Corneal sensitivity and correlations between decreased sensitivity and anterior segment pathology in ocular leprosy

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Abstract

Leprosy is one of the leading causes of corneal hyposensitivity. In this article the corneal sensitivity of 143 leprosy patients was examined, and correlations between corneal hyposensitivity and anterior segment pathology were detected. Twenty four healthy volunteers were examined as controls. Various degrees of corneal loss of sensitivity were found in 46·2% of leprosy patients. Lagophthalmos, chronic lepromatous granulomatous uveitis, iris atrophy, and social blindness were found 4·5–16·6 times more frequently in eyes which developed severe corneal hyposensitivity.

Leprosy, the agent of which is *Mycobacterium leprae*, is one of the systemic and infectious diseases which mostly involve the eye.[1-3] Regardless of the portal of entry of the leprosy bacillus the target tissue is the Schwann cells of peripheral nerves.[4] The bacillus prefers the nerves in areas where the body temperature is low. It may affect the zygomatic branch of nervus facialis and corneal nerves innervated by the ophthalmic branch of the trigeminal nerve.[5]

Although it has long been known that in leprosy corneal sensitivity is decreased, the degree of hyposensitivity, how frequently it appears, whether or not it leads to anaesthesia, and whether it is correlated with anterior segment lesions of leprosy have not been completely evaluated. Various rates of corneal hyposensitivity have been reported, but few of these studies are quantitative, carried out with cotton, and control groups have generally not been included.

In this study we have investigated the actual incidence of corneal hyposensitivity in leprosy and tried to answer those questions.

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Materials and methods

The study was carried out in the Department of Ophthalmology, Cerrahpaşa School of Medicine, University of Istanbul, and Istanbul Leprosy Hospital and Research Centre, from June 1986 through June 1989. A total of 286 eyes were included, from 88 patients with lepromatous leprosy (LL) and 55 patients with borderline lepromatous leprosy (BL). As controls, 48 eyes of 24 healthy adults who had no ocular or systemic diseases and who were not taking any topical or systemic medication when they were included in the study. The study was carried out prospectively, and all ophthalmic examinations and corneal sensitivity measurements were made by the same researcher (MAK). Since there were visible deformities in some of the patients, masking of the investigator was of no use.

The diagnosis of leprosy was established by the case history, clinical and bacteriological tests, and in some cases histopathological investigations at Istanbul Leprosy Hospital and Research Centre. The patients were sent to our working group for ophthalmic evaluation, regardless of whether or not they had any complaints. The cases were classified by the Ridley-Jopling classification.[6]

Systemic and ophthalmic examinations of all patients were undertaken and were recorded on previously prepared forms. Corneal sensitivity was measured by the Cochet-Bonnet aesthesiometer and the intraocular pressure by the Goldmann applanation tonometer.

MEASUREMENT OF CORNEAL SENSITIVITY

Before the corneal sensitivity measurement was carried out the reason for it and the method were explained to the patient, and his co-operation was sought. The patient, sitting before the biomicroscope, was fixated on an asterisk placed in the distance, lest he should see the filament by means of accommodation. The examination was initiated by a filament 60 mm in length. The cornea, divided into four quadrants and one central area, was measured first at the centre, and the measurements were then continued clockwise beginning from the lower nasal quadrant. The blinking reflex was not accepted as a response to the contact of the filament. The patient was asked if he felt the contact of the filament, and sometimes the accuracy of his answer was verified by approaching the filament to the cornea but not touching it and asking the patient the same question. The examination began with 60 mm of filament and was continued by shortening the filament by 5 mm, until the patient responded that he did not feel the contact of the filament. Measurements were carried out in the afternoon from 13 00 to 17 00 with the same aesthesiometer, in the same setting, and by the same researcher, but the temperature and humidity control of the examination room was not verified.

SEVERITY OF CORNEAL HYPOSENSITIVITY

The severity of corneal hyposensitivity was graded in the groups included in the study. Those who had a mean corneal sensitivity of 55 mm or more, measured in five separate quadrants of the cornea, were considered to have normal corneal sensitivity. Corneas having a value of 50–54 mm were considered as showing a

Table 1 Corneal sensitivity values in the eyes of leprosy patients and the normal control group in relation to the quadrants of the cornea

Corneal quadrants	Leprosy eyes n:286	Control group n:48	p
Centre	52·5 (11·8)*	57·2 (4·3)	0·007
Upper temporal	48·0 (14·1)	54·0 (6·3)	0·004
Upper nasal	46·5 (14·2)	54·5 (5·4)	0·001
Lower nasal	52·3 (11·2)	57·6 (4·6)	0·002
Lower temporal	52·4 (12·3)	57·5 (4·7)	0·005
Average	50·3 (12·1)	56·2 (4·3)	0·001

*Milimetres, mean (SD).

slight hyposensitivity, those with a value of 40–49 mm had a moderate hyposensitivity, and those with a value of 30–39 mm had a severe hyposensitivity. The patients with a value of 30 mm or lower were considered to have an advanced degree of corneal hyposensitivity.

