NEUROFUNCTIONAL EVALUATION IN PATIENTS AFFECTED BY LEPROSY

Avaliação neurofuncional em pacientes com hanseníase

Evaluación neurofuncional de pacientes con hanseniasis

Original Article

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ABSTRACT

Objective: To investigate neurofunctional alterations in patients affected by leprosy, also searching to identify their socioeconomic and clinical profile. **Methods:** Cross-sectional study with 51 adult patients diagnosed with leprosy, regardless of gender, conducted in a reference center in 2010, in which the simplified neurofunctional evaluation form and a questionnaire (socioeconomic and clinical data) were applied. Findings were presented in a descriptive approach. **Results:** The study found a mean age of 46.4 ± 14.9 years, 32 (62.7%) patients of male sex, 32 (62.7%) with incomplete elementary school and 37 (72.5%) with family income between 1 and 3 minimum wages. The mean time of treatment was 14.4 ± 15.63 months. The multibacillary type of leprosy predominated (n=18/35.3%) with tuberculoid form (n=11/21.6%). The interphalangeal joints of upper and lower limbs were compromised in 5 (9.8%) and 6 (11.7%) patients, respectively. The most affected nerves were the posterior tibial in 19 (37.3%), the ulnar in 17 (33.3%), and the common fibular in 13 (25.5%) patients. The muscles with deficit were the extensor hallucis (n=8/15.7%), the toe extensors (n=6/11.8%) and the 5th finger abductor (n=6/11.8%). It was observed that 35 patients (68.6%) presented sensitive alterations in lower limbs and 14 (27.5%) presented functional incapacity degree 1. **Conclusion:** The study highlighted the socioeconomic profile of leprosy patients as men, low educational level and income, with multibacillary operational classification showing tuberculoid clinical form. In the neurofunctional assessment, there were sensory changes with higher incidence than the motor alterations, as well as discreet presence of deformities and high degree of functional disability.

Descriptors: Leprosy; Health Profile; Disability Evaluation; Rehabilitation.

RESUMO

Objetivo: *Investigar as alterações neurofuncionais apresentadas pelos pacientes com hanseníase, buscando também identificar seu perfil socioeconômico e clínico.* **Métodos:** *Estudo transversal com 51 pacientes adultos diagnosticados com hanseníase, independentemente do sexo, realizado em centro de referência, em 2010, no qual se aplicou a ficha de "avaliação neurológica simplificada" e um questionário (dados socioeconômicos e clínicos). Achados apresentados de forma descritiva.* **Resultados:** *Encontrou-se média de idade de 46,4 ± 14,9 anos, 32 (62,7%) pacientes do sexo masculino, 32 (62,7%) com ensino fundamental incompleto e 37 (72,5%) com renda familiar de 1 a 3 salários mínimos. O tempo médio em tratamento era de 14,4 ± 15,63 meses. Dominou a hanseníase do tipo multibacilar (n=18/35,3%) e a forma tuberculoide (n=11/21,6%). Articulações interfalangeanas em membros superiores e inferiores comprometidas em 5 (9,8%) e 6 (11,7%) pacientes, respectivamente. Nervos mais acometidos: tibial posterior em 19 (37,3%), ulnar em 17 (33,3%) e fibular comum em 13 (25,5%) pacientes. Músculos com déficits: extensor do hálux (n=8/15,7%), extensor dos artelhos (n=6/11,8%) e abdutor do 5º dedo (n=6;11,8%). Observou-se que 35 (68,6%) pacientes tinham alterações sensitivas em membros inferiores e 14 (27,5%) apresentavam incapacidade funcional grau 1.* **Conclusão:** *O estudo evidenciou o perfil socioeconômico dos pacientes com hanseníase como sendo homens, de baixa escolaridade e renda, com classificação operacional multibacilar apresentando a forma clínica tuberculoide. Na avaliação neurofuncional, houve maior ocorrência de alterações sensitivas sobre as motoras, como também discreta presença de deformidades e elevado grau de incapacidade funcional.*

Descritores: *Hanseníase; Perfil de Saúde; Avaliação da Deficiência; Reabilitação.*

