

The Prevalence of Ocular Morbidity in Leprosy Patients at Kuyera Leprosy Rehabilitation Center

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Abstract

Background: Leprosy is among the oldest disease in the world but it is the least studied chronic disease in Ethiopia and worldwide to cause more ocular complications than any other systemic bacterial disease.

Methods: Community-based, cross-sectional study was conducted from March to April 2023 among leprosy patients at Kuyera Rehabilitation Center. Detailed sociodemographic, medical history and clinical examination findings were recorded by the principal investigator. Comprehensive eye examinations, including slit-lamp evaluation, fundus examinations, and refraction were performed on all participants. Descriptive statistical and logistic regression analysis was done.

Results: A total of 70 participants were included. Most participants were over 40 years old ($n=61$, 87.2%), and 95.7% ($n=67$) had leprosy for more than 5 years. Most of them (93%) had ocular complaints. Cataract was the most common ocular condition observed (21.4%), while refractive errors were the leading cause of visual impairment (24.3%). The prevalence of visual impairment and blindness among the participants was 34% and 20%, respectively.

Conclusion: Ocular complications are frequent among leprosy patients in Ethiopia. Regular eye examinations are necessary to prevent leprosy-related ocular complications.

Keywords: Ocular Leprosy, Uveitis, Lagophthalmos, Madarosis, Blindness, Visual Impairment

Abbreviations

VA: Visual Acuity

IOP: Intraocular Pressure

A/C: Anterior Chamber

KPs: Keratic Precipitates

COR: Crude Odds Ratio

AOR: Adjusted Odds Ratio

1. Background

Leprosy, also known as Hansen's disease, is a chronic infectious disease caused by the bacterium *Mycobacterium leprae*. However, it is known that leprosy is not highly contagious. The primary mode of transmission is through respiratory droplets [1]. The bacterium has a long incubation period and predominantly affects cooler areas of the body, such as the skin, peripheral nerves, and the anterior segment of the eye [1,2]. The prevalence of ocular complications in leprosy patients is influenced by many factors: including like anti-leprosy drug treatment, the type of leprosy, duration of disease and the eye treatment received [3,4]. Ocular manifestation

of leprosy includes, eyelid lesion like madarosis, lagophthalmos and ectropion; corneal opacity, exposure keratopathy and cataract. Uveitis and retinal detachment are also the rare complications of leprosy [2,3,5].

Leprosy is among the oldest disease in the world but it is the least studied chronic disease in Ethiopia and worldwide and it has been noted to cause more ocular complications than any other systemic bacterial disease [2,6]. Leprosy patients require better vision to see any objects so that, they prevent their extremities from injury. In addition, they need early diagnosis of complications for urgent

intervention. This study aims to describe ocular manifestation of leprosy and their associated complications that cause Visual impairment.

2. Methods

This study was conducted at the Kuyera Leprosy Rehabilitation Center, located in Kuyera town, Oromia Region, 246 km south of Addis Ababa, from April to March 2023, and all leprosy patients residing in the rehabilitation center were included in the study. Kuyera town serves as the primary functioning leprosy center in the southern part of Ethiopia.

3. Recruitment of Study Participants

After explaining the purpose of the study, informed verbal consent was obtained from participants. All leprosy patients meeting the eligibility criteria at the rehabilitation center were enrolled in the study. Participants who were not located after three visits were recorded as missed patients. Mobile participants were gathered in one place and evaluated for leprosy-related complications, while house-to-house ocular examinations were conducted for those unable to walk. Structured questionnaires and comprehensive ophthalmic examinations were performed for all participants.

4. Data Collection Instruments and Analysis

The structured data collection format captured various information, including sociodemographic characteristics (age, sex, educational level, and occupation) and ocular symptoms such as visual reduction and eye discomfort. Additionally, ocular signs such as madarosis, lagophthalmos, trichiasis, ectropion, entropion, corneal opacity, punctate keratitis, exposure keratitis, keratic precipitates (KPs), anterior chamber (A/C) reactions, lens opacity, and fundus abnormalities were documented. Vision was assessed using a Snellen's chart at a distance of 6 meters, with each eye tested separately. For participants unable to see the chart, vision was evaluated using finger counting or by checking light perception. Best-corrected visual acuity (BCVA) was determined using trial lenses, and visual impairment was classified according to WHO criteria.

