Ocular conditions in newly diagnosed and post-treatment leprosy patients at a National Reference Center in Brazil

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Summary

Objectives: This study aimed to evaluate the ocular abnormalities in leprosy patients.

Methods: Patients were classified as multibacillary or paucibacillary, and also according to the Ridley–Jopling classification. They were assessed for their World Health Organization Disability Grade (DG) and evaluated by an ophthalmologist following the International Council of Ophthalmology guidelines.

Results: Of 249 patients, 79% were seen at the time of diagnosis, while 21% had completed treatment. The mean age was 50.2 (± 16.5) years; 52.2% (130/249) were women; 79.9% (199/249) were MB. At diagnosis, 20.1% (50/249) had DG = 2. The most affected disability sites were the feet, followed by hands and eyes. Considering the eyes alone, 87.2% (217/249) of patients had DG = 0; 4.4% (11/249) had DG = 1 and 8.4% (21/249) had DG = 2. Ocular involvement occurred in 49.4% (123/249) of patients, and 207 conditions were diagnosed in total. The main conditions were: pterygium (12.9%), dry eye (11.2%), dermatochalasis (9.2%), keratitis (6.8%), cataract (6.8%), retinal disorders (6.8%), glaucoma (5.6%) and madarosis (4.4%). Conditions that were seen more often in the post-discharge group included lagophthalmos, iridocyclitis and cataract.

Conclusion: Leprosy patients frequently develop disabilities in their feet and hands, but also require specialized ophthalmological assessment of ocular damage, which remains prevalent, regardless of whether lesions are caused by leprosy or not.

Keywords: Leprosy, ocular conditions, disabilities, ophthalmology

Introduction

Leprosy is highly prevalent in developing countries. Brazil ranked second worldwide in 2016.¹ It is a chronic bacterial infection which often involves the eyes, in up to 70–75% of cases, and leads to blindness in 5%.²

The Ridley–Jopling classification places patients on a spectrum between those with intense cellular immune response (tuberculoid, TT), through borderline tuberculoid (BT), mid-borderline (BB), borderline lepromatous (BL), to those who are anergic (lepromatous, LL).^{3,4}

Leprosy reactions are acute or subacute inflammatory episodes, which may involve the eyes, and are classified as Type 1, reversal reaction (RR), or Type 2, Erythema Nodosum Leprosum (ENL).^{5,6} Treatment of choice for RR are corticosteroids and for ENL, thalidomide.⁷

Patients are classified as paucibacillary (PB) or multibacillary (MB) according to their bacilloscopic index (BI), number of skin lesions and affected nerves.⁸ PB cases are treated for six months with rifampicin and dapsone; MB cases are treated for 12 months with rifampicin, dapsone and clofazimine.⁹

Physical disability due to leprosy is measured as the disability grade (DG): grade 0 (DG = 0), or no disability, and grades 1 (DG = 1) and 2 (DG = 2), corresponding to impairment due to leprosy neuropathy of increasing severity.^{10–12} Ophthalmologic evaluation in leprosy is highly important because of possible severe disabilities.¹¹

Presumably, *M. leprae* enters the eyes via the blood vessels of the ciliary body and then via small autonomic nerves. Leprosy may involve the eyes in many ways: direct bacterial infection; cranial nerve dysfunction; RR; and ENL, or damage to protective extraocular structures.^{2,6,13}

Ophthalmological conditions in leprosy patients have been described by studies in Africa and Asia, but not recently in Brazil.^{14–17}

Our aim was to characterize the ocular conditions in leprosy patients at diagnosis and after discharge from multidrug therapy (MDT), and correlate these findings with the clinical forms and operational classification of the disease, highlighting the importance of ophthalmological evaluation in leprosy patients.

Methods

This was a cross-sectional study conducted in a National Reference Center for Leprosy, at the Federal University of Uberlândia/MG (CREDESH-UFU) in Uberlândia/MG, Brazil, developed between June 2015 and July 2017. Although all leprosy patients undergo routine eye examination by the ophthalmologist at the CREDESH-UFU, the research protocol was approved by an independent ethics committee at the Federal University of Uberlândia (#1.067.169). All participants were informed about the research and voluntarily agreed to take part in this study without any financial incentive, and written consent was obtained.

