Original Article

**Pattern of Ocular and Adnexal Injuries Requiring
Surgical Intervention among Children in a Tertiary
Center in North-Central Nigeria: A 14 Year Review**

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ABSTRACT

The study assessed the pattern of ocular and adnexal injuries that required surgical intervention among children with the aim of strengthening preventive, curative and promotive eye care services. The ophthalmic surgical database of the facility was retrospectively reviewed to obtain information on children who had surgical intervention due to trauma from 1st January 2004-31st December 2017; these included demographic data; diagnosis, procedure and the type of anaesthesia administered. Epi Info software, version 3.4 was used for analysis. A total of 361 children (aged <18 years) underwent a surgical procedure as a result of ocular trauma within the stated period. There were more males 255(70.6%) than females 106(29.4%) with a male:female ratio of 2.4:1. The mean age was 7.7 ± 3.5 years, 356(98.6%) participants had general anaesthesia administered, 267(73.9%) were aged ≤ 10 years. The main indications for surgical intervention were corneal laceration 143(39.6%), traumatic cataract 99(27.4%), corneo-scleral laceration 34(9.4%), lid $\pm$ canaliculal laceration 21 (5.8%), intraocular foreign body 16(4.4%), ruptured globe 14(3.9%) and limbal rupture 11(3.1%). A higher proportion of males had corneal laceration 104(40.8%, $p=0.40$), intraocular foreign body 13(5.1%, $p=0.25$) and ruptured globe 12(4.7%, $p=0.17$) while a higher proportion of females had traumatic cataract 35(33%, $p=0.14$), lid laceration 4(3.8%, $p=0.76$) and scleral laceration 2(2.8%, $p=0.33$). The observed differences were however not statistically significant. Of 21 participants who had lid injuries 14(66.7%) were aged ≤ 5 years. Of 14 participants who had ruptured globe, 8(57.1%) were aged 11-17 years. We observed that a male child is twice more likely to have an ophthalmic surgery due to trauma.

Keywords: Adnexa, Ocular, Paediatric, Surgery, Trauma.

INTRODUCTION

Trauma can be defined as "bodily lesion at the organic level, resulting from acute exposure to energy (mechanical, thermal, electrical, chemical or radiant) in amounts that exceed the threshold of physiological tolerance".¹ Eighteen million people worldwide have unocular blindness from traumatic injury. Injuries are disproportionately more common in childhood.² Eye trauma is the most common cause of unilateral blindness in

children.² The number of serious eye injuries in children has been estimated at 11.8 per 100,000 per year, at least 35% of all serious eye injuries occur in children.²⁻³ Ocular adnexal injuries that could necessitate surgical intervention include laceration of the eyelid, conjunctival and lacrimal drainage system. Ocular trauma can be broadly classified into two. 'Closed globe' and 'open globe' injuries. Ocular injury that occurs when there is

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no full thickness wound of the cornea and sclera is termed “closed globe injury”⁴, while open globe injury refers to ocular injury which occurs when there is a full thickness wound of the cornea/sclera.⁵ Closed globe injuries comprise contusive and lamellar lacerations while open globe injuries comprise laceration and rupture. Globe laceration can be further subdivided into penetrating injuries, perforating injuries and injuries with retained intraocular foreign bodies. A laceration of the globe that has only an entry point is referred to as “a penetrating injury”. The causative agent enters the eye but does not pass all the way through.⁵ When there are two full thickness lacerations (an entry point and an exit point) caused by the same offending agent, it is termed a perforating ocular injury.⁴ In simple lacerations, the eye is injured with a sharp object. Virtually any object imaginable has been responsible at one time or another for an ocular laceration. Very young children usually suffer ocular injury when they fall on sharp objects, such as pencil, nail or toothpick. Older children may suffer eye wall lacerations from glass (particularly when they wear spectacles) and projectiles.⁵⁻⁷ Bottle rockets and knives are other common causes. Unusual causes include the peck of a chicken which carries the risk of endophthalmitis caused by unusual bacterial species from the bird’s beak.

When a globe is ruptured, it is pushed or squeezed so hard that the coats of the eye break under pressure. The results are usually devastating, with partial or complete expulsion of intraocular contents. Expulsion is facilitated due to the increase intraocular pressure followed by a sudden decompression through a hole in the wall of the eye. Events that can cause ruptured globes include encounters with large, usually blunt, objects. A fist fight can result in a ruptured globe, as can injury from the force of a small projectile, such as a handball, squash ball, racquetball or baseball. Eyes are more likely to be ruptured or lacerated in areas where the sclera or cornea are thinnest. The areas under the insertions of the recti and superior oblique muscles and also the corneo-scleral limbus are thin and more likely to give way under pressure. Globe lacerations could be anterior or posterior. Anterior locations of injuries generally carry a better prognosis. Injuries anterior to the pars plana (located approximately 5mm posterior to the limbus) will not cut the retina and therefore carry a better prognosis.⁶ Posterior injuries cut the retina and often result in a complicated retinal detachment. Although these retinal detachments may be amenable to treatment, they carry a far worse prognosis than if the laceration were anterior.

