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The magnitude and associated factors of ocular lesions/complications among leprosy patients treated at Boru Meda General Hospital, Ethiopia: Cross-sectional study design, 2021

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ABSTRACT

BACKGROUND: Leprosy, also known as Hansen's disease, is one of the world's oldest diseases, and it is one of the major blinding diseases. Visual impairment in leprosy patients needs special consideration by dermatologists and ophthalmologists, not only preventable but also has a severe burden that affects productivity if not managed early. Nevertheless, little was understood about ocular complications and associated factors among leprosy patients in low-income countries like Ethiopia, including the study locality.

MATERIAL AND METHODS: An institution based cross-sectional study was conducted among a total of 423 leprosy patients at the dermatology clinic at Boru Meda Hospital, Dessie, Ethiopia. The collected data were entered into EpiData v3.1 and exported to the statistical package for SPSS v.20 for statistical analysis. The odds ratio (OR) and a 95% confidence interval (CI) were estimated to measure the strength of the association between dependent and independent variables. $p \leq 0.05$ was used to determine the level of statistical significance.

RESULT: 419 leprosy patients participated in this study, accounting for a response rate of 99%. The proportion of ocular complications was found to be 69.9% (95% CI: 65.09–73.9). Age 40 years and above [adjusted odds ratio (AOR) = 5.2, 95% CI: 3.14–8.83], presence of leprosy reaction (AOR = 1.92, 95% CI: 1.12–3.24), and leprosy disability grading [grade 1 disability (AOR = 2.9, 95% CI: 1.35–6.33), grade 2 disability (AOR = 3.0,95% CI: 1.36–7.08)]were associated with the presence of ocular complication among leprosy patients.

CONCLUSION: Our finding showed that the ocular complication/lesion magnitude was high. Age 40 and above, the presence of leprea reaction and disability were significant factors associated with developing ocular complications among leprosy patients. Our results emphasize the need for solid collaboration efforts and commitment to handling ophthalmologic complications among leprosy patients aged 40 and above with leprosy reactions and disabilities.

KEY WORDS: magnitude; associated factors; leprosy; ocular complication/lesions

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INTRODUCTION

Leprosy, otherwise called Hansen' disease, is one of the world's most established illnesses. It is a persistent infection caused by a corrosive quick, bar-molded bacillus called *Mycobacterium leprae*. The bacillus influences the skin and Schwann cells of the fringe nerves, bringing about cutaneous injuries and neuropathy. Loss of tangible, engine, and autonomic nerve work in the eyes, hands, and feet can bring about optional difficulties, like disfigurement, impedance, mental aggravations, and social rejection [1, 2]. The mycobacteria enter the human body through the nose and spread to the bodily fluid film, skin, and nerves [3]. People, regardless of age and gender, are impacted by this infection [4].

It has two structures: the first is multi-bacillary, where more than five skin sores are observed, which incorporate polar lepromatous (LL) borderline lepromatous (BL), and borderline lepromatous (BB). The second is pauci-bacillary lepromatous, where up to five skin injuries are found in disease patients which incorporates just smear-negative uncertain (I), borderline tuberculoid (BT), and polar tuberculoid (TT) [5–7]. Sickness responses are the primary intricacy of the illness. A critical extent of uncleanliness in patients fosters sickness responses and an intense immunologic extreme touchiness that can happen before the analysis and during or after therapy, and cause nerve injury if not suitably treated. There are two essential sorts of touchiness response:

- type 1 responses or inversion responses;
- type 2 responses, or erythema nodosum leprosum (intensification of humoral invulnerability).

There is a reasonable proposal for corticosteroid treatment of severe kinds 1 and 2 reactional episodes. This uncleanliness response prompts pulverizing impacts on various pieces of the body [6].

The World Health Organization's (WHO) elimination strategy for leprosy is defined as reducing registered cases of leprosy to less than one per 10,000 people. The global prevalence of leprosy is reduced by 90% compared to 1985. In Ethiopia, the prevalence was 0.6 per 10,000 inhabitants [8]. However, the highest proportion of childhood leprosy and a considerable number of new cases could witness the active transmission of the disease and the existence of new infections within the country [4].

In leprosy, the eyes are frequently affected [9]. It is a blinding disease. It affects the eye due to its effect on the skin of eyelids, tear ducts, and lacrimal glands. It also affects the facial and trigeminal nerves that supply the eye. Its direct effect leads to ophthalmic complications. Visual impairment and blindness occur in patients with ocular leprosy; these individuals are from a severely disadvantaged group because of other disabilities due to the disease, its social stigma, and the difficulties and delay in receiving appropriate eye care [10]. However, multi-drug therapy reduced the global incidence of leprosy-related eye diseases. Most leprosy-related eye sufferers are those in older age groups and disabled [5, 11].

