# A Study on Prevalence, Magnitude and Patterns of Preexisting Corneal Astigmatism in Patients with Cataract in South India

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**ABSTRACT**

**Introduction:** Correction of pre existing corneal astigmatism is possible at the time of cataract surgery. The need to know the magnitude and pattern of pre existing corneal astigmatism thus becomes necessary. Purpose of the research was to study the prevalence, magnitude and patterns of preexisting corneal astigmatism among patients with cataract.

**Material and Methods:** Preoperative Keratometry records of all consecutive patients with cataract who were enrolled and planned for cataract surgery at Ophthalmology department in Government General Hospital, located in Nellore, Andhra Pradesh, South India, during January 2015 and December 2015, were reviewed. Data collected included the age and gender distributions, keratometric readings and the anterior corneal astigmatism in dioptres and retrospective analysis was done.

**Results:** 1578 eyes of 1568 patients with cataract who were subjected to keratometry were included. The mean age of the patients in our study was 59.48 years (23to 85 years). Of these, 911(57.7%) were women, while 667 (42.3%) were men. The mean keratometry in diopters was 43.5( K1) and 43.49 (K2) respectively. The mean corneal astigmatism was 1.5 diopters (D). 803 eyes (51%) eyes had ≤ 0.5D astigmatism, 40 eyes (2.5%) had an astigmatism < 1D, 674 eyes (42.7%) had astigmatism of ≥ 1D and 56 eyes (3.5%) an astigmatism of ≥ 2 D and 5 eyes (0.3%) an astigmatism of ≥ 3D.

**Conclusion:** Correction of astigmatism especially by the use of more surgical techniques like modifying the site of incision, limbal relaxing incisions or toric IOLs should be considered for better visual outcomes after cataract surgery.

**Keywords:** Corneal astigmatism, Age related cataract, South india

## INTRODUCTION

Cataract surgery is no more a visual rehabilitation surgery. Residual astigmatism after surgery is a concern for both ophthalmologists and patients and can leave patients with symptomatic decreased visual function.[1-5] With the advances in modern surgical techniques and intraocular lenses (IOLs), patients expect and demand refractive error correction after cataract surgery.

Goal of surgery is to achieve a desirable refractive outcome with minimal induction of astigmatism after surgery.[6] Architecture, site of incision, surgical skill, and to a great extent pre - existing corneal astigmatism are some of the factors affecting the Surgically Induced Astigmatism (SIA).

Correcting pre existing 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] As the postoperative visual expectation of patients increases, there is an anticipated need for astigmatism correction as a part of refractive cataract surgery. The need to know the pattern of corneal astigmatism for population groups in order for surgeons and IOL manufacturers to predict patient requirement consequently becomes necessary.

The distribution and prevalence of corneal astigmatism in cataract patients of different countries have been previously reported. [5,9–15] However, there are no similar reports for cataract patients in Indian population.

This study aims to study the prevalence, patterns and magnitude of corneal astigmatism among adult patients undergoing cataract surgery in a high volume teaching hospital in South India over a period of one year.

## MATERIAL AND METHODS

**Study area:** Preoperative Keratometry records of all consecutive patients with cataract who were enrolled and planned for cataract surgery at Ophthalmology department in Government General Hospital, a teaching hospital, located in Nellore, Andhra Pradesh, South India, during January 2015 and December 2015, were reviewed.

**Exclusion criteria:** (if occurring in the cataractous index eye) included a history of contact lens wear, present or past corneal disease, and previous eye surgery.

**Study protocol:** A retrospective analysis of the preoperative keratometry record of all patients aged 16 years and above that underwent routine elective cataract surgery was done for the period from January to December 2015. Keratometry readings of 1578 eyes of 1568 patients were studied.

All the patients had manual keratometry using the Bausch and lomb keratometer by two trained Paramedical Ophthalmic assistants as a part of the preoperative biometric assessment for IOL implantation. Three readings were taken and average of three was taken as final reading.

Data collected included the age and sex of the patient, keratometric readings in dioptres along the two principal meridians, and the anterior corneal astigmatism in dioptres.

