

Original Research Article

Astigmatism and its Associated Factors in Pediatric Population, Nepal

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Abstract: Introduction: Astigmatism is a common vision disorder that leads to blurred vision due to the inability of the ocular system to form a sharply focused image on the retina. A child with uncorrected astigmatism experiences blur on a continuous basis and also child has a clear retinal image when looking at a near environment. **Objective:** The objective of this study was to access the prevalence and risk factors associated with Astigmatism in pediatric population. **Method:** This was a hospital based cross sectional study conducted among 2 to 14 years children with astigmatism of ≥ 1.0 D in either eye. Study conducted from 1st September 2022 to 28th February 2023. Data was entered in Ms-Excel and further analyzed in SPSS Version 12.0. **Result:** Prevalence of astigmatism was found to be 38.80%. Prevalence in Male was found to be higher 65.20% than in female. Age was found to be statistically significant $p = (0.003)$ with astigmatism. **Conclusion:** Astigmatism is a common vision disorder that leads to blurred vision due to the inability of the ocular system to form a sharply focused image on the retina. Concerned stakeholder need to screen the problem to minimize preventable blindness in children.

Keywords: Best corrected visual acuity, Cylindrical correction, Diopter, Low birth Weight, Spherical Correction, Uncorrected visual acuity.

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INTRODUCTION

Astigmatism is a common vision disorder that leads to blurred vision due to the inability of the ocular system to form a sharply focused image on the retina, and it accounts for approximately 13.0% of the refractive errors of the human eye (Read *et al.*, 2007). Anatomically, astigmatism results from toricity in the anterior or refracting structures of the eye (cornea and/or lens), whereas emmetropization occurs from fine-tuned adjustments in axial length that may produce only spherical errors (Shih Y *et al.*, 2004). A child with uncorrected astigmatism experiences blur on a continuous basis and also child has a clear retinal image when looking at a near environment, and a hyperopic child can achieve a clear retinal image through accommodation (Miller JM *et al.*, 1999). It is believed that an astigmatic child is therefore at increased risk for the development of refractive amblyopia (Huang *et al.*, 2014). Some researchers have suggested that optical blur imposed by astigmatism may predispose to myopia development (Sushil O *et al.*, 2016). Astigmatism is an important clinical and public health problem for a number of reasons. The exact cause of astigmatism is unknown however, factors such as high risk genes, eyelid pressure, extraocular muscle tension, gestational age, birth weight, and medical conditions such as cerebral

palsy also may play a role. However, risk factors for astigmatism have been evaluated, particularly from population-based studies (Tong L *et al.*, 2002). Persistent astigmatism causes ametropia and reduced acuity by prohibiting the formation of a clear image on the retina, which has been related to poor work performance. Myopic children had a higher incidence rate of astigmatism than non-myopes. In addition, astigmatism increases the risk of developing refractive amblyopia in a child and the outcome of amblyopia treatment is affected by the type of astigmatism (Sjostrand J, *et al.*, 2002). Some associations have also been found between astigmatism and the development of myopia (Hashemi H *et al.*, 2003).

As Tilganga Institute of Ophthalmology is the tertiary centre of Nepal and Astigmatism in children is one of the most common Refractive error being diagnosed in children in this centre, we use cylindrical lens of appropriate power in children. Astigmatism is one of the important refractive error in pediatric population, the incidence of astigmatism is increasing in pediatric population these days, we found it necessary to know the risk factors associated with Astigmatism in our society.

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METHODOLOGY

This study is a hospital based cross-sectional observational study conducted from 1st September 2022 to 28th February 2023 in Tilganga Eye Hospital, taking the Institutional Review Board Approval and following the health research ethical principle. This study aim to assess the prevalence and risk factors associated with Astigmatism in Pediatric population.

A structured close ended questionnaire was developed to collect the data from the study participants. Sample size of the study was calculated to be 276 and study participants were children 2 to 14 years of age with astigmatism of ≥ 1.0 D in either eye presenting in the Tilganga institute of Ophthalmology during the study period.

Data regarding socio-demographic characteristics, Antenatal history, Postnatal history, birth history, ocular complains and ocular examination were collected. A detail birth history, Age, gender, duration use of electronic devices, association with other refractive errors were recorded. Data were collected for a period of 6 months and the data was analysed. Data was entered in Ms-exel and further analyzed in SPSS version 12.0. The study assessed prevalence of astigmatism and its risk factors.

RESULTS

There were 276 patients included in the study during the study period. In our study total number of patients were 276, of which 180 (65.20%) were male and 96 (34.80%) were Female with male to female ratio of 1.9: 1. Similarly, in our study we found that patients of age group 2 to 14 yrs were included of which most of the patients (46.70%) were in age group 6 to 10 years as shown in Table 1.

Table 1: Socio-Demographic Distribution of Participants (n=276)

	Frequency	Percentage
Gender		
Male	180	65.20
Female	96	34.80
Age in Years		
2 to 6	61	22.10
6 to 10	129	46.70
10 to 14	86	31.20

In our study, 27 patients (9.80%) gave positive history of maternal smoking during antenatal period while 249 patients (90.20%) did not give positive history

of maternal smoking during antenatal period as shown in Table 2.

