

Prevalence of astigmatism in school going children in a tertiary eye hospital

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ARTICLE INFO

Article History:

Received: 30 May, 2025
Accepted: 15 June, 2025

Keywords:

Refractive error, astigmatism, amblyopia.

ABSTRACT

Background: Astigmatism is a type of refractive error due to distorted and irregularity of cornea. Now a days its frequency is increasing among school going children. **Purpose:** To assess the prevalence of astigmatism and to find the most common type of astigmatism among school going children. **Methods:** This prospective cross-sectional study was conducted in a tertiary eye hospital in Bangladesh from October, 2024 to April, 2025. The investigator will maintain pre design data and data were analyzed by SPSS software. A comprehensive eye examination was used to analyze the refractive error including astigmatism. The research was approved by the institutional review board and the ethics committee of Gopalganj Eye Hospital and Training Institute. **Results:** We examined 1000 eyes of 500 students including male 478 (47.8%) eyes and female 522 eyes (52.2%). Astigmatism was seen in 417 eyes (41.7%) which was more frequent than all type of refractive error. Among all type of astigmatism compound myopic astigmatism was mostly seen in about 210 eyes (50.36%). Among the axis of astigmatism with the rule astigmatism was seen in 302 eyes (72.42%) which were more frequent in 13 to 16 years age group both in male and females. Among the amount of astigmatism ± 0.25 to 1.00 Diopter cylinder was the most common which was present in 224 eyes (53.72%). **Conclusion:** With the rule astigmatism and compound myopic astigmatism were more common among males and females and maximum in the age group of 13-16 years of age in this study which was conducted in a tertiary hospital where mostly the children come from Southern part of Bangladesh. It is important to study in future to evaluate further the causer and magnitude of astigmatism and increase awareness among parents of school going children for timely screening about refractive status.

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INTRODUCTION

Refractive error is the most common cause of visual impairment and the second most common cause of blindness in the world [1]. Around 12.8 million children between 5 to 15 years of age are visually impaired with a global prevalence of 1% due to uncorrected or inadequately corrected refractive errors [2]. Astigmatism is refractive error in which the parallel rays of light coming from 6 meters entering the eye through the refractive medium do not focus on a single sharp point on the retina [3]. In astigmatism light rays do not refract equally in all meridians and do not focus equally in all meridians. Due to unequal focusing, light comes to focus along a line instead of a point (astigma = no point) [4]. Astigmatism is clinically important condition that account for about 13% of the refractive errors of the eye [5]. Its prevalence has been reported to vary with ethnicity, age and sex [6]. The importance of astigmatism in children lies in the fact that it is a correctable cause of visual impairment in this ages and whether it coexists with spherical error [7]. In addition, astigmatism increases the

incidence of amblyopia in children, and even treatment results are affected by the type of astigmatism^[8]. Astigmatism may be classified as simple myopic astigmatism, simple hypermetropic astigmatism, mixed astigmatism, compound myopic astigmatism, compound hypermetropic astigmatism^[9]. Astigmatism is diagnosed by retinoscopy, which is objective method to assess refractive status of the eye ^[10]. In a study by Dobson et al, against the rule (ATR) astigmatism was 2.5 times more common than with the rule (WTR) in children younger than 3.5 years of age. In contrast, WTR astigmatism was 3 times more common in children older than 5.5 years ^[10]. Severe degree of astigmatism can be caused by disease of cornea e.g. Keratoconus and late effects of scarring from wound such as corneal incision following cataract surgery ^[11].