**Definitions:** In the present study, K1 was defined as keratometry reading along vertical meridian and K2 as keratometry reading along horizontal meridian. Astigmatism was calculated as the dioptric difference along the two meridians. When K1 (vertical dioptric power) > K2 (horizontal dioptric power), it was WTR (With the rule) and the viceversa is considered as

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ATR astigmatism.

The data thus collected was subjected to analysis. Analysis was done using MS.Excel spreadsheet.

## RESULTS

This study was composed of 1578 eyes from 1568 patients with cataract. Of these, 911 (57.7%) were female, while 667 (42.3%) were male and a female to male ratio of 1.36:1.

The age group of patients in the study population ranged from 23 to 80 years,with majority of them falling in the age group of 50 to 70 years. The same is represented in figure 1. The mean K1 value was 43.5 D and mean K2 was 43.49 D. The range of keratometry readings was found to be 35 D to 48.75 D. Astigmatism ranged from 0.25 diopters to 3.00 diopters with a mean of 1.5 diopters.

Table 1 shows grouping of eyes according to magnitude of astigmatism. 803 eyes (51%) eyes had ≤ 0.5D astigmatism, 40 eyes (2.5%) had an astigmatism < 1D, 674 eyes (42.7%) had astigmatism of ≥ 1D and 56 eyes (3.5%) an astigmatism of ≥ 2 D and 5 eyes (0.3%) an astigmatism of ≥ 3D.The same is represented in figure 2 in graphical form. WTR astigmatism was noted in 595 eyes (37.7%). ATR astigmatism was observed in 561 eyes (35.5%). 422 eyes (26.8%) had no astigmatism (Figure 2).

## DISCUSSION

The cornea and lens are the main contributors to ocular astigmatism. For patients undergoing uncomplicated cataract surgery (which eliminates lenticular astigmatism), significant preoperative corneal astigmatism remains the major obstacle to obtain satisfactory postoperative visual outcome.[11] This presumes that surgically induced astigmatism has been minimized. Prevalence and nature of preoperative corneal astigmatism in patients with cataract have been reported by several countries.[5,9-15] To our knowledge there has been no previously published report from India.

Table 2 shows the comparative analysis of the data with other published studies. The mean age observed in the present study is observed to be lower than previously reported data.[5,10-12] It is observed that the 51-60 year-old age group occupied 36.4% of all cases, followed by the 61–70-year-old age group (33.7%) and 41-50 year age group (17.6 %); these results were similar to those of Chen et al. report from Guangzhou but differed from those of Khan and Muhtaseb's report.[5,10] Khan et al. reported that the 71–80-year-old age group was the largest, followed by the 81–90- and 61–70-year-old age groups.[5]

In terms of gender distribution, our study showed that the number of female patients was greater than that of males, which is consistent with other published studies.[5,10,12]

The mean corneal astigmatism of this cohort was 1.5D (range from 0.0 to 3D), which is slightly higher than that in other published studies.[5,10-12]

In our study 51 % of eyes had a corneal astigmatism of ≤ 0.5D, which is more when compared with the results from other groups.[5,10,12] This differs from Isyaku et al which reported an incidence of 31.53% of study population as having an astigmatism of ≤0.5 D. A large proportion of eyes (42.7%) had a corneal astigmatism of ≥ 1.0D which is similar to that of Chen et al (41.3%). This coincides with Khan et al,which reported an incidence of 40% (Table 2).[5,10] In the present study, 3.5% reported an astigmatism of ≥ 2 D, whereas 0.3% had

an astigmatism of ≥ 3D.This differs from the results of other studies.[5,10-12] Genetic factors known to be important in the etiology and manifestation of corneal astigmatism may be partly responsible for this finding.[18]

Regarding the patterns of astigmatism, WTR astigmatism was noted in 37.7% of the study group whereas ATR astigmatism was seen in 35.5% of the patients. This does not comply with the results of other studies.[9,10,12,15]

No significant difference was noted in the distribution of various patterns of astigmatism between males and females.

**Limitations:** Some limitations of this study include the non measurement of posterior corneal astigmatism. Anterior corneal astigmatism though more significant, underestimates total corneal astigmatism by about 0.25–0.50 diopter.[16] Although manual keratometry is both accurate and reliable as a method of measuring corneal astigmatism, computerized corneal topography has over time become the gold standard.[17] The range of astigmatism observed in our study is in between 0 to 3 D, whereas in other studies it is upto 6.59 D. This might be because of the manual keratometry method employed in the current study by Bausch and Lomb keratometer which measures only central cornea.

