



# Nerve Damage in Young Patients with Leprosy Diagnosed in an Endemic Area of the Brazilian Amazon: A Cross-Sectional Study

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**Objective** To describe nerve damage and its association with clinical and epidemiologic characteristics in young patients with leprosy diagnosed in an endemic area of the Brazilian Amazon.

**Study design** All 45 patients with leprosy younger than 15 years of age and diagnosed at a health referral unit in northern Brazil were invited to participate in a cross-sectional, descriptive, analytical study. Subjects were submitted to a templated simple neurologic examination of the peripheral nerves and answered a structured questionnaire.

**Results** Of 41 cases, referral was the mode of detection in 33 participants (80.5%); 19 (46.3%) had been seen by 3 or more physicians to obtain a diagnosis, and 26 (63.4%) had received other diagnoses. The interval between the onset of symptoms and diagnosis was more than 1 year in 30 cases (73.2%). Borderline leprosy was the predominant clinical form (48.8%); 63.4% of the participants had multibacillary leprosy, 31.7% had nerve damage, and 17.1% exhibited disabilities. The following variables showed a statistically significant association ( $P \leq .05$ ) with nerve damage at diagnosis: home visit by the community health worker, number of doctors seen, number of skin lesions (>5), and lesions along the path of nerve trunks.

**Conclusion** Centralized healthcare, a low frequency of home visits by community health workers, and the difficulty in diagnosing leprosy in children are factors that contribute to late treatment initiation and an increased risk of peripheral nerve damage. In addition, multiple skin lesions and lesions along the path of nerve trunks require rigorous monitoring. (*J Pediatr* 2017;185:143-8).

Leprosy is a chronic granulomatous infection caused by the obligate intracellular parasite *Mycobacterium leprae*, which affects the skin and peripheral nerve trunks. The nerve damage caused by the disease can progress to physical disabilities and deformities owing to the loss of protective sensation and motor function. Associated with dry skin, traumas such as skin wounds and secondary infections are frequent and can progress to osteomyelitis, which leads to the stigmatizing deformities seen in patients with leprosy.<sup>1</sup>

Although there has been a notable decrease in the number of leprosy cases in the world over the last 10 years, the disease continues to be a public health problem, especially in developing countries. In 2014 alone, 213 899 people worldwide were diagnosed with leprosy and Brazil was the country with the second largest number of new cases, after India.<sup>2</sup> The disease is not distributed uniformly in Brazil, but is concentrated in poorer regions such as the north, northeast, and midwest. In the State of Pará, which is part of the Brazilian Amazon region in the north of the country, leprosy is highly endemic, even in the pediatric population. According to recent data from the Brazilian Ministry of Health, although the national detection rate of leprosy in children under 15 years of age was 4.78 cases per 100 000 inhabitants in 2014, this rate was 3- to 4-fold higher (16.93) in Pará. With 428 cases detected in persons under the age of 15 years, Pará was the Brazilian state with the greatest number of children diagnosed with leprosy in 2014.<sup>3</sup>

Despite low rates of mortality, leprosy in childhood, if not diagnosed and treated early, can result in future physical, social, and psychological problems associated with severe forms of the disease, as well as in the disabilities caused by peripheral nerve damage.<sup>4</sup> Children with deformities caused by leprosy can suffer discrimination in school and experience difficulties in social life.<sup>5</sup>

The new World Health Organization (WHO) Leprosy Strategy 2016-2020 is aiming for zero child cases with grade 2 disability by 2020, that is, the early detection of all cases before the occurrence of deficits.<sup>6</sup> Thus, identifying factors that increase the risk of nerve damage in children under 15 years of age is an important tool to support leprosy control programs and to help achieve this new target.

Some epidemiologic studies of leprosy in children have reported the incidence of nerve damage.<sup>7-10</sup> However, studies investigating the relationship of nerve

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BCG	Bacillus Calmette-Guérin
CHW	Community health workers
UREMC	Sanitary Dermatology Unit "Dr. Marcello Cândia"
WHO	World Health Organization

damage and physical disability with the clinical and epidemiologic characteristics of this population are sparse.<sup>11</sup>

The present study describes nerve damage and its association with the clinical and epidemiologic characteristics of patients with leprosy who were younger than 15 years of age and diagnosed at a health referral unit in a highly endemic area of the Brazilian Amazon.

## Methods

A cross-sectional, descriptive, and analytical study was conducted on patients under the age of 15 years who were diagnosed with leprosy at the Sanitary Dermatology Referral Unit “Dr. Marcello Cândia” (UREMC in the Portuguese acronym), municipality of Marituba, Pará State (Amazon region in the northern part of Brazil). The UREMC was founded 25 years ago in the area of an old leper colony in the municipality of Marituba (Marituba leprosarium). Today, it is the only referral unit specializing in leprosy in the Pará State where patients are attended by an experienced, multidisciplinary team trained in leprosy care. The team consists of physicians, nurses, physiotherapists, an occupational therapist, a nutritionist, and social workers.

