, in lower socio-economic status, more in rural area in patient of illiterate parents.

Prevention of penetrating ocular injury requires greater education of community, parents and children and their care takers especially on the potential dangers within the home.

A vast majority of ocular trauma in children is preventable. Effective and targeted preventive strategies will helps in reducing their incidence with the help of thorough understanding of the epidemiology.

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