

# Posterior tibial nerve neurolysis for treatment of leprosy induced plantar ulcers

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## Abstract

**Introduction:** Damage to the peripheral nerves due to neuritis caused by *Mycobacterium leprae* is responsible for most of the deficits and deformities associated with leprosy. The trophic or chronic plantar ulcer of leprosy due to involvement of posterior tibial nerve is one of the principle causes of disability. Multiple treatment options are mentioned in the literature but none of them is found to be gold standard. Thus we formulated this study to evaluate the results of posterior tibial nerve neurolysis in treatment of plantar ulcers in leprosy.

**Patients and methods:** Diagnosed patients of leprosy with plantar ulcers and who have positive Tinel's sign, numbness in feet with thickened tender posterior tibial nerve underwent posterior tibial nerve decompression and debridement of the ulcers were included in the study. Post operatively ulcers were assessed after 2, 6 and 12 weeks after surgery for the signs of healing and according to the grading system described by Sehgal et al.

**Results:** 34 patients with mean age of 48 years with plantar ulcers we included in the studies. There were 4 patients with grade IV, 21 patients with grade III and 9 patients with grade II ulcers. All the patients except one had clinical improvement and showed signs of healing at 12 weeks of follow up. Also the sensations in the sole of foot improved in all our patients.

**Conclusion:** Posterior tibial nerve decompression or neurolysis is an effective method to treat plantar ulcers in leprosy which also improve the plantar sensations.

**Keywords:** Posterior tibial nerve, Leprosy, Neurolysis, Plantar ulcers, Trophic ulcers.

## Introduction

Leprosy also known as Hansen's disease is a chronic granulomatous disease caused by *Mycobacterium leprae*, which mainly affects skin and peripheral nerves and causes significant morbidity. The disease is clinically characterized by hypo pigmented or erythematous skin patches with definite loss of sensation, thickened peripheral nerves, and acid-fast bacilli in skin smears or biopsy material.<sup>1</sup> Despite reduced prevalence of leprosy following implementation of multidrug therapy (MDT) program by World health organization new case detection rates are still high-indicating active transmission thus causing significant health problems in endemic countries like India.<sup>1</sup> Damage on the peripheral nerves due to neuritis caused by *Mycobacterium leprae* is responsible for most of the deficits and deformities associated with leprosy.<sup>2, 3</sup>

Nerve involvement in leprosy can affect the sensory, motor or autonomic functions of peripheral nerves. The manifestations include sensory loss, motor loss in the distribution of the affected nerves; glove and stocking neuropathy and anesthesia on soles of feet.<sup>4</sup> Posterior tibial and common peroneal nerves

are the most commonly affected nerve of the lower limb due to leprosy. Posterior tibial is affected in around 82% and common peroneal nerve in around 79 % of leprosy patients.<sup>5</sup> Combination of deformity and decreased sensitivity is responsible for severe functional limitations and the formation of ulcers over feet.

The trophic or chronic plantar ulcer of leprosy due to involvement of posterior tibial nerve is one of the principle causes of disability due to its prolonged and recalcitrant course. Multiple treatment options both surgical as well as medical has been tried for the treatment of this difficult problem but none of them have been found to be foolproof. In this study we have evaluated the results of posterior tibial nerve neurolysis combined with debridement of the ulcer.

## Patients and methods

The study was conducted in a tertiary care hospital in central India between Jan 2014 and Dec 2019. Thirty four diagnosed patients of leprosy with plantar ulcers and who have positive Tinel's sign, numbness in feet with thickened tender posterior tibial nerve underwent posterior tibial nerve decompression and debridement of the ulcers were included in the study.

Data from these patients with respect to age, sex, type of leprosy and duration of ulcer was recorded along with the morphological features of ulcers like size, site, depth, and presence of secondary infection. Radiography of the foot was done to assess bone involvement and presence of osteomyelitis. Bacterial cultures were also obtained per operatively. Ulcers were graded pre and post operatively by grading system described by Sehgal et al.<sup>6</sup> (Table 1)

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**Figure 1:** Intra operative posterior tibial nerve neurolysis

**Operative technique**

All the surgeries were done under spinal anesthesia with patient in supine position. The thickened nerve was identified behind the medial malleolus and direct incision was taken over this nerve reaching up to flexor retinaculum. The nerve was carefully dissected and flexor retinaculum was incised to identify and separate the posterior tibial vessels. Epineurotomy was done and the nerve was decompressed internally. (Figure-1) The nerve sheath abscess was drained and the debris curetted out gently. The wound was washed and closed with 3-0 Ethilon. At the same setting the ulcer was debrided and edges were freshened and samples were sent for bacterial culture and sensitivity.

Post operatively the patients were kept non weight bearing for 2 weeks and daily dressing of the ulcer was done for 2 weeks after this the ulcer was dressed on alternate day for 4-6 weeks depending upon the healing. Appropriate antibiotics were prescribed according to the culture reports. Sutures from the operative site were removed after 10 days. The ulcers were assessed after 2 weeks, 6 weeks and 12 weeks after surgery for the signs of healing and according to the grading system described above.

**Results**

The mean age of the patients in the study was 48 years, the youngest patient being 22 years old and the oldest being 76

**Table 1: Grading system for plantar ulcers**

Grade	Diameter of ulcer in centimeter (cm)	Percentage of granulation tissue and/or re-epithelialization
I	<1	25%
II	2-Jan	26-50 %
III	4-Feb	51-75 %
IV	>4	76-100 %

**Table 2: Patient demographics**

Patient description	No of patients
Total number	32
Males	22
Females	10
Male: female	2.2:1
Mean age (in years)	48 (Range 22-76years)



**Figure 2:** Healed ulcers

years. There were 23 males (67%) and 11 females (33%) with male to female ratio being 2.1:1. Out of 34 patients 32 patients had multi bacillary leprosy and only 2 patients had pauci bacillary disease. 24 patients were on MDT during the study period and rest 10 patients have completed MDT with in 2 year of the surgery. Heel ulcers were the most common type of ulcers present in 19 patients (56%) followed by fore foot ulcers seen in 10 patients (29%) and ulcers over toes were present in 5 patients (15%). (Table-2)

There were 4 (12%) patients with grade IV, 21 (62%) patients with grade III and 9 (26%) patients with grade II ulcers. None of the patients had grade I ulcers to start with. Eight patients had bony involvement suggesting osteomyelitis. Bacteriological cultures from the 23 patients grew single organism while remaining 11 patients showed multiple organisms. (Table- 3) All the patients except one had clinical improvement and showed signs of healing at 12 weeks of follow up. Also the sensations in the sole of foot

**Table 3: Bacterial colonization of the ulcers**

Organism	No. of patients	Percentage
Staph aureus	16	47%
E coli	4	12%
Pseudomonas aeruginosa	2	6%
Bacteroid	1	3%
Poly-microbial culture	11	32%

**Table 4: Grading of ulcers before and after posterior tibial nerve neurolysis.**

Grade	No of patients	No of patients	No of patients	No of patients
	Before treatment	At 2 weeks	At 6 weeks	At 12 weeks
I	0	8 (24%)	17 (50%)	8 (24%)
II	9 (26%)	12 (35%)	12 (35%)	6 (18%)
III	21 (62%)	12 (35%)	4 (12%)	1 (3%)
IV	4 (12%)	2 (6%)	1 (3%)	0

improved in all our patients after posterior tibial nerve decompression although this was not objectively measured. The improvement according to grading system at 2 weeks, 6 weeks and 12 weeks are shown in table-4. (Table-4) At the final follow up of 12 weeks, ulcer was completely healed in 19 (55%) patients, (Figure- 2) 8 (24%) patients had grade I, 6 (18%) had grade II and 1 (3%) patients had grade III ulcer. None of the patients had grade IV ulcer at the final follow up. The patients who did not improve had grade III ulcer that remained in grade III even after treatment, this patient also had osteomyelitis of calcaneum and had severe sensory loss over the sole.

### Discussion

Plantar or trophic ulcers is not a common presentation of leprosy, but it is one of the most troublesome complications of the disease. These ulcers can appear during reactional states or secondary to neuropathy<sup>7</sup> particularly on plantar surface due to involvement of posterior tibial nerve. These ulcers have a recalcitrant course and very difficult to heal. The important reason for this is the sensory loss caused due to nerve involvement leading to repetitive trauma. Nerve damage may occur before, during, and after disease treatment and can result in long term disability and disfigurement.<sup>8</sup> The exact mechanisms involved in nerve injury are not clearly understood, and there is no test to evaluate the cause of nerve damage or the best treatment for this neuropathy.<sup>9</sup>

Leprous neuropathy was due to bacillus invasion and the inflammatory process in the peripheral nerves classified as leprosy with grade 2 disability; as per classification the World Health Organization classification of physical disability in leprosy.<sup>10</sup> The presence of *M. leprae* within Schwann Cells and intra-neural macrophages has been confirmed by Kumar et al in their ultrastructural study of nerve involvement in leprosy.<sup>11</sup> Well-organised granulomas and abscess are seen within cutaneous nerves as well as in larger nerve trunks in leprosy and destruction of nerve due to these inflammatory process, trauma and mechanical

stress is responsible for nerve damage especially in tuberculoid and borderline type leprosy patients.<sup>12, 13</sup> The main reasons for the development of plantar ulcers are related to the loss of protective sensitivity and structural changes due to muscle atrophy.<sup>14</sup> Trophic skin ulceration in leprosy is a frustrating complication, the management of which has always been challenging.

Neurolysis or decompression of nerve is known treatment option for leprosy neuropathy and Husain et al. has reported that neurolysis restores sensation in 50% of cases.<sup>15</sup> Nerve decompression also helps in ulcer healing and pain relief. There are very few studies assessing the effectiveness of nerve decompression on healing of trophic ulcers caused due to leprosy, in fact we could not find any study in literature which has dedicatedly seen the effects of neurolysis on healing of these plantar ulcers. Thus we decided to conduct this study and found that neurolysis of the posterior tibial nerve with the abscess drainage and gentle curettage of the granulation tissue along with debridement of the ulcer provides good results. This procedure not only helps in ulcer healing but also improves sensations over the sole of the foot, thus preventing repetitive trauma and formation of granulation tissue.

We know that our study have certain drawbacks like it is a non randomized study also the sample size is small and the follow is short, but still it provides substantial evidence that posterior tibial nerve neurolysis is effective adjuvant procedure which helps in healing of plantar ulcers.

### Conclusion

Decreased sensation over the sole due to involvement of posterior tibial nerve in leprosy is the most important cause of plantar ulcers along with foot deformities and muscle dystrophy. Posterior tibial nerve decompression or neurolysis is an effective method to treat plantar ulcers in leprosy which also improves the plantar sensations, which in turn may help in preventing recurrence.

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