

Endoscopy-Assisted Resection of Neurilemmoma of the Tibial Nerve at the Distal Leg



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Abstract: Neurilemmoma of the tibial nerve at the distal leg is a deep-seated tumor, and diagnosis can be delayed for several years. The purpose of this Technical Note is to describe the technique of endoscopy-assisted resection of neurilemmoma of the tibial nerve at the distal leg. This minimally invasive approach can minimize soft-tissue dissection and may reduce the risk of postoperative perineural fibrosis.

Neurilemmoma is a benign, slow-growing tumor that constitutes 8% of all soft-tissue tumors and 4% of soft-tissue tumors in the foot and ankle region.^{1,2} Even though it can occur on any part of the foot, the most frequent locations were found to be the ankle, heel, and plantar aspect of the foot.² The symptoms of neurilemmoma of the foot and ankle are mainly related to the tumor location, especially at the sites of weight bearing or easily compressed regions including the plantar aspect and interdigital spaces.² It usually presents as a painful, movable (from side to side but not in the longitudinal axis), well-defined mass; weakness and paresthesia can be observed when associated nerves are affected. Neurilemmoma within the tarsal tunnel can present as tarsal tunnel syndrome just like other space-occupying lesions.^{2,3} Histologically, neurilemmoma is composed of hypercellular Antoni A zone with palisaded spindle cells with strong

immunostaining for S-100 and hypocellular Antoni B zone with vascularization in myxoid stroma.²

The diagnosis of a neurilemmoma in the tibial nerve is often delayed for several years. This may be because the deep-seated tumor in the calf may escape detection by palpation, and the Tinel sign is then difficult to elicit. Moreover, neuropathic pain expressed in the foot in the absence of a palpable mass may mislead the clinician to suspect radiculopathy or entrapment neuropathy.⁴ Actually, in patients with a long history of neuropathic pain in the lower limb in whom lumbar and pelvic lesions have been excluded, a peripheral nerve sheath tumor should be considered.

Surgical excision is the primary treatment option, with excellent outcomes. Extreme care needs to be taken to dissect the tumor from associated nerves to preserve or restore nerve function to the maximal level. Recurrence is extremely rare unless tumor tissue is incompletely excised.² Traditionally, the tumor is resected by an open approach. Recently, techniques of endoscopy-assisted resection of neurilemmoma have been reported.⁵⁻⁷ This Technical Note describes the technique of endoscopy-assisted resection of neurilemmoma of the tibial nerve at the distal leg. This technique is indicated

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Table 1. Indication and Contraindications of Endoscopy-Assisted Resection of Neurilemmoma of Tibial Nerve at Distal Leg

Indication	Symptomatic neurilemmoma of tibial nerve at level distal to gastrocnemius and proximal to tarsal tunnel
Contraindications	Neurilemmoma at level proximal to gastrocnemius Neurilemmoma within tarsal tunnel Recurrent cases Presence of marked soft-tissue fibrosis at operative site

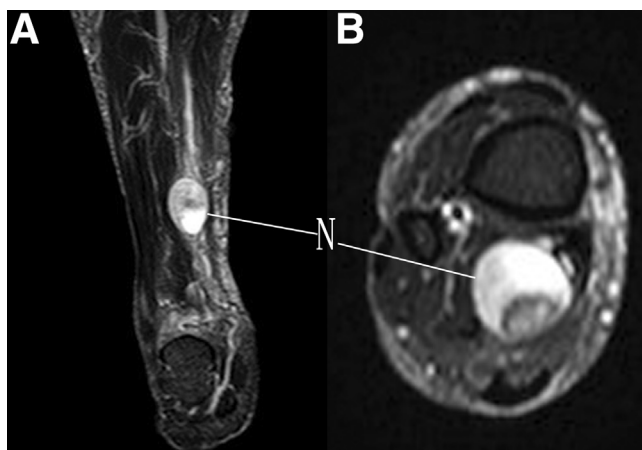


Fig 1. Endoscopy-assisted resection of neurilemmoma (N) of tibial nerve at distal part of right leg. The patient is in the supine position with the legs spread. Preoperative magnetic resonance imaging gives information about the nature of the tumor, the relation between the tumor and the tibial nerve, and the anatomic site of the tumor. (A) Coronal view. (B) Transverse view.

for symptomatic neurilemmoma of the tibial nerve at the level distal to the gastrocnemius and proximal to the tarsal tunnel. It is contraindicated if the neurilemmoma is at the level proximal to the gastrocnemius or within the tarsal tunnel, for which different endoscopic approaches should be considered.⁸⁻¹⁰ This endoscopic approach is also contraindicated in recurrent cases or in the presence of marked soft-tissue fibrosis at the operative site (Table 1).

