

# Neural complications and physical disabilities in leprosy in a capital of northeastern Brazil with high endemicity

## *Complicações neurais e incapacidades em hanseníase em capital do nordeste brasileiro com alta endemicidade*

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**ABSTRACT:** *Introduction:* Leprosy is an infectious disease whose etiologic agent is *Mycobacterium leprae*, manifested by dermatological and neurological signs and symptoms. *Objective:* To investigate neural changes and the degree of physical disability in the eyes, hands and feet before and after treatment, as well as sociodemographic and clinical profile of patients affected by leprosy. *Method:* A longitudinal epidemiological study comprising 155 patients with leprosy, from a spontaneous demand, diagnosed between March 2010 and February 2011, and treated with multidrug therapy (MDT) between March 2010 and July 2012 in a program for leprosy eradication in São Luís (MA), Brazil. *Results:* Before treatment, 46.5% of patients were considered as borderline, 51.6% had some alteration in the eyes and 52.3% in the feet, and the radial nerve (18.7%) was the most affected. There was a statistically significant difference between the changes in the radial nerve at the beginning of and after treatment. *Conclusions:* The analysis points to late diagnosis, as some patients have had abnormal neural and physical disabilities before treatment.

**Keywords:** Leprosy. Therapeutics. Disabled persons. *Mycobacterium leprae*. Nerve degeneration. Epidemiology.

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**RESUMO:** *Introdução:* A hanseníase é uma doença infectocontagiosa cujo agente etiológico é o *Mycobacterium leprae*, que se manifesta por sinais e sintomas dermatoneurológicos. *Objetivo:* investigar as complicações neurais e o grau de incapacidades físicas nos olhos, mãos e pés antes e após o tratamento, bem como o perfil sociodemográfico e clínico dos pacientes acometidos pela hanseníase. *Método:* Estudo epidemiológico do tipo longitudinal constituído por 155 pacientes com hanseníase, a partir da demanda espontânea, diagnosticados no período de março de 2010 a fevereiro de 2011 e tratados com poliquimioterapia (PQT) entre março de 2010 a julho de 2012, em um programa de eliminação da hanseníase, no município de São Luís (MA). *Resultados:* Antes do tratamento, 46,5% dos pacientes apresentaram forma dimorfa, 51,6% possuíam alguma alteração nos olhos e 52,3% nos pés, sendo o nervo radial (18,7%) o mais acometido. Houve diferença estatisticamente significativa entre as complicações do nervo radial no início e após o tratamento. *Conclusões:* Evidenciou-se a presença do diagnóstico tardio, posto que alguns pacientes já apresentavam complicações neurais e incapacidades físicas antes do tratamento.

**Palavras-chave:** Hanseníase. Terapêutica. Pessoas com incapacidade. *Mycobacterium leprae*. Degeneração neural. Epidemiologia.

## INTRODUCTION

Leprosy is still considered a serious public health issue in developing countries. In 2011, a high detection rate of 15.88/100,000 inhabitants was registered in Brazil, according to parameters of the Ministry of Health<sup>1</sup>. Maranhão, in 2011, showed an overall detection rate of 56.0/100,000 inhabitants and was classified as a hyperendemic state. The prevalence reached 8.5/10,000 inhabitants, and its average detection rates exceeded the average of the Northeastern region and of Brazil as a whole<sup>2</sup>. The extent of elimination of leprosy has not been easy in some regions due to the complexity of the disease<sup>3</sup>.

Leprosy is characterized as a chronic infectious disease, with great crippling potential, whose etiologic agent is the bacterium *Mycobacterium leprae* and the route of transmission is direct contact<sup>4</sup>. It is characterized by dermatological and neurological symptoms, such as lesions on the skin and on peripheral nerves of the eyes and of upper and lower limbs. It presents various clinical forms that are determined according to levels of cellular immune response to *Mycobacterium leprae* bacteria, classified as indeterminate, tuberculoid, borderline or lepromatous<sup>5</sup>.