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RESUMEN

Objetivo: *Investigar las alteraciones neurofuncionales presentadas por los pacientes con hanseniasis e identificar su perfil socioeconómico y clínico.* **Métodos:** *Estudio transversal con 51 pacientes adultos con el diagnóstico de hanseniasis independiente del sexo realizado en un centro de referencia em el 2010 en el cual se aplico la ficha de "evaluación neurológica simplificada" y un cuestionario (datos socioeconómicos y clínicos). Los hallazgos fueron presentados de forma descriptiva.* **Resultados:** *Se encontró una media de edad de 46,4 ± 14,9 años, 32 (62,7%) pacientes del sexo masculino, 32 (62,7%) con enseñanza fundamental incompleta y 37 (72,5%) con renta familiar de 1 a 3 ingresos mínimos. El tiempo medio de tratamiento fue de 14,4 ± 15,63 meses. Hubo predominio de la hanseniasis del tipo multibacilar (n=18/35,3%) y la forma tuberculoide (n=11/21,6%). Las articulaciones interfalángicas en los miembros superiores e inferiores estaban comprometidas en 5 (9,8%) y 6 (11,7%) pacientes, respectivamente. Los nervios más acometidos: tibial posterior en 19 (37,3%), cubital en 17 (33,3%) y fibular común en 13 (25,5%) pacientes. Los muslos con déficits: extensor del halux (n=8/15,7%), extensor de los artellos (n=6/11,8%) y El abductor del 5º dedo (n=6;11,8%). Se observó que 35 (68,6%) tenían alteraciones sensitivas en los miembros inferiores y 14 (27,5%) presentaban incapacidad funcional de grado 1.* **Conclusión:** *El estudio evidencio el perfil socioeconómico de los pacientes con hanseniasis de hombres, con baja escolaridad y renta, de clasificación operacional multibacilar presentando la forma clínica tuberculoide. En la evaluación neurofuncional hubo más ocurrencia de alteraciones sensitivas que motoras y también discreta presencia de deformidades y elevado grado de incapacidad funcional.*

Descriptores: *Lepra; Perfil de Salud; Evaluación de La Discapacidad; Rehabilitación.*

INTRODUCTION

Leprosy is defined as a chronic infectious, slowly progressive, and curable disease that primarily affects the skin and peripheral nervous system. It is caused by *Mycobacterium leprae*, which has high infectivity, low pathogenicity and is transmitted from person to person by the daily contact with contagious patients without treatment[1].

According to the World Health Organization (WHO), over 230 thousand new cases of leprosy are identified worldwide, and approximately 15 thousand people develop sequelae and/or deformities caused by the disease[2]. Brazil is the second country with the highest number of leprosy cases in the world, accounting for 34,000 new cases. This means a detection rate of 17.6 per 100,000 inhabitants and, of this total, 5.4% are under 15 years and 7.1% had late diagnosis with the presence of deformities[3].

Despite the continuous decreases registered in prevalence rates and in detection of new leprosy cases in Brazil, the North and Northeast regions have the highest prevalence rates, comprising most of the cases. According to DATASUS, in Ceará, that rate is above the national average, with 2,066 cases reported in 2012, accounting for a detection rate of 24.0/100,000 inhabitants, with a total population of 8,547,750 affected by disease[4].

For affecting an economically active population between 20 and 59 years of age, this disease has a social and economic impact on those people's lives, thus constituting a major public health problem. Therefore, programs aimed at the elimination of this disease are among the priority actions of the Ministry of Health[5].

It has a wide spectrum of clinical presentations, and its diagnosis is mainly based on the presence of skin lesions, loss of tactile sensitivity and nerve enlargement. The correct diagnosis and proper and early treatment of reactions are of great value for the prevention of disabilities, mainly to prevent nerve damage and functional disabilities[1,3,6].

The neurofunctional assessment of the patient aims to investigate possible neurological, motor and skin changes caused by leprosy, thus being essential that all the health staff is properly trained to carry out an effective evaluation, following the same pattern, with focus on the early detection of disease, and the prevention of disabilities as well[6,7].

