Use of high resolution ultrasonography as an additional tool in the diagnosis of primary neuritic leprosy: a case report

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Introduction

Leprosy is a disease primarily affecting the skin and the nerve. In certain situations nerve involvement is seen in the absence of skin lesions. Such cases of leprosy are negative on skin smear examination and are referred to as Pure Neural or Primary Neuritic Leprosy (PNL).\(^1\) The fact that it may resemble other peripheral neuropathies and does not have demonstrable bacilli in skin smears contributes to the delay in diagnosis.\(^2\) High Resolution Ultrasound (HRUS) has been shown to be a useful technique to detect leprosy nerve damage.\(^3,4\) We present a case report of PNL where HRUS gave significant information for diagnosis and management.

Case Report

A 30 year old female presented with numbness and pain, followed by weakness and deformity of the left hand of 6 months duration. After consulting private physicians she presented at the neurology department at Nizams Institute of Medical Sciences (NIMS) in Hyderabad from where she was referred to our centre.
On examination, there was weakness and wasting of the small muscles of the left hand and anesthesia of the ulnar side of the hand tested by Semmes Weinstein Monofilaments. Voluntary muscle testing (VMT) revealed severe weakness of the hypothenar muscles, Abductor Digiti Minimi (ADM) muscle and of the interossei muscles of the left hand (MRC grade 0). Nerve palpation revealed thickening of the left ulnar and radial cutaneous nerve (RCN) with tenderness of the left ulnar nerve. All other nerves appeared normal. There were no skin lesions.

Electrophysiological testing of left ulnar nerve showed reduced compound motor action potentials, absent sensory nerve action potentials and normal distal latencies suggestive of axonal neuropathy.

Slit skin smears taken from the left earlobe, forehead and left hand were negative for acid fast bacilli. All other routine laboratory investigations were within normal limits. HRUS (Esaote -MyLab 5 Colour Doppler System, The Netherlands) using linear array probe (LA435 Bandwidth frequency of 6–18 MHz) of peripheral nerves was carried out which revealed enlargement of the left ulnar nerve at sulcus and upper arm. The cross sectional area of the nerve just above the elbow was 40 mm² (normal value: 4.44 ± 0.68 mm²) and the enlargement extended to a length of 12 cm above the elbow. The echo texture of the nerve was severely damaged and there was increased epineural blood flow on colour Doppler imaging (Figures 1A and B).

Additionally, HRUS revealed thickening of the left radial cutaneous nerve and dorsal ulnar cutaneous nerves. Size and echo texture of all other peripheral nerves (right ulnar and bilateral median, fibular and posterior tibial) were within normal limits.

Subsequently an open surgical biopsy of the left dorsal ulnar cutaneous nerve was done at NIMS and a sliver of the nerve was taken and stained with Haematoxylin & Eosin stain. The biopsy material revealed enlargement of four of the nerve fascicles with thickening of the perineurium. The endoneurium showed areas of necrosis with granulomas comprising of epithelioid cells, Langhans giant cells, lymphocytes and areas of edema and increased vascularity. Nerve fibre integrity was assessed by Kpal stain which showed near total nerve fibre destruction of the fascicles. The sections were consistent with a histological diagnosis of borderline leprosy in Type 1 reaction and were in concordance with the ultrasound findings. Based on these findings the patient was started on WHO Multibacillary Multidrug Therapy (MB MDT) and corticosteroid therapy to address the Type 1 reaction in the nerve and to reverse the nerve damage. The patient’s reaction is being monitored during follow up.