Participants with a visual acuity (VA) of less than 6/18 had their vision reassessed using a pinhole. Ocular examinations were conducted using a pen torch and a portable slit lamp, while

fluorescein paper was used to diagnose punctate keratitis or corneal ulcers. Fundus examinations were performed using a direct ophthalmoscope. Patients identified with refractive errors underwent refraction, and corrective lenses were prescribed as needed. Intraocular pressure (IOP) was measured using Tonopen tonometry. The collected data were entered, coded, and analyzed using SPSS (Statistical Program for Social Sciences) version 26. Variables were analysed using descriptive statistic, and logistic regression analysis. and a p-value of <0.05 was considered statistically significant.

5. Operational Definitions

1. Cataract: Presence of lens opacity and visual acuity less than 6/18.
2. Refractive Error: Visual acuity less than 6/18 that improves to 6/18 or better with a pinhole.
3. For individuals unable to achieve 6/18 with pinhole correction, clinical judgment was applied to determine the primary cause of visual impairment or blindness. If two or more pathologies were found, the cause of visual impairment or blindness was attributed to the most treatable cause.

6. Ethical Considerations

This study adhered to the principles of Helsinki Declaration. Ethical approval was obtained from the Ethics Committee of the Department of Ophthalmology, College of Health Sciences, Addis Ababa University. Verbal informed consent was secured from each participant prior to their involvement in the study. Participants were well informed about the research. Leprosy patients with identified ocular findings were referred to nearby hospitals for appropriate interventions, and those with refractive errors were given prescriptions for corrective glasses.

7. Result

7.1. Sociodemographic Characteristics of Leprosy Patients

Out of the total 78 leprosy patients, 70 agreed to participate in the study, while 3 refused for unknown reasons and 5 were not available during the three visits. . Sixty seven (95.7%) had the disease for more than 5 years. Three patients were newly diagnosed leprosy patients. The age range of the participants were from 21 to 85 (mean + SD = 57.8 ±16.64Yrs). Half of them (n=37, 52.9%) were female, 77.1% were illiterate and 85.7% were farmer. Table1

Variable	Frequency	Percent
Age		
20-40	9	12.9
41-60	30	42.9
≥61	31	44.3
Gender		
Male	33	47.1
Female	37	52.9
Educational status		
Illiterate	54	77.1
Primary school	5	7.1

Secondary school	11	15.7
Occupation		
Farmers	60	85.7
Others	10	14.3

Table 1: Sociodemographic Characteristics of Study Participants

7.2. Ocular Symptoms of the Study Participants

In this study 78.6% (n=55) of the study participant had ocular symptom of itching and 77.1 % (n=54) had foreign body sensation.

From those complaining itching, 50 (90.9%) of them had itching on both eyes, 3(5.5%) had on the right eye and 2(3.6%) on the left eye. Figure 1

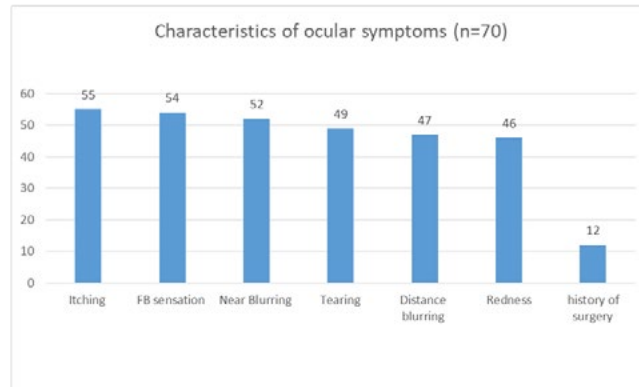


Figure 1: The Ocular Symptom of Leprosy Patients at Kuyera Rehabilitation Centre

7.3. Ocular Sign Related Characteristics of Leprosy Patients

The mean intraocular pressure (IOP) of the right and left eye were 13.37 ± 6.42 mmHg and 13.80 ± 6.49 mmHg respectively. Two patients (2.9%) had history of glaucoma surgery. Fifteen (21.4%)

participants had cataract. Thirteen (18.6%) participants had lagophthalmos. Eleven (15.7%) patients had madarosis on lower lid. See Tables 2