When diagnosed and treated late, leprosy can have serious consequences, such as physical disabilities in the hands, feet and eyes resulting from involvement of the peripheral nerves. In the natural course of the disease, complications occur initially in thermal sensitivity: hyperesthesia, followed by hypoesthesia and, after some time, anesthesia.

Then, progressive loss of pain sensitivity, and, finally, loss of tactile sensitivity<sup>6</sup>. In more advanced stages of the clinical manifestation, truncal neural impairment occurs, which causes repercussions such as paresthesias and muscle plegias<sup>7</sup>. When these complications are identified early, before the presence of more severe nerve damage, disability can be avoided<sup>4</sup>. The delay in diagnosis is an independent risk factor for the presence of physical disability at diagnosis<sup>8</sup>.

Physical disability affects approximately 23.0% of leprosy patients after discharge<sup>9</sup>. The evaluation and monitoring of the state of the patients are essential to the preservation of the structure and function of the peripheral nerve, contributing to the early identification of neural complications and disabilities<sup>6</sup>.

The current global goal for reduction of the leprosy burden is defined by the “Enhanced Global Strategy for Further Reducing the Leprosy Burden: 2011 – 2015”, and it defines the reduction of the number of new cases diagnosed with grade 2 disabilities per 100,000 inhabitants in, at least, 35% by the end of 2015. It will also contribute to the correct and timely diagnosis of new cases before the development of disabilities and neural complications and will work to reduce the social and economic impact on the lives of individuals affected by the disease<sup>10</sup>.

Considering the importance of the evaluation and monitoring of leprosy patients, this study aims to investigate the neural complications and the degree of physical disability in the eyes, hands and feet before and after treatment, and to identify the sociodemographic and clinical profile of patients affected by leprosy.

## METHODS

This is an epidemiological longitudinal study consisting of 161 leprosy patients enrolled in a program of elimination of leprosy in São Luís (MA), Brazil. There was a loss of six subjects (3.7%), with a total final sample of 155 patients. The sample was selected by convenience from spontaneous demand, and consisted of patients diagnosed in the period from March 2010 to February 2011. Patients without treatment were included if it was a new case and if the patient was a São Luís resident. No patients with sequelae from other disabling diseases, such as neurological, trauma-orthopedic, and/or rheumatic, or other associated conditions, were included.

Patients were evaluated by nurses and occupational therapist with experience in dermatological and neurological evaluation. These professionals were trained aiming at a standardization of the technique for assessing patients, using the national protocol for simplified neurological evaluation and classification of the degree of disability according to the parameters adopted by the Brazilian Ministry of Health<sup>11,12</sup>. Evaluations were performed before and after multidrug therapy (MDT) recommended by WHO<sup>11</sup>. For the collection of data on sociodemographic and clinical conditions, a specific questionnaire was used, containing direct questions to be answered by the patients after they signed an informed

consent approved by the Ethics Committee on Human Research of Universidade Federal do Maranhão (protocol no. 23115-003005 / 2009-36).

The disability of the patient was classified as:

- Grade 0: refers to the absence of physical disability (no neural involvement in eyes, hands and feet);
- Grade 1: refers to the presence of disability (only decrease or loss of sensation in the eyes, hands and/or feet);
- Grade 2: refers to the presence of disability and complications (eyes, as lagophthalmos and/or ectropion, trichiasis, corneal opacities, visual acuity lower than 0.1 or when the patient does not count the fingers of the examiner at a distance of 6 meters; hands and feet, corresponding to trophic and/or traumatic injuries, claws, bone resorption, “fallen hand or foot” or contracture of the ankle).

A descriptive analysis of all variables was performed. A quantitative variable (age) was presented as mean and standard deviation for presenting normality according to the Shapiro-Wilk test. To assess the frequency of neural complications and disability at baseline and end of treatment, the Mc-Nemar test with significance level equal to or less than 0.05 and a confidence interval of 95% were applied. The statistical package used was Stata® (version 10).