Ocular complications can be divided into leprosy-related and general ocular complications. Lagophthalmos, ectropion, entropion, madarosis, trichiasis, episcleritis, scleritis, scleritis, diminished corneal sensation, corneal opacity, acute and chronic iritis can be categorized as leprosy-related ocular complications. While pterygium, cataract, and aphakia can be categorized as general ocular complications [1]. In contrast, cataract is categorized as the leading cause of blindness [5].

Boru Meda Hospital is a known as leprosy and ophthalmic center serving many patients; however, the extent of ophthalmic complications of leprosy is not yet reported. Therefore, this study was conducted to determine the ocular complications or lesions and to identify associated factors.

MATERIAL AND METHODS

Study setting and design

This study was conducted in Boru Meda General Hospital, which serve as a referral for treatment and rehabilitation center for dermatology (primarily for leprosy patients) and ophthalmology cases in the East of the Amhara region.

The research was conducted as an institutional-based cross-sectional study design.

Source population

All leprosy patients who came to the Dermatology Outpatient Department of Boru Meda Hospital within the data collection period were enrolled in the study.

Inclusion criteria

Inclusion criteria were as follows: all leprosy patients who came to the Dermatology Outpatient Department during the data collection period and accepted consent.

Exclusion criteria

Exclusion criteria were as follows: patients who came more than once, who were critically ill and unable to communicate, and age < 18 years old and came without caregiver during the data collection period were excluded.

Sample size determination

The sample size was determined using a single population proportion formula considering the following assumptions: standard normal distribution with a confidence interval (CI) of 95% (Z = 1.96), absolute precision, or tolerable margin of error (d = 0.05). Totan number of samples was 423**.**

Sampling procedures

Boru Meda Hospital was selected purposively because it is a known leprosy center in northeast Ethiopia with greater leprosy patient flow and due to the availability of an ophthalmic center. Among patients admitted to Dermatology Outpatient Department, confirmed leprosy patients were selected consecutively based on their arrival. For those who fulfilled the eligibility criteria, data collectors (dermatologists) from Dermatology Outpatient Department completed the data collection tool from part one to part two. Then, they sent the patient with their medical record and the data collection tool to Ophthalmic Outpatient Department through porters and selected ophthalmologists to collect the data filled part three of the data collection tool. A list of ID numbers of leprosy patients was recorded at Dermatology Outpatient Department to avoid redundancy/double count.

Data collection instrument and procedure

An interviewer-administered tool (questionnaire) was used to collect information on the socio-demographic status. It was prepared in English and translated into Amharic. Trained supervisors supervised the data collection process. During data collection, three dermatologists from dermatology department and two ophthalmologists from ophthalmic department were involved in collecting the data. Dermatologists evaluated leprosy patients for the type of leprosy and filled part one and two of the questionnaire. Patients with leprosy were sent for an ophthalmological eye examination, including observing the external part of the eye and examining the anterior part with slit-lamp, tonometry, and visual acuity by ophthalmologists. Similar professionals were collecting the data in each department, and supervisors were reviewing data for completeness to keep the reliability of data. Data were collected by a pretested tool.

Data processing and analysis

Data were checked for culmination, coded, and entered into EpiData adaptation 3.1 and sent to the factual bundle for Statistical Package for Social Sciences (SPSS) form 20 for investigation. For all straight out factors frequencies and rates were determined. Parallel strategic relapse examination was utilized to get chances proportion and certain time-related factors. All factors with $p < 0.2$ in the bivariable investigation were remembered for the last model/multivariable paired strategic relapse. Hosmer and Lemeshow were utilized for the model wellness test, the greatness of the relationship between various factors corresponding to the result variable was estimated by chances proportion with a 95% certainty span, and the level of factual importance was announced at p-value ≤ 0.05.

Data quality management

To keep the data quality, the (part one) questionnaires were prepared in English and translated into Amharic. Again, to check the consistency of the Amharic questionnaire, it was re-translated to English by another person fluent in the local language very well. All data collectors, two ophthalmologists, three dermatologists, and one supervisor (BSc cataract surgical officer) were trained for one day about the purpose of data collection, how to collect the data, and confusing things on the data collection tool were cleared.

Pretest was conducted on 5% of patients at Boru Meda Hospital who came to dermatology department before the actual data collection period. Then based on the result of the pretest, relevant corrections were made. During the data collection period, supervision was undertaken by a supervisor at the data collection site on how data collectors were doing their tasks daily. At the end of each data collection day, the principal investigator carefully checked, entered, and thoroughly cleaned the data before the commencement of the analysis.

