Prevalence of corneal astigmatism in patients undergoing cataract surgery in a tertiary care hospital

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Received Date: 20/04/2023 ***Revised Date: 13/05/2023*** ***Accepted Date: 25/05/2023***

Abstract

Background: The goal of cataract surgery is to achieve a desirable refractive outcome with minimal surgically induced astigmatism (SIA) after cataract surgery. However, the presence of preoperative corneal astigmatism continues to challenge the final visual outcome. Present study was aimed to study prevalence of corneal astigmatism in patients undergoing cataract surgery in a tertiary care hospital. **Material and Methods:** Present study was prospective, observational study, conducted in patients of age > 40 years, either gender, posted for cataract surgery. **Results:** In present study, 644 patients/ 460 eyes considered for evaluation, mean age was 68.1 ± 10.2 years, gender ratio (Male: Female) was 1:1.22. Majority of cataracts were mixed type (44.57 %) & nuclear sclerosis (38.04%) other less common types were posterior sub capsular opacification (8.7 %), mature cataract (5.75 %), cortical cataract (2.48 %) & developmental cataract (0.47 %). Mean keratometry values were K1 - 43.97 D & K2 - 42.45 D and range was 36-55 D. Mean corneal astigmatism 0.91 ± 0.80 D & range was 0-5.72 D. Mean sphere was 1.75 ± 1.67 D, mean cylinder 0.54 ± 0.45 D & range of cylinder was 0-2.43 D. No astigmatism was noted in 7.45 %, while oblique astigmatism was in 10.71 % cases. Majority of cases had with the rule astigmatism (WTR) (43.79 %), followed by against the rule astigmatism (ATR) (38.04 %). **Conclusion:** Majority patients posted for cataract surgery have preoperative corneal astigmatism, commonly with the rule (WTR) as well as against the rule astigmatism (ATR), which can affect the quality of vision after cataract surgery.

Keywords: cataract surgery, preoperative corneal astigmatism, against the rule astigmatism, quality of vision

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] Cataract surgery has undergone great refinement in recent years. with improvements and advances in operating techniques, instruments and technical aids, the patients' as well as the surgeons' demands and expectations are continuously increasing. 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.[3]

The goal of cataract surgery is to achieve a desirable refractive outcome with minimal surgically induced astigmatism (SIA) after cataract surgery. Some of the factors affecting SIA are site of incision, surgical skill and to a great extent, pre-existing corneal astigmatism.[4,5] Present study was aimed to study prevalence of corneal astigmatism in patients undergoing cataract surgery in a tertiary care hospital.

Material And Methods

Present study was prospective, observational study, conducted in Department of Ophthalmology, JIIU's Indian Institute of Medical Science & Research, Warudi, India. Study duration was of 1 year (January 2022 to December 2022). Study approval was obtained from institutional ethical committee.

Inclusion criteria

- Patients of age > 40 years, either gender, posted for cataract surgery at our hospital, willing to participate in present study

Exclusion criteria

- Patients with corneal diseases, irregular astigmatism,
- History of ocular inflammation, corneal or intraocular surgery

Study was explained to patients in local language & written consent was taken for participation & study. All cases underwent history taking (present, past medical/surgical), general/systemic examination followed by complete ophthalmological evaluation (visual assessment, slit lamp anterior segment examination and ophthalmoscopy through the dilated pupils). Corneal curvature was assessed by IOL. The keratometric values were collected by an experienced technician for the consecutive patients and an average of three measurements of the parameters was subjected to analysis.

Corneal astigmatism (CA) was categorised as with the rule (WTR) when meridian of maximum curvature was within 308 of vertical 908 or against the rule (ATR) when meridian of maximum curvature was within 308 of horizontal 1808 and oblique (OBL) if it was neither WTR nor ATR. Data was collected and compiled using Microsoft Excel. Statistical analysis was done using descriptive statistics.

Results

In present study, 644 patients/ 460 eyes considered for evaluation, mean age was 68.1 ± 10.2 years, gender ratio (Male: Female) was 1:1.22. Majority of cataracts were mixed type (44.57 %) & nuclear sclerosis (38.04%) other less common types were posterior sub capsular opacification (8.7 %), mature cataract (5.75 %), cortical cataract (2.48 %) & developmental cataract (0.47 %).

Table 1: General characteristics

Characteristic	**Number of cases (n=644)**	**Percentage (%)**
Mean age (Mean ± SD)	67.8 ± 13.8 years	
Gender		
Male	290	45.03 %
Female	354	54.97 %
Gender ratio (Male: Female)	1:1.22	
Types of cataract		
Mixed type	287	44.57 %
Nuclear sclerosis	245	38.04 %

Posterior sub capsular opacification	56	8.7 %
Mature cataract	37	5.75 %
Cortical cataract	16	2.48 %
Developmental cataract	3	0.47 %

Mean keratometry values were K1 - 42.19 D & K2 - 42.91 D and range was 32-51 D. Mean corneal astigmatism 0.89 ± 0.82 D & range was 0- 5.61 D. Mean sphere was 1.51 ± 1.92 D, mean cylinder 0.39± 0.59 D & range of cylinder was 0-2.51 D.