Variable	Right eye	Left eye	Both eyes	Person (n)	Percent
Cataract	6	2	7	15	21.4
Lagophthalmos	4	0	9	13	18.6
Madarosis in lower lid	1	1	9	11	15.7
Madarosis in upper lid	1	9	0	10	14.3
Ectropion	2	3	3	8	11.4
Corneal opacity	3	0	4	7	10.0
Pinguecula	5	0	2	7	10.0
Exposure keratopathy	0	2	3	5	7.1
Pseudophakia /aphakic	1	2	0	3	4.3
Trichiasis	2	0	0	2	2.9
Iris synechia	0	0	1	1	1.4

Table 2: Ocular Signs of Leprosy Patients at Kuyera R.C

7.4. Visual Acuity and Visual Impairment of Leprosy Patients

Of the total participants, 54.3% (n=38) were found to have visual impairment. Blindness was identified in 20.0 % (n=14) of

participants. Table 3. There were 28.6% (n=20) presbyopic, 15.7% (n=11) hyperopic and 8.6% (n=6) myopic patients.

Visual impairment	Right eye	Left Eye	Leprosy Person (%)
6/6-6/18	38 (54.3)	38(54.3)	32(45.7)
6/18-6/60	18(25.7)	17(24.3)	17(24.2)
6/60-3/60	4(5.7)	3(4.3)	7(10.0)
Less than 3/60	10(14.3)	12(17.1)	14(20.0)

Table 3: Visual Acuity of Leprosy Patients at Kuyera R.C

7.5. The Determinant Factor of Low Vision and Blindness

In this study elderly patients had higher risk of visual impairment as seen in logistic regression analysis. (AOR=26.3, 95% CI = 6.48, 107.83). Men participants had more visual impairment compared

to women. (AOR=17.8, 95% CI = 2.73, 28.86). Table 4 There was an association of redness and tearing with visual impairment that need more large sample size study.

Variable	Visual status		P-value	C-Odds Ratio (95%CI)	P-value	A-Odds Ratio (95%CI)
	Low vision/ blindness	Normal vision				
Age of the study participants						
20-40	1	8		Reference		Reference
41-60	10	20	0.220	4 (0.44, 36.58)	0.134	12.1(0.46, 31.16)
≥61	25	5	0.001	14.6 (0.42,41.22)	0.003	26.3(6.48, 107.83)
Gender						
Male	24	9	0.002	4.9 (1.77, 13.67)	0.003	17.8(2.73, 28.86)
Female	13	24		Reference		Reference
Tearing						
Yes	28	21	0.225	1.8(0.63, 4.99)	0.026	3.7(1.38, 36.39)
No	9	12		Reference		Reference
Redness						
Yes	27	19	0.178	1.9(0.73, 5.42)	0.042	1.4(1.05, 3.45)
No	10	14		Reference		Reference

Table 4: The Bivariate and Multivariate Logistic Regression Analysis of Association between Independent Variable and Low Vision/Blindness

8. Discussion

The aim of this study was to identify the ocular morbidity and causes of visual impairment related to leprosy in Ethiopia. Unfortunately, due to social stigma and economic constraints, many leprosy patients in Ethiopia do not seek medical treatment for their ocular symptoms, leading to long periods of untreated eye conditions. The participants in this study were much older, from 21 to 85 (mean + SD = 57.8 ±16.64) than other study like in Nepal (32), India (36), Addis Ababa (34.9)... In this study, 95.7% of the patients had ocular complications, which is comparable to other studies in Yemen (97%) and Iran (98.53%) but much higher than Nepal (57%) and Brazil (31.5%). The higher proportion of ocular complication in this study can be due to the chronicity of the disease and age [3,4,8-14].

