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Eye ball deviation patterns in traumatic cataract among children in Uttar Pradesh of India

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ABSTRACT

Background: Paediatric cataract is an important cause of treatable childhood blindness, provided it is recognized and managed early. Timely diagnosis, management, and visual rehabilitation of a child with a paediatric cataract are crucial determinants of a favourable prognosis. This particular topic, study of pattern of deviation of eye ball after traumatic cataract in children was selected because of the difference between the firm literature of Keith Lyle and the clinical observations.
Materials and Methods: This study includes analysis of 25 patients.
Results: The key findings of this study were: Maximum incidence of traumatic cataract was seen in 6-10 years of age group, that too more commonly in boys and it was 2.5 times more than that of girls. Incidence of perforating injuries leading to cataract was 1.5 times more common than blunt trauma. In paediatrics cataract, the Diminution of vision in cases of traumatic cataract is usually at the level of mature or hypermature cataract. 40% of cases showed deviation in the range of 11-20° (irrespective to divergence or convergence). There was higher incidence of Exotropia than esotropia.
Conclusion: Originally eye was divergent as per evolution of binocular vision in primates & our study also came out with a conclusion that when there is no force or compulsion of binocular Vision, most of the eyes tended to be Divergent in children after traumatic cataract.

1. Introduction

Ocular Injury whether blunt or penetrating specially in paediatrics age group is not an uncommon problem in Indian Setup. An Inter-professional team approach involving paediatric ophthalmology specialty-trained ophthalmic surgeons, paediatricians, anesthetists, optometrists, nurses along with informed and motivated parents can bring about the best possible visual outcome.[1]

A paediatric cataract often presents with Leukocoria, strabismus, and nystagmus as common presenting signs.[1] Paediatric traumatic cataract should be treated in time to attenuate the complications, and education on paediatric traumatic cataract and improvements in paediatric health care are needed for the early detection of cataract in children.[2] Patients with traumatic cataract if managed appropriately can have best possible visual outcome. Young males are often commonly affected. Taking protective measures in sports and work as well as patient education can avoid ocular trauma and traumatic cataract formation.[3]

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In traumatic cataract there is a clouding of the lens that may occur after either blunt or penetrating ocular trauma that disrupts the lens fibers. Most traumatic cataracts are intumescent, but their type and clinical course depend on trauma mechanism and the integrity of the capsular bag. The morphology of a classic traumatic cataract is often referred to as a rosette or stellate type.[4] It is also important to note lens position, presence of phacodonesis, and anterior capsule rupture. These features help confirm whether there is zonular injury and determine the urgency of performing cataract extraction.[5]

In one study[5] Male children were more prone to traumatic cataract than female children. Open globe injury with corneal laceration and opacity was the major cause of decreased visual acuity.[6] In one study the posterior chamber IOLs can be safely implanted by experienced surgeons in most children older than 2 years with traumatic cataract.[7] Elongation of the eyeball is significantly greater in penetrating trauma than in blunt trauma. Trauma at a younger age; presentation at a later age and penetrating type of trauma are statistically significant factors associated with an increase in axial length in the traumatic eye.[8] Anterior segment damage is the main cause of visual morbidity in paediatric ocular trauma. Injuries with sharp objects occur twice as often as blunt trauma and reduce vision with residual corneal scarring in about two-thirds of patients. Understanding the pattern of eye injuries is useful in determining the strategies required to protect children's eye health.[9]

Paediatric traumatic cataract should be treated in time to attenuate the complications, and education on paediatric traumatic cataract and improvements in pediatric health care are needed for the early detection of cataract in children.[10] In one study children with posttraumatic cataracts, final visual acuity was not affected by patient age and gender; trauma type, cause, and zone; duration between the time of trauma and cataract surgery; surgical method used; and time, location, and type of intraocular lens (IOL) implantation.[11]

Despite the availability of few studies in paediatrics traumatic cataract the area of eye ball deviation patterns has largely being untouched, leading to a research gap, which was attempted to fulfill by authors in this article.