Technique

Preoperative Planning and Patient Positioning

Magnetic resonance imaging is an important preoperative investigation because it can give information about the nature of the tumor, the relation between the tumor and the tibial nerve, and the anatomic site of the tumor (Fig 1), which is essential for preoperative planning. The tumor usually presents as a well-circumscribed, round or ovoid mass with iso-intense or reduced signal intensity compared with the surrounding skeletal muscles on T1-weighted images and significantly increased homogeneous or heterogeneous signal intensity on T2-weighted images.² The fascicular sign (fascicular bundles in neurogenic tumors), target sign (centrally decreased with peripherally increased signal intensity), and split-fat sign (a rim of fat surrounding the tumor), reflecting different proportions of stromal tissues and tumor components, may be observed.²

The patient is placed in the supine position with the legs spread. A thigh tourniquet is applied to provide a bloodless operative field. A 2.7-mm 30° arthroscope (Henke Sass Wolf, Tuttlingen, Germany) is used. Fluid inflow is driven by gravity, and no arthropump is used.

Portal Placement

This procedure is performed via the anterior, proximal posterior, and distal posterior portals. The proximal posterior portal is at the proximal posterior corner of the tumor. The distal posterior portal is at the distal posterior corner of the tumor. The anterior portal is at the anterior edge of the tumor at the mid level between the proximal posterior and distal posterior portals (Fig 2).

Exploration of Neurilemmoma of Tibial Nerve

Three-millimeter incisions are made at the proximal posterior and distal posterior portals. These portals are interchangeable as the viewing and working portals.

With the distal posterior portal as the viewing portal, the deep fascia is fenestrated with an arthroscopic shaver (Dyonics; Smith & Nephew, Andover, MA) and a No. 15 blade scalpel via the proximal posterior portal. The muscles of the posterior compartment of the leg are then exposed.

The arthroscope is advanced into the posterior compartment, and the tibial nerve is identified deep to the soleus muscle. The nerve is traced distally to the neurilemmoma (Fig 3). The arthroscope is then switched to the proximal posterior portal. The neurilemmoma is bluntly dissected from the surrounding soft tissue by the arthroscopic shaver (which is used as a blunt-ended dissector) via the distal posterior portal (Fig 4).

Dissection of Neurilemmoma

A 1.5- to 2-cm incision is made at the anterior portal site. The fluid inflow is switched off, and the procedure

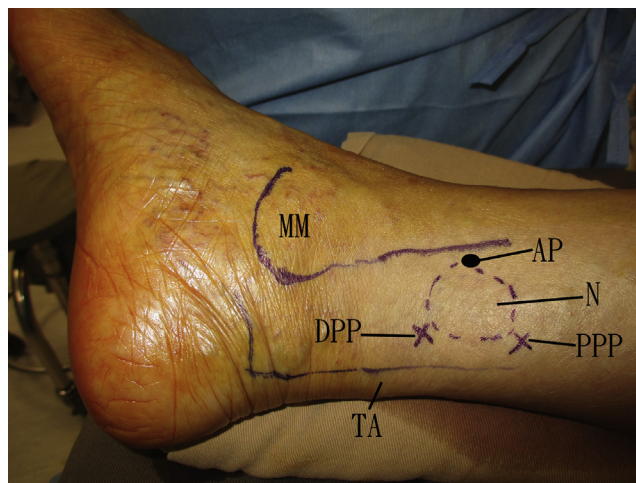


Fig 2. Endoscopy-assisted resection of neurilemmoma (N) of tibial nerve at distal part of right leg. The patient is in the supine position with the legs spread. This procedure is performed via the anterior portal (AP), proximal posterior portal (PPP), and distal posterior portal (DPP). The PPP is at the proximal posterior corner of the tumor. The DPP is at the distal posterior corner of the tumor. The AP is at the anterior edge of the tumor at the mid level between the PPP and DPP. (MM, medial malleolus; TA, Achilles tendon.)

