

**A Hospital Based Observational Study Assessing Corneal Astigmatism in Patients Undergoing Cataract Surgery****Gopal Prasad Singh<sup>1</sup>, Pranay Kumar<sup>2</sup>, Rajesh Kumar Singh<sup>3</sup>, Rajiv Kumar Singh<sup>4</sup>**<sup>1</sup>Senior Resident, Department of Ophthalmology, SKMCH, Muzaffarpur, Bihar, India<sup>2</sup>Senior Resident, Department of Ophthalmology, SKMCH, Muzaffarpur, Bihar, India<sup>3</sup>Senior Resident, Department of Ophthalmology, SKMCH, Muzaffarpur, Bihar, India<sup>4</sup>Associate Professor and HOD, Department of Ophthalmology, SKMCH, Muzaffarpur, Bihar, India

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Conflict of interest: Nil

**Abstract****Aim:** The aim of the present study was to assess the clinical profiles of patients with astigmatism who were scheduled for cataract surgery at our tertiary hospital and to report the prevalence of corneal astigmatism.**Methods:** The present study, a cross-sectional investigation, was carried out in the department of Ophthalmology. The study was carried out for the period of two years. In total 1000 patients with 1000 eligible eyes were scheduled for cataract surgery during the study period. The patients who have been scheduled for cataract surgery were included.**Results:** Males made up the majority (56%) of the population and a mean age of  $64.6 \pm 12.8$ . The majority of cataracts (46%) and nuclear sclerosis (37%) were of the mixed type. Other less frequent kinds included cortical cataract (2.70%), mature cataract (5.6%), posterior sub capsular opacification (8.5%), and developing cataract (0.2%). K1 and K2 had mean keratometry values of 41.19 and 42.48 D, respectively, with a range of 31 to 52 D. The range of corneal astigmatism was 0-5.34 D, with a mean of  $0.48 \pm 0.42$  D. The range of the cylinder was 0-2.25 D, and the mean sphere was  $1.28 \pm 1.42$  D. The mean cylinder was  $0.20 \pm 0.30$  D. In the current investigation, astigmatism was absent in 8.5% of patients, but oblique astigmatism was present in 14.5%. With the rule astigmatism was present in the majority of instances (43%), followed by against the rule astigmatism (34%).**Conclusion:** For the best visual outcomes and patient satisfaction following cataract surgery, a preoperative assessment of corneal astigmatism is crucial. Astigmatism worsens with age, and a sizable portion of patients have preoperative corneal astigmatism of 1D or higher, which might impair the quality of vision after cataract surgery.**Keywords:** Preoperative Assessment, Corneal Astigmatism, Cataract Surgery, Keratorefractive Procedures.This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

Ocular astigmatism is a refractive condition which occurs because of unequal curvatures of the cornea and the crystalline lens, decentration or tilting of the lens, or unequal refractive indices across the crystalline lens and in some cases, alterations of the geometry of the posterior pole. [1] ]Cataract is the cause of the half of blindness worldwide and cataract extraction is one of the most commonly performed surgeries. [2] .A cataract is the opacity of the lens in the eye that is considered as one of the major causes of blindness worldwide and its only treatment is surgery.2 Significant efforts are being undertaken to increase the output of vision through safe cataract services.

Cataract surgery has undergone great refinement in recent years.3 with improvements and advances in

operating techniques, instruments and technical aids, the patients' as well as the surgeons' demands and expectations are continuously increasing. The main aim of cataract surgery today is rapid visual rehabilitation, the best possible uncorrected visual acuity, and minimal postoperative astigmatism. [4] Some of the factors affecting the Surgically Induced Astigmatism (SIA) are the architecture and site of incision, surgical skill, and to a great extent of pre-existing corneal astigmatism. [5] It has been documented that approximately 15% of cataract patients have more than 1.5 diopter of preexisting keratometric astigmatism. [6] Cataract extraction with implantation of an artificial Intraocular Lens (IOL) implant is the currently accepted treatment for symptomatic cataracts. [7]