1.1. Rationale of study

This particular topic, study of pattern of deviation of eye ball after traumatic cataract in children was selected because of the difference between the firm literature of Keith Lyle and the clinical observations. According to Belchowsky and Chavasse - A congenitally blind eye tends to diverge as it never acted Convergent in act of binocular Vision-supporting of Lyles statement.

2. Materials and Methods

2.1. Definition of traumatic cataract

Both penetrating and non-penetrating Injuries may cause cataract formation. Concussion of the lens without rupture of capsule, may result in a cataract that is initially subcapsular & has star shaped apperance. In this anterior and posterior subcapsular fibres are affected except in severe cases. These subcapsular opacities sink down in the lens as age advances. So following operational definition of traumatic cataract was used.

2.2. Operational definition of traumatic cataract

Any child with a history of eye trauma (Blunt or Penetrating) leading to resultant break in anatomical configuration of crystalline lens leading to hydration & opacification of lens.

3. Materials and Methods

The present study comprises of 25 patients out of which majority of the patients were seen in out-patients department of Ophthalmology, while few were admitted in indoor department of ophthalmology, SMMH Govt Medical college, Saharanpur UP from 1^{st} September 2021 to 31^{st} May 2022, who were diagnosed as a case of traumatic cataract. After receiving the patients, they were analysed in the following manner

3.1. History

The following history for this study was taken from patient/relative:

1. Name
2. Age
3. Sex
4. Occupation
5. Address (Rural/Urban)
6. Mode of trauma, Date of Trauma
7. Status of the eye and complaints after trauma.
8. Course of diminution of vision
9. Treatment taken – Medical
10. Surgical
11. Status of eyes before trauma i.e. whether there was any pre-existing squint or not.

3.2. Examination

Hirschberg test was used for examining eye of children, which is a simple method of taking an approximate quantitative deviation in an eye, as children were supposed to be examined, this test was more practical and feasible for them. The study tried to see types of deviation (Endo, Exo, or Ortho) rather than simply measuring exact angle. So main

puropose of study was to see traumatic cataract outcomes and its conservative management (as most cases have poor visual outcomes, so less patients undergo surgery).

The following tools were adopted for this study:

1. Visual acuity – PL, PR, HM, FC, Suellen's Chart.
2. Tension
3. Slit Iamp examination for-
4. Corneal opacity
5. Depth of anterior chamber
6. Signs of anterior uveitis
7. (Synechie etc.)
8. Status of lens.
9. Ocular position by Hirschberg's method.
10. Ocular movements – to differentiate or rule out any muscle palsy.
11. Orthoptics checkup (if required)
12. Fundus –other eye
13. Retinoscopy – other eye
14. A scan ultrasonography
15. Radiological investigations (if required)

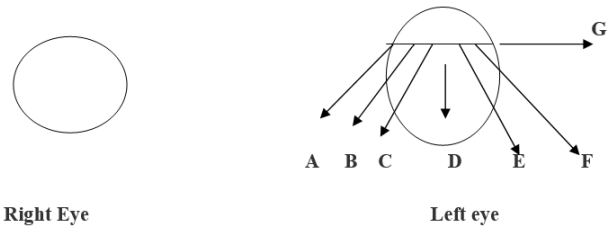

Fig. 1: Method of examination of eye

3.3. Quantitative estimate of ocular deviation

Normally light was thrown on both eyes open and Researcher saw the reflection of torch light in both eyes. When Right eye is normal its reflection seen Central. But in Left eye Divergence may be from A to G points (A-45 degree, B-30 degree, C-15 degree, D- Nil, E-15 degree Convergent, F-30 degree Convergent degree, G-45 degree Convergent.) In this way the clinical estimate of amount of deviation was done.

3.4. Statistical analysis

The proportions were calculated for findings and were expressed in percentages.