A total of 249 leprosy patients were included. They were classified according to the clinical forms of disease into: TT, BT, BB, BL and LL.⁴ The indeterminate (I) clinical form was also included. Criteria used for this assessment were: lesion pattern, anti-PGL-1 antibody titers, real-time quantitative polymerase chain reaction (qPCR) of blood, skin biopsy and skin smear samples, as well as bacilloscopy of skin biopsy and skin smear samples. For treatment purposes, the operational classification based on the WHO criteria was applied, namely, PB and MB types.⁸

These patients were evaluated to determine the DG in the eyes, hands and feet. When hands and feet are evaluated, patients with DG = 0: no anesthesia, visible deformity or damage; DG = 1: anesthesia, but no visible deformity or damage; DG = 2: visible deformity and/or disability

present.⁹ When the eyes are evaluated, DG = 0: no eye problem due to leprosy; no evidence of visual loss; DG = 1: eye problems due to presence of leprosy, resulting in cornea sensory impairment, but vision not severely affected as a result (vision: 6/60 or better; can count fingers at 6 m); DG = 2: severe visual impairment (worse than 6/60; inability to count fingers at 6m), lagophthalmos, iridocyclitis and/or corneal opacities.⁹

The ophthalmic evaluation was always performed by a single ophthalmologist in the Ophthalmology Clinic at Clinics' Hospital/UFU, and included a standardized eye examination according to the International Council of Ophthalmology Guidelines:¹⁸ anamnesis, ectoscopy, ocular motility exam, visual acuity with logMAR chart, objective and subjective refraction with retinoscopy or auto-refractor, biomicroscopy of the anterior segment, corneal sensitivity test with Cochet-Bonnet esthesiometer, Schirmer's basal test, fluorescein tear film break-up test; ocular fundus exam under mydriasis.

During ophthalmological evaluation, strict criteria were used for diagnosis of each of the following conditions. We considered an eye presenting best corrected vision of 1.0 logMAR or worse due to lens opacity, without other conditions that justify visual disability, as presenting severe vision loss due to cataract. For the diagnosis of dry eye, the Schirmer test was performed and tear break up time was analyzed to observe indirect signs of an ocular surface with inflammation, poor lubrication, blink conditions and/or corneal hyposensitivity. All cases of glaucoma were grouped together because we hadn't enough data to determine the etiology, but it was defined as a progressive optic neuropathy with visual field loss and structural changes at the optic disc head.

The ocular conditions were divided into leprosy-related ocular conditions (LROA) and general ocular conditions (GOA). LROA included lagophthalmos, trichiasis, madarosis, scleritis, episcleritis, dry eye, corneal sensory absence, corneal opacities and iridocyclitis. GOA included pterygium, cataract and glaucoma.¹⁹

Bivariate statistical analyses were performed using Fisher's exact test to verify the association between dichotomous non-parametric variables, which were approached in relation to ophthalmological conditions. The chi-square test was used to analyze associations between the presence or absence of ophthalmologic changes and the clinical forms of leprosy. Finally, multivariate analysis was enabled through multiple logistic regression, aiming to verify the relationship between dependent and independent variables. The software *Graphpad Prism 7.0* (GraphPad Software, Inc., San Diego, CA) was used in all analyses; the α significance level was 0.05 (5%) in all tests.

Results

PATIENT CHARACTERISTICS

A total of 249 leprosy patients evaluated by an ophthalmologist were enrolled in this study, 52.2% were females. The mean age was 50.2 ± 16.5 years. The evaluation occurred at diagnosis before MDT treatment in 79.1% of cases and after MDT treatment in 20.9% (Table 1).

The majority of leprosy cases were BT (67.1%), followed by LL (12.4%); BL (9.6%); BB (7.7%), TT (2.0%) and I (1.2%). As to the operational classification of leprosy, 79.9% were MB and 20.1% were PB (Table 1).