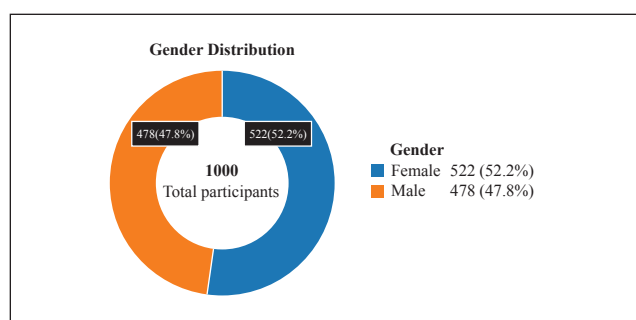
MATERIALS AND METHODS

This prospective cross- sectional study was carried out in Gopalganj Eye Hospital and Training Institute (GEHTI). 500 subjects with 1000 eyes were included in the study by simple random sampling. Children aged between 5-16 years of age attending the outpatient department (OPT) during 6 months period from October, 2024 to April, 2025 and having complaints of decreased vision were subjected to routine history and eye examination. Visual acuity with Snellen chart, slit lamp examination, retinoscopy under cycloplegia and fundoscopy was done. Best corrected visual acuity (BCVA), power of glasses (POG) and types of refractive error were recorded. Astigmatism was classified as with the rule (WTR) and against the rule (ATR). WTR was defined as if the vertical meridian is more curved than the horizontal meridian. That was corrected with minus (-) cylinder at 180 or plus cylinder at 90. ATR was defined if the horizontal meridian is more curved than the vertical meridian. That was corrected with minus (-) cylinder at 90 or plus cylinder at 180.

RESULTS

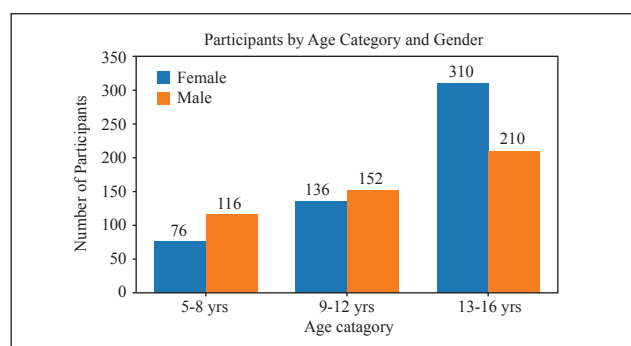
A total 1000 eyes of 500 children who were suspected as having refractive errors are included in this study age range from 5 years to 16 years. Here each eye of children was considered as separate study population. Among them 522 were female eyes and 478 were male eyes. (Figure 1)

Figure 1: Distribution of study population among boys and girls



The age of children was categorized into 3 categories aged 5 to 8 years are in category 1, 9 to 12 years children in category 2 and 13 to 16 years children are categorized in category 3. The result shows in table 1 Among male 116 eyes are of 5 to 8 years, 152 eyes are of 9 to 12 years and 210 eyes are of 13 to 16 years. Among females 76 study population are of 5 to 8 years age, 136 eyes belonging to 9 to 12 years of age and 310 eyes are belonging to 13-16 years category. (Figure 2)

Figure 2: Distribution of Age categories vs gender of study population



The study populations are divided into emmetropia, (refractive error ± 0.25 and only myopic/hypermetropic astigmatism of 0.25), myopia, hypermetropia and astigmatism. Among female eyes having decreasing vision 183 (18.3%) eyes have astigmatism, 163 (16.3%) eyes have emmetropia, 23 eyes (2.3%) have hypermetropia and 153 (15.3%) eyes have myopia. Among male study population complaining decreasing vision 234 (23.4%) eyes have astigmatism, 85 (8.5%) eyes are emmetropic, 11 (1.1%) eyes have hypermetropia and 148 (14.8%) eyes have myopia. Astigmatism are more than any other refractive error in both male and females. (Table 1)

Table 1: Distribution of type of refractive error vs gender of study population

		Gender		Total
		Female	Male	
Refractive error (percentage)	Astigmatism	183 (18.3%)	234 (23.43%)	417 (41.7%)
	Hypermetropia	23 (2.3%)	11 (1.1%)	34 (3.4%)
	Myopia	153 (15.3%)	148 (14.8%)	301 (30.1%)
	Emmetropia	163 (16.3%)	85 (8.5%)	248 (24.8%)
Total (percentage)		522 (52.2%)	478 (47.8%)	1000

Among type of astigmatism in 4-8 years age group, myopic astigmatism are found in 36 patients (8.63%), hypermetropic astigmatism are found in 4 patients (0.95%), Mixed astigmatism are found in 24 patients (5.75%), Compound myopic astigmatism are found in 34 patients (8.15%) and compound hypermetropic astigmatism are found in 1 patients only (0.24%). In 9-12 years age group myopic

astigmatism are found in 52 patients (12.47%), hypermetropic astigmatism are found in 2 patients (0.48%), mixed astigmatism are found in 10 patients (2.40%), compound myopic astigmatism are found in 58 patients (13.91%), compound hypermetropic astigmatism are found in 6 patients (1.44%). Among 13-16 years age group myopic astigmatism are found in 58 patients (13.91%), hypermetropic astigmatism are found in 3 patients (0.72%), mixed astigmatism are found in 6 patients (1.44%), compound myopic astigmatism are found in 118 patients (28.30%), compound hypermetropic astigmatism are found in 9 patients (2.16%). (Table 2)