4. Results

Minimum trauma was seen in 0-5 year. Maximum was seen in 6-10 years. Intermediate in > 10 year age. The M.F. ratio was 2.5 times.(Table 1)

The trauma to the left eye was slightly more common than right eye. Incidence of perforating injury leading to cataract was about 1.5 times more common than blunt injury.(Table 2)

Vision had no significant role in type of deviation as it was 2 to 2.5 times in above cases between divergent & convergent eyes. The diminution of vision in cases of traumatic cataract was usually at the level of mature or hypermature cataract. Severity of diminution of vision was not much related to duration of trauma whether it is progressive or stationary. (Table 3)

40% of the cases show deviation in the range of 11°-20°(irrespective to divergence or convergence) "Duration of trauma does not have any direct relationship with the amount of deviation because no case where duration was > 1 year, showed deviation more than 20° while many patients where duration was less than 1 year, showed a deviation of > 20°. About $\frac{3}{4}$ of cases had progressive course.(Table 4)

This Table 5 shows a much higher incidence of exotropia than esotropia. About 50% of the cases of perforating injury showed signs of old anterior uveitis while this incidence was on $1/5^{th}$ in cases of blunt injury. About 1/3 of cases of traumatic cataract show signs of anterior uveitis.(Table 5)

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5. Discussion

Paediatric traumatic cataract should be treated in time to attenuate the complications, and education on paediatric traumatic cataract and improvements in paediatric health care are needed for the early detection of cataract in children.[10]

In our present study, there was less involvement of children <than 5 Years(4%) as compared to >than 5 Years (96%) and there was a male child preponderance(72%), trauma to the left eye (56%) is slightly more common than right eye. This finding was in unison with other Chinese study[10] where 117 eyes of 117 patients (96 boys and 21 girls) with unilateral injuries (66 right and 51 left eyes) were there and The mean (SEM) age at diagnosis was (6.6±3.2) years (range, 1.3-13.8 years). Each cataract was categorized according to the type of trauma: closed-globe (n=26) or open-globe (n=91) injuries.

In our present study, there was higher Incidence of perforating injury(60%) and this finding was almost similar to study[12] where Most injuries (54.7%) were caused by a stick or a bow and arrow and most (53.2%) of the cataracts were total.

It also appears from our study that vision does not have any significant role in type of deviation as it is 2 to 2.5 times in above cases between divergent & convergent eyes. Diminution of vision in cases of traumatic cataract is usually at the level of mature or Hyper mature cataract. The severity of diminution of vision was also not much related to duration of trauma whether it was progressive or stationary.

Table 1: General profile of paediatric traumatic cataract patients

		Age incidence of trauma		
	0-5	6-10	10	Total
No. of cases	1	17	7	25
%	4%	68%	28%	100%
		Sex incidence		
	Male	Female	Total	
No. of cases	18	7	25	
%	72%	28%	100%-	

Table 2: Profile of eyes of paediatric traumatic cataract patients

	Side of eyes		
	Right eye	Left eye	Total
No. of cases	11	14	25
%	44%	56%	100%
	Modes of trauma		
	Blunt	Perforating	Total
No. of cases	10	15	25
%	40%	60%	100%

Table 3: Profile of vision of paediatric traumatic cataract patients

Amount of vision and type of deviation					
Vision	**No. of Cases**	**%**	**Type of deviation**		**No**
			Convergent	Divergent	Deviation
FC or more	7	28%	2	5	0
HM or iess	18	72%	5	9	4
		Duration of trauma v/s of vision			
Duration	**Cases**	**Percentage**	**FC or Vision**	**HM or more**	
Upto 1 month	9	36%	2	7	
Upto 1 year	10	40%	2	8	
> 1yr	6	24%	3		

Table 4: Profile of deviation of pediatric traumatic cataract patients

		Duration of trauma v/s amount of deviation				
Duration	**Cases**	**%**	**Amount of deviation**			
Upto 10			Upto 10°	Upto 20°	20°	Nil
Upto 1 month	9	36%	4	1	3	1
Upto 1 year	10	40%	0	5	4	1
More than 1yr	6	24%	0	4	0	2
			4	10	7	4
		Total	16%	40%	28%	16%
		Cause of Diminution of vision after trauma				
Mode of injury	**Case**	**%**	**Course**			
			Progressive	Stationary		
Blunt	10	40%	7	3		
Pref.	15	60%	11	4		
			18	7		
			72%	28%		

Table 5: Profile of patterns of deviation of pediatric traumatic cataract patients

Mode of trauma v/s Anterior Uveitis			
Mode of trauma	**Cases**	**Ant Uveitis +nt**	**Absent**
Blunt	10	2	8
Perforating	15	7	8
Total		9	16
Patterns of deviation			
Exotropia	**Esotropia**	**Straight eyes**	**Total**
15	6	4	25
60%	24%	16%	100%

60% XT, 24%ET 16%Ortho.