Student's *t* test and analysis of variance were used for statistical analysis.

Results

The mean age (with SD) of the patients with lepromatous leprosy was 42·0 (13·7) years, those with borderline lepromatous leprosy 40·8 (13·0) years, and of the control group 40·7 (12·7) years. The duration of the disease was 20·6 (12·7) years in cases with LL and 18·1 (11·3) years in those with BL.

When the measurements of corneal sensitivity by quadrants of the leprosy patients and of the normal control group were compared, the sensitivity in all the quadrants of the leprosy patients was significantly low, being lowest in the upper nasal quadrant (Table 1).

When the cases of LL and BL were studied separately, corneal sensitivity in all quadrants was found to be significantly lower in the group with lepromatous leprosy than in the control group. In cases with borderline lepromatous leprosy, though the mean corneal sensitivity was lower than in the control group, the decrease was statistically significant only for the upper nasal quadrant (Table 2).

When the correlation between the duration of the disease and corneal hyposensitivity was investigated in the patients with LL and BL leprosy, it was observed that corneal sensitivity was significantly lower in cases with a duration over 15 years as compared with the control group (Table 3).

When the severity of corneal hyposensitivity was evaluated, the proportion of cases in which

Table 2 Corneal sensitivity values in LL, BL, and control groups in relation to the quadrants of the cornea

Corneal quadrants	LL n:176	BL n:110	Control group n:48
Centre	50·0 (13·7)*	56·5 (6·2)	57·2 (4·3)
p	<0·001	>0·05	
Upper temporal	45·2 (15·9)	52·6 (8·9)	54·0 (6·3)
p	<0·001	>0·05	
Upper nasal	43·6 (15·8)	51·0 (9·8)	54·5 (5·4)
p	<0·001	<0·05	
Lower nasal	50·0 (13·4)	56·0 (6·6)	57·6 (4·6)
p	<0·001	>0·05	
Lower temporal	49·8 (14·3)	56·6 (6·1)	57·5 (4·7)
p	<0·001	>0·05	
Average	47·7 (13·9)	54·5 (6·6)	56·2 (4·3)
p	<0·001	>0·05	

*Millimetres, mean (SD).

Table 3 Correlation between the duration of disease and corneal hyposensitivity in leprosy patients

Duration of disease (yr)	n (%)	LL+BL eyes n:286	Control group n:48	p
0·5	36 (% 12·6)	53·5 (9·1)*	56·2 (4·3)	>0·05
6–10	56 (% 19·6)	56·3 (6·2)	56·2 (4·3)	>0·05
11–15	28 (% 9·8)	51·2 (12·6)	56·2 (4·3)	>0·05
16–20	48 (% 16·8)	49·8 (13·5)	56·2 (4·3)	<0·01
>20	118 (% 41·2)	46·4 (12·9)	56·2 (4·3)	<0·003

*Average values, milimetres, mean (SD).

the sensitivity of all five corneal quadrants was 55 mm or more in the control group was 72·9%. This rate was 53·8% in patients with leprosy. While the value of corneal sensitivity was below 50 mm in 6·3% of patients in the control group, it was 32·2% in patients with leprosy (Table 4). Table 4 shows that, in 46·2% of patients with leprosy, there were various degrees of corneal hyposensitivity.

In order to investigate the correlation of corneal hyposensitivity with the anterior segment pathology in leprosy, a group of patients with leprosy who had normal corneal sensitivity (154) were compared with another group of patients with leprosy (30) who had an advanced degree of hyposensitivity responding only to the filament length below 30 mm (4th degree), and the incidence of anterior segment pathology was investigated in both groups (Table 5).

