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Evaluation of the Anterior Segment of the Eye Through a Corneal Topograhic Analysis in Leprosy Patients

Objective: The present study evaluates the anterior chamber volume, anterior chamber angle, anterior chamber depth and pupil diameter using a corneal topographic analysis method in a group of leprosy patients. A further evaluation is made of intraocular pressure using a Goldman applanation tonometer.

Materials and Methods: The study included 46 eyes of 25 patients with leprosy and 44 eyes of 22 patients as the control group. Following an ophthalmological examination of the patients, a segment analysis was carried out using a corneal topographic method, while a Goldman applanation tonometer was used to track the changes in intraocular pressure.

Results: A significant increase was identified in anterior chamber depth and anterior chamber angle in the leprosy group when compared to the control group. The changes in intraocular pressure were not significantly different between the two groups. Although anterior chamber volume was seen to increase in the control group, this increase was not significantly different to that noted in the leprosy group. Furthermore, there was a greater decrease in pupil diameter in the leprosy group, although when compared to the control group, the difference in increase was not statistically significant.

Conclusion: The present study identified a significant increase in the anterior chamber depth and anterior chamber angle values in the patients with leprosy. The authors believe the findings of the present study should be considered when evaluating patients with leprosy for possible glaucoma. The present study revealed also that parameters such as anterior chamber depth, anterior chamber angle and anterior chamber volume, which cannot be objectively evaluated upon a physical examination, and a slit lamp examination for such clinical conditions as lagophthalmos, ectropion, entropion and ptosis, but which can be evaluated through a corneal topographic analysis, can be found to be affected in patients with leprosy.

Key words: *Leprosy, cornea topography*

Lepra Hastalarında Kornea Topografisi ile Ön Segment Değerlendirilmesi

Amaç: Lepralı hasta grubunda biyomikroskop ile ön segment muayenesinde tespit edilmeyen yalnızca Kornea Topografisi (KT) ile görülebilen parametrelerin analizini yapmayı amaçlandı.

Gereç ve Yöntem: Bu çalışmaya lepra hasta grubunda 25 hastanın 46 göz'ü ile kontrol grubun da ise 22 hastanın 44 göz'ü çalışmaya dahil edildi. Bu çalışmada vakaların oftalmik muayenelerinden sonra KT ile segment analizini, Goldman aplanasyon tonometrisi ile de göz içi basınç değişikleri değerlendirildi.

Bulgular: Kontrol grubu ile karşılaştırıldığında lepralı hasta grubunda ön kamara derinliğinde ve ön kamara açısında istatistiksel olarak anlamlı artış mevcuttu. Göz içi basınç değişikliğinde istatistiksel olarak anlamlı azalma saptanmadı. Ön kamara volümü kontrol grubunda artmasına rağmen istatistiksel olarak anlamlı değildi. Ayrıca lepralı hasta grubunda Pupil Çapındaki küçülmenin daha fazla olduğu ancak bunun istatistiksel olarak anlamlı bir sonuç olmadığı izlendi.

Sonuç: Bu çalışmanın sonucunda lepra hastalarında ön kamara derinliği ve ön kamara açısında anlamlı bir artış olduğu ve bu hasta grubunda göz içi basınçda olan değişikleri glokom açısından değerlendirilirken bunun göz önünde bulundurulması gerektiği aksi halde glokomun atlanabileceği kanısına varıldı. Ayrıca lepra hasta grubunda literatürde belirtilen lagoftalmus, ektropiyon, entropiyon, ptozisvb gibi sekellere ek oftalmik muayenede tespit edilmeyen yalnızca KT ile tespit edilebilen ön segment parametrelerin de etkilenebileceğini gösterdik.

Anahtar Kelimeler: *Lepra, kornea topografi*

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Introduction

Leprosy is a chronic infectious disease caused by a bacterium called Mycobacterium leprae, which has a higher prevalence rate in underdeveloped and the developing countries. This bacterium affects the autonomous nervous system after entering the body, which occurs mainly through inhalation through the mouth and nose, and rarely through breaks in the skin. Although it affects many systems in the body, it is the eye tissue where the disease leaves the most sequela (1). The overall prevalence of leprosy are less than 1%, but varies depending on the geographic region (2). According

to World Health Organization data, an average of more than 200.000 new cases of leprosy are detected each year. The most recent data indicates that over 200 thousand new cases of leprosy were reported in 2017 (3). The prevalence of leprosy in Turkey is less than 1%, with a total of 605 patients with leprosy in 2017, two of whom were recently detected (4).

The disease may leave sequela on the body in affected patients, and these are most commonly encountered in the eye tissue, with the rate of severe complications that may even lead to blindness being in the range of 5–58% (5-6). Primary eye infections often present as conjunctivitis, keratitis and uveitis, whereas secondary infections involve the nerves innervating the orbit. These infections can result in such complications as lagophthalmos, ectropion, entropion and ptosis (7).