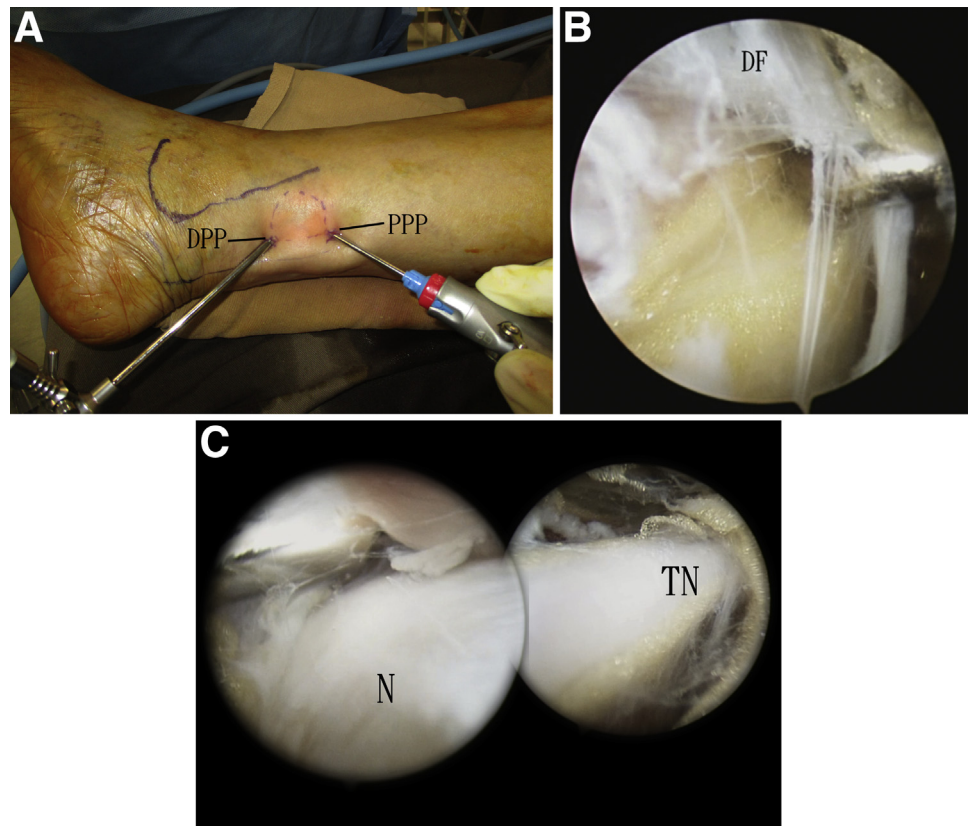


Fig 3. Endoscopy-assisted resection of neurilemmoma (N) of tibial nerve (TN) at distal part of right leg. The patient is in the supine position with the legs spread. (A) The distal posterior portal (DPP) is the viewing portal, and the proximal posterior portal (PPP) is the working portal. (B) The deep fascia (DF) is fenestrated by an arthroscopic shaver. (C) The TN can be identified deep to the soleus muscle.

is converted to dry endoscopy. With the proximal distal portal as the viewing portal, the epineurium is incised with a No. 5 blade scalpel to expose the neurilemmoma.

The surgeon should be cautious not to cut the nerve fibers during this step. The neurilemmoma is carefully dissected out with a peanut swab (Fig 5).

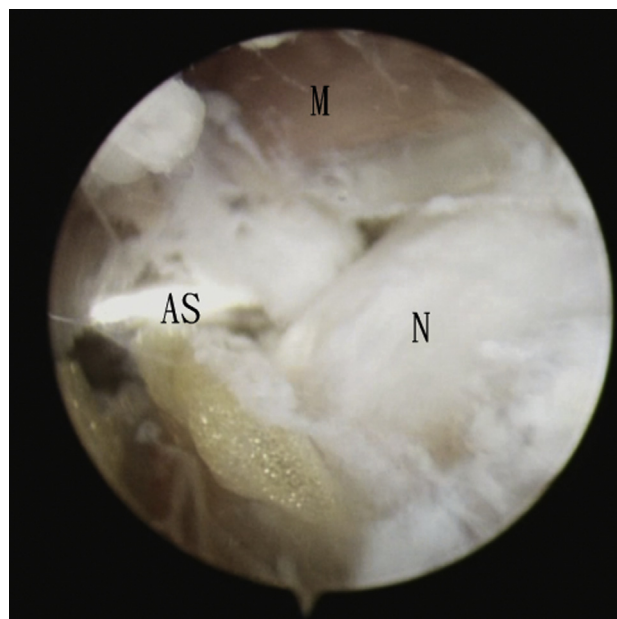


Fig 4. Endoscopy-assