Clinics in Dermatology (2016) **34**, 70–78

ELSEVIER

Clinics in Dermatology

Imaging techniques in leprosy clinics

Suman Jain, MBBS, DCH[a,*], Leo H. Visser, MD, PhD, DTM&H[b], Sujai Suneetha, MBBS, DCP, PhD[a]

[a]*CODEWEL Nireekshana AIDS Care Education and Training (ACET), Narayanaguda, Hyderabad 500029, India*
[b]*Department of Neurology and Clinical Neurophysiology, St. Elisabeth Hospital, PO Box 90151, 5000 LC, Tilburg, The Netherlands*

Abstract Leprosy is the most common treatable peripheral nerve disorder worldwide, with periods of acute neuritis leading to functional impairment of limbs and stigmatizing deformities. The nerve involvement in leprosy reactions, if recognized early and promptly treated with steroids and nerve release surgery, can be reversible. Currently, the nerve assessment in leprosy relies mainly on clinical assessment and nerve conduction studies. High-resolution ultrasonography (HRUS) of peripheral nerves is finding wider application in the differential diagnosis of peripheral neuropathy. HRUS provides a noninvasive tool that gives information on location and degree of nerve enlargement, nerve morphologic alterations, echo texture, fascicular pattern, and vascularity of the nerve, which mirrors the histologic changes. HRUS is amenable to studying structural changes in nerve sites that cannot be biopsied for histopathologic examination and is more cost effective than magnetic resonance imaging. So far other there are only five studies available on the sonographic findings in leprosy. These findings are reviewed and the technique of HRUS is described in this paper, with a recommendation of a standard protocol and proforma.

Introduction

Although the incidence of leprosy has come down in many countries of the world, new cases are still being detected in a few countries.[1] India contributes more than 55% of the world's caseload of leprosy; other countries where leprosy is prevalent are Brazil, Nepal, Bangladesh, Sri Lanka, and a few other countries in Africa and the South Asian region.[1] In most nations, with the integration of leprosy into general health care services, patients with skin patches and signs and symptoms of peripheral neuropathy report to dermatologists and neurologists in the government health facilities or in the private sector.[2] In the light of the risks of hepatitis B and HIV, there is a reduced emphasis on invasive investigations, such as slit skin smears, skin biopsy, or nerve biopsy, and clinicians are looking for alternative ways to confirm a diagnosis.[3]

Diagnosing leprosy relies on the identification of the typical clinical and histopathologic involvement of the skin and nerves. Peripheral nerves are often enlarged in leprosy, and palpation of nerves is a highly subjective clinical tool. The absence of typical dermatologic features greatly decreases clinical diagnostic accuracy and often necessitates histologic confirmation. Early diagnosis and treatment of leprosy and neuritis is vital for the prevention of disability in leprosy. The damage to peripheral nerves in leprosy occurs by direct invasion of the bacillus and during reactional states, especially in type 1 or reversal reaction (RR), where the inflammatory process can be intense and result in irreversible damage.[4] The nerve involvement in leprosy reactions, if recognized early and

* Corresponding author. Tel.: +91-40-23221033, +91-9989706399; fax: +91-40-23093957.
E-mail address: sumanjaindr@gmail.com (S. Jain).

http://dx.doi.org/10.1016/j.clindermatol.2015.10.014
0738-081X/

promptly treated with steroids and nerve release surgery, can be reversible. Currently, nerve assessment in leprosy relies mainly on clinical assessment and nerve conduction studies. A limitation of these studies not providing spatial information about the nerve anatomy or its surroundings.

Peripheral nerve high-resolution ultrasonography (HRUS) provides a noninvasive tool that gives information on location and degree of nerve enlargement, nerve morphologic alterations, echo texture, fascicular pattern, and vascularity of the nerve, which mirrors the histologic changes (Figure 1). This information brings a new dimension to the diagnosis of leprosy and neuritis during the reaction phase. The increased blood flow and vascularity observed in ultrasound has been corroborated with the edema and vascularity, histologically indicating that ultrasound could be a tool to determine the need to initiate corticosteroid therapy to prevent or treat the nerve damage associated with reactions.