The diagnosis of penetrating eye injury is obvious when a laceration is apparent. Clues to occult penetration include subconjunctival haemorrhage, distorted pupil, wrinkled lens capsule and lowered intraocular pressure, particularly compared to pressure in the fellow, uninjured eye. The child’s or family’s history may or may not corroborate the physical findings.

Closed globe injuries that may necessitate surgical intervention include traumatic hyphaema and traumatic cataract. Traumatic cataracts can occur either as a result of a sharp penetrating injury to the lens or a blunt concussive force.⁷ Traumatic cataracts may occur immediately after the injury, or may occur days to even years after a concussive blow. So long as the child is beyond the age when amblyopia can develop, the initial repair of a corneal or scleral laceration can be followed at a later date with the removal of the lens if the anterior capsule is intact. This ‘wait-and-see’ strategy has no deleterious effects on the child other than the necessity for a second general anaesthetic.

Aim

To assess the pattern of ocular and adnexal injuries that required surgical intervention among children for the purpose of further strengthening preventive, curative and promotive eye care services.

MATERIALS AND METHODS

The ophthalmic surgical database of our eye care facility was retrospectively reviewed to obtain information on children who had surgical intervention due to trauma from 1st January 2004-31st December 2017. These included demographic data; preoperative diagnosis, surgical procedure, type of anaesthesia administered and the rank of surgeon. The data was entered into Epi Info statistical software, version 3.4 and analyzed after validation by double entry. Descriptive statistics was used to yield frequencies, percentages and proportions. Analytical statistics was applied and a p value <0.05 was considered statistically significant. Ethical approval was obtained from the Institutional Medical Research Ethics Committee.

RESULTS

A total of 361 children (aged <18years) underwent a surgical procedure as a result of ocular trauma within the stated period. There were more males 255(70.6%) than females 106(29.4%)

with a male:female ratio of 2.4:1 (Table 1). The observed difference in the distribution of participants by gender was statistically significant ($\chi^2=122.8$, $p<0.001$). The mean age was 7.7 ± 3.5 years. Table 1 also revealed the highest proportion of participants 147(40.7%) were aged 6-10 years, and 267(73.9%) were aged ≤ 10 years.

Table 1: Age -sex distribution of children with ocular injuries that required surgical intervention

Age Group (years)	Male		Female		Total	
	No	%	No	%	No	%
<1	6	2.4	1	0.9	7	1.9
1-5	72	28.2	41	38.6	113	31.3
6-10	102	40.0	45	42.5	147	40.7
11-15	64	25.1	15	14.2	79	21.9
16-17	11	4.3	4	3.8	15	4.2
Total	255	100	106	100	361	100

Up to 356(98.6%) persons had general anaesthesia administered while only 5(1.4%) had local anaesthesia administered ($\chi^2=682.6$, $p<0.001$). A significantly higher proportion 298(82.5%) of children had their procedure performed by an ophthalmologist-in training while 63(17.5%) had it done by a consultant ophthalmic surgeon ($\chi^2=591.2$, $p<0.001$). The main indications for surgical intervention were corneal laceration 143(39.6%), traumatic cataract 99(27.4%), corneo-scleral laceration 34(9.4%), lid $\pm$ canalicular laceration 21 (5.8%), intraocular foreign body 16(4.4%), ruptured globe

14(3.9%) and limbal rupture 11(3.1%). Lacerations involving the outer fibrous coat of the eye were an indication for surgery in 204(56.5%) participants while traumatic cataract (with and without comorbidity) was an indication in 105(29%) persons. Table 2 revealed a higher proportion of males had corneal laceration 104(40.8%), intraocular foreign body 13(5.1%) and ruptured globe 12(4.7%). A higher proportion of females had traumatic cataract 35(33%), lid laceration 4(3.8%) and scleral laceration 2(2.8%). None of the observed differences between males and females was statistically significant. A total of 2 children sustained injuries to both eyes thus 363 eyes were operated. A seven year old male child had both eyes mutilated in an attempt to remove his eyes for ritual practice; another child had bilateral lid laceration. A total of 372 procedures were performed on 363 eyes of 361 children, 9 eyes had more than 1 procedure. The most common surgical procedures were corneal repair 152(41.0%), cataract extraction/lens washout 105(28.3%), corneo-scleral repair 34(9.2%) and lid $\pm$ canalicular repair 25(6.7%). Procedures on the outer fibrous coat of the eyes (limbal repair, corneal repair, corneo-scleral repair and scleral repair) accounted for 204(54.8%) of all procedures (Table 4).