Table 1. Socio-demographic characteristics of leprosy patients at Boru Meda Hospital, Dessie city administration, South Wollo Zone, Amhara region, 2019/20 (n = 419)

Characteristics/variable	Frequency	Percent
Sex		
Male	290	69.2
Female	129	30.8
Age group [years]		
< 40	134	32
≥ 40	285	68
Residence		
Urban	96	22.9
Rural	323	77.1
Marital status		
Single	91	21.7
Married	268	64.0
Divorced	47	11.2
Widowed	13	3.1
Educational status		
Cannot read and write	206	49.2
Have no formal education	111	26.5
Elementary (1–8)	93	22.2
Secondary (9–12) and above	9	2.2
Occupation		
Govt/NGO employee	25	6
Self-employee	39	9.3
Housewife	107	25.5
Farmer	204	48.7
Other	44	10

RESULTS

Socio-demographic variables

From a total of 423 leprosy patients who were recruited, 419 participated in the study with a response rate of 99%. Among the study participants, 290 (69.2%) were males; ages ranged from 16 to 78 years, the mean age of respondents was 46 years (SD ± 13.89) years (Tab. 1).

Clinical factors

Of 419 subjects, 54 (12.9%) were new, (30.3%) had had the disease for over 20 years. The duration was derived from the statement of patients. Two hundred eighty-five patients (68%) were classified as having multibacillary leprosy. One hundred sixty-one patients had a physical deformity. Disability grade 1 was found in 17.2% of leprosy patients, and disability grade 2 was found in 20.5%. Regarding leprosy reaction, 67.5% of participants had type 1 and 2 reactions (Tab. 2)

Table 2. Clinical characteristics of leprosy patients at Boru Meda Hospital, Dessie city administration, South Wollo Zone, Amhara region, 2019/20 (n = 419)

Clinical variables	Frequency	Percent
Category of disease		
Pauci bacillary (PB)	134	32
Multi bacillary (MB)	285	68
Duration of leprosy		
New	54	12.9
1 year–20 years	238	56.8
≥ 20 years	127	30.3
Presence of physical deformity		
No	258	61.6
Yes	161	38.4
Disability grade		
0	261	62.3
1	72	17.2
2	86	20.5
Presence of leprosy reaction		
No	136	32.5
Yes	283	67.5
*No patient was found as relapse or defaulter		

Visual status of each eye as examined by Snellen eye chart

Out of 838 eyes examined, 244 (58.2%) and 243 (57.9%) had visual impairment in the right eyes and the left eyes, respectively, and 16 (3.8 %) of right eyes and 29 (6.9%) of left eyes were severely blind. Visual status was assessed for both the right and left eyes (Tab. 3).

Ocular complications in leprosy patients

The major ocular complications found were lid involvement — 52.0%, cataract — 33.2%, and corneal ulcer — 19.8% (Tab. 4).

The proportion of ocular complications

Ocular complications were counted if there was at least one eye complication. The proportions of ocular complications were found to be 69.9% with 95% CI (65.09–73.9).

Factors associated with the ocular complication of leprosy

On bivariable analysis, duration of leprosy, marital status, educational status, category of treatment,

Table 3. Visual status of examined eyes of leprosy patients at Boru Meda hospital, Dessie City administration, South Wollo Zone, Amhara Region, 2019/20

Visual status	Right eye		Left eye	
	Frequency	Percent	Frequency	Percent
Normal	175	41.8	176	42.0
Mild visual impairment	154	36.8	140	33.4
Moderately blind	74	17.7	74	17.7
Severely blind	16	3.8	29	6.9
Total	419	100	419	100

Table 4. Major ocular complications among leprosy patients at Boru Meda General Hospital, Ethiopia, 2019/20

Ocular complications	Frequency	Percent
Corneal sensation (n = 419)		
Normal	356	80.2
Diminished	83	19.8
Corneal opacity (n = 419)		
Normal	323	77.1
Corneal ulcer	72	17.2
Keratitis	23	5.5
Lids normal (n = 419)		
No	201	48
Yes	218	52
Ectropion (n = 201)		
No	171	85.1
Yes	30	14.9
Entropon (n = 201)		
No	163	81.1
Yes	38	18.9
Lagophtalmos (n = 201)		
No	153	76.1
Yes	48	23.9
Madriasis (n = 201)		
No	165	82.1
Yes	36	17.9

Ocular complications	Frequency	Percent
Trichiasis (n = 201)		
No	152	75.6
Yes	49	24.4
Lid closure (n = 419)		
Normal	303	72.3
Impaired	116	27.7
Pupil reaction (n = 419)		
Normal	343	81.9
Slugish	76	18.1
Iris (n = 419)		
Normal	368	87.8
Atrophy	41	9.8
Acute iritis	7	1.7
Chronic iritis	3	0.7
Sclera (n = 419)		
Normal	334	79.7
Episcleritis	29	6.9
Scleritis	56	13.4
Lens (n = 419)		
Normal	240	57.3
Cataract	139	33.2
Other	40	9.5

reversal reaction, age, leprosy reaction, occupation, category of leprosy, and disability grading were found to be < 0.2 and entered into the final model.