The research has no conflicts of interest.

## RESULTS

The sample consisted of 25.7% of students in the 16-30 years age group (29.7%), with mixed skin color (58.6%) in a marital relationship (57.4%), with incomplete primary education (32.9%) and family income equal to or greater than three minimum wages (52.3%) (Table 1).

It was observed that, at the start of treatment, 51.6% of patients had complications in the eyes and, after treatment, there was a decrease in the proportion of patients with these complications (45.8%). Regarding nose, 7.1% of patients had complications at diagnosis and, at the end of treatment, there was an increase (11.0%) (Table 2).

At the beginning of treatment, 40.6% of patients had complications in their hands and, after treatment, 32.9% still showed complications. There was therefore an improvement of patients regarding complications in the hands after treatment. With respect to vascular complications, there was an improvement in the proportion of complications, since 52.3% had complications in diagnostic and, after the treatment, 47.1% (Table 2).

At beginning of treatment, patients had complications in the nerves, with 18.7% in the radial, 9.7% in the median, 11.0% in the ulnar, 16.8% in the fibular and 14.8% in the tibial. There was a decrease in the proportion of complications in the ulnar (1.3%) and tibial (3.8%) nerves, and an increase in the proportion of patients with complications in the radial (11%), medium (3.9%) and fibular (0.6%) nerves at the end of treatment. There was statistical significance ( $p = 0.005$ ) only for the complications observed in the

Table 1. Sociodemographic and clinical characteristics of patients with leprosy in the municipality of São Luís (MA), 2012.

Variables	n	%
<b>Gender</b>		
Male	69	44.5
Female	86	55.5
<b>Age (years)</b>		
≤ 15	19	12.2
16 – 30	46	29.7
31 – 45	42	27.1
46 – 60	28	18.1
> 60	20	12.9
<b>Marital status</b>		
Without partner	66	42.6
With partner	89	57.4
<b>Education</b>		
Illiterate	5	3.2
Primary school	51	32.9
High school	75	48.4
Higher education	24	15.5
<b>Occupation</b>		
Student	40	25.7
Salaried worker	29	18.7
Self employed	29	18.7
Retired	7	4.5
Other	50	32.3
<b>Household income (minimum wage)</b>		
< 1	18	11.6
1 – 2	56	36.1
≥ 3	81	52.3
<b>Type of housing</b>		
Stucco	5	3.2
Wood	1	0.7
Brick	149	96.1
<b>Waste disposal</b>		
Sewer network	87	56.1
Cesspool	55	35.5
Ditch	13	8.4
<b>Garbage disposal</b>		
Public collection	147	94.8
Burning	5	3.2
Open-air dump	2	1.3
Burying	1	0.7
<b>Clinical form</b>		
Unspecified	26	16.8
Tuberculoid	45	29.0
Borderline	72	46.5
Lepromatous	12	7.7
<b>Total</b>	<b>155</b>	<b>100.0</b>

radial nerve, when we compared the proportions of complications in the beginning (18.7%) and in the end (29.7%) of treatment (Table 3).

At diagnosis, patients experienced grade 1 or 2 disability, 11.0% being in the hands, 12.3% in the eyes and 25.8% in the feet. At the end of treatment, a decrease was observed in the proportion of disability in the eyes (0.7%) and hands (2.0%) and an increase of 2.6% in the proportion of patients with disability in the feet (Table 4).

## DISCUSSION

The present study showed that a higher rate of leprosy patients were female. This finding agrees with Figueiredo and Silva<sup>13</sup>, who evaluated the spread of leprosy in São Luís (MA) in the period from 1993 to 1998. Another study, conducted in the city of Buriticupu (MA), also reported a higher rate of female leprosy patients<sup>14</sup>. However, there are studies<sup>15,16</sup> that found a higher percentage of males. It has been suggested that the biggest concern with body image and specific policies for the female population would justify the predominance of females<sup>14</sup>.

