Factors Influencing Corneal Involvement in Leprosy[1]

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Leprosy is a chronic infectious disease, the incidence of which varies widely in different parts of the world. It involves almost all of the ocular tissues and is responsible for blindness because of complications due to involvement of the cornea or uveal tissue. The corneal affections may be either primary, or secondary to 5th and 7th nerve palsy with exposure keratitis, or due to a concomitant disease. Although the presence of dry eye in leprosy patients has been mentioned ([7]), the detailed study of the status of the pre-corneal film in leprosy is scanty ([3]). The present study investigated the role of various factors contributing to the etiopathogenesis of corneal involvement in leprosy with special reference to the status of the pre-corneal tear film.

MATERIALS AND METHODS

The study was conducted on 400 eyes of patients with various types of leprosy. All of the eyes were examined with particular reference to corneal involvement. Stability of the pre-corneal tear film was tested in all patients by Schirmer's test and tear film break up time (BKUT). Patients with paralytic ectropion and other lid abnormalities, such as lagophthalmos and central corneal opacity, formed a separate group in the study of tear-film stability. The control group comprised 50 normal eyes of patients of comparable age, sex, and socioeconomic status attending the ophthalmic outpatient department of Lady Hardinge Medical College, New Delhi, India. In these normal eyes, the tear-film BKUT was 18.3 ± 2.38 sec and Schirmer's test was 17.4 ± 1.8 mm. Schirmer's test I was done, and a wetting of 10–30 mm of the paper strip was taken as normal. A value of <10 mm indicated hyposecretion; a mean of at least three readings done on the same day was taken for analysis. The test for tear-film BKUT was done, and the time taken for the appearance of the first dry spot on the cornea after the last blink was noted. A BKUT of <15 sec was considered diagnostic of dry eyes, irrespective of the lack of objective signs referable to mucin deficiency. The test should not be done in conjunction with topical anesthetic agents.

In addition, the conjunctiva was stained with 1% rose Bengal. The central corneal sensitivity of all the patients was recorded using the Cochet and Bonnet anesthesimeter. Any reading <25 mm was taken as hypoesthesia. (This value corresponds to 4.6 g/mm^2.) A punch biopsy from the lower fornix of the conjunctiva was taken for the study of mucous-secreting goblet cells, and its relation with the clinical dry eyes was analyzed.

RESULTS

A total of 400 eyes of 212 leprosy patients were included in this study. Of these, 22.16% were tuberculoid, 25.94% borderline, 46.22% lepromatous, and 5.68% were unclassified.

Table 1 gives the findings of the Schirmer test. It was seen that 98 eyes (24.5%) of the leprosy patients showed <10 mm wetting of the filter paper and 75.5% of the eyes had a normal Schirmer's test. An abnormal tear film BKUT of 0–15 sec was seen in 47.2% of the eyes, while 52.8% of the eyes had a normal BKUT (>15 sec) (Table 2). Regarding abnormalities of the BKUT and Schirmer's tests, it was found that in 100 eyes the BKUT was recorded as abnormal even with a normal value of Schirmer's test. Only in 15 eyes was the Schirmer test abnormal with a normal BKUT. Abnormality of both BKUT and Schirmer's test was seen in 73 eyes (18.2%). There was no statistically significant difference in the tear film abnormality in different types of leprosy (Table 3). The frequency of abnormal tear-film BKUT was consistently higher than an abnormal Schirmer test in different types of

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TABLE 1. *Schirmer's test in leprosy.*

Wetting of Whatman paper	No. eyes	%
0–10 mm	98	24.50
11–15 mm	95	23.75
>15 mm	207	51.75

leprosy, the maximal difference being in lepromatous leprosy.

Lagophthalmos was present in 40 eyes. Table 4 shows the frequency of abnormal BKUT (70%) as compared to abnormal Schirmer's test (40%) among patients with lagophthalmos. In spite of the presence of lagophthalmos, 25% of the eyes showed the tear-film BKUT to be within normal limits. It is significant that lagophthalmos was more frequently observed in cases of lepromatous leprosy (50%). Cases of lagophthalmos with ectropion had a lower incidence of abnormal Schirmer's test (26.8%) as compared to cases without ectropion (58.3%) (Table 5).

Corneal sensations were diminished in 54% of the eyes. This observation was seen more frequently in lepromatous leprosy (67.35%) as compared to the tuberculoid type (49%). There was an increased incidence of corneal opacities (24%) in cases with abnormal corneal sensation, while only 7.5% of the eyes had corneal opacities with normal corneal sensations (Table 6). Of the various corneal affections seen, 10 eyes had active corneal ulcer and 13 eyes had anterior staphyloma or phthisis bulbi. The prevalence of corneal affections in this study was 30.4% (122 eyes). Of this 30.4% of corneal affections, a large majority of eyes, i.e., 60% (73 eyes), had corneal opacity secondary to lid pathology or concomitant disease (injuries, secondary infections) and only 40% (49 eyes) had primary leprotic corneal involvement (chalky white deposits, lepromatous pannus, interstitial keratitis). Conjunctival biopsies performed in 41 cases revealed decreased goblet cells in 31.7% (13 cases) and evidence of chronic inflammation in 41.5% (17 cases).

