

Corneal astigmatism in leprosy and its importance for cataract surgery

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Summary

Background: In leprosy, the eyes are frequently affected and many patients were found to have a higher degree of corneal astigmatism than expected during their routine cataract work up.

Aim: To compare pre-existing (before any surgical intervention) corneal astigmatism in leprosy patients as compared to age-matched normal controls.

Methods: A retrospective study was done, using the charts of leprosy patients and age-matched controls without leprosy, who had undergone cataract surgery between 2009 and 2013. The pre-existing astigmatism of the patients in both the groups was compared and analysed.

Results: Severe and very severe astigmatism did not occur in the non-leprosy group, but was found in 6.5% of the eyes of patients in the leprosy group. The difference between the groups was significant ($\chi^2 = 21.68, P = 0.0001$).

Conclusion: Pre-existing corneal astigmatism is significantly more severe in leprosy patients than in non-leprosy patients being prepared for cataract surgery. This knowledge helped us to customise the cataract surgery in order to achieve a better outcome.

Introduction

The common eye complications observed in leprosy include lagophthalmos, impaired corneal sensation, exposure keratopathy, corneal ulceration, corneal opacity, cataract, iridocyclitis, ectropion, entropion, trichiasis, secondary glaucoma, iris atrophy and chronic dacryocystitis.^{1–5} Cataract surgery in leprosy patients is done to regain visual acuity lost from the development of age-related or complicated cataracts. Certain biometric readings such as axial length and keratometry are performed before calculating the intraocular lens power for

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cataract surgery. The keratometry readings determine the nature and extent of corneal astigmatism.

Astigmatism is an optical condition of the eye in which light rays from an object do not focus to a single point but form a set of two focal lines because of variations in the curvature of the cornea.⁶ Broadly, there are two types of astigmatism - regular and irregular. In regular astigmatism the refractive power changes uniformly from one meridian to another.

Regular astigmatism is sub-classified into 'with-the-rule' and 'against-the-rule' astigmatism. In 'with-the-rule' astigmatism the vertical meridian is steeper than the horizontal meridian and a minus cylinder is used at or near the 180° axis, to correct the astigmatism. In 'against-the-rule' astigmatism the horizontal meridian is steeper than the vertical meridian and a minus cylinder is used at or near the 90° axis, to correct the astigmatism. In irregular astigmatism the orientation of the principal meridian changes from point to point across the pupil. It can be demonstrated by retinoscopy or keratometry that the principal meridians of the cornea, as a whole, are not perpendicular to one another. Instruments such as corneal topography can be used to detect this condition clinically.⁶

Keratometry is an objective method of estimating the corneal astigmatism by measuring the curvature of central cornea. It is a critical measurement used in the calculation of the power to be used in an intraocular lens that is implanted into the eye after cataract surgery.

Various studies have shown that the general astigmatism in a normal population ranges from 0.89 to 1.25 D.⁷⁻¹² Our hospital, which is a tertiary care facility for treating leprosy, has a sizable proportion of leprosy patients with cataract. Before performing cataract surgery, during routine biometric preoperative evaluation, it was noticed that some leprosy patients tended to have high corneal astigmatism. We therefore investigated the severity and prevalence of corneal astigmatism in leprosy patients undergoing pre-operative investigations before cataract surgery and present our results in this paper.

Methods

This is a retrospective study performed at the ophthalmology department of the Schieffelin Institute of Health Research & Leprosy Centre, Karigiri, Vellore district, Tamil Nadu, India. Data were collected from the records of patients attending the out-patient clinic in ophthalmology from January 2009 to October 2013. Both new and old registered patients diagnosed with any type of leprosy were eligible for inclusion. Data of age-matched controls without leprosy who attended the clinic during the same period were used for comparison.

A Bausch and Lomb keratometer was used for taking the keratometry readings. Each patient was asked to keep his/her chin on the chin rest. Each eye was tested individually. The eye piece of the keratometer was adjusted until the reticle (cross hair) was clearly seen. The patient was asked to look at the fixation target and the focus was adjusted until the mires of the three circles were seen clearly. The horizontal meridian was measured after bringing the two pluses into superimposition and the vertical meridian was measured after superimposing the minus signs. The readings were recorded in diopters (D) and the difference between the two meridians was taken as the amount of astigmatism.^{6,13}

Demographic characteristics such as age and sex and the type of leprosy were analysed together with the keratometry readings. The data were analysed using the χ^2 test and significance was calculated using Med Calc version 16.2.

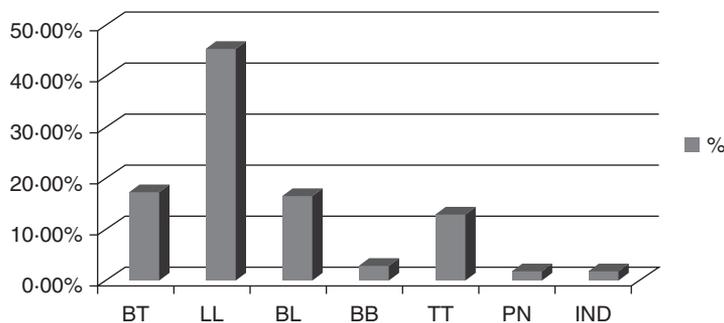


Figure 1. Types of leprosy.

Results

A total of 138 eyes from 103 leprosy patients were compared with 138 eyes of age-matched, non-leprosy patients. Figure 1 shows the number of leprosy patients of each type enrolled in the study.

The age and sex distribution of the leprosy and non-leprosy subjects are shown in Table 1.