It is one of the most successfully and commonly performed cataract surgeries worldwide. Postoperative astigmatism can be either surgery induced or residual of preoperative corneal astigmatism. Correcting preexisting corneal astigmatism is commonly carried out at the time of cataract surgery by making limbal or corneal relaxing incisions or by the implantation of toric IOLs. [8] However, the presence of preoperative corneal astigmatism continues to challenge the final visual outcome. The goal of cataract surgery is to achieve a desirable refractive outcome with minimal surgically induced astigmatism (SIA) after cataract surgery. [9,10] Some of the factors affecting SIA are site of incision, surgical skill and to a great extent, pre-existing corneal astigmatism.

The aim of the present study was to assess the clinical profiles of patients with astigmatism who were scheduled for cataract surgery at our tertiary hospital and to report the prevalence of corneal astigmatism.

### Materials and Methods

The present study, a cross-sectional investigation, was carried out in the department of Ophthalmology, SKMCH, Muzaffarpur, Bihar, India. The study was carried out for the period of two years. The patients who have been scheduled for cataract surgery were included. In total, 1000

patients with 1000 eligible eyes were scheduled for cataract surgery during the study period.

Patients with corneal disorders, irregular astigmatism, a history of ocular inflammation, and those who have had corneal or intraocular surgery are excluded.

After a formal informed consent was obtained, the study was discussed.

All cases underwent a full ophthalmological evaluation, general/ systemic examination, and history taking (current, prior medical/surgical) (visual assessment, slit lamp anterior segment examination and ophthalmoscopy through the dilated pupils). IOL measured the curvature of the cornea. An experienced technician collected the keratometry readings for the successive patients, and an average of three measurements of the parameters was analysed. Corneal astigmatism (CA) was classified as either with the rule (WTR) or against the rule (ATR) depending on whether the meridian of maximum curvature was within 308 of the vertical 908 or the horizontal 1808, or as oblique (OBL) if it was neither WTR nor ATR. Microsoft Excel was used to construct and collect the data. Descriptive statistics were used in the statistical analysis.

### Results

**Table 1: General characteristics**

Characteristic	Numbers (n) / Mean $\pm$ SD	Percentage (%)
Number of patients/ Number of eyes	1000	100
Age range (years)	15-80	
Mean age (years)	64.6 $\pm$ 12.8	
Gender		
Male	560	56
Female	440	44
<b>Types of cataracts</b>		
Mixed type	460	46
Nuclear sclerosis	370	37
Posterior sub capsular opacification	85	8.5
Mature cataract	56	5.6
Cortical cataract	27	2.7
Developmental cataract	2	0.2%

Males made up the majority (56%) of the population and a mean age of 64.6  $\pm$  12.8. The majority of cataracts (46%) and nuclear sclerosis (37%) were of the mixed type. Other less frequent kinds included cortical cataract (2.70%), mature cataract (5.6%), posterior sub capsular opacification (8.5%), and developing cataract (0.2%).

**Table 2: Keratometry values**

Keratometry values	Value / Mean $\pm$ SD
Mean keratometry (D)	
K1	41.19
K2	42.48
Mean corneal astigmatism (D)	0.48 $\pm$ 0.42
Range of corneal astigmatism (D)	0- 5.34
Range of Keratometry	31-52
Mean sphere (D)	1.28 $\pm$ 1.42
Mean cylinder (D)	0.20 $\pm$ 0.30
Range of cylinder (D)	0-2.25

K1 and K2 had mean keratometry values of 41.19 and 42.48 D, respectively, with a range of 31 to 52 D. The range of corneal astigmatism was 0-5.34 D, with a mean of  $0.48 \pm 0.42$  D. The range of the cylinder was 0-2.25 D, and the mean sphere was  $1.28 \pm 1.42$  D. The mean cylinder was  $0.20 \pm 0.30$  D.