TABLE 2. *Tear-film break up time (BKUT) in ocular leprosy.*

BKUT (sec)	No. eyes	%
0–5	54	13.50
6–10	58	14.50
11–15	77	19.25
≥16	211	52.75

TABLE 3. *Tear-film abnormality in different types of leprosy.*

Type of leprosy	Abnormal Schirmer's test <10 mm	Abnormal tear-film BKUT <15 sec
Tuberculoid	26.9%	42.9%
Borderline	21.9%	41.7%
Lepromatous	24.0%	52.3%
Unclassified	50.0%	20.0%

The tear-film status in the group of patients without corneal or lid pathology (296 eyes) showed an abnormal Schirmer's test in 21.6% and an abnormal BKUT in 36% of the eyes.

DISCUSSION

The exact etiopathogenesis of dry eyes in leprosy is not well understood. Various factors contributing to its occurrence may be a decreased basic tear secretion or a decreased reflex secretion from the lacrimal gland. The tear film is a dynamic structure that does not remain stable for any prolonged length of time. The tear-film formation is a complex event in which the normal lid function and anatomy are absolutely necessary ([4]). The mucin layer is formed by the secretions of the goblet cells and is the natural wetting agent in the tear film. The mucus coat of the superficial epithelium is very important for the stability of the tear film. While the reflex secretion of the lacrimal gland is controlled by the parasympathetic nerve supply, the sympathetic fibers may control the basic secretors in the lids and conjunctiva ([1]). Jones ([5]) stated that there is no efferent nerve supply to the basic secretors but the mucin secretion may increase as a result of inflammation. Conjunctival sensory stimulation activates the reflex system wherever the basic secretors become inadequate. An abnormal Schirmer's test was seen less frequently (26.8%) in cases of lagophthalmos with ectropion than without ectropion (58.3%), a picture very close to a true hypersecretion of tears. Thus, the aqueous quantity of such tear fluid would tend to increase in cases of lagoph-

TABLE 4. *Pre-corneal film findings in eyes with lagophthalmos.*

Lagophthalmos		BKUT		Schirmer's test	
Type of leprosy	No. eyes	Normal	Abnormal	Normal	Abnormal
Tuberculoid	11 (27.5%)	3	8	5	6
Borderline	9 (22.5%)	3	6	6	3
Lepromatous	20 (50.0%)	4	16	13	7
Total	40 (100%)	10 (25%)	30 (75%)	24 (60%)	16 (40%)

thalmos with ectropion explained on the basis of associated chronic conjunctivitis.

An abnormal tear-film BKUT was frequently observed in the present study (47.2%). This results in poor lubrication and wetting of the corneal epithelium even when the Schirmer's test was within the normal range. A continuous tear film can form only with difficulty across the corneal and conjunctival surface that lacks a good blinking of lids and has a deficient mucin layer. Regardless of the origin, all dry eyes lead to dessication and necrosis of corneal and conjunctival epithelium with the cornea ultimately responding with vessel ingrowth and scarring.

Corneal sensations are altered in leprosy, and abnormalities are seen more frequently in lepromatous leprosy. The presence of corneal opacity was seen more frequently (44.4%) with hypoesthesia. This disproportionate increase in the development of corneal opacity in eyes with abnormal corneal sensation may be attributed to the tear-film abnormality which takes place in anesthetic corneas in association with lagophthalmos. The combination of leprosy and trachoma is particularly disastrous for patients, because these two diseases work in concert to produce crippling disease of the anterior ocular segment ([8]). Typically, when trachoma is superimposed on leprosy patients with corneal anesthesia and tear deficiency, the severe cicatrizing trachoma with inturned upper lid and xerosis produces enhanced damage to the cornea and more frequent corneal scarring.

In our study, corneal disease was seen more frequently among lepromatous leprosy patients (43.2%) followed by tuberculoid leprosy (26.9%) and borderline leprosy (14.0%). In contrast to the classically described corneal changes in leprosy, the present series demonstrates that 60% of the corneal involvement was secondary to pathology of the lid, e.g., lagophthalmos and other concomitant diseases such as acute infections and injuries. Active corneal ulcer was present in 10 eyes. Superficial punctate keratitis was observed in 12.8% of the eyes. An altered pattern of corneal morbidity in leprosy has been observed in this country, probably due to local factors such as infection, including trachoma, humidity and other environmental factors.