There are various methods for the evaluation of anterior and posterior chamber parameters and for the measurement of intraocular pressure, including optic coherence tomography (OCT), corneal topography (CT) and Goldman applanation tonometry (GAT). OCT analyzes the posterior chamber, whereas a CT analysis is a non-contact method that is used to evaluate the anterior chamber. GAT is a contact measurement device that measures changes in intraocular pressure (IOP) through contact with the cornea. The present study aims to compare the pupil diameters (PD), anterior chamber volumes (ACV), anterior chamber depths (ACD) and anterior chamber angles (ACA) of patients with leprosy with those in the control group. To our knowledge this is the first such study to be conducted in patients with leprosy.

Materials and Methods

This prospectively designed study was conducted after obtaining approval from Fırat University, ethical committee decision numbered 97132852 / 050.02.04. The study included 46 eyes of 25 patients who were hospitalized in the leprosy ward, and who attended the outpatient clinic of Department of Ophthalmology, University of Health Sciences, Fethi Sekin City Hospital. The control group was composed of 44 eyes of 22 patients. The CT analysis and GAT were used to evaluate ACV, ACD, ACA and PD. The exclusion criteria were presence of corneal pathology (scarring, ulcer, etc.), retinal pathology (retinal dystrophies, age-related macular degeneration, macular oedema, retinal vascular disease, etc.), systemic diseases (diabetes, hypertension, etc.), and a history of complications during cataract surgery (sulcus IOL, anterior chamber IOL, etc.).

Ophthalmological Examination: The patients first underwent a slit lamp examination in the ophthalmology outpatient clinic, after which they were directed to the technician in charge for a CT analysis. In the ophthalmological measurement room, the technician instructed the patients to place their chin on the CT device and to fixate on the target light without blinking. Based on the priority of the procedures, the relevant parameters were first measured with a CT analysis, after which intraocular pressure was measured by GAT. These analyses were performed by the same technician within working hours (09:00–16:00).

Analysis of the Parameters Measured by CT: Following the slit lamp examination, the patients were moved to the ophthalmological measurement room where the parameters mentioned above were analyzed involving instructions to the patients after they were seated on a chair and their chins placed on the CT device. The acquisition of images was repeated in the event of patient non-compliance with the procedure or if the image quality was low, and the images with the highest quality were taken into consideration. ACV, ACD, ACA and PD were measured from these images (Figure 1).

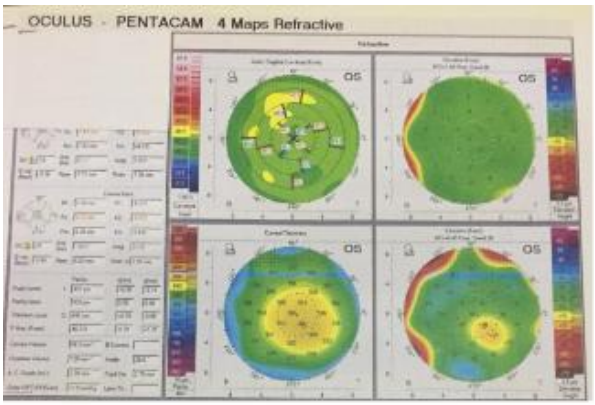

Figure 1. Left Eye Analysis of the Parameters Measured (ACV, ACD, ACA, PD) by Pentacam CT

Measurement of IOP by GAT The patients were initially examined with a slit lamp mounted on the biomicroscope. Proparacaine – a topical anesthetic agent – was dropped into the eye and a 0.25% sodium fluorescein dye was applied to the same eye. After the patients had placed their chin on the chin rest of the device, the plastic tip of the tonometer was moved slowly toward the center of the eye, and upon contacting the cornea, the tips of the crescent-shaped circles were aligned and converged to form an S shape in horizontal plane, after when the equivalent of this appearance in applanation was measured as IOP in mmHg (Figure 2 a and b).

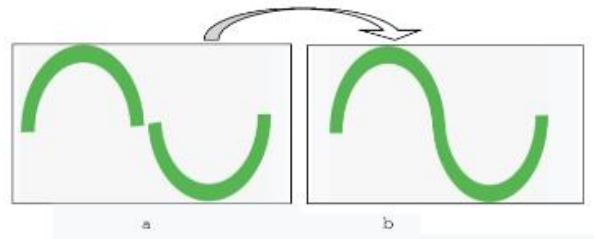

Figure 2. Measurement of intraocular pressure by Goldman applanation tonometry. Crescent-shaped

circles were aligned (a) converged to form an S shape in horizontal plane (b)

Statistical Analysis: Descriptive statistics included mean±standard deviation. The SPSS 22.00 software package was used for the statistical analysis. A Mann-Whitney U test was used for between-group comparisons. A P value of less than 0.05 was considered statistically significant.