Table 2. Comparison between alterations in the eyes, nose, hands and feet before and after therapy in patients with leprosy in the municipality of São Luís (MA), 2012.

Complications*							
	Before		After		Total n (%)	95%CI	p-value
	n	%	n	%			
Eyes							
Absent	55	65.5	20	28.2	75 (48.4)	0.79 – 2.70	0.1985
Present	29	34.5	51	71.8	80 (51.6)		
Total	84	54.2	71	45.8	155 (100.0)		
Nose							
Absent	130	94.2	14	82.3	144 (92.9)	0.21 – 1.46	0.2863
Present	8	5.8	3	17.7	11 (7.1)		
Total	138	89.0	17	11.0	155 (100.0)		
Hands							
Absent	77	74.0	15	29.4	92 (59.4)	0.79 – 2.70	0.1985
Present	27	26.0	36	70.6	63 (40.6)		
Total	104	67.1	51	32.9	155 (100.0)		
Feet							
Absent	56	68.3	18	24.7	74 (47.7)	0.76 – 2.80	0.2278
Present	26	31.7	55	75.3	81 (52.3)		
Total	82	52.9	73	47.1	155 (100)		

\*Mc-Nemar Test.

Table 3. Comparison between complications in nerves (thickening and/or spontaneous pain or pain on palpation) in the upper and lower limbs at the beginning and after therapy in patients with leprosy in São Luís (MA), 2012.

	Nerves*					95%CI	p-value
	Before		After		Total n (%)		
	n	%	n	%			
<b>Radial</b>							
Absent	99	90.8	27	58.7	126 (81.3)	0.16 – 0.79	0.005
Present	10	9.2	19	41.3	29 (18.7)		
Total	109	70.3	46	29.7	155 (100)		
<b>Median</b>							
Absent	128	95.5	12	57.1	140 (90.3)	0.15 – 1.44	0.157
Present	6	4.5	9	42.9	15 (9.7)		
Total	134	86.4	21	13.6	155 (100)		
<b>Ulnar</b>							
Absent	129	92.1	9	60.0	138 (89.0)	0.46 – 3.34	0.655
Present	11	7.9	6	40.0	17 (11.0)		
Total	140	90.3	15	9.7	155 (100.0)		
<b>Fibular</b>							
Absent	118	92.2	11	40.7	129 (83.3)	0.35 – 2.36	0.827
Present	10	7.8	16	59.3	26 (16.8)		
Total	128	82.6	27	17.4	155 (100)		
<b>Tibial</b>							
Absent	123	89.1	9	52.9	132 (85.2)	0.68 – 4.32	0.221
Present	15	10.9	8	47.1	23 (14.8)		
Total	138	89.0	17	11.0	155 (100)		

\*Mc-Nemar Test.

Table 4. Comparison of physical disability in the eyes, hands and feet before and after treatment in patients with leprosy in São Luís (MA), 2012.

	Physical disabilities*					95%CI	p-value
	Before		After		Total n (%)		
	n	%	n	%			
<b>Eyes</b>							
Zero	127	92.7	9	50.0	136 (87.7)	0.41 – 3.09	0.818
Grade 1 or 2	10	7.3	9	50.0	19 (12.3)		
Total	137	88.4	18	11.6	155 (100)		
<b>Hands</b>							
Zero	133	94.3	5	37.5	138 (89.0)	0.46 – 6.22	0.405
Grade 1 or 2	8	5.7	9	64.3	17 (11.0)		
Total	141	91.0	14	9.0	155 (100)		
<b>Feet</b>							
Zero	100	90.1	15	34.1	115 (74.2)	0.30 – 1.71	0.433
Grade 1 or 2	11	9.9	29	65.9	40 (25.8)		
Total	111	71.6	44	28.4	155 (100)		

\*Mc-Nemar Test.