Table 2: Distribution of Type_of_astigmatism vs Age categories of study population:

		Age categories			Total (percentage)
		4-8 years	9-12 years	13-16 years	
Type of astigmatism And percentage	Compound Hypermetropic Astigmatism	1 (0.24%)	6 (0.24%)	5 (1.20%)	12 (2.88%)
	Compound Myopic Astigmatism	34 (8.15%)	58 (13.91%)	118 (28.30%)	210 (50.36%)
	Hypermetropic Astigmatism	4 (.95%)	2 (0.48%)	3 (0.72%)	9 (2.16%)
	Myopic Astigmatism	36 (8.63%)	52 (12.47%)	58 (13.91%)	146 (35.01%)
	Mixed Astigmatism	24 (5.75%)	10 (2.40%)	6 (1.44%)	40 (9.59%)
Total (percentage)		99 (23.74%)	128 (30.70%)	190 (45.57%)	417 (100%)

Among axis of astigmatism, against the rule astigmatism are found in 10 eyes (2.40%) in 4 to 8 years age group, in 12 eyes

(2.88%) in 9 to 12 years age group, in 19 eyes (4.56%) in 13 to 16 years age group. Oblique astigmatism are found in 12 eyes (2.88%) in 4 to 8 years age group, in 24 eyes (5.76%) in 9 to 12 years age group and in 38 eyes (9.11%) in 13-16 years age group. With the rule astigmatism are found in 74 eyes (17.75%) in 4 to 8 years age group; in 98 eyes (23.50%) in 9 to 12 years age group, in 130 eyes (31.18%) in 13 to 16 years age group. (Table 3)

Table 3: Distribution of axis of astigmatism vs Age categories Crosstabulation

		Age category			Total
		4-8 years (percentage)	9-12 years (percentage)	13-16 years (percentage)	
According to axis	Against the rule	10 (2.40%)	12 (2.88%)	19 (4.56%)	41 (9.83%)
	Oblique	12 (2.88%)	24 (5.76%)	38 (9.11%)	74 (17.75%)
	With the rule	74 (17.75%)	98 (23.50%)	130 (31.18%)	302 (72.42%)
Total Count		96 (23.02%)	134 (32.13%)	187 (44.84%)	417 (100%)

In table 4, which shows distribution of amount of astigmatism in female population 94 eyes (22.54%) have -0.25 to -1 astigmatism; 31 eyes (7.43%) have -1.25 to -2 astigmatism; 30 eyes (7.19%) have -2.25 to -3 astigmatism; 15 eyes (3.60%) have -3.25 to -4 astigmatism; 9 (2.16%) have -4.25 to -5 astigmatism; 1 eye have -5.25 to -6 astigmatism; 3 eyes have + 0.25 to 1 astigmatism. Among male study population 118 eyes (28.30%) have -.25 to -1 astigmatism; 45 eyes (10.80%) have -1.25 to -2 astigmatism; 33 eyes (7.91%) have -2.25 to -3 astigmatism; 21 eyes (5.03%) have -3.25 to -4 astigmatism; 6 eyes (1.44%) have -4.25 to -5 astigmatism; 9 eyes (2.16%) have +0.25 to 1 astigmatism; 2 eyes (0.48%) have 1.25 to 2 astigmatism.

Table 4: Distribution of amount of astigmatism vs Gender Crosstabulation

		Category of amount of astigmatism								Total
		-.25 to -1	-1.25 to -2	-2.25 to -3	-3.25 to -4	-4.25 to -5	-5.25 to -6	0.25 to 1	1.25 to 2	
Gender	Female	94 (22.54%)	31 (7.43%)	30 (7.19%)	15 (3.60%)	9 (2.16%)	1 (.24%)	3 (0.72%)	0 (0%)	183 (43.89%)
	Male	118 (28.30%)	45 (10.80%)	33 (7.91%)	21 (5.03%)	6 (1.44%)	0 (0%)	9 (2.16%)	2 (0.48%)	234 (56.11%)
Total		212 (50.84%)	76 (18.23%)	63 (15.11%)	36 (8.63%)	15 (3.60%)	1 (0.24%)	12 (2.88%)	2 (0.48%)	417 (100%)

