



Article/Artigo

Risk factors for physical disability at diagnosis of 19,283 new cases of leprosy

Fatores de risco para incapacidade física no momento do diagnóstico de 19.283 casos novos de hanseníase

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ABSTRACT

Introduction: The purpose of this study was to evaluate risk factors for physical disability at the moment of leprosy diagnosis. **Methods:** This is a retrospective, descriptive and exploratory investigation of 19,283 patients with leprosy, registered in the State of Minas Gerais, Brazil, between 2000 and 2005. **Results:** The risk of Grade 2 disability was 16.5-fold higher in patients with lepromatous leprosy, and 12.8-fold higher in patients presenting the borderline form, compared to patients presenting indeterminate leprosy. The occurrence of more than one thickened nerve increased the odds of a patient developing Grade 2 disability, 8.4-fold. Age <15 years, multibacillary leprosy and no formal education presented 7.0, 5.7 and 5.6 odds of developing physical disability, respectively. **Conclusions:** These factors should be considered as strong prognostic indicators in the development of physical disability at diagnosis.

Key-words: Leprosy. Physical disability. Risk factors for disability. Lepromatous leprosy. Physical disability prognosis.

RESUMO

Introdução: O objetivo deste estudo foi o de avaliar os fatores de risco para incapacidade física no momento do diagnóstico. **Métodos:** Trata-se de estudo retrospectivo, descritivo e exploratório de 19.283 pacientes com hanseníase, notificados entre 2000 e 2005, no estado de Minas Gerais, Brasil. **Resultados:** O risco para desenvolver grau 2 de incapacidade física foi 16,5 vezes maior no paciente com hanseníase virchowiana e 12,8 vezes maior no paciente com a forma dimorfa, quando comparados aos pacientes com a forma indeterminada. A presença de mais de um nervo acometido aumentou o risco de desenvolver grau 2 de incapacidade em 8,4 vezes. A idade inferior a 15 anos, os pacientes multibacilares e a falta de escolaridade aumentaram a chance de deformidades em 7,0, 5,7 e 5,6, respectivamente. **Conclusões:** Estes fatores devem ser considerados indicadores importantes do prognóstico para incapacidade física no momento do diagnóstico.

Palavras-chaves: Hanseníase. Incapacidade física. Fatores de risco para deformidade. Hanseníase virchowiana. Prognóstico para incapacidade física.

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Received in 19/06/2009
Accepted in 06/01/2010

INTRODUCTION

Leprosy stands out for its morbidity, notwithstanding its low mortality rates, leading to physical disability, deformity, psychological disturbances, economical dependence and social exclusion¹. It has been estimated that 2 million people presently live with physical incapacity as consequence of the disease².

The elimination of leprosy, proposed by the World Health Organization (defined as a reduction of the prevalence rate to less than 1 affected person per 10,000 inhabitants) was important to redefine the activities for controlling the disease. However, many investigators, considered this as an intermediate goal, because the interruption of transmission and disease control are, in fact, the main objective³.

The worst prognostic factor for predicting deformity is the presence of physical disability at the moment of diagnosis. Interestingly, the use of prednisone decreased morbidity in 88% of the infected subjects^{4,5}.

The objective of this study was to identify and quantify the most important risk factors for physical disability at diagnosis.

METHODS

From 2000 to 2005, 19,283 patients with leprosy diagnosed in the State of Minas Gerais were registered in the Brazilian Health System (*Sistema Nacional de Informações de Agravos de Notificação - SINAN*). The information obtained was transferred to a databank using the EPI-INFO software, version 3.5.1 (CDC 2008) and analyzed using the statistical package SPSS for Windows, version 13 (SPSS Incorporated) at the Federal University of Minas Gerais, Brazil. The variables analyzed are presented in **Table 1**.

Physical disability was the outcome investigated; all other variables were explanatory. The WHO

TABLE 1 - Description of study variables obtained in SINAN's notification form, Ministry of Health, Brazil, 2000-2005.

Demographic variables	Categories
Age	< 15 years old, ≥ 15 years old, unknown
Gender	Male, female
Ethnic/Racial group	White, black, yellow, indian, unknown
Formal education in years	None, from 1 to 3, from 4 to 7, from 8 to 11, 12 or more, unknown
Geographic area	Urban, rural, urban/rural, unknown
Clinical variables	
Patient inclusion	referred, spontaneous demand, community survey, contacts of patients, other, unknown
Number of skin lesions	≤ 5 lesions, > 5 lesions, unknown
Thickened nerves	≤ 1 nerve, > 1 nerve, unknown
Bacilloscopy	Negative, positive, not performed, unknown
Incapacity level	Grade 0, Grade 1, Grade 2, not evaluated, unknown
Operational classification	Paucibacillary, multibacillary, unknown
Clinical forms	Indeterminate, tuberculoid leprosy, borderline leprosy, lepromatous leprosy, not classified, unknown
Treatment	Paucibacillary polychemotherapy using 6 doses, multibacillary polychemotherapy using 12 doses, multibacillary polychemotherapy using 24 doses, ROM (rifampin, ofloxacin and minocycline), alternative schemes and unknown

classification of physical disability in leprosy is defined in 3 categories⁶: 1) no disability (no anesthesia) and no visible deformity or damage to the eyes, hands or feet (Grade 0); 2) only disability (anesthesia, but no visible deformity or damage to the eyes, hands or feet) (Grade 1); and 3) visible deformity or damage to the eyes (lagophthalmos, iridocyclitis, corneal opacities, severe visual impairment), hands (claw hands, ulcers, absorption of the digits, thumb-web contracture and swollen hand), feet (plantar ulcers, foot-drop, inversion of the foot, clawing of the toes, absorption of the toes, collapsed foot and callosities) (Grade 2).