Table 2: Distribution by Antenatal History of Maternal Smoking (n=276)

Maternal smoking	Frequency	Percentage
Yes	27	9.80
No	249	90.20
Total	276	100

Among all the participants in our study, 157 patients (56.90%) gave history of using modern e-devices more than 2 hrs per day and 119 patients (43.10

%) used modern e-device less than 2 hrs per day as shown in Table 3.

Table 3: Distribution by Use of Modern E-Devices (n=276)

Use of modern e-devices	Frequency	Percentage
More than 2hr/day	157	56.90
Less than 2hr/day	119	43.10
Total	276	100.00

In this study total of 105 (38.00 %) patients gave positive history of refractive error in family while 171 patients (62.00 %) had no history of refractive error

in family i.e. majority of patients included in study did not have positive family history as shown in Table 4.

Table 4: Family History of Refractive Error (n=276)

Family history of refractive error	Frequency	Percentage
Yes	105	38.00
No	171	62.00
Total	276	100.00

Table 5: Association Between Different Independent Variables with Astigmatism in Pediatric Population (n=276)

Characteristics	Astigmatism		Total	P-value
	Present	Absent		
Age				
2-6	21	40	61	0.003^{b*}
6-10	67	62	129	
10-14	59	27	86	
Gender				
Male	91	98	180	0.217 ^b
Female	56	40	96	
History of premature birth				
Yes	16	12	28	0.664 ^b
No	131	117	248	
Use of spectacles in family				
Positive	62	43	105	0.131 ^b
Negative	85	86	171	

*: Significant at $p < 0.05$

^a: Fischer's Exact test

^b: Chi square test

DISCUSSION

Astigmatism is a common vision disorder that leads to blurred vision due to the inability of the ocular system to form a sharply focused image on the retina, and it accounts for approximately 13.00% of the refractive errors of the human eye (Read *et al.*, 2007). Anatomically, astigmatism results from toricity in the anterior or refracting structures of the eye (cornea and/or lens), whereas emmetropization occurs from fine-tuned adjustments in axial length that may produce only spherical errors (McKean-Cowdin R *et al.*, 2011). It is believed that an astigmatic child is at increased risk for the development of refractive amblyopia (Miller JM *et al.*, 1999). Out of 276 patients astigmatism was present in 38.76%. There were 180 males (65.20%) and 96 (34.80%) females with the male to female ratio of 1.9:1 (p-value 0.217) which is clinically not significant. Male is to female ratio in astigmatism was 1.8:1. Similar study was done by Raju Kaiti *et al.*, which concluded male to female ratio was 0.77:1 (Raju K *et al.*, 2018). The other study done by AK Malhotra *et al.*, showed that astigmatism was 29.08%, male to female ratio among them was 0.77:1 (AK Malhotra *et al.*, 2016). Similarly study done by pin-pin Goh which showed the prevalence of myopia, astigmatism and hypermetropia was 39.08%, 17.32% and 5.74% (Pin -Pin G *et al.*, 2005). A study found that male: female ratio among people with refractive study was 1.3:1 which is comparable to our study (Dr. Debrata Das *et al.*, 2018).

In this study most of the patients were in age group 6-10 yrs. Out of 276 patients 129 patients (46.70%) were in this age group. However of 107 patients with astigmatism, most of them were in 10-14 yrs old (50.47%), 47 patients (43.92%) were in age group 6-10 yrs, and 6 patients (5.60%) in age group 4-6 yrs. Statistically significant (P-value < 0.003). In our study also the number of patients increased from 40 to 67 from age 4-6 yrs to 6-10 yrs, however the number decline as

the age increased i.e. 10-14 yrs. But other study performed by Gewen *et al.*, showed age is not a risk factor for myopia and hypermetropia while astigmatism was lower in older age group (Gewen *et al.*, 2013).

Of 43.11% of patients used e-device less than 2 hours and 56.88% Used more than 2 hours of those patients 60% in patients using e device more than 2 hrs and 47.77% using e-device more than 2 hrs had astigmatism. In our study 62 patients i.e. 59.04% with astigmatism had family history of refractive error. Similar study done by Ahmed Emad *et al.*, concluded there is significant association with refractive error and family factors (Ahmed Emad *et al.*, 2018).

CONCLUSION

Astigmatism is a common vision disorder that leads to blurred vision due to the inability of the ocular system to form a sharply focused image on the retina. Concerned stakeholder need to screen the problem to minimize preventable blindness in children.

Limitation

In this study, history was taken with the guardian whoever has brought child to hospital so the guardian might not recall the past history, especially birth history. To all the patients, who were involved in this study retinoscopy was done by different ophthalmic assistant. It would have been better if all child had undergone cycloplegic refraction.

RECOMMENDATION

Further research is needed with larger samples from diverse geographical areas and longitudinal studies to increase knowledge regarding epidemiology and risk factors associated with astigmatism.

Conflict of Interest: None.

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