DISCUSSION

This is a hospital based study. 1000 eyes of 500 children complaining of decreasing vision were subjected to routine eye examination and best corrective glasses were prescribed. Among them 522 are female eyes (52.2%) and 478 are male eyes (47.8%). There was no relation between gender with type and amount of astigmatism. Similar findings are found in the study in China where there is no significant difference in occurrence of astigmatism between boys and girls.^[12]

The study population are divided into 3 age group: 5 to 8 years, 9 to 12 years and 13 to 16 years. Among all the participants in both male and females 13 to 16 years age group are participating more.

In this study most common refractive error are found is astigmatism (in 417 eyes) and least common refractive error is hypermetropia (in 34 eyes). The prevalence of astigmatism, myopia, hypermetropia and emmetropia were 41.7 & 30.4%, 3.4%

and 24.8%. The similar result was also seen in a study done by candidates Gupta et al in 2015 in India showed that the astigmatism (54.27%) was more common in school going children.^[13] Astigmatism can occur in any age group, children and adults. Uncorrected astigmatism is associated with increased risk of myopia or amblyopia. Early detection of astigmatism in pediatric populations is particularly important because of its potential influence on normal visual development.^[14,15]

Among type of astigmatism in this study the prevalence was compound hypermetropic astigmatism were found in 2.88% eyes, compound myopic astigmatism was found in 50.36% eyes, hypermetropic astigmatism was found in 2.16% eyes, myopic astigmatism were found in 35.01% eyes and mixed astigmatism were found in 9.59% eyes. Here compound myopic astigmatism and myopic astigmatism were more common. Similar findings were found in a study done by Rida Ijaz et al in 2017 in Pakistan where myopic astigmatism were found in 700 eyes (76.60%), hypermetropic astigmatism were found in 175 eyes (19.14%) and mixed astigmatism were found in 39 eyes (4.26%)^[16].

The rate of myopic astigmatism increases with age in contrast the rate of hypermetropic and mixed astigmatism decreases with age. Similar findings were found in Taiwan school children in 2004^[17]

In this study with the rule (WTR) astigmatism was found in 72.42% eyes, against the rule (ATR) astigmatism was found in 9.83% eyes, oblique astigmatism was found in 17.75% eyes. The causes of WTR astigmatism are usually genetic factors, lid pressure, eye lid slant and accommodation. Whereas the causes of ATR astigmatism are age related factors, muscle tension in near task and reduce tear film. In this study the prevalence of with the rule astigmatism (WTR) was found more. Similar finding was found in a study conducted by Jamsed et al in 2017 at Majeedia Hospital, New Delhi where prevalence of with the rule (WTR) astigmatism was found in 76.75% eyes^[18].

In this study -.25 to -1 and +.25 to +1 astigmatism were found in 50.84% and 2.88% eyes. High astigmatism (> +1 D cylinder and > -1 D cylinder) were present in rest 46.28% eyes. A study held in Canada in 2004 on preschool children included 129 children for their study. Of the 129 subjects, 29 were classified as high astigmatism (-1 D of cylinder) in one or both eyes and the other 100 subjects were classified as normal astigmatism^[19].

LIMITATION

1) Limited resources

2) We did not collect detailed information on lifestyle factors such as visual habits, reading behaviour, electronic device use, physical activity levels, study habits, or any family history of astigmatism limiting our ability to analyze their potential influences on astigmatism development

CONCLUSION

Refractive error is common in school going children. Among all refractive error astigmatism was common and among astigmatism compound myopic and myopic astigmatism were seen more frequently. With the rule astigmatism was more common in male and females maximum at 13 to 16 years of age. If refractive errors including astigmatism are not treated timely it will leads to amblyopia. We recommended country wide epidemiological research on the refractive status of school going children.

ACKNOWLEDGEMENT

The present study was supported by the paediatric outpatient department of Gopalganj Eye Hospital & Training Institute, Gopalganj, Bangladesh. The authors are grateful to all the nursing & other staff of Paediatric Ophthalmology OPD.

Conflict of Interest: None declared

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