In many studies like Nepal and Nigeria, ocular involvement increased with disease duration and patient age. In this study, elderly patients had higher risk of developing ocular related complication like visual impairment. However, the study did not investigate the relationship between age and duration of ocular complications. Therefore, the precise impact of the duration of ocular issues on different age groups was not evaluated in this particular study [3,7]. Eye lid involvement like lagophthalmos (18.6%) and madarosis (15.7%) were the most frequent manifestation of ocular leprosy. This finding was similar to a study done in Yemen [13]. For the fact that chronic leprosy primarily affects peripheral nerves. Age-related cataract found exclusively in patients above 40 years old contributing 21.4%. Refractive error was the leading cause of visual impairment. Cataract related blindness were comparable to UK (22.7%) and Nigeria (17%) [9,10]. but higher than India

(6.9%) [4]. Cataract extraction could potentially reduce the burden of blindness in these populations. In the Indian study, the low prevalence of cataract may be attributed to the classification of cataracts into mature and immature forms, whereas in this study, all cataracts were considered together.

The prevalence of visual impairment (34%) and blindness (20%) at Kuyera Rehabilitation Center was high, which was comparable to studies in Yemen (50%), and Nepal (48%) [13,3]. It was much higher than in Nigeria (10.4%), India (10.3%) and United Kingdom (2.4%) [4,9,10]. The wide difference in the prevalence of blindness can be explained by several factors. Some studies (United Kingdom) were conducted in a developed country with sophisticated materials for early detection of leprosy-related complications. This enabled early intervention and treatment of ocular complications before they develop visual impairment and blindness. Other studies were conducted on newly diagnosed active leprosy patients, who generally have a lower rate of blindness as leprosy is a chronic disease. In this study elderly patients had higher risk of visual impairment as seen in logistic regression analysis. (AOR=26.3, 95% CI = 6.48, 107.83). This is expected as seen in many community studies as cataract is mainly age related. Men participants had more visual impairment compared to women. (AOR=17.8, 95% CI = 2.73, 28.86). This gender difference is contrary to many community based surveys of blindness that showed more women affected by blindness and visual impairment. The association of redness and tearing with visual impairment need more large sample size study. We know that these are signs of ocular inflammation that can be complications of leprosy.

The prevalence of glaucoma in this study were 20% (n= 14), and 7.1% (n=5) had glaucoma in both eyes. Only 2 patients had a history of using anti-glaucoma medications. These very high prevalence may be due to advanced age of the subjects in this study. This study found that lagophthalmos and madarosis are the most common ocular lesions; these ocular lesions were more prevalent compared to a longitudinal study conducted in three countries (Ethiopia, India and Philippines), indicating that chronically ill leprosy patients have a higher risk of developing these ocular manifestations [8].

Blindness caused by leprosy not only affects the individual patient but also has significant implications for their household and community. Therefore, it is crucial to address and prevent ocular complications of leprosy as early as possible to minimize the burden on the patients and their communities. By identifying these issues, healthcare providers and policymakers can implement targeted strategies to improve the eye health of leprosy patients in the country. Overall, this study underscores the importance of early detection and treatment of ocular complications in leprosy patients in Ethiopia to prevent unnecessary visual impairment and its associated burden on individuals and communities. Further research is needed to understand the specific mechanisms leading to these ocular manifestations in leprosy patients and to develop appropriate management strategies.

9. Conclusion

Leprosy is a chronic infectious disease that requires early diagnosis and treatment of ocular complications, even in the absence of visual complaints. Ocular complications are frequent among leprosy patients in Ethiopia. Regular eye examinations are necessary to prevent leprosy-related ocular complications.

Limitations

We acknowledge that this study is single center study with small sample size. Future studies should consider to include multiple centers to capture a broader range of participants and get larger sample size. The rarity of uveitis and retinal disease findings in this study can be attributed to the presence of constricted pupils, which makes it difficult to conduct retinal and posterior segment evaluation.

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