Data were collected from April 2014 to June 2015. All consecutive patients younger than 15 years of age at the time of a leprosy diagnosis were invited to participate in the study. Patients lacking cognitive capacity or with difficulties in understanding the commands of the strength and sensory tests in the simple neurologic examination and patients with a diagnosis of other associated neurologic diseases were excluded. In total, 41 patients recruited by convenience sampling participated in the study.

The classification of Madrid (1953) was adopted for the clinical classification of leprosy into the indeterminate, tuberculoid, borderline, and lepromatous form.<sup>12</sup> Patients were diagnosed by specialists of UREMC according to the criteria of the WHO.<sup>13</sup>

Although autonomic nerve dysfunction, such as skin anhidrosis, autonomic functions, and respiratory and cardiac changes have been observed in patients with leprosy,<sup>14</sup> in this study, only sensory motor function was evaluated clinically, according to the WHO standardized neurologic evaluation. In this way, alterations in sensory and/or motor function were defined as nerve damage.<sup>13</sup> In addition, nerve damage was classified as a severe type 1 reaction, whether it was associated with cutaneous inflammation or not.<sup>15</sup>

Patients diagnosed with leprosy and their responsible persons were interviewed using a structured questionnaire for data collection. This questionnaire collected personal, socioeconomic, demographic, and clinicoepidemiologic data and information about access to diagnostics. The household income of the study participants was expressed as Brazilian minimum wage, that is, the lowest remuneration that may legally be paid to a worker in Brazil. The experience of hunger was defined as 24 hours without food. The time to diagnosis was defined as the interval between the perception of signs and symptoms and diagnosis of leprosy. In addition, home visits by the

community health workers (CHW) of less than 1 monthly visit classified as rare.

Patients underwent evaluation of neural function of the main nerve trunks affected by leprosy, based on recommendations of the WHO. Tests for sensory evaluation of the dorsum of the hands (ulnar and radial nerve sensibility) and dorsum of the feet (fibular nerve sensibility) were added, as well as strength measurements of the lumbrical muscles to evaluate the strength of the intrinsic muscles of the hands. The adapted simple neurologic examination thus consisted of inspection, nerve palpation, muscle strength testing, and sensory evaluation of the eyes and upper and lower limbs. Disabilities found in the eyes, hands, and feet resulting from leprosy were graded on a scale of 0 to 2 (where 0 = no disability; 1 = loss of sensation; 2 = visible damage or disability).<sup>13</sup>

Results were analyzed statistically using the GraphPad Prism 5.0 software (GraphPad Software, Inc, San Diego, California). First, descriptive analysis consisting of the calculation of absolute and relative frequencies of the categorical variables was performed. For bivariate analysis, the nonparametric Fisher exact test was applied to determine which variables were significantly associated with nerve damage. ORs with 95% CIs were calculated to identify the variables that could be a risk factor for nerve damage at diagnosis. A level of significance of  $P \leq .05$  was adopted.

The study was approved by the Ethics Committee of the Institute of Health Sciences, Federal University of Pará (Approval No. 1.059.013), and was conducted in accordance with the Declaration of Helsinki (1964) and its subsequent revisions. All data were anonymous. An informed consent form was signed by the parents or legal representative, as well as by children 12-14 years of age, who agreed to participate in the study.

## Results

During the period of data collection, 403 new cases of leprosy were diagnosed at UREMC, with 45 cases (11.2%) in children under the age of 15 years. Only 4 children were excluded from the study, one because he did not have the cognitive capacity to understand the neurologic tests and the other 3 because they were not authorized by their responsible persons to participate. Thus, the final sample consisted of 41 children.

Of the 41 participants, 24 (58.5%) were boys, 21 (51.2%) were between 10 and 14 years old, and 23 (56.1%) were from the metropolitan region of Belém, the capital of Pará State. Slightly more than one-half of the participants, 22 (53.7%), had previous contact with individuals with leprosy. Of these, 16 of 22 (72.7%) had household contact and 16 of 22 (72.7%) also reported 2 or more contacts. However, 35 participants (85.4%) had only 1 *Bacillus Calmette-Guérin* (BCG) vaccine scar and only 1 participant had 2 scars. A household income of up to 1 minimum wage was reported by 35 (85.4%) of the responsible persons interviewed and 17 participants (41.5%) had suffered from hunger (Table I).

Referral was the mode of detection in 33 participants (80.5%); 24 (58.5%) reported rare or absent home visit by

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