Leprosy is a major public health problem. Its early detection and control depend directly on the integrated participation of municipal, state and federal health systems, from basic health units to specialized centers. It is important that the health team performs actions plans aimed at orienting self-care and prevention of patients' functional limitations in carrying out their daily activities, promoting rehabilitation[7,8,9].

Given the above, this study sought to investigate the pathophysiological changes presented by leprosy patients, also seeking to identify their socioeconomic and clinical profile.

METHODS

Quantitative cross-sectional study conducted at the Dona Libania National Reference Center for Sanitary Dermatology (*Centro de Referência Nacional em Dermatologia Sanitária Dona Libânia*), located in the city of Fortaleza, in the period from November to December 2010.

The research participants were 51 adults or elderly patients, aged over 18 years, regardless of sex, with clinical diagnosis of leprosy established by dermatologists of that service. Patients referred to the Prevention of Disability

(PD) Sector met the inclusion criteria, being excluded the patients without definition of clinical diagnosis, since the above-mentioned service accepts patients for evaluation in the PD Sector even before the definition of leprosy diagnosis.

Evaluations were performed twice a week during two months (November and December), in the morning and afternoon, by a sole previously trained researcher, to reduce errors and bias in data collection.

For the neurofunctional evaluation, the study used the medical records and the simplified neurological assessment by the Ministry of Health, adopted by the *Dona Libânia Dermatology Centre*[10], with some modifications necessary to the current study. The tactile sensitivity, peripheral muscle strength, presence of deformities of the interphalangeal joints, nerve thickening, and the degree of disability were evaluated. A questionnaire prepared by the researchers was used to collect socioeconomic and clinical data[11].

The tactile sensitivity was evaluated through the Semmes-Weinstein monofilaments or aesthesiometer with a range of colours (green, blue, violet, red and orange) applied on the dorsal and plantar foot, dorsal and palmar hand, following the path of the nerves responsible for skin sensitivity of these regions. The use of monofilaments allows graduating various sensitivity levels from normal to profound loss of sensitivity. Thus, it produces stimuli of different intensities, which allow to quantify and monitor the improvement/worsening or stability of neural function[12].

The measurement of muscle strength was performed through the Oxford table, comprising the 2nd and 5th fingers abductors; intrinsic muscles; wrist and thumb extensors; extensor digitorum, extensor hallucis; dorsiflexors and evertors. This table consists of 5 grades, in which 0 (zero) score represents the absence of muscle contraction detectable by palpation; in grade 1, there is only a trace of muscle contraction on palpation; in grade 2, the individual can realize the active movement when gravity is eliminated; in grade 3, active movement occurs against gravity; in grade 4, there is movement against gravity and moderate manual resistance added by the evaluator; in grade 5, movement occurs against gravity and maximum manual strength added by the evaluator[13,14]. Degrees 5 or 4 were considered "normal", while grades 3, 2 and 1 were considered "deficit"[13].

Through inspection, the study found the presence of fixed or movable claws in the interphalangeal joints. Presence of pain, thickening, shock, fibrosis or nodule were investigated by palpation of the ulnar, median, radial, radial cutaneous, common peroneal and posterior tibial nerves[10].

The classification of the degree of disability was defined according to the Ministry of Health, using the following criteria: grade 0 (zero) when there is no neural impairment in hands or feet; grade 1, corresponds to the decrease or loss of sensation; grade 2, indicates the presence of disabilities and deformities like claws, bone resorption, fallen hands and feet, among others[14].

After data collection, the results were presented descriptively, expressed as mean ± standard deviation, or absolute and relative frequency. SPSS version 16.0 (SPSS Inc., Chicago, IL, USA) was used.

This study was approved by the Research Ethics Committee of the institution, in compliance with Resolution 196/96 of the National Health Council, which rules the ethical and legal aspects of research in human subjects, with opinion No. 008/08. All patients were instructed about the research and signed the Free Informed Consent Form.

RESULTS

Of the 51 patients in the study, 32 (62.7%) were male. The age of patients ranged between 18 and 79 years, with mean age of 46.4 ± 14.90 years.