This finding was also similar to one study[11] in children with posttraumatic cataracts, where final visual acuity was not affected by patient age and gender; trauma type, cause, and zone; duration between the time of trauma and cataract surgery; surgical method used; and time, location, and type of intraocular lens (IOL) implantation and also similar to other studies.[10,12]

Our study also shows that 40% of the cases show deviation in the range of 11°-20°(irrespective to divergence or convergence) and "Duration of trauma does not have any direct relationship with the amount of deviation because no case where duration was > 1 year,, showed deviation more than 20° while many patients where duration was less than 1 year, showed a deviation of > 20° and this finding was also similar to other studies.[6–12] One study[13] however found that Bow and arrow injury caused the maximum cases of traumatic cataract; cataract extraction resulted in significant visual improvement; and CGI tended to have better prognosis in paediatric traumatic cataracts. In our present study, about $\frac{3}{4}$ of cases had progressive vision course just similar to studies.[6–13]

Another interesting finding which came out from our study that about half of the cases of perforating injury showed signs of old anterior uveitis while this incidence was on $1/5^{th}$ in cases of Blunt injury and about 1/3 of cases of traumatic cataract show signs of anterior uveitis. Our this finding was also similar to study[14] in Egypt where Twenty-one eyes sustained open globe injury (62%) with the most common cause of trauma was wooden sticks, while 13 eyes had closed globe injury (38%) with the most common cause of injury was thrown stones. This study[14] was also of opinion that paediatric traumatic cataract is commonly present in primary school age especially after open globe injury. Primary prevention through health awareness should target this age population. Useful vision can be regained with timely proper surgical intervention and posterior chamber intraocular lens implantation.

One more Important aspect which emerged from our study was that there was a higher incidence of exotropia than esotropia. One study[15] in India had found that Visual acuity of 6/18 or better (was considered good visual outcome) was achieved by 87.9%, 97.3%, and 97.9% at 1, 6, and 36 months, postoperatively. Eyes which underwent primary posterior capsulotomy and anterior vitrectomy during cataract surgery showed statistically better visual outcome than those without it. Phacoaspiration with posterior chamber intraocular lens implantation along with primary posterior capsulotomy and anterior vitrectomy and timely introduction of amblyopia therapy helped in gaining good visual outcome in pediatric traumatic cataract patients irrespective of the age of presentation and the type of injury.

Moreover, our present study also reveals few issues such as : a) Traumatic cataract has got an intermediate prevalence in more than 10 years age group b) Trauma to the left eye is slightly more common than right eye, although the difference is not significant) Amount of visual acuity in the affected eye does not have any significant influence in the type of deviation d) Severity of diminution of vision is not much related to duration of trauma, whether the course is progressive or stationary.

From this study we can also conclude that maximum incidence of traumatic cataract is seen in 6-10 years of age group. Traumatic cataract is seen more commonly in boys and it is 25 times more than that of girls. lncidence of perforating injuries leading to cataract is 1.5 times more common than blunt trauma. Diminution of vision in cases of traumatic cataract is usually at the level of mature or hypermature cataract. 40% of cases show deviation in the range of 11-20° (irrespective to divergence or convergence). There was higher incidence of exotropia than esotropia.

6. Conclusion

Originally eye was divergent as per evolution of binocular vision in primates & our study also came out with a conclusion that when there is a no force or compensation of binocular vision, most of the eyes tended to be divergent in children after traumatic cataract.

7. Source of Funding

None.

8. Conflict of Interest

None.

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