In the multivariable analysis, age, leprosy reaction, and advanced disability grading were significant factors for developing ocular complications, as shown in Table 5. The likelihood of developing ocular complications for leprosy patients aged 40 years or older was five times more than younger than 40 years old [adjusted odds ratio (AOR) = 5.2, 95% CI: 3.14–8.83]. Leprosy patients who have had leprosy reactions were about two times more likely to develop ocular complications than those with no leprosy reaction (AOR = 1.92, 95% CI: 1.118–3.235). Leprosy patients with grade 1 disability were 2.9 times more likely to develop ocular complication than those with disability grade zero (AOR = 2.9, 95% CI: 1.349–6.332) and the presence of leprosy disability grade two were 3 times more likely to develop ocular complication than those with disability grade zero (AOR = 3.0, 95% CI: 1.356–7.083) (Tab. 5).

Table 5. Factors associated with ocular complication among leprosy patients at Boru Meda Hospital, 2019/20 (n = 419)

Variables associated with ocular complications	Ocular complication		COR	AOR
	Yes	No		(95% CI) Lower–Upper
Age category in years				
< 40	61	73	1	1
≥ 40	232	53	5.24	5.2 (3.143–8.833)
Leprosy reaction				
No	79	57	1	1
Yes	214	69	2.24	1.92 (1.118–3.235)
Disability grading				
Grade 0	156	105	1	1
Grade 1	61	11	3.72	2.9 (1.349–6.332)
Grade 2	76	10	5.12	3.0 (1.356–7.083)

AOR — adjusted odds ratio; CI — confidence interval

DISCUSSION

This study revealed that the proportion of ocular complications was 69.9% (95% CI: 65.09–73.9) among leprosy patients. Age, leprosy reaction, and disability grading were significantly associated with ocular complications among leprosy patients.

The proportion of ocular complications observed in this study was 69.9%. This result is less than in Cameroun, where 77.5% of leprosy patients have ocular complications [7], and less than in Yemen, where the percentage was 97% [21]. In contrast, this result is much higher than a study in the United Kingdom, where 51.6% of leprosy patients had ocular complications [1], and a study done in Gulbarga, India, where 24.4% of leprosy patients had ocular complications [20]. This may be due to the difference in leprosy controlling strategy of different countries, variations in socio-demographic factors, and differences in the study designs.

In this study, age was a strongly associated independent factor for the development of ocular complications in leprosy patients where leprosy patients with older age (≥ 40 years) had the likelihood of developing ocular complications five times than those with younger age (< 40 years). Similar findings were documented where ocular complications increased with the patient's age [20]. This may be because an increase in the aging process may increase the risk of ocular problems.

This study also revealed that the presence of leprosy reaction was one of the significant factors for the development of ocular complications, where participants who developed leprosy reactions had around two times the chance of developing ocular complications than those without leprosy reactions. This is supported by a study on Filipinos that leprosy reactions are one of the risk factors for developing leprosy [2].

The other significant factor found for the development of ocular complication is the presence of an advanced disability that is identified based on disability grading, where leprosy patients with disability grades 1 and 2 were three times more likely to develop leprosy-related ocular complication than patients with no disabilities. This is supported by a study performed in the United Kingdom [1], where the involvement of ocular complications in patients with grade 2 disabilities was high. This may be because, in patients with grade 2 disabilities, the eyes are one of the affected organs.

This study allows patients to have clinical examination but has a limitation that it did not exclude the effect of co-morbid illness and the effect of previous treatment on the eye.

CONCLUSION

Based on the findings of this study, ocular complication was found in more than half of the study participants.

The age of 40 and above, the presence of leprosy reaction, and leprosy disability grades 1 and 2 were significant factors associated with ocular complications in leprosy patients.

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Authors' contributions

F.B.B. conceived the study, developed the tool, coordinated data collection, conducted statistical analysis, and drafted the manuscript. F.T.Z. conceived the study, participated in the statistical analysis, and drafted the manuscript. K.A.G., Y.A.D. reviewed the drafted manuscript. All authors read and approved the final manuscript.

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Competing interests

The authors declare that they have no competing interests.

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