A higher frequency of individuals in their economically productive years, from 16 to 30 years of age, was observed. A similar result was observed in the study by Oliveira et al.<sup>16</sup>, in a municipality in the Midwest region of Paraná. The greater affection of people in their economically productive years has social and economic importance, since leprosy has a high disabling potential, interfering in the work and social life of the patient, causing economic loss and psychological trauma<sup>17</sup>. In relation to patients under 15 years of age, there was a rate of 12.2% of affection by the disease in this age group, results superior to those recommended by the Ministry of Health, suggesting that the infection is recent and active in the studied municipality<sup>4</sup>.

Regarding marital status, most of the patients had a partner, similar to that reported by Aquino et al.<sup>17</sup>, when studying leprosy patients in Buriticupu / Amazon of Maranhão.

With regard to education, there was a predominance of subjects who completed high school, but the frequency of patients without schooling and with only primary education is noteworthy. Disagreeing with the present study, data found in Brazil, in 2009, showed that 67.5% of registered leprosy patients had incomplete primary education and 11.7% were illiterate<sup>18</sup>. As similar to the study by Moraes<sup>19</sup>, held in the city of Governador Valadares (MG), when it was observed that 55.1% of individuals with leprosy had primary education and 11.6% were illiterate. It is known that low educational level is associated with low family income, which was an important risk factor to health.

With regard to occupation, most people with leprosy in this study were students, and 18.7% were salaried and were employed and working at the moment of diagnosis, unlike the data obtained in a study by Costa<sup>20</sup>, in which 53.0% were retired or on sick leave. However, this author evaluated patients with leprosy during reaction episodes, while in the present study, new cases were evaluated.

With regard to family income, the highest percentage of the population studied had a family income between 1 and 2 minimum wages, unlike the findings of Aquino et al.<sup>17</sup>, where most of the population had a household income of less than one minimum wage. This increase in minimum wages may be due to the increase in income in Brazil, resulting from the implementation of public policies in Brazil that are favoring a higher socioeconomic status for the underprivileged population.

Most individuals of the population studied reported proper disposal of waste, but there was a significant rate in the use of cesspools by the patients (35.5%). Leite et al.<sup>14</sup>, in a study of contacts made in Buriticupu (MA), found different results, in which only 4.1% had proper disposal of waste and 58.9% disposed waste directly into cesspools.

The clinical multibacillary form (borderline or lepromatous) was the most frequent among the patients studied. The study by Lima et al.<sup>21</sup> also found a higher frequency of clinical borderline, followed by tuberculoid, indeterminate and lepromatous forms. Similar results were observed in the study by Corrêa et al.<sup>22</sup>, also conducted at the leprosy elimination program of Hospital Universitário Presidente Dutra (MA) between 2008 and 2009, in which 42.3% of patients presented the clinical lepromatous form,



which demonstrates that the diagnosis of leprosy was performed later, with a higher likelihood of disease transmission, and the development of neural complications and disability in the patient.

Regarding frequency of neural complications, it was observed that more than half of the individuals had some alteration in the eyes and feet prior to treatment. In a study by Carvalho and Alvarez<sup>23</sup>, there was a high frequency of disability in the feet alone when compared with the results found in the hands. The slightest evidence of hand injuries can be justified by greater self-care and early perception of disabling problems in hands, which does not happen with the feet.

There was no statistical significance in the comparison of neural complications in the eyes, hands and feet before and after treatment. Only one reduction in the proportion of these complications was observed. According to Meima et al.<sup>24</sup>, neural complications occur mainly before diagnosis.

The frequency of nasal complications increased after the treatment. The study of Julio et al.<sup>25</sup> showed that there was a worsening of 4.2% of nasal lesions in 7.0% of cases, despite the guidelines given by health professionals regarding the care needed to prevent the development of injuries. One explanation for this occurrence may be the known side effects of clofazimine, one of the drugs used in multidrug therapy that causes dryness of the skin and mucous membranes<sup>26</sup>.