Discussion

High-resolution ultrasonography is a noninvasive, imaging technique, which provides real-time examination of deeper tissues including peripheral nerves in static and dynamic states such as blood flow. The recent advances in HRUS has improved spatial and contrast resolution with this technique and made it possible to virtually depict all nerves in the limbs and extremities with excellent details for the study of peripheral neuropathies. HRUS is a new field in peripheral nerve disorders and surprisingly very few studies have been performed in polyneuropathies which may clinically present with nerve enlargement, such as hereditary neuropathies, Guillain-Barré Syndrome (GBS), chronic inflammatory neuropathies, multifocal motor neuropathy (MMN), vasculitic and paraneoplastic polyneuropathy, diabetic
neuropathy and leprosy. Most reports are case reports, case series and small case control series. The two best studied polyneuropathies are leprosy and MMN. HRUS has proven to be useful in the context of leprosy. Since the hallmarks of leprosy are nerve enlargement and inflammation, HRUS and colour Doppler (CD) imaging can be used to demonstrate nerve enlargement and inflammation. Currently five studies have evaluated the sonographic findings in leprosy (evaluating a total of 111 subjects). It has been found that HRUS is able to detect multifocal nerve enlargements. Moreover, nerve damage appeared sonographically more extensive and included more nerves than clinically expected. Furthermore it is more sensitive and more specific for detecting nerve enlargement because thickness can be measured objectively and compared with a set of reference values. In comparison to the other studied polyneuropathy, MMN nerve enlargement in leprosy seems to be more extensive with enlargement along a long course of nerve with the maximum enlargement being just proximal to the entrapment sites. In MMN maximum enlargement is at the proximal sites of the nerves. In leprosy thickening of the epineurium occurs; it is not known whether this also occurs.

Figure 1. (A) Ultrasonography and colour Doppler images of peripheral nerve of leprosy patient. A transverse scan of an enlarged left ulnar nerve indicated by an arrow (CSA = 40 mm²) from Primary neuritic leprosy patient with Type 1 reaction showing no endoneural blood flow signals with hypoechoic areas showing extensive nerve damage. Inset shows epineurial blood flow. (B) Ultrasonography and colour Doppler images of peripheral nerve of leprosy patient. A longitudinal scan of ulnar nerve with hypoechoic fascicles separated by hyperechoic bands. There is epineurial blood flow on the right side of the image. Inset shows magnified image of epineurial blood flow.
in other polyneuropathies. Whether leprosy has specific sonographic characteristics, disting-
ishing leprosy from other neuropathies is not known yet and has to be examined further.

So, peripheral nerve ultrasound provides information on the exact location of nerve
enlargement and morphological alterations in the nerve including echo texture, fascicular
pattern and vascularity.3,14 This information brings a new dimension to the diagnosis of PNL
type of leprosy and the early recognition of leprosy neuritis especially during reactional
phases of the disease.11 The increased blood flow and vascularity observed on ultrasound was
correlated with the oedema and vascularity histologically showing that ultrasound could be a
noninvasive tool to recognise neuritis and to indicate need for corticosteroid therapy to
prevent permanent nerve damage associated with reactions.

Approximately 5–10% of all leprosy patients are of a pure or primary neuritic type,
presenting with involvement of (a) nerve(s) without skin lesions and PNL carries the highest
risk of deformity.15–17 Therefore, in countries where leprosy occurs it can be difficult to
differentiate ulnar nerve neuropathy at the elbow from PNL and it requires a nerve biopsy or
fine needle aspiration cytology for the correct diagnosis.18,19 In our case high-resolution
sonography was very useful to make the diagnosis of leprosy more likely as it involved multiple
nerve thickening (left ulnar nerve, dorsal ulnar cutaneous nerve and radial cutaneous nerve)
with characteristic nerve echotexture, endoneural flow and nerve thickening of leprosy.
Moreover, it helped to localise from where to obtain the biopsy. The other neuropathy
condition for differential diagnosis is ulnar nerve entrapment (UNE) which can be
sonographically distinguished from leprosy by nerve enlargement which is usually at the sulcus
or just above the elbow.3,14 In leprosy the nerve enlargement is more extensive involving
greater length with increased endo – and epineurial blood flow and thickened epineurium.12

Conclusion

In the absence of visible skin lesions and acid fast bacilli in skin smears, PNL continues to be
a diagnostic challenge. With an increasing awareness and use of HRUS among neurologists
and leprologists to diagnose peripheral neuropathies it can become an additional tool to
improve the diagnosis of leprosy, including the primary neuritic form. This case study
demonstrated that HRUS has significantly impacted the diagnosis and management of a PNL
case. HRUS can be an additional diagnostic tool for leprosy and especially PNL form.

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