Among the leprosy patients, 63.5% had general DG = 0, versus 16.4% of cases with DG = 1 and 20.1% with DG = 2, according to the WHO grading system.⁸ In relation to the degree of ocular disability, 87.2% had DG = 0, 4.4% had DG = 1 and 8.4% had DG = 2 (Table 1).

Table 1. Epidemiological and clinical characteristics of patients with leprosy submitted to ophthalmologic evaluation

Clinical and epidemiological variables		Leprosy patients	
		n	%
Average age (SD)		50.2 (16.5)	
Gender	Male	119	47.8
	Female	130	52.2
OC	PB	50	20.1
	MB	199	79.9
Clinical forms	I	3	1.2
	TT	5	2.0
	BT	167	67.1
	BB	19	7.7
	BL	24	9.6
	LL	31	12.4
DG (general)	0	158	63.5
	1	41	16.4
	2	50	20.1
DG (ocular)	0	217	87.2
	1	11	4.4
	2	21	8.4
Moment of evaluation	At diagnosis	197	79.1
	Post discharge	52	20.9

Notes - OC: Operational classification; PB: paucibacillary; MB: multibacillary; I: indeterminate; TT: tuberculoid; BT: borderline- tuberculoid; BB: mid-borderline; BL: borderline-lepromatous; LL: lepromatous leprosy; DG: disability grade.

OCULAR CONDITIONS

Among the 249 patients evaluated, 123 (49.4%) presented a total of 207 ocular conditions, averaging 0.83 ocular conditions per patient and 1.68 per affected patient.

At diagnosis, pterygium (12.7%) was most prevalent, followed by dry eye (10.7%). The most common LROA in this group, beside dry eye, were madarosis (3.0%) and trichiasis (1.0%). The most common GOA at diagnosis, beside pterygium, were general keratitis (6.6%), retinal disorders (6.6%), dermatochalasis (6.1%), glaucoma (4.1%), and cataract (3.5%). In the evaluation of visual acuity, 11 (5.6%) presented severe reduction of vision. Refractive errors were present in 60 (30.4%) patients (Table 2).

At post discharge evaluation, dermatochalasis (21.1%) was the most common condition. The most prevalent LROA in this group were dry eye (13.5%), madarosis (9.6%), lagophthalmos (9.6%), and iridocyclitis (9.6%). Beside dermatochalasis, the most common GOA were cataract (19.2%), pterygium (13.4%), and glaucoma (11.5%). As to visual acuity, 8 (15.4%) presented severe vision loss. Refractive errors were present in 28 (53.8%) patients (Table 2).

Among the retinal conditions, there were 4 cases of chorioretinal scars by toxoplasmosis, 3 of central serous chorioretinopathy, 3 of macular edema in diabetic retinopathy, 3 of age-related macular degeneration, 2 of central retinal vein occlusion, 1 of neovascular membrane of undetermined cause, and 1 of retinitis pigmentosa. The most common cause of impaired vision in all patients was cataract (6.8%).

Between LROA, madarosis was predominant in LL patients (22.6%) ($p < 0.0001$) and iridocyclitis in BL ones (12.5%) ($p = 0.0011$). Among GOA, pterygium was more prevalent in BB (31.6%) and BL (20.8%) ($p = 0.0389$) patients; glaucoma in LL ones (9.7%) ($p = 0.0001$);

Table 2. Comparison of ophthalmologic alterations in leprosy patients, according to evaluation period