Of 21 participants who had lid $\pm$ canalicular injury 14(66.7%) were aged ≤ 5 years. And of 14 participants who had ruptured globe, 8(57.1%) were aged 11-17 years (Table 3).

Table 2: Distribution of type of ocular injury by gender

Type of ocular trauma	Male		Female		Total		*Test statistic/ p value
	Freq	%	Freq	%	Freq	%	
Foreign body on the eyelid	1	0.4	0	0	1	0.3	0.4, $p=0.52$
Lid $\pm$ canalicular laceration	14	5.4	7	6.6	21	5.8	0.15, $p=0.76$
Limbal rupture	7	2.7	4	3.8	11	3.1	0.31, $p=0.61$
Corneal laceration	104	40.8	39	36.8	143	39.6	0.53, $p=0.40$
Corneo-scleral laceration	23	9.0	11	10.4	34	9.4	0.15, $p=0.58$
Scleral laceration	4	1.6	3	2.8	7	1.9	0.61, $p=0.33$
Corneal and lid lacerations	2	0.8	1	0.9	3	0.8	0.02, $p=0.64$
Corneal laceration and traumatic cataract	5	2.0	1	0.9	6	1.7	0.56, $p=0.41$
Traumatic hyphaema	5	2.0	0	0	5	1.4	2.12, $p=0.17$
Traumatic cataract	64	25.1	35	33.0	99	27.4	2.4, $p=0.14$
Intraocular Foreign body	13	5.1	3	2.8	16	4.4	0.95, $p=0.25$
Ruptured globe	12	4.7	2	1.9	14	3.9	1.66, $p=0.17$
Orbital FB	1	0.4	0	0	1	0.3	0.4, $p=0.52$
Total	255	100	106	100	361	100	

*Chi Square test/Fischer's exact test

Table 3: Distribution of type of ocular trauma by age group

Age group	FB on the eyelid, Globe & orbit	Lid ± canalicular laceration	Limbal rupture	Corneal laceration	Corneo scleral laceration	Scleral laceration	Corneal and lid laceration	Corneal laceration & traumatic cataract	Traumatic hyphaema	Traumatic cataract	Ruptured globe	Total
<1	1(5.5)	1(4.8)	0(0)	2(1.4)	1(2.9)	1(14.3)	0(0)	0(0)	0(0)	1(1.0)	0(0)	7(1.9)
1-5	7(38.9)	13(61.9)	2(18.2)	52(36.3)	11(32.4)	1(14.3)	2(66.7)	3(50.0)	2(40)	19(19.2)	1(7.1)	113(31.3)
6-10	6(33.3)	2(9.5)	6(54.5)	58(40.6)	13(38.2)	4(57.1)	1(33.3)	1(16.7)	2(40)	49(49.5)	5(35.7)	147(40.7)
11-15	3(16.7)	4(19.0)	3(27.3)	29(20.3)	7(20.6)	0(0)	0(0)	2(33.3)	1(20)	24(24.2)	6(42.9)	79(21.9)
16-17	1(5.6)	1(4.8)	0(0)	2(1.4)	2(5.9)	1(14.3)	0(0)	0(0)	0(0)	6(6.1)	2(14.3)	15(4.2)
Total	18(100)	21(100)	11(100)	143(100)	34(100)	7(100)	3(100)	6(100)	5(100)	99(100)	14(100)	361(100)

Table 4: Distribution of types of surgical procedures

S/no	Type of surgery	No	%
1	Foreign body removal from/eyelid/globe/orbit	18	4.8
2	Lid ± canalicular repair	25	6.7
3	Limbal repair	11	3.0
4	Corneal repair	152	40.9
5	Corneo-scleral repair	34	9.1
6	Scleral repair±cryotherapy	7	1.9
7	Anterior chamber paracentesis	5	1.3
8	Cataract extraction/lens washout	105	28.2
9	Evisceration	15	4.0
	Total	372	100

DISCUSSION

Generally speaking, children are more prone to severe ocular injuries due to their immature motor skills and their tendency to imitate adult behavior without anticipating the attendant risks coupled with ignorance and natural curiosity. The relative inability of younger children to detect and avoid hazards is also contributory.⁸⁻⁹ This study revealed that over two-thirds (70.6%) of participants were males. This is comparable to related studies in Nigeria which showed a range of 63%-72.2%.¹⁰⁻¹⁶ This preponderance of the male gender is also in consonance with global findings that males (even in the pediatric age group) are more prone to ocular injuries compared with females with proportions ranging from 60% to over 70% reported in literature.¹⁷⁻²³ We observed that a male child is twice more likely to have an ophthalmic surgical intervention due to trauma compared to a female child. In our setting, boys are generally allowed more liberty than girls and tend to spend more time outside with their peers, with less parental supervision. Boys are allowed and even encouraged to exhibit more aggressive behavior as part of their normal development.²⁴⁻²⁵