In considering the level of education, 32 patients (62.7%) were found with incomplete secondary education; 4 (7.8%) had complete secondary education; 3 (5.9%), incomplete high education; 11 (21.6%), complete high school; and only 1 (2%) had higher education.

With regard to family income, 10 patients (19.6%) reported having income below 1 minimum wage; 37 (72.5%), from 1 to 3 minimum wages; 3 (5.9%), from 4 to 6 minimum wages; and only 1 (2%) had income above 7 minimum wages.

Regarding the operational classification, 18 (35.3%) patients were found with multibacillary operational classification, 8 (15.7%) had the paucibacillary type, and 25 (49.0%) did not have this information in their records. On the clinical presentation of leprosy, 11 patients (21.6%) presented the tuberculoid type; 10 (19.6%), the dimorphous type; and 9 (17.6%), the lepromatous form. This information was not available to the rest of the patients (n=21/41.2%). Time of treatment in the referral centre ranged from 1 day to 72 months, with mean of 14.4 ± 15.63 months.

Of the total, 46 patients (90.2%) reported being under treatment for leprosy. Of these, 7 (13.7%) also underwent physical therapy, 3 (4.9%) received attention from nurses and 1 (2%) was under occupational therapy, all related to the disease. At the time of evaluation, 5 patients (9.8%) did not use any treatment because they had been discharged or were in their first evaluation in the PD sector.

As for the main complaint, 30 patients (58.8%) reported numbness in upper or lower limbs and 21 (41.2%) reported pain, edema and shock.

Table I - Evaluation of presence of peripheral nerves alterations in leprosy patients under treatment in dermatology reference center. Fortaleza-CE, 2010.

Neurological evaluation		Findings	
		n	%
ulnar nerve	normal	34	66.7%
	Tinel's sign/shock	11	21.6%
	pain	0	0%
	thickening	6	11.8%
	total	51	100%
median nerve	normal	41	80.4%
	Tinel's sign/shock	10	19.6%
	pain	0	0%
	thickening	0	0%
	total	51	100%
radial nerve	normal	48	94.1%
	Tinel's sign/shock	2	3.9%
	pain	1	2%
	thickening	0	0%
	total	51	100%
radial cutaneous nerve	normal	48	94.1%
	Tinel's sign/shock	3	5.9%
	pain	0	0%
	thickening	0	0%
	total	51	100%
posterior tibial nerve	normal	32	62.7%
	Tinel's sign/shock	15	29.4%
	pain	1	2%
	thickening	3	5.9%
	total	51	100%
common peroneal nerve	normal	38	74.5%
	Tinel's sign/shock	11	21.6%
	pain	1	2%
	thickening	1	2%
	total	51	100%

In the functional assessment, it was found that 5 patients (9.8%) had alterations in interphalangeal joints of the upper limbs, being movable claw type in 3 patients (5.9%) and fixed claw type in 2 (3.9%). In the lower limbs, 6 patients (11.7%) had alterations, being movable claw type in 4 patients (7.8%) and fixed claw type in 2 (3.9%). The other 40 patients (78.5%) showed no alterations in these joints.

In assessing the nerves of the upper limbs, it was found that 17 patients (33.3%) had changes in the ulnar; 10 (19.6%) in the median; 3 (5.9%) in the radial; and 3 (5.9%)

Table II - Evaluation of muscle strength in the upper limbs in leprosy patients under treatment in dermatology reference center. Fortaleza-CE, 2010.

Muscle evaluation		Findings	
		N	%
5th finger abductor	normal	43	84.3%
	good	2	3.9%
	regular	3	5.9%
	weak	2	3.9%
	insufficient	1	2%
intrinsic	normal	43	84.3%
	good	3	5.9%
	regular	1	2%
	weak	3	5.9%
	insufficient	1	2%
2nd finger abductor	normal	46	90.2%
	good	1	2%
	regular	1	2%
	weak	2	3.9%
	insufficient	1	2%
thumb extensors	normal	49	96.1%
	good	0	0%
	regular	1	2%
	weak	0	0%
	insufficient	1	2%
wrist extensors	normal	51	100%
	good	0	0%
	regular	0	0%
	weak	0	0%
	insufficient	0	0%

in the radial cutaneous nerve. The most frequent type of nerve injuries was the Tinel's sign/shock (Table I).