Ocular alterations	At diagnosis		Post discharge		*p-value
	n(197)	%	n(52)	%	
LROA					
Madarosis	6	3.0	5	9.6	0.0552
Lagophthalmos	1	0.5	5	9.6	0.0017
Trichiasis	2	1.0	1	1.9	0.4685
Dry eye	21	10.7	7	13.5	0.6218
Corneal sensory absence	1	0.5	1	1.9	0.3747
Corneal opacity	1	0.5	2	3.8	0.1115
Iridocyclitis	-	-	5	9.6	0.0003
Scleritis	1	0.5	-	-	-
GOA					
Pterygium	25	12.7	7	13.4	0.9996
Glaucoma	8	4.1	6	11.5	0.0819
Cataract (<0.5 logMAR)	7	3.5	10	19.2	0.0004
Dermatochalasis	12	6.1	11	21.1	0.0022
Blepharitis	6	3.0	-	-	-
General keratitis	13	6.6	4	7.7	0.7579
Symblepharon	1	0.5	1	1.9	0.3747
Keratoconus	1	0.5	-	-	-
Retinal disorders	13	6.6	4	7.7	0.7579
Visual acuity					
0.5–1.0 logMAR	3	1.5	5	9.6	0.0113
>1.0 logMAR (blindness)	2	1.0	1	1.9	0.9913
Monocular blindness	6	3.0	2	3.8	0.9887
Refractive errors					
Myopia	5	2.5	3	5.8	0.3692
Hyperopia	17	8.6	4	7.7	-
Astigmatism	22	11.2	11	21.1	0.1051
Myopic astig.	9	4.6	3	5.8	0.7145
Hyperopic astig.	7	3.6	7	13.5	0.0122

Notes – LROA: leprosy-related ocular alterations; GOA: General ocular alterations; *Fisher's exact test. - A p-value equal to 1 indicates equal proportions between both groups.

cataract in BL (25.0%) and LL ones (12.9%) ($p = 0.0009$); and keratitis in BT (5.4%) and BB (10.5%) ($p = 0.0217$) ones. It should be emphasized that in this statistical analysis, a high proportion of cases was not always significant, especially in the clinical forms I and TT, given the small number of patients (3 and 5, respectively) (Table 3).

According to the operational classification, some conditions were noted only in the MB group, especially LROA. However, the only statistically significant difference between the two groups was in cataract, which was only present in group MB (8.5%; 17/199; $p = 0.0279$) (Table 4).

PB patients presented a lower prevalence of disability than their MB counterparts. This was noted for all grades, but was statistically significant only for DG = 0 patients ($p = 0.0081$) and not DG = 1 ($p = 0.1274$) or DG = 2 ($p = 0.0864$) (Table 4).

A multivariate statistical method was employed to evaluate the existence of a dependence relation between the presence of ocular conditions and the reporting of symptoms, demonstrating that in the LROA group, dry eye conferred a 3.2891-fold greater chance of presence of symptoms (OR, 3.2891; CI95%, 1.18–9.16; $p = 0.0227$). In the GOA group, pterygium presented a 3.0684-fold higher chance (OR, 3.0684; CI95%, 1.20–7.84; $p = 0.01191$); cataract

Table 3. Ocular conditions in patients with leprosy according to Ridley–Jopling clinical forms