The mean age of this study group (7.7±3.5years) is also comparable to 7.73 years reported by Kyari *et al.* but lower than 8.7 years and 9.7 years reported by Adio *et al.*¹² and Ojabo *et al.*¹⁰ respectively. The composition of the study population

may be responsible for the difference in the mean age. We observed that close to three quarters (73.9%) of participants were aged ≤10 years. This is in agreement with report of studies in both developing and developed countries that the majority of eye injuries occur in children under the age of 12 years.^{8,9,26-29} Lacerations involving the outer fibrous coat (a total of 56.5%) and traumatic cataract (a total of 29%) were the most common ocular injuries that required surgical intervention. This is similar to findings by Adio *et al.* Okeigbmen *et al.*, Ojabo *et al.*, and Kyari *et al.*,^{10-12,14} Up to 3.9% of participants had ruptured globe. This is less than 10.3% reported by Ojabo *et al.*, in Makurdi, 5.1% reported by Kyari *et al.*, in Kaduna and but higher than 1.9% reported by Okeigbmen in Benin City all in Nigeria.^{10,11,14}

When the intraocular contents are affected, ocular trauma carries a poor prognosis.³⁰⁻³¹ Once a laceration or globe rupture is diagnosed, emergency surgery is indicated, but the patient's overall health status should not be ignored. The eye laceration may accompany head trauma or other injuries. The main goal of surgery is repair of the laceration. With anterior lacerations, prompt closure and re-evaluation of the patient's vision and ocular status in the ensuing several days is advisable.³² The prophylactic use of antibiotics that cover against a broad range of infectious organisms is recommended. The prompt closure of an eye wall laceration would seem to be adequate to greatly reduce the risk of traumatic endophthalmitis.³² Additionally, corneal sutures in children attract blood vessels and scarring much more quickly than in adults. Sutures may need to be removed in a matter of weeks in young children. Failure to remove sutures may result in a completely vascularized cornea which impedes vision.³²

Posterior lacerations almost always cut through the retina. Even so, the initial goal of surgery is wound closure. Most authorities do not use cryosurgery or scleral buckling at initial surgery. The trauma alone is enough to cause a retinal scar around a

break. Management continues even after successful closure and repair of the wound.³²

Surgical management of traumatic cataract consists of removal of a visually significant opaque lens. If a lens is removed at the same time that an eye wall laceration is closed, it may be safer to avoid simultaneous lens implantation but simultaneous corneal repair, lens aspiration, and posterior chamber lens implantation has its advocates.³³ The reason for caution is that the implant could conceivably foster survival of bacterial organisms which penetrated the eye as a result of the trauma.

Without doubt, anterior lacerations carry a better prognosis than posterior lacerations. But in young children, with the risk of amblyopia, the prognosis may not be so good, even with anterior lacerations. When anterior lacerations are combined with cataract, the prognosis worsens.³⁴ The prognosis also is highly dependent upon success in the management of amblyopia or the potential for amblyopia.

Hyphaema is the presence of red blood cells in the anterior chamber of the eye. Blunt or penetrating ocular trauma is a common cause.³⁵ It was an indication for surgical intervention in 5(1.4%) participants, of whom all 5(100%) were male. This is comparable to a proportion of 86.7% reported by Uhumwangho in Benin City.³⁶

CONCLUSION

We observed that most ocular traumas that required surgical intervention were preventable. A male child is twice more likely to have an ophthalmic surgical intervention due to trauma. The best form of management for ocular trauma is prevention.

Recommendation

We therefore recommend an extensive public enlightenment campaign that will focus on safety measures to prevent ocular injuries among children. It includes the following:

Encourage the wearing of suitable safety glasses or goggles by players who participate in games involving a small ball.^{37, 38}

Encourage parents and teachers to supervise play and sport when sharp objects (fencing, archery, etc) are used and teaching young people with respect to the use of handguns, air guns and all projectiles.

Emphasis must also be laid on the dangers associated with letting young children have unsupervised access to household implements such as nails, bottles, brooms, knives etc. Children

must be discouraged from playing with stones, catapult, bottles, knives, sticks, pencils, biros, and all sharp toys.

Knowledge of where the injuries occur helps.³⁹ Most injuries occur in the home, therefore parental education must be a priority. Furthermore, enforcing road safety rules and encouraging peaceful coexistence in the community will all help in preventing ocular injuries among children. Preventive, promotive and curative eye health services for the paediatric age group should be further strengthened.

Conflict of interest

None declared.

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