In this study, low rates of complications in upper and lower nerves at the start of treatment were found. In the study by Pimentel et al.<sup>27</sup>, it was as observed that 67.0% of patients showed nerve thickening and/or pain at the beginning of the treatment. According to Kumar et al.<sup>28</sup>, two-thirds of new cases already have some degree of nerve thickening at diagnosis. Among new patients, 62.0% had at least one thickened nerve.

Comparing the presence of thickening and/or pain in the peripheral nerves at the beginning and the end of treatment, there was a significant increase in complications only in the radial nerve. Research conducted by Orsini<sup>29</sup>, which evaluated the frequency of complications in lower and upper nerves before and after discharge of patients, coincides with the findings of this study, as it also noted worsening in the nerves of the upper limbs after treatment ( $p = 0.03$ ). The same author<sup>29</sup> questions whether this worsening could be related to the technical improvement of the examiner or by type of household activity (washing clothes, washing dishes), considered of high impact to the radioulnar joint, favoring the affection of the radial nerve. Importantly, in late diagnosis, reactions and trauma may increase the affection of the nerves.

The rates of physical disabilities at the beginning of treatment were low, with the presence of physical disability in the feet being more common. The study by Schiapati<sup>30</sup>, which verified the grade of disability attributable to new leprosy cases, showed a large majority of patients without disability at onset. Oliveira et al.<sup>31</sup>, in their cohort study, showed that about 20.0% of the patients had physical disabilities during or after treatment. Contrary to these findings, the study by Aquino et al.<sup>17</sup> pointed to worrying

results: high rates of disability grade 1 or 2. In both studies, the higher frequency of disability was mainly on the feet.

Possibly, this disagreement of the present study with Aquino et al.<sup>17</sup> happened because this study was conducted in the state capital (São Luís, MA), where access to health services and actions is better. Moreover, the data observed in the state municipalities, where access to health services are scarce, show that there is a difficulty in early diagnosis and appropriate treatment, which are the best strategies to prevent disease progression.

Regarding the comparison of the disability rates at the beginning and end of treatment, no statistically significant differences were found. Ribeiro's study<sup>32</sup> showed a decrease of 21.5% in the frequency of physical disabilities of patients after discharge. The study of Julio et al<sup>25</sup> also showed a decrease in the frequency of physical disability throughout the treatment, and this is a significant decrease, unlike in the present study. The greater presence and increased rates of physical disabilities, particularly in the feet, can be explained by the neglect of guidelines related to self-care.

One limitation of this study was the use of the grade of disability as the method of investigation, according to the Brazilian Ministry of Health, which, despite being one of the most widely used instruments, may present a great variation in the change of the sensitivity threshold for the grades 0 – 1. The relevance of this work should be highlighted, because it is a follow-up study of subjects with leprosy during treatment. We were able to analyze the sociodemographic characteristics of 155 individuals diagnosed with leprosy, as well as the evaluation of their clinical characteristics, being able to assess the complications and disabilities that were more frequent in the beginning and the end of treatment.

## CONCLUSION

It is evident that most of the subjects with leprosy had a late diagnosis, since they already had some neural alterations and grade 1 and 2 disabilities at diagnosis, which have high crippling power on the individual. Before treatment, more than half of patients had complications in the eyes and feet, and the most affected nerve was the radial. No significant changes were observed in the presence of neural complications and disability in the first approach and after treatment. It is noteworthy that the study population was composed mostly of students in an age range from 16 to 30 years old which had an income greater than or equal to three minimum wages. In this sense, public policies aimed at encouraging professionals and authorities to improve the early diagnosis of leprosy, case evaluation and follow-up and services for the prevention of neural complications and disability of patients with leprosy should be developed.

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