Discussion

In leprosy the organ most often involved after the skin, nasal mucosa, and peripheral nerves is the eye. The eye is liable to infiltration as soon as the disease agent disseminates through the blood stream. The leprosy bacillus may be present in any part of the eye, but the main lesion is almost always in the structures of anterior segment. Although the primary lesions appear on the cornea, it has been suggested that the earliest affected part is the ciliary body.[37]

The involvement of the trigeminal nerve-ends in the cornea, together with the zygomatic branch of the facial nerve, leads on to the association of corneal hyposensitivity with lagophthalmos, and this in turn indicates how liable the globe has been to the risks inherent in leprosy.

The incidence of corneal hyposensitivity in leprosy has been reported as being between 8·1% and 59·2%. As noted above, most of these studies lack valid scientific criteria. Table 6 shows the incidence of corneal hyposensitivity reported in literature.

When the results of our study are examined, it is seen that corneal hyposensitivity in cases with lepromatous leprosy, although the duration of the disease is not different, is more severe than in

Table 4 Severity of corneal hyposensitivity in patients with leprosy and the control group

Severity of corneal hyposensitivity	Leprosy eyes n:286	Control group n:48
Normal (50–60 mm)	154 (%53·8)	35 (% 72·9)
1st degree (mild) (50–54 mm)	40 (% 14·0)	10 (% 20·8)
2nd degree (moderate) (40–49 mm)	46 (% 16·1)	3 (% 6·3)
3rd degree (severe) (30–39 mm)	16 (% 5·6)	–
4th degree (advanced) (<30 mm)	30 (% 10·5)	–

Table 5 Incidence of anterior segment lesions in leprosy patients with normal corneal sensitivity and leprosy patients with advanced degree of corneal hyposensitivity (4th degree)

Anterior segment lesions related to leprosy	*Normal sensitivity 154 (% 53·8)** %	*Advanced hyposensitivity 30 (% 10·5)* %
Prominent corneal nerves	32·5	23·3
Corneal nerve beading	33·8	20·0
Avascular keratitis	15·6	3·3
Exposure keratitis	3·9	46·7
Acute non-granulomatous uveitis	13·0	6·7
Chronic granulomatous uveitis	20·1	96·7
Iris atrophy	17·5	80·0
Social blindness (<3/60)	0·6	10·0

*The number among leprosy patients.

Table 6 Incidence of corneal hyposensitivity in leprosy according to various studies

Authors	*Year*	*%*
Shields *et al*[8]	1971	36
Acharya[9]	1978	59·2
Courtright *et al*[10]	1984	20
Prasad *et al*[11]	1984	8·1
Ffytch[12]	1984	20
Tsai and Suryawanshi[13]	1985	24
Present study	1989	46·2

cases of borderline lepromatous leprosy and that, the longer the duration of the disease, the worse is the hyposensitivity.

When the topographical distribution of corneal hyposensitivity is examined, the most severe hyposensitivity is found in the upper nasal and temporal quadrants, whether in cases of lepromatous leprosy or of borderline lepromatous leprosy, and that, although there is some hyposensitivity in the corneal centre, this has been relatively less than in the outer quadrants.

Corneal hyposensitivity was examined in the normal state and in four degrees of severity, and it was found that the patients with advanced hyposensitivity who responded to a filament length of less than 30 mm had had the disease for significantly longer than the leprosy patients with normal corneal sensitivity, and that they became leprous when they were considerably younger.

Various rates of hyposensitivity were determined in 46·2% of leprous patients. Even when the confidence limit was assumed to be 95%, this rate showed such a high value as 32·2% approximately.

Contrary to mistaken beliefs, leprosy was not found to cause deep corneal hyposensitivity approaching anaesthesia. In this study the number of eyes which had a mean corneal hyposensitivity under 5 mm was 0·6%. The percentage of such cases has been reported to be 53·3% in patients with herpetic stromal keratitis.[14] Leprosy causes less corneal hyposensitivity than herpetic stromal keratitis.

When the leprosy patients with no corneal hyposensitivity and those with advanced corneal hyposensitivity were divided into two groups and examined as to the leprous lesions in the anterior segment, it was found that, in the first group, avascular keratitis occurred approximately five times and acute non-granulomatous uveitis twice as frequently; whereas in the second group, that is, in the cases with advanced hyposensitivity, chronic granulomatous lepromatous uveitis occurred approximately five times, iris atrophy four times, and social blindness 16 times as frequently.

It has been shown that leprosy causes a high percentage of corneal hyposensitivity among patients with the disease in Turkey, and that severe corneal hyposensitivity was more frequent among cases of lepromatous leprosy. The incidence increased with duration of disease, and in patients with advanced corneal hyposensitivity the anterior segment lesions of this disease were found more often.

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