**Table 3: Distribution of different types of corneal astigmatism**

Types of astigmatism	Numbers (n)	Percentage (%)
With the rule	430	43
Against the rule	340	34
Oblique astigmatism	145	14.5
No astigmatism	858	8.5

In the current investigation, astigmatism was absent in 8.5% of patients, but oblique astigmatism was present in 14.5%. With the rule astigmatism was present in the majority of instances (43%), followed by against the rule astigmatism (34%).

### Discussion

The major goals of cataract surgery nowadays are quick visual recovery, the highest level of uncorrected vision, and the least amount of postoperative astigmatism. Ocular astigmatism is a refractive disorder brought on by uneven corneal and crystalline lens curvatures, lens decentration or tilting, or uneven refractive indices across the crystalline lens. [11,13] According to reports, the proportion of cataract patients who have anterior corneal astigmatism of more than one diopter (D), more than two diopters (D), or both ranges from 32.5 to 45.5%, 21.0 to 26.20 percent, and 8%, respectively. Both spherical and cylindrical components need to be adjusted during surgery for the greatest postoperative visual performance. [14,15]

Males made up the majority (56%) of the population and a mean age of  $64.6 \pm 12.8$ . The majority of cataracts (46%) and nuclear sclerosis (37%) were of the mixed type. Other less frequent kinds included cortical cataract (2.70%), mature cataract (5.6%), posterior sub capsular opacification (8.5%), and developing cataract (0.2%). Sharma A et al [16] studied 3597 eyes, 50.3% females, mean age was  $59.121 \pm 15.19$ . The mean corneal astigmatism among all patients was  $1.17 \pm 1.15$  D (range 0–12.5 D). There was no astigmatism in 99 eyes (2.78%), with-the-rule (WTR) in 1062 eyes (29.83%), against-the-rule (ATR) in 1843 eyes (51.72%) and oblique astigmatism (OA) in 555 eyes (15.59%). The tendency of a gradual change from with the rule (WTR) to against the rule (ATR) astigmatism was noted as the age advanced. Around 56.69% of eyes had corneal astigmatism of <1.0 D that can be managed by simple cost-effective keratorefractive procedures especially in developing countries while 40.49% patients had >1.0 D of corneal astigmatism, which may benefit by toric intraocular lenses. Similar findings were noted in present study. Gupta PS [17] studied 370 eyes of 370 patients, mean age was  $60.43 \pm 9.9$  years and 50.54% were males and

the rest were females. The mean of K, K1, and K2 was  $44.23 \pm 1.65$  D,  $43.75 \pm 1.68$  D, and  $44.71 \pm 1.74$  D, respectively. Almost 82.16% of the studied population had mean corneal astigmatism <1.5 D. The corneal astigmatism was against the rule (ATR) in 52.16%, with the rule (WTR) in 27.29%, and oblique in 17.83%. With increasing age, there is a gradual shift of astigmatism from WTR to ATR, in both males and females, which peaks in the sixth decade of life. Similar findings were noted in present study.

K1 and K2 had mean keratometry values of 41.19 and 42.48 D, respectively, with a range of 31 to 52 D. The range of corneal astigmatism was 0-5.34 D, with a mean of  $0.48 \pm 0.42$  D. The range of the cylinder was 0-2.25 D, and the mean sphere was  $1.28 \pm 1.42$  D. The mean cylinder was  $0.20 \pm 0.30$  D. In the current investigation, astigmatism was absent in 8.5% of patients, but oblique astigmatism was present in 14.5%. With the rule astigmatism was present in the majority of instances (43%), followed by against the rule astigmatism (34%). Postoperative astigmatism can be either surgery induced or residual of preoperative corneal astigmatism. Surgically induced astigmatism has greatly been reduced by the use of small phacotips and smaller incisions. However, the presence of preoperative corneal astigmatism continues to challenge the final visual outcome. [18]

### Conclusion

For the best visual outcomes and patient satisfaction following cataract surgery, a preoperative assessment of corneal astigmatism is crucial. Astigmatism worsens with age, and a sizable portion of patients have preoperative corneal astigmatism of 1D or higher, which might impair the quality of vision after cataract surgery. The majority of them are treatable with straightforward, affordable keratorefractive techniques.

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