Tear-film abnormalities in association with lagophthalmos and abnormal corneal sensation are identified as factors contributing to the corneal morbidity in the present study. The abnormality of the tear film (BKUT) was observed to be much more informative in the present series than the study of the Schirmer test alone. However, the BKUT will not be significantly informative if there is an epithelial abnormality on the corneal surface. The diagnosis of subclinical dry eye in leprosy is important for the management of a case. Rose Bengal staining of the conjunctiva and cornea was seen to be a valuable adjuvant in eliciting devitalized cells and precipitated mucin.

Recent studies have demonstrated an early autonomic denervation hypersensitivity response to the uveal tract in leprosy ([2, 6]). Since the basic secretors in the lids and conjunctiva are indirectly influenced by the sympathetic supply through the regulation

TABLE 5. *Relation of Schirmer's test to ectropion in lagophthalmic eyes.*

Schirmer's test	Lagophthalmos			
	Without ectropion		With ectropion	
	No. eyes	%	No. eyes	%
Normal	10	41.7	11	73.2
Abnormal	14	58.3	5	26.8

TABLE 6. *Corneal sensations.*

Type of leprosy	Normal corneal sensation			Abnormal corneal sensation		
	No. eyes	Lagoph-thalmos	Corneal opacity	No. eyes	Lagoph-thalmos	Corneal opacity
Tuberculoid	48	—	8	46	11	18
Borderline	72	3	5	38	6	8
Lepromatous	64	—	17	132	20	70
Total	184	3	30	216	37	96

of blood flow to these glands ([1]), it is postulated that an autonomic denervation may play a similar role in producing an abnormality of the mucin layer, resulting in subclinical dry eye.

SUMMARY

Corneal involvement in leprosy is known to be influenced by factors such as lagophthalmos, ectropion, and corneal anesthesia. In the present study conducted on 400 eyes of leprosy patients, observations were made on tear film abnormalities, and their relation to the above-mentioned factors was analyzed. The abnormality of tear film breakup time (BKUT) was found to be clinically more significant (47.2%) than a Schirmer's test alone (24.5%), and this finding was of greater significance in the lepromatous form of leprosy. An abnormal BKUT reflects a decreased mucin secretion by the conjunctival goblet cells. Tear film abnormalities in association with lagophthalmos, corneal anesthesia, concomitant ocular diseases, and environmental factors such as high relative humidity have been identified as factors contributing to corneal involvement in leprosy in India. It is not surprising that with so many mechanisms of corneal involvement the clinical manifestations are diverse, and all forms of pathological changes may contribute to corneal morbidity.

RESUMEN

Se sabe que la afección corneal en la lepra está influenciada por diversos factores tales como logoftalmos, ectropion y anestesia corneal. En el presente estudio realizado en 400 ojos de pacientes con lepra, se hicieron observaciones de las anormalidades en la fragilidad de la película lacrimal y se analizó su relación con los factores antes mencionados. Se encontró que la anormalidad en el tiempo de rompimiento de la pelícual lacrimal (BKUT) fue clinicamente más significativa (47.2%) que la prueba de Schirmer sola (24.5%), y esta hallazgo fue de mayor significancia en la forma lepromatosa de la lepra. Un BKTU anormal refleja una disminución en la secreción de mucina por las células conjuntivales en forma de copa. Las anormalidades en la fragilidad lacrimal en asociación con logoftalmos, anestesia corneal, enfermedad ocular concomitante y factores ambientales tales como una alta humedad relativa, se han identificado como factores que contribuyen a la afección corneal en la lepra, en la India. No es sorprendente que tantos mecanismos de afectación corneal conduzcan a diversas manifestaciones clínicas y que todas la formas de cambios patológicos puedan contribuir a la morbilidad corneal.

RÉSUMÉ

On sait que l'atteinte de la cornée dans la lèpre est influencée par des facteurs tels que la lagophthalmie, l'ectropion, et l'anesthésie cornéenne. Dans cette étude, menée sur quatre cent yeux de malades de la lèpre, on a procédé à des observations concernant les anomalies du film lacrymal, et leur relation avec les facteurs mentionnés ci-dessus a été analyseé. On a noté qu'une anomalie du temps de rupture du film lacrymal (BKUT) était cliniquement plus significative (47, 2%) qu'une épreuve unique de Schirmer (24, 5%). Cette observation présentait une signification plus élevée dans la forme lépromateuse de la lèpre. Un temps de rupture anormal reflète une diminution de la sécrétion de mucine par les cellules conjonctivales en gobelets. Les anomalies du film lacrymal, associées avec la lagophthalmie, l'anesthésie cornéenne, les affections ocularies concommittantes ou des facteurs de l'environnement telle une humidité relative élevée, contribuent en Inde à l'atteinte cornéenne due à la lèpre. Il n'est pas surprenant que, devant tant de mécanismes possibles pour une atteinte cornéenne, les manifestations cliniques soient diverses, toutes les modifications pathologiques pouvant contribuer à la morbidité au niveau de la cornée.

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