As there was no clear definition of skin color in the notification card this variable was excluded from analysis. Treatment was not included, because the information was obtained at diagnosis.

The multivariate analysis was adjusted in 3 distinct logistic models, as some explanatory variables were multicollinear. Among the models, the one which included thickened nerves and the clinical form was chosen because it presented a smaller confidence interval for the odds ratio.

RESULTS

All the variables presented statistically significant association with disability levels. The model used to evaluate risk factors for disability at the moment of diagnosis is presented in **Table 2**.

Geographic area was dropped from the model as it did not maintain statistical significance.

Lepromatous leprosy at diagnosis had the highest impact on physical disability and deformity. It increased the odds of developing grade 2 disability 16.5-fold, whereas borderline form increased the odds 12.8-fold, when both were compared to the indeterminate clinical form.

The occurrence of more than one thickened nerve at diagnosis increased the odds of grade 2 disability 8.4-fold compared to one thickened nerve.

The other models are not presented here, but age <15 years, multibacillary patients and no formal education presented 7.0, 5.7

and 5.6 odds of developing physical disability, respectively. Other variables were identified as risk factors, but with low effect on physical disability: 1 to 3 years of formal education (3.51 times), positive bacilloscopy (1.77 times), more than 5 skin lesions (1.60 times), male gender (1.40 times) and detection through community survey (1.24 times).

DISCUSSION

The presence of lepromatous leprosy at diagnosis showed the highest impact as a risk factor for disability and physical deformity, followed by borderline leprosy. Physical disability and deformity are seen in both clinical forms and are explained by the host immune response and the long time span of the disease before diagnosis is confirmed. When the cellular immune response is strong (tuberculoid leprosy), bacillary destruction with minimal nerve injury occurs⁷⁻¹⁰. When it is weak (lepromatous leprosy), the bacilli multiply and spread to nerve trunks¹¹. Multibacillary leprosy and bacillary index ≥2 have been reported as risk factors for neuropathy¹⁴.

Nerve damage is associated with physical disability and deformity and is considered the most severe complication of leprosy^{12,15-19}. In our analysis, this variable presented the most precise odds for developing physical disability and deformity (95%CI 7.41-9.68). Although it is considered a subjective variable (palpation of peripheral nerves), the number of thickened nerves should be evaluated and its prognostic importance recognized. The frequency of neuropathy increases significantly in elderly patients, in cases with late diagnosis and in patients with higher number of thickened nerves^{12,20,21}.

Diagnosis of leprosy using community surveys (e.g., schools, nurseries, small villages) increased the detection of Grade 2 disability. This may reflect the examiners' better training, with a defined focus on verifying leprosy complications.

Aged 15 years-old and over at diagnosis was a strong risk factor for disability. Age is known to be related to disease duration and diagnosis delay^{22,23}, but this is the first study to quantify the association^{12,20}. Tissue damage caused by magnified and prolonged immunological

TABLE 2 - Multivariate model to identify risk factors for disability at the moment of leprosy diagnosis, Minas Gerais, Brazil, 2000-2005.

Variables	b*	SE(b) [†]	OR [#]	95% CI OR ^a	p-value
Age					
≥ 15 years old				1.0	
< 15 years old	-1.172	0.162	0.31	0.23; 0.43	0.000
Gender					
female				1.0	
male	0.335	0.055	1.40	1.26; 1.56	0.000
Formal education in years					
none	1.739	0.167	5.69	4.10; 7.90	0.000
from 1 to 3	1.254	0.171	3.51	2.51; 4.91	0.000
from 4 to 7	0.906	0.160	2.47	1.81; 3.39	0.000
from 8 to 11	0.303	0.173	1.35	0.96; 1.90	0.101
from 12 or more				1.0	
unknown	0.214	0.443	1.24	0.52; 2.95	0.341
Thickened nerves					
≤1 nerve				1.0	
> 1 nerve	2.136	0.066	8.47	7.41; 9.68	0.000
Clinical forms					
lepromatous	2.798	0.174	16.42	11.67; 23.10	0.000
borderline	2.551	0.167	12.82	9.24; 17.79	0.000
tuberculoid	1.506	0.177	4.51	3.18; 6.39	0.000
indeterminate				1.0	
not classified	3.521	0.474	33.83	13.35; 85.73	0.000
Patient inclusion					
spontaneous demand	0.291	0.096	1.34	1.11; 1.62	0.003
referred	0.318	0.096	1.37	1.14; 1.66	0.004
community survey	0.213	0.170	1.24	0.88; 1.72	0.492
contacts				1.0	
others	1.281	0.233	3.60	2.28; 5.69	0.000

*b: regression coefficient, [†]SE(b): standard error, ^aCI: confidence interval, [#]OR: odds ratio.

response is reduced by early diagnosis and treatment which prevent the development of neural damage.

At diagnosis, illiteracy was associated with physical disability, as previously reported^{24,25}. Formally educated people are more aware of their needs, seek medical attention at an earlier stage of the disease and have timely access to health system facilities²⁶⁻²⁹.

Male patients presented deformity more frequently than females and the following arguments have been proposed to explain such difference: 1) the difficulty of male subjects to come to a health facility during their working day³⁰⁻³⁴; 2) the fear of losing their jobs because of the stigma of leprosy and 3) since they are more likely to be engaged in heavy physical activities the risk of deformity is increased.

In summary, the most important risk factors for physical incapacities at diagnosis, in decreasing order of importance, were: lepromatous clinical form, borderline leprosy, the presence of more than one thickened nerve and tuberculoid clinical form. A more aggressive approach is necessary to diagnose leprosy at an earlier stage, targeting the reduction of disability and deformity.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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