Ocular conditions	I n(3)	%	TT n(5)	%	BT n(167)	%	BB n(19)	%	BL n(24)	%	LL n(31)	%	Total n(249)	%	χ^2	p-value
LROA																
Madarosis	-	-	-	-	4	2.4	-	-	-	-	7	22.6	11	4.4	20.30	<0.0001
Lagophthalmos	-	-	-	-	3	1.8	1	5.3	-	-	2	6.5	6	2.4	0.79	0.3713
Trichiasis	-	-	-	-	3	1.8	-	-	-	-	-	-	3	1.2	-	-
Dry eye	1	33.3	1	20.0	19	11.4	1	5.3	-	-	6	19.4	28	11.2	3.89	0.4203
Corneal sensitive absence	-	-	-	-	1	0.6	-	-	-	-	1	3.2	2	0.8	0.13	0.7148
Corneal opacity	-	-	-	-	3	7.2	-	-	-	-	-	-	3	1.2	-	-
Iridocyclitis	-	-	-	-	1	0.6	-	-	3	12.5	1	3.2	5	2.0	13.65	0.0011
Scleritis	-	-	-	-	-	-	-	-	1	4.2	-	-	1	0.4	-	-
Episcleritis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dacriocystitis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GOA																
Pterygium	-	-	1	20.0	16	9.6	6	31.6	5	20.8	4	12.9	32	12.9	8.37	0.0389
Glaucoma	-	-	2	40.0	7	4.2	-	-	2	8.3	3	9.7	14	5.6	21.04	0.0001
Cataract (<0.5 logMAR)	-	-	-	-	6	3.6	1	5.3	6	25.0	4	12.9	17	6.8	16.55	0.0009
Dermatochalasis	-	-	1	20.0	12	7.2	3	15.8	3	12.5	4	12.9	23	9.2	2.63	0.4510
Blepharitis	-	-	-	-	3	1.8	1	5.3	1	4.2	1	3.2	6	2.4	1.28	0.7339
General keratitis	1	33.3	2	40.0	9	5.4	2	10.5	1	4.2	2	6.5	17	6.8	13.18	0.0217
Synblepharon	-	-	-	-	-	-	2	10.5	-	-	-	-	2	0.8	-	-
Keratoconus	-	-	-	-	1	0.6	-	-	-	-	-	-	1	0.4	-	-
Retinal disorders	1	33.3	-	-	10	6.0	1	5.3	3	12.5	2	6.5	17	6.8	4.69	0.3200
Visual acuity																
0.5–1.0 logMAR	-	-	-	-	3	1.8	1	5.3	1	4.2	3	9.7	8	3.2	5.38	0.1454
>1.0 logMAR (blindness)	-	-	-	-	-	-	-	-	3	12.5	-	-	3	1.2	-	-
Monocular blindness	-	-	-	-	6	3.6	-	-	-	-	2	6.5	8	3.2	0.06	0.8058
Refractive errors																
Myopia	-	-	-	-	8	4.8	-	-	-	-	-	-	8	3.2	-	-
Hyperopia	-	-	2	40.0	14	8.4	1	5.3	2	8.3	3	9.7	22	8.8	6.33	0.1756
Astigmatism	1	33.3	1	20.0	18	10.8	5	26.3	3	12.5	5	16.1	33	13.3	5.19	0.3926
Myopic astig.	1	33.3	-	-	5	3.0	1	5.3	3	12.5	2	6.5	12	4.8	9.17	0.0570
Hyperopic astig.	-	-	-	-	10	6.0	1	5.3	2	8.3	1	3.2	14	5.6	0.67	0.8784

Notes – LROA: leprosy-related ocular conditions; GOA: General ocular conditions; I: indeterminate; TT: tuberculoid; BT: borderline-tuberculoid; BB: mid-borderline; BL: borderline-lepromatous; LL: lepromatous leprosy; DG: disability grade.

Table 4. Comparison of ophthalmologic conditions in patients with leprosy, according to operational classification

Ocular conditions	PB		MB		*p-value
	n(50)	%	n(199)	%	
LROA					
Madarosis	2	4.0	9	4.5	-
Lagophthalmos	1	2.0	5	2.5	-
Trichiasis	-	-	3	1.5	-
Dry eye	6	12.0	22	11.1	0.8500
Corneal sensitive absence	-	-	2	1.0	-
Corneal opacity	-	-	3	1.5	-
Iridocyclitis	-	-	5	2.5	0.5863
Scleritis	-	-	1	0.5	-
GOA					
Pterygium	8	16.0	24	12.1	0.4799
Glaucoma	2	4.0	12	6.0	0.7420
Cataract (<0.5 logMAR)	-	-	17	8.5	0.0279
Dermatochalasis	4	8.0	19	9.5	0.7958
Blepharitis	2	4.0	4	2.0	0.6018
General keratitis	5	10.0	12	6.0	0.3469
Symblepharon	1	2.0	1	0.5	0.3619
Keratoconus	1	2.0	-	-	-
Retinal disorders	2	4.0	15	7.5	0.5365
Visual acuity					
0.5–1.0 logMAR	1	2.0	7	3.5	0.7007
>1.0 logMAR (blindness)	-	-	3	1.5	-
Monocular blindness	3	6.0	5	2.5	0.3638
Refractive errors					
Myopia	3	6.0	5	2.5	0.3638
Hyperopia	5	10.0	17	8.5	0.7800
Astigmatism	5	10.0	28	14.1	0.4977
Myopic astig.	3	6.0	9	4.5	0.7085
Hyperopic astig.	3	6.0	11	5.5	0.9903
DG (ocular)					
DG = 0	49	98.0	168	84.4	0.0081
DG = 1	-	-	11	5.5	0.1274
DG = 2	1	2.0	20	10.1	0.0864