Results

The study included 46 eyes of 23 patients in the leprosy group, after two patients in the group withdrew from the study; and 44 eyes of 22 patients in the control group. The mean age was 57.3±4.2 (51–67) years in the leprosy group (13 M,12 F), and 55.2±3.8 (50-59) years (8 M, 14 F) in the control group. All of the patients in the control group and the patient group had undergone cataract surgery. There was a significant increase in the ACD in the leprosy group when compared to the patients in the control group (P=0.01). Although there was an increase of ACV in the control group, this was not significantly different to the leprosy group. There was also a significant increase in ACA in the leprosy group when compared to the control group (P=0.04). When the groups were compared in terms of PD, a further decrease was noted in pupil diameter in the leprosy group, although the difference from the control group was not statistically significant. Similarly, a further decrease was identified in the IOP of the leprosy group when compared to the control group, but the difference between the groups was not statistically significant (Table 1).

Table 1. Compared parameters of mean patient and control group (mean ± SD)

Location	Control	Patient P	P
ACV	190 ± 35.5	156.59 ±42.54	*
ACD	3.06 ± 0.32	3. 44 ±1.08	0.01
ACA	35.7 ± 4.2	41.30 ±0.42	0.04
PD	3.61 ± 0.3	3.31 ± 0.42	*
GİB	15 ± 2.3	13.91 ±3.21	*

ACV: Anterior chamber volume, ACD: Anterior chamber depth, ACA: Anterior chamber angle, PD: Pupil diameter, IOP: Intra ocular pressure, *P>0.05.

Discussion

Although leprosy affects multiple organs in the body, the eye is the site where the disease leaves the most sequela (1). The sequela and complications associated with ocular involvement vary depending on a multitude of factors, including the type of leprosy, patient's age, genetics, race, and duration of and compliance with therapy. Ocular involvement is commonly seen in leprosy patients (8), and severe complications occur in up to 58% of patients with ocular involvement, leading to irreversible blindness (6). Such patients may suffer from lagophthalmos, ectropion, entropion, ptosis, corneal anesthesia or hypoaesthesia, associated with the involvement of the seventh cranial nerve (9), and this can lead eventually to corneal ulceration and scarring (10), making visual impairment inevitable. A decrease in PD may occur as a result of the involvement of the sympathetic nerve innervating the iris (11), with a mean PD of 3.31±0.42 recorded in the present study. Demir et al. (12) reported a mean PD of 3.57 mm in patients with leprosy. Iris atrophy, chronic iritis and insufficient production of the aqueous humor caused by the involvement of the ciliary body may occur in leprosy patients as a result of the involvement of vascular structures innervating and supplying the iris (13). As a result, changes in IOP are at low levels. In a study by Brand et al., IOP was found to be lower in the leprosy patients who developed chronic iridocyclitis than in the patients in the control group (14). Also in the present study, a decrease was recorded in IOP in the leprosy patients, but this was not statistically significant. Changes to the anterior chamber can occur in leprosy patients as a result of the involvement of the iris and ciliary body. There was a greater decrease in the ACV of the leprosy group than in the control group, but this difference was not significant. That said, ACV and ACA were found to be higher in patients with leprosy when compared to the patients in the control group. A review of literature failed to identify any studies evaluating these parameters in leprosy patients. The authors consider that decreased ACV and increased ACD and ACA in patients with leprosy may probably be due to atrophy of the iris and ciliary body that occurs over time in relation to chronic iritis. Leprosy patients are often rejected by society and abandoned to their fate in an isolated area due to the sequelaon their bodies, particularly those on the face. Accordingly, such patients must be treated promptly without delay upon the diagnosis of the condition. The early application of therapy and follow-up at regular intervals may avoid complications in the ocular structures, where the disease is most often involved (15). There have been studies showing that delays in diagnosis and treatment can lead to blindness associated with ocular involvement (1, 5, 6). For this reason, the World Health Organization (WHO) launched its 2020 vision program in an attempt to prevent blindness in leprosy patients (16). The present study identified a significant increase in ACD and ACA in leprosy patients, and such changes in ACD and ACA must be taken into consideration when evaluating leprosy patients for glaucoma. There have been different studies evaluating the relationship between glaucoma, and ACD and ACA. In a study of an Asian population, Deverux et al. (17) reported that the anterior chamber depth could play a role when screening for primary angle closure glaucoma. Doğanay et al. (18) found the anterior chamber to be shallower in patients with pseudo exfoliation glaucoma than those in their control group. Another study reported lower anterior chamber volume, depth and angle in patients with primary angle closure glaucoma than in the control group (19). In conclusion, the present study contributes to literature by showing that ocular involvement in leprosy not only produces such sequela as lagophthalmos, ectropion, entropion and

ptosis, but can also affect other parameters, such as ACD and ACA. As ocular complications such as cataracts are in leprosy patients (8), subjects from both the patient and control groups were selected from those who underwent cataract surgery, as leprosy patients who have not undergone cataract surgery are rare. The parameters evaluated in the present study may be affected by cataract surgery, which can be considered as a weakness of the study. The authors suggest larger randomized studies be carried out, as the present study involved only a limited number of patients.

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