Neural changes in lower limbs comprised alterations in the posterior tibial nerve in 19 patients (37.3%), and lesions in the common peroneal nerve in 13 (25.5%). The most detected type of injury was also Tinel's sign/shock (Table I).

In assessing muscle strength of the upper limbs, 6 patients (11.8%) showed deficit in the 5th finger abductor; 5 (9.8%), in the intrinsic muscles; 4 (7.8%), in the 2nd finger abductor; 2 (3.9%), in the thumb extensors; and none on the wrist extensors (Table II).

On the muscles of the lower limbs, 8 patients (15.7%) had deficit in the extensor hallucis muscle; 6 (11.6%), in the extensor digitorum muscles; 2 (3.9%) in dorsoflexor; and 2 (3.9%) in ankle evertor muscles (Table III).

On the surface sensitivity, 7 patients (13.7%) showed alterations in the upper limbs and 35 (68.6%), in the lower limbs.

In the classification of the disability degree, the study found 26 (51.0%) normal patients, 14 (27.5%) with grade 1, and 11 (21.6%) with grade 2.

Table III - Evaluation of muscle strength in the lower limbs in leprosy patients under treatment in dermatology reference center. Fortaleza-CE, 2010.

Muscle evaluation		Findings	
		n	%
extensor hallucis	normal	43	84.3%
	good	0	0%
	regular	3	5.9%
	weak	1	2%
	insufficient	4	7.8%
extensor digitorum	normal	43	84.3%
	good	2	3.9%
	regular	1	2%
	weak	1	2%
	insufficient	4	7.8%
dorsoflexor	normal	48	94.1%
	good	1	2%
	regular	0	0%
	weak	1	2%
	insufficient	1	2%
ankle evertor	normal	48	94.1%
	good	1	2%
	regular	0	0%
	weak	1	2%
	insufficient	1	2%

DISCUSSION

Of the 51 patients studied in this research, it was found that the majority were male. This finding corroborates the literature, according to which much of communicable diseases is prevalent in males[6]. In addition, leprosy in adults is found to be more common in men, the risk of exposure being determinant of such difference[15].

With respect to age range, the mean was 46.4 years in the current study. In other studies, there is a significant and unexpected increase from 40 years of age[16,17]. One possible explanation would be the possibility of an inadequate diagnosis of leprosy in this age group, since diseases such as diabetes mellitus or arterial and venous insufficiencies could lead to false-positive results, particularly in the absence of classical lesions of leprosy[15,16].

In considering the level of education and family income in the selected sample of this study, the majority was found in disadvantageous conditions. Study performed in a health center in São Paulo, with 37 subjects with leprosy, shows that 70% had low education level, resulting in precarious family income ranging from one to three minimum wages[11]. Another study, which used data from the Notifiable Diseases Information System (*Sistema de Informação de Agravos de Notificação*) in the period from 2001 to 2009 in the state of Minas Gerais, observed prevalence of complete secondary education, with family income of one to three minimum wages[17].

Analysis of the treatment time in the reference center investigated in this study allows to observe that the sample mean exceeds 12 months. According to WHO, discharge among leprosy patients of paucibacillary type takes about 6 months (from the evaluation and/or registration of disabilities), and for the multibacillary type, 12-24 months, with follow-up evaluations every 6 months[18,19]. This treatment time is thus in line with the high number of multibacillary type found in this research.

In Brazil, the Ministry of Health suggests an operational classification with the following criteria: paucibacillary (PB), patients with preserved cellular immunity; negative bacilloscopy, up to five skin lesions and one nerve affected; multibacillary (MB), corresponding to clinical forms with reduced or absent specific immunity to bacillus; positive bacilloscopy, more than five skin lesions and more than one nerve affected[3].

On the operational classification of the type of leprosy, it was found that 35.3% of the patients were classified as MB in this research. This finding differs from a study conducted in the city of Fortaleza, CE, where it was noted that the PB form is the most frequent, reaching 67% of the forms identified in 2006. Only in 2003 and 2007, that proportion was equivalent, with a slight superiority in the number of cases of MB form[20].