Notes – LROA: leprosy-related ocular conditions; GOA: General ocular conditions; PB: paucibacillary; MB: multi-bacillary. * Fisher's exact test; - p-value equal to 1 since proportions are equal or similar.

demonstrated 6.4915-fold higher chance (OR, 6.4915; CI95%, 1.19–35.45; $p = 0.0308$). There was no dependence relation between symptoms and the other ocular conditions investigated.

Discussion

The present study was carried out in a national reference center for leprosy in Brazil, where all patients have access to an ophthalmologist. We assessed 249 leprosy patients. These followed previously described patterns of epidemiological characteristics such as clinical form and operational classification, though not gender.^{10,11,14,20–26}

Most patients were classified as having a general DG = 0, suggesting early diagnosis of leprosy. However, nearly two out of five patients presented with some disability. It was mainly related to the hands and feet, and not the eyes. In our populational sample, a prevalence of 20.1% of DG = 2 is considered high and suggests hidden prevalence.^{9–11}

Prevalence of ocular DG = 2, which constitutes deformity, was considered within the mean parameter (<10%). It was lower than other studies, given that there's a report from India, Ethiopia and the Philippines, where 13.5% (5.9%–19.3%) of patients presented with DG = 2 and another from India, where 19.86% of patients did.^{14,15}

Most patients were examined by an ophthalmologist at the time of diagnosis, according to the protocol of our center. Only more recently, access to an ophthalmologist was granted to patients upon discharge from MDT and/or after discharge, which accounts for the lower number of patients evaluated in this period in this study.

The eye surface was predominantly affected. The most common ocular finding was pterygium (12.9%). It is most prevalent in hot climate areas, where there is greater exposure to predisposing factors such as ultraviolet light and dryness due to wind, sunlight or dust. In cases of leprosy, two main causes are implicated in the establishment of a pterygium: the presence of bacilli in the eye and the ocular surface dryness aggravated by the use of clofazimine, one of the components of MDT for treating MB leprosy.^{7,27}

The prevalence of pterygium in leprosy patients is not well established, given some studies report higher values while others report similar values to the general population.^{28,29} In LL patients, recent studies point to a prevalence ranging from 4.8% to 11.34%.^{19,30}

The second most common ocular condition was dry eye, which corroborated the findings of a previous study from Brazil.²³ There is increased risk of keratoconjunctivitis in leprosy patients, indicating reduction of the aqueous layer of the lacrimal film. This may be due to either reduced tear secretion from the accessory lacrimal gland of the conjunctiva or autonomic denervation of the afferent arc of the lacrimal gland.^{31–33} Madarosis was most common in LL patients. It is considered a benchmark of this form of the disease. Histiocytic infiltration of the hair follicles is the mechanism implicated in the genesis of cicatricial symmetric bilateral madarosis.³⁴

All cases of iridocyclitis were classified as MB, corroborating previous research.³⁵ Given the higher titers of IgM anti-PGL1 (specific antigen for *M. leprae*) in MB patients,^{36–38} they are more likely to develop an antigen-antibody-complement reaction, which characterizes type 2 leprosy reactions that cause iridocyclitis.³⁹ In this study, however, we noted one case of a BT patient with iridocyclitis, an unusual finding, given it is more frequent in patients at the lepromatous pole.³⁵ Although the reaction is uncommon in the BT form, it may occur in the uveal tissue without systemic conditions.^{6,13}