Table 2: Keratometry values

Keratometry values	**Value / Mean ± SD**
Mean keratometry (D)	
K1	43.97
K2	42.45
Mean corneal astigmatism (D)	0.91 ± 0.80
Range of corneal astigmatism (D)	0- 5.72
Range of Keratometry	36-55
Mean sphere (D)	1.75 ± 1.67
Mean cylinder (D)	0.54 ± 0.45
Range of cylinder (D)	0-2.43

In present study, no astigmatism was noted in 7.45 %, while oblique astigmatism was in 10.71 % cases. Majority of cases had with the rule astigmatism (WTR) (43.79 %), followed by against the rule astigmatism (ATR) (38.04 %).

Table 3: Distribution of different types of corneal astigmatism

Types of astigmatism	**Numbers (n)**	**Percentage (%)**
With the rule	282	43.79 %
Against the rule	245	38.04 %
Oblique astigmatism	69	10.71 %
No astigmatism	48	7.45 %

Discussion

The preoperative assessment of patients with cataract should include corneal astigmatism (CA), and it should be addressed either at the time of cataract surgery or afterward to provide the best visual performance. Techniques to measure astigmatism include keratometry (manual or automated), corneal topography (eg, placido-based or based on the reflection of multicolor, light-emitting diode [LED] points), and corneal tomography (eg, slit-scan imaging, Scheimpflug imaging). Additionally, the use of intraoperative aberrometry has been documented to improve the astigmatic outcomes.[6,7]

Various factors such as physiological changes in the corneal curvature as age advances, pressure from eyelids, pressure by intraocular pressure, and of the extraocular muscles have been anticipated to be responsible factors for changes in ATR and WTR with age. There exist a variety of surgical techniques to reduce or eliminate the CA including corneal relaxing incisions (CCIs), limbal relaxing incisions (LRIs), opposite clear corneal incisions, femtosecond laser-assisted astigmatic keratotomy, excimer laser keratectomy, and toric IOL implantation.[8,9]

Arun B K[10] studied 460 patients/ 460 eyes, mean age was 67.8 ± 13.8, gender ratio (Male: Female) was 1.23:1. Majority of cataracts were mixed type (45.43%) and nuclear sclerosis (38.91%) other less common types were posterior sub capsular opacification (7.61%), mature cataract (5.22%), cortical cataract (2.39%) and developmental cataract (0.43%). Mean

keratometry values were K1 - 42.19 D and K2 - 42.91 D and range was 32-51 D. Mean corneal astigmatism 0.89 ± 0.82 D and range was 0- 5.61 D. Mean sphere was 1.51 ± 1.92 D, mean cylinder 0.39± 0.59 D and range of cylinder was 0-2.51 D. In present study, no astigmatism was noted in 8.04%, while oblique astigmatism was in 14.78% cases. Majority of cases had with the rule astigmatism (41.09%), followed by against the rule astigmatism (36.09%).

Chaudhary M[11] studied 225 eyes of 185 subjects, 61.3% were female eyes. The mean age of the subjects was 64.45±12.89 years. Mean amount of corneal astigmatism in our study was 0.84±0.80 D. 16.9% had no significant corneal astigmatism while 65.3% had corneal astigmatism between 0.25 and 1.50 diopter and 17.8% had corneal astigmatism of 1.50D or higher. With-the-rule astigmatism (axis of correcting cylinder 180±30 degrees) was present in 44.4% eyes, 40.04% of the eyes had against-the-rule (ATR) astigmatism (correcting minus cylinder 90±30 degrees), and 12.9% of the eyes had oblique astigmatism.

Gupta PS et al.,[12] studied 370 eyes of 370 patients, mean age was 60.43 ± 9.9 years. Nearly 50.54% were males and the rest were females. The mean of K, K1, and K2 was 44.23 ± 1.65 D, 43.75 ± 1.68 D, and 44.71 ± 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.

Anuj Sharma et al.,[13] studied 3597 eyes, 1810 (50.3%) were females and mean age was 59.121±15.19 years. The mean corneal astigmatism among all patients was 1.17±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.

Studies have indicated that corneal diameter can be a factor which can predict the incidence of astigmatism in patients who undergo cataract surgery. It was shown that those patients with a higher white to white corneal diameter was less at risk of developing corneal astigmatism as compared to patients with lesser diameter.[14] Shorter axial length, shallow anterior chamber, lower intraocular pressure and advancing age, has been shown as risk factors for SIA, in those undergoing cataract surgeries.[15]

With the improvement in the quality of healthcare and better age expectancy more number of patients would require quality vision following cataract surgery, which can only be achieved if pre-operative astigmatism correction is taken into consideration.

Conclusion

Majority patients posted for cataract surgery have preoperative corneal astigmatism, commonly with the rule (WTR) as well as against the rule astigmatism (ATR), which can affect the quality of vision after cataract surgery. Preoperative assessment & correction of corneal astigmatism is important component of cataract surgery.

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