In certain situations, nerve involvement in leprosy occurs in the absence of visible skin lesions. Such cases of leprosy are negative on skin smear examination and are referred to as pure neural or primary neuritic leprosy.[5] Its possible resemblance to other peripheral neuropathies and the fact that it does not have demonstrable bacilli in skin smears contribute to the delay in diagnosis.[6] HRUS has been found to be a useful technique to detect leprosy nerve damage.[7,8]

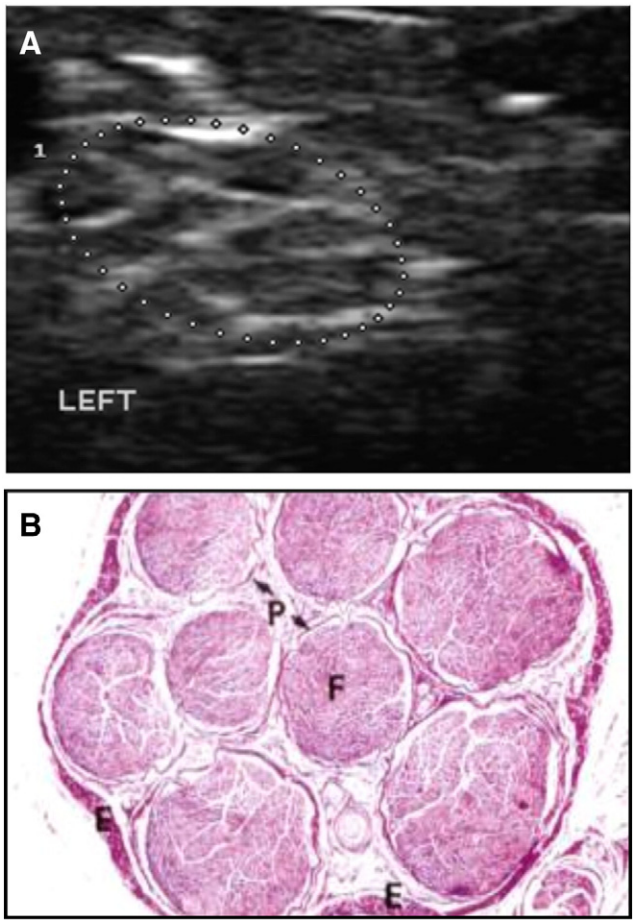

Fig. 1 Normal nerve appearance: cross-sectional view. The cross-sectional view of posterior tibial nerve. A, By ultrasonographic imaging; B, histologic picture by sectioning and hematoxylin-eosin stain of nerve. (*P*, perineurium; *F*, fasicles; *E*, epineurium). The ultrasonographic imaging reveals histology and anatomy of the peripheral nerve.

Ultrasonic evaluation of the peripheral nervous system

There is a growing interest in HRUS as a diagnostic tool for diseases of the peripheral nervous system, including mononeuropathies, polyneuropathies, and peripheral nerve tumors.[9] HRUS is noninvasive, amenable to studying structural changes in nerve sites that cannot be biopsied for histopathologic examination, and is more cost effective than magnetic resonance imaging (MRI). HRUS of peripheral nerves is finding wider application in the differential diagnosis of peripheral neuropathy.[10] High-resolution ultrasonography is an imaging technique that provides real-time examination of soft tissues in static and dynamic states such as blood flow. The refinement of high-frequency broadband linear array transducers and sensitive color and power Doppler technology have improved the ability of HRUS to detect fine textural abnormalities of tender tissues as well as to identify a variety of pathologic conditions; however, there is a need for increased awareness and training in its day-to-day application.[11] The improved spatial and contrast resolution of this technique has made it possible to virtually depict all nerves in the limbs and extremities with excellent details, especially in the context of leprosy; furthermore, descriptions of MRI features of peripheral nerve involvement in leprosy are also sparse in literature. Its use in leprosy has been growing over the years.[7,12,13] Technical developments leading to improved image quality and reduced sizes of ultrasonographic equipment, together with a reduction in price will make it possible for HRUS to become a tool that can be used in countries where leprosy is still endemic.

High-resolution ultrasonography techniques

Sonography of peripheral nerves requires the use of linear array transducers with high insonation frequencies (usually 15 MHz or more). Normal peripheral nerves reveal a characteristic echotexture: tubular structure with multiple hypoechoic but discontinuous linear areas separated by hyperechoic bands in longitudinal and multiple rounded hypoechoic areas in a homogenous background in transverse plane (fascicular or honeycomb pattern) (Figure 2).[9,14,15] Nerve sonography can demonstrate five main pathologic changes: (1) nerve enlargement, (2) increased hypoechogenicity or hyperechogenicity, (3) enlarged fascicles, (4) increased thickness of the epineurium, and (5) increased endoneural or epineural blood flow.