Glaucoma is uncommon in leprosy, though it may be associated with uveitis.⁴⁰ We recorded 5.6% of patients with glaucoma, but not this association. The prevalence of this finding in the general population is only of 3.4%.⁴¹ A possible cause for our finding is the corticosteroid use for long periods in reactional episodes of leprosy.⁴²

Cataract is the main cause of reversible blindness in leprosy. In LL, the most serious complications occur, due to eyeball invasion by *M. leprae*. In our study, cataract was most prevalent in BL (approximately 1/4) and LL (approximately 1/6) patients. Most cases of cataract were in the borderline group (BT, BB, BL), in which type 1 leprosy reactions occur.^{20,21} Treatment for these reactions is chronic corticosteroid use,^{7,43} to which we attribute the cataract prevalence in these groups.

Although keratitis is potentially threatening to the vision of a leprosy patient, we did not have any case of infective keratitis, only cases of punctate superficial keratitis. In our study, the TT group presented the highest proportion of keratitis (40%). This superficial form of keratitis is related to dry eye, a similar finding to a previous study.⁴⁴

All noted ocular conditions considered, it is noted that statistically relevant difference between the MB and PB groups arises in both LROA and GOA. MB patients were more prone than their PB counterparts to develop both iridocyclitis, as a LROA, and cataract, as a GOA. Mechanisms responsible for these conditions have already been discussed. PB patients were also more likely to have a DG = 0 than MB ones, due to low bacillary load and the rarity of reactional events.¹³

Given the relevance of spontaneous complaints by the patients as a warning sign for ocular disabilities, we studied the relation between the complaints and the conditions detected. We found clear dependence relation for dry eye, pterygium and cataract. All three of these conditions are frequent in leprosy patients.^{19,30} Only around 60% of patients with these conditions spontaneously reported related signs or symptoms, however. Thus, it is clear that all patients with leprosy should be directly questioned about ocular complaints in order to provide for early diagnosis and treatment for the remaining 40%.

Considering the infectious and chronic character of leprosy, which may inflict highly incapacitating acute reactional episodes, these patients require long-term care / monitoring with clinical, surgical and rehabilitative assistance.^{39,46} Consequently, the frequency and period of ophthalmologic evaluation of leprosy patients has been the focus of various studies.^{10,11,45}

A previous work by our group found an increase in the ocular disability degree at discharge, even though the setting was a center that provides ophthalmologic assistance to patients.¹¹

In this study, we noted a positive correlation between post-discharge evaluation and the presence of LROA, namely lagophthalmos and iridocyclitis. This may be attributable to the proportion of patients who develop post-discharge reactions, which may vary from 23%,⁴⁵ to 35%,⁴⁶ to 57%.²⁰ These, in turn, may lead to damage to the zygomatic branch of the facial nerve or uveal deposition of immunocomplexes causing respectively lagophthalmos and iridocyclitis.^{6,13,47}

A positive relation between post-discharge evaluation and the presence of cataracts and dermatochalasis was also noted. The mean age found in the sample of the present study can account for dermatochalasis associated with facial and ocular involvement, resulting from the disease, both by bacillary infiltration and by neural damage.¹³

In a previous study,²² a population of leprosy patients was reevaluated 11 years after the initial assessment. It demonstrated the necessity of continuous follow-up even after MDT discharge, since related ocular conditions can progress. Even earlier, it had been demonstrated that around a fifth of all patients were affected by ocular conditions between seven and eight years after discharge.⁴⁷ Most cases in both studies were lagophthalmos, corneal conditions or cataract.

Maintaining vision is not only a protective factor against new impairments in these patients but is also a right that must be ensured in caring for people affected by leprosy.

Conclusion

Leprosy most commonly leads to disabilities in the hands and feet. However, around half of leprosy patients in our series also had some form of ocular impairment.

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Ethical approval

Research protocol was approved by an independent ethics committee at the Federal University of Uberlândia (#1.067.169). All participants were informed about the research, voluntarily agreed to take part in this study without any financial incentive and written consent was obtained.

Competing interests

None declared.

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