The corneal astigmatism of the leprosy patients and non-leprosy patients were classified as mild (<2 D), moderate (2–<4 D), severe (4–<6 D), or very severe (≥ 6 D). Table 2 shows the distribution of different grades of astigmatism among the leprosy and non-leprosy patients.

Among the leprosy patients, 111 eyes (80.4%) were in the mild group, 18 (13%) were moderate, six (4.4%) were severe, and three (2.2%) were very severe. For non-leprosy patients 135 (97.8%) had mild astigmatism, while only three (2.2%) were classified as moderate; however, there were no cases with severe or very severe corneal astigmatism.

The statistical significance was determined using the chi-square test and it was found that the distribution of astigmatism was significantly different between the leprosy and non-leprosy patients ($\chi^2 = 21.68$, $P = 0.00001$). There were more against-the-rule astigmatism than with-the-rule astigmatism with 70.28% and 66.67% in Leprosy and Non Leprosy group respectively.

Table 1. Age and sex distribution of leprosy & non-leprosy patients

AGE	Leprosy Patients				Non-Leprosy Patients			
	Male		Female		Male		Female	
	No of pt	%	No of pt	%	No of pt	%	No of pt	%
<= 44	2	2.9	1	2.8	1	1.96	–	–
45–54	5	7.3	5	14.23	3	5.88	7	8.04
55–64	17	25	11	31.42	25	49.2	40	46
65–74	36	52.9	13	37.14	13	25.49	37	42.52
75–80	5	7.3	3	8.51	5	9.8	2	2.2
>80	3	4.4	2	5.7	4	7.8	1	1.14
Total	68	100	35	100	51	100	87	100

Table 2. Astigmatism of leprosy & non-leprosy patients

Patients	Mild (0-< 2)	Moderate (2-< 4)	Severe (4-< 6)	Very Severe (≥6)	Total
Leprosy Patients	111 (80.43%)	18 (13.04%)	6 (4.34%)	3 (2.17%)	138 (100%)
Non-leprosy Patients	135 (97.82%)	3 (2.17%)	0	0	138 (100%)
Total	246	21	6	3	276

Discussion

The visual disability in leprosy can be due to various reasons, including a damaged cornea secondary to lid abnormalities, exposure keratitis, dry eye, cataract etc. Cataract in leprosy patients could be age related, or it may occur as a complication of the disease process or as a consequence of treatment with steroids. If the eye is inactive without uveitis and if there are no contraindications for surgery such as non-healing ulcers in the extremities, the patient can be safely taken for surgery and rehabilitated. With the advanced techniques of surgery the patient can be almost fully rehabilitated. But since we see a lot of leprosy patients having a corneal curvature asymmetry called astigmatism, we were prompted to look into this, as it could affect the ultimate vision after a very successful cataract surgery technically.

Our study comparing a group of leprosy patients and their age-matched controls revealed that the grade of astigmatism is significantly more severe in the leprosy patients. The astigmatism found in leprosy could be due to corneal opacity, keratitis, trichiasis, entropion, ectropion and others as seen in Figure 2. This, if foreseen, could help us plan the cataract surgery in these patients in a customised way. There are many options to reduce the astigmatism due to corneal causes during surgery, and there are methods to negate the same

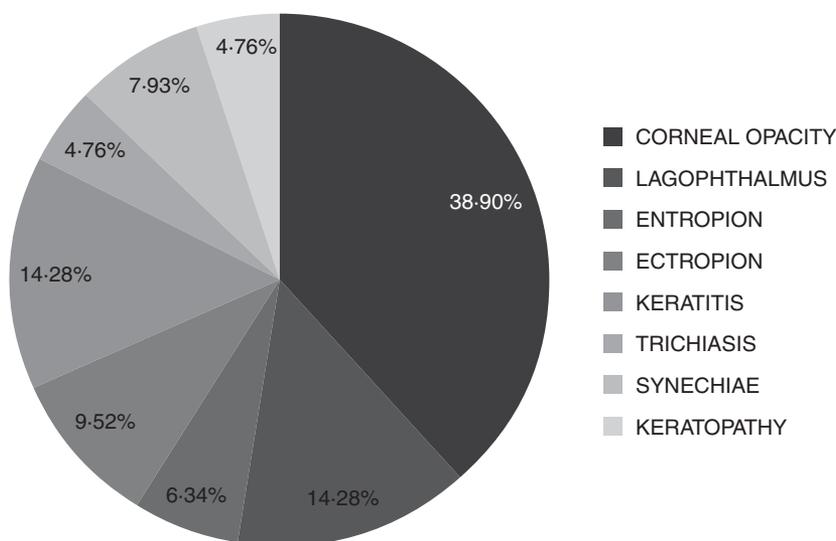


Figure 2. Eye complication causing astigmatism.

using customised intra-ocular lenses (IOL), although a description of these techniques is beyond the scope of this study. With this knowledge, the visual rehabilitation in these patients could be improved.

Eighty percent of leprosy patients have mild astigmatism, while the remaining 20% have moderate, severe or very severe astigmatism. Amongst non-leprosy patients, 97.8% have mild and 2.2% have moderate astigmatism, but there is no sign of severe or very severe astigmatism in this group.

Conclusions

Our study shows that leprosy patients, when compared to non-leprosy controls, have a significantly higher grade of astigmatism. The cause for the same could be attributed to the complications of the disease, including corneal scars, lid anomalies and lagophthalmos. Since this could affect the final visual outcome after cataract surgery in these patients, this finding must be taken into account when planning cataract surgery in leprosy patients.

Recommendation

Our study recommends that leprosy patients need special attention during their preoperative cataract surgery evaluation, so that instead of following a routine cataract surgery procedure, these patients can be approached on an individual basis and given treatment appropriate to their degree of astigmatism.

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