## CONCLUSION

In conclusion, our study revealed the distribution of preopera-

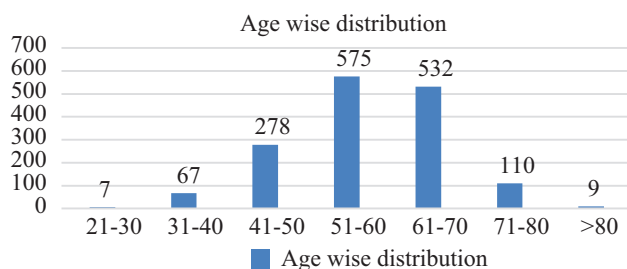| Astigmatism(D) | No.of eyes | Percentage (%) |
|---|---|---|
| ≤0.5 | 803 | 51 |
| <1 | 40 | 2.5 |
| ≥1 | 674 | 42.7 |
| ≥2 | 56 | 3.5 |
| ≥3 | 5 | 0.3 |
| Total | 1578 | 100 |
| **Table-1:** Magnitude of astigmatism in 1578 eyes | | |



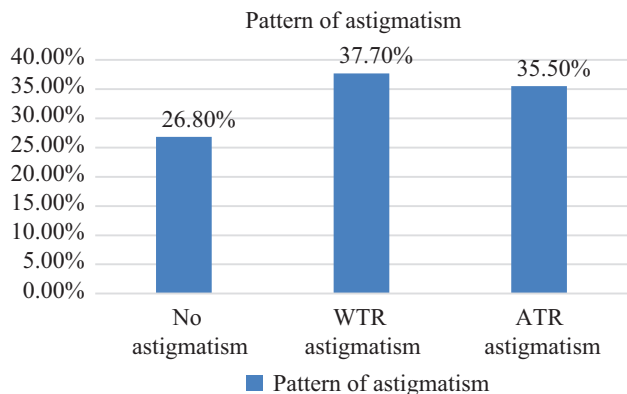**Figure-1:** Frequency distribution of the sample by age group.



**Figure-2:** Pattern of pre existing astigmatism among the study group

| Parameter | Present | Isyaku et al[11] | Khan et al[5] | Guan et al[12] | Chen et al[10] |
|---|---|---|---|---|---|
| Eyes/patients (n) | 1578/1568 | 3286/3169 | 1230/746 | 1430/827 | 4831/2849 |
| Age(y) Mean+/ SD Range | 59.48 23,85 | 60.8±12.7 16,110 | 75.54±0.71 30,104 | 72.27 ±11.59 16,98 | 70.56±9.55 40,95 |
| Male/Female | 667/911 | 1826/1343 | 343/403 | 359/468 | 1090/1759 |
| Corneal astigmatism Mean Range | 1.5 0.0,3.00 | 1.16 0.25,6.00 | 1.03±0.73 0.0,6.2 | 1.07±0.73 0.06,5.52 | 1.01±0.69 0.05,6.59 |
| K1 mean +/SD K2 mean+/SD | 43.5 43.49 | 43.99 43.80 | 43.43± 1.49 44.46±1.56 | 43.57±1.56 44.64±1.65 | 43.76±1.53 44.76±1.56 |
| Corneal astigmatism(%) ≤0.5D <1 ≥1.0D ≥2.0 ≥3.0 | 51 2.5 42.7 3.5 0.3 | 31.53  45.92 14.88 6.12 | 24.47  40.4 9.67 4.61 | 21.2  45.37 10.33 2.22 | 23.14  41.3 8.22 3.52 |
| **Table-2:** Comparison with other studies | | | | | |

tive astigmatism in all cataract candidates in one year in a single hospital in South India. A significant number of our cases (42.7%) exhibited a corneal astigmatism of ≥ 1.0D. Correction of this astigmatism especially by the use of toric IOLs or by modification of the surgical technique like site of incision or using limbal relaxing incisions lshould be considered in order to improve the visual outcome of these patients undergoing cataract surgery.

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803