One study[21] found that, in Ceará, the tuberculoid clinical form is the most common, reaching more than 50% of the cases detected in 2006 and remaining at levels close to that, in other years. In 2007, there was a decrease in this percentage, but it should be pointed out the high proportion of cases classified as unknown or in blank. The tuberculoid form is characteristic in people with resistance to *Mycobacterium leprae*, but underwent successive contacts and developed the disease[21,22]. The findings of the current study corroborate those results, since the predominance of the tuberculoid clinical form was observed.

In this study, it was observed the importance of the use of medical drugs, since most of the patients (n=46) received drug treatment, contributing to good outcomes. Previous studies have shown the efficiency of multidrug therapy (MDT), with decrease in the rate of deformities among new cases. This treatment protocol has enabled early diagnosis and systematized follow-up associated with neural monitoring, interventions for diagnosis and appropriate drug and non-drug treatments for neuropathy episodes, associated or not with reactional states[23,24]. Despite these practices, there was a high rate of patients with neurological disabilities.

As for the main complaint, the majority of patients reported numbness in the upper or lower limbs in this study. Among the clinical manifestations of leprosy, intense pain, nerve hypersensitivity, edema, sensory and motor functional deficit can be mentioned. In many cases, however, the phenomena of neuritis can develop without pain, being called silent neuritis. In those cases, pain or nerve hypersensitivity are not observed, but changes in the sensitivity and motor strength occur, which are often detected exclusively through sensitivity and muscle strength examination[19,20].

During the inspection of the interphalangeal joints, it was found that most patients in this study showed no change. Deformities and disabilities found in the upper and lower limbs, called “claws”, are due to factors related to the nervous involvement: the changes in sensitivity and motor skills, and immunoinflammatory states[20,21].

The neural involvement occurs in all forms of leprosy, as its most striking feature, and responsible for the crippling stigma of this disease[19,25]. However, no changes were observed during palpation of the nerves of the arms and legs in most patients.

Hansen’s bacilli affect the peripheral nerves, from its dermal endings to the nerve trunks. The leprosy neuropathy is clinically mixed, affecting both sensory and motor autonomic nerve fibers, leading to changes and imbalances in flexibility and strength[20,26]. In this study, it was observed that most of the patients achieved grade 5 during the evaluation of muscle strength.

In the current study, the degree of incapacity was assessed at the time of the evaluation in the PD sector, therefore, being the majority of patients with MDT in progress, and the remaining patients after discharge. The literature reports that this assessment should be performed in the stages of disease diagnosis and discharge, using secondary data[16,23].

As the proportion of degree of disability found was considered high, the need for early diagnosis is suggested. Other studies also showed a high number, disabilities thus being acknowledged as major factors of the disease stigma, liable to adversely affect the social life in its development[8,15,23].

Studies have revealed the importance of early diagnosis of leprosy, as well as the need for evaluation and monitoring in the prevention of disabilities, both having a strong impact on reducing and inhibiting the onset of disabilities[9,16,19].

In this context, it is important to emphasize the need to prioritize the integrated attention to the patient, with planning measures and continuing education in the healthcare units. It is essential that innovative training actions are provided for the professional involved directly and indirectly in the care of these patients, seeking to standardize the assessment and early detection measures as well as actions of diseases guidance and control, in order to prevent disability and functional deformities and provide healthcare of quality[27,28].

This study may contribute to a more detailed picture of physical disabilities caused by leprosy and hence form the basis for future proposals aimed at reducing their incidence. It should be noted, however, that the reduced amount of patients participating in this study and the lack of data in the records are presented as limitations.

CONCLUSION

The study evidenced the socioeconomic profile of leprosy patients as men with low education and income, with multibacillary operational classification presenting the tuberculoid clinical form.

In neurofunctional evaluation, the study found incidence of sensory changes higher than the motor alterations, as well as discreet presence of deformities. These findings, however, did not prevent the detection of high level of functional disability.

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