ABSTRACT

The authors assessed all tibial nerve conduction studies (NCS) of the patients suspicious of acute or subacute leprosy neuropathy, who have been attended at the Leprosy Ambulatory Clinic of the ILSL during a period of two years. Seventy-five patients have been included as follows: 52 male and 23 female, between 21 and 73 years old, with the mean age of 44.5 totaling 150 nerves. The medial plantar (MP) and lateral plantar (LP) branches were studied separately. The most involved was the LP with 57.4%, followed by the MP with 42.6%. The most frequent injury among the abnormal nerves was the axonal lesion with 66%, followed by the myelin lesion with 28.7%. The most frequent and disproportional involvement of the PL branch not only demonstrates the compressive character of the tibial nerve injury in the tarsal tunnel but also indicates a multiple entrapment mononeuropathy in the lower limbs. The high prevalence of the tibial nerve injury was considered a hallmark of the disease, as well as the ulnar neuropathy.

Key words: leprosy, tibial nerve, tarsal tunnel syndrome, neural conduction

INTRODUCTION

The tarsal tunnel syndrome (TTS) is characterized by the compression of the tibial nerve at the tarsal tunnel, under the flexor retinaculum muscle. The tunnel contains, besides the tibial nerve, the tendons of the following muscles: posterior tibial, flexor hallucis longus, flexor digitorum longus and the vascular bundle, composed of the posterior tibial artery and vein. The sensitive complaints on the distribution territory of the nerve are more relevant than the motor ones. During physical examination one can find thickening, Tinel’s sign and pain upon palpation of
the tibial nerve at the medial retromalleolar region of
the ankle\(^2\). Among known causes, the most frequent
are the traumatic and idiopathic. Traumatic injuries
result from scarring after sprains, tenosynovitis of the
flexor tendons and bone alterations due to fractures.
The most common alterations, either external or
internal to the tarsal tunnel, are: varicose veins, ganglia
(synovial cysts), lipomas, bone exostosis e and nerve
sheath tumors – neurilemmomas\(^1\). Opposite to carpal
tunnel syndrome, TTS is less commonly associated
with systemic diseases. Among systemic causes,
TTS is associated more frequently with diabetes,
rheumatoid arthritis and leprosy, and may occur in
systemic lupus erythematosus and hyperlipidemia\(^1,3,4\).
In a sample of 265 leprosy patients evaluated with the
Semmes-Weinsten monofilament (Kit-SORRI Bauru),
the frequency of the tibial nerve involvement was
found to be the highest (82\%) among all cranial and
spinal nerves assessed\(^6\). During the reaction stages
of leprosy compressive phenomena occur, due to
a great volume expansion caused by edema of the
nerves at the osteoligamentous tunnels at the elbow,
wrist, knee and ankle joints\(^2,5,6\). Electrophysiological
demonstration of focal alterations at compression
sites suggest the presence of compressive syndromes.
Although compressions will initially course with focal
demyelination, in leprosy, a chronic inflammatory
neuropathy, they may progress to pronounced focal
axonal injury. The complexity of this process in leprosy
has motivated the authors of this study.

**OBJECTIVE**

To assess the motor involvement of the medial plantar
(MP) and lateral planatar (LP) branches of the tibial
nerve in leprosy patients under suspicion of acute
or subacute neuropathy, who have been submitted
to neurophysiological examination. To study the
frequency of neurophysiological findings of motor
conduction of the MP and LP through the tarsal tunnel,
and the late responses of the MP. To characterize the
types of injury regarding physiopathology, if axonal
or myelinic.

**METHODS**

Prospective neurophysiological study of patients
attended at the Leprosy Ambulatory of ILSL, between
November 2009 and December 2011, under suspicion
of acute or subacute neuropathy – neuritis –due to
leprosy in all its forms of disease, focusing on the

Figure 1.
In order to define demyelination, the criteria used were temporal dispersion of CMAP above 50% and conduction velocity below 70% of the inferior normal values\textsuperscript{10,11}. Conduction blocks were also considered as acute demyelination due to compression and not because of axonal causes, and defined as a reduction of amplitude greater than 50%, in the absence of temporal dispersion\textsuperscript{9}. \textbf{Figures 2 and 3}.

Figura 1 – Axonal injury of the tibial nerve, stimuli A1 below and B1 above the ankle at the medial plantar branch; and stimuli C1 below and D1 above the ankle at the lateral plantar branch. Observe the low amplitude of the motor potentials.

Figura 2 – Myelinic injury of the tibial nerve, stimuli A1 below and B1 above the ankle at the medial plantar branch; and stimuli C1 below and D1 above the ankle at the lateral plantar branch. Observe the important temporal dispersion of the motor potentials.
All examinations were revised by another researcher in order to reduce bias and diagnosis errors.

Frequency of involvement of the tibial nerve was calculated in this series of patients, as well as which of its branches was more commonly and precociously affected.

**RESULTS**

Eighty-three patients with a suspicion of leprosy neuritis were attended at the Leprosy Ambulatory of ILSL, during the period of November 2009 and December 2011. Eight patients were excluded for presenting comorbidities. Seventy-five patients were included, 52 male and 23 female, ages 21 to 73 years and a mean age of 44.5 years. Regarding clinical presentation, the distribution of patients was as follows: borderline lepromatous and lepromatous 38.6%; mid-borderline 30.6%; borderline tuberculoid and tuberculoid 17.3% and unclassified 13.5%. Medial plantar branch \((n = 150)\) was within normal values in 57.4% of nerves and presented an injury in 42.6%, thus distributed: axonal 24%, axonal predominance 3.3%, myelinic 11.3% and myelinic predominance 4%. Lateral plantar branch \((n = 150)\) was normal in 47.3% and injured in 52.7%, distributed as follows: axonal 36%, axonal predominance 3.3%, myelinic 8.7% and myelinic predominance 4.7%. Considering an alteration of the tibial nerve as an injury in any of its branches, 58.7% of the nerves presented an alteration. Among injuries of myelinic predominance, conduction block was found in 39.1% of the MP branches and 50% of the LP branches. For these same injuries temporal dispersion was observed in 17.4% of the MP branches and 15% of the LP branches. F-Wave was recorded only at the MP branch, and found altered in 55.3% of the nerves in which it was possible to record it. The presence of A-Wave was observed during the recording of F-Wave, being present in 12% of those nerves. Table 1.
Tab. 1: Frequency of involvement of the tibial nerve at the medial plantar and lateral plantar branches according to the type of injury regarding electrophysiological findings of motor conduction through the tarsal tunnel, i.e., axonal, myelinic or predominance of either form, conduction block and temporal dispersion and late responses: F-waves and A-waves.

<table>
<thead>
<tr>
<th>Type of injury</th>
<th>Medial plantar branch n =150</th>
<th>Lateral plantar branch n =150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>57.4%</td>
<td>47.3%</td>
</tr>
<tr>
<td>Axonal</td>
<td>24%</td>
<td>36%</td>
</tr>
<tr>
<td>Axonal &gt; myelinic</td>
<td>3.3%</td>
<td>3.3%</td>
</tr>
<tr>
<td>Myelinic</td>
<td>11.3%</td>
<td>8.7%</td>
</tr>
<tr>
<td>Myelinic&gt; axonal</td>
<td>4%</td>
<td>4.7%</td>
</tr>
<tr>
<td>Conduction block</td>
<td>39.1%</td>
<td>50%</td>
</tr>
<tr>
<td>Temporal dispersion</td>
<td>17.4%</td>
<td>15%</td>
</tr>
<tr>
<td>Increased F-Wave</td>
<td>55.3%</td>
<td></td>
</tr>
<tr>
<td>A-Wave present</td>
<td>12%</td>
<td></td>
</tr>
</tbody>
</table>

DISCUSSION

The frequency of involvement of the tibial nerve was high, as demonstrated by a previous study, reaching more than half of the examined tibial nerves, considering the alterations found in the LP branch. LP branch was the most commonly compromised at 52.7%, when compared to MP branch at 42.6%, as well as the most intensely affected, finding that suggests earlier injury. Axonal and axonal predominance injuries occurred at a higher frequency than myelinic or myelinic predominance ones. At the LP branch 39.3% of injuries were axonal and 13.4% myelinic; at the MP branch 27.3% were axonal and 15.3% myelinic. Even though leprosy is an initially demyelinating neuropathy, it will evolve to axonal loss. Since in this sample there is a high number of lepromatous, borderline lepromatous and mid-borderline forms, i.e., multibacillary cases in which a longer time of disease without treatment is presumed, advanced stage neuropathies with more serious axonal loss are expected. F-wave, a feature that indicates nerve pathology, either axonal or myelinic, was prevalent in this group of nerves in which axonal injuries prevailed. Conduction blocks, that could be harder to confirm due to the difficulty of evaluating strength at the foot muscles, were confirmed through the analysis of the F-waves, from which a lower persistence is expected in the case of a conduction block.

A hypothesis to explain the higher involvement of the LP branch is that it is exposed to more compression sites, either at the tarsal tunnel under the flexor retinaculum as through the fibromuscular tunnel between the muscle layers of the foot, entering medially through the abductor hallucis and lateral to the quadratus plantae, and exiting at the mid-foot between the flexor digitorum brevis and the abductor digiti minimi.

CONCLUSIONS

1. Considering the high frequency of neurophysiological alterations exhibited at this series of patients, the involvement of the tibial nerve must be considered as one of the hallmarks of the disease, as has been the case with the involvement of the ulnar nerve.
2. The most prevalent involvement of the LP branch demonstrates the compressive character of the involvement of the tibial nerve at the tarsal tunnel, since this branch is subject to more compression zones, being more intensely and precociously injured. The disproportional spatial and temporal injury to the LP branch also reveals the structure of a multiple entrapment mononeuropathy in the lower limbs, the main hallmark of the leprosy neuropathy.
3. Early and more frequent involvement of the LP branch makes it an eligible nerve, to be included in the routine of the neurophysiological examination for the investigation of TTS in leprosy and other diseases, including in the absence of a specific clinical complaint. As for the cases of TTS from other diseases, sensory conduction at the MP and LP branches should naturally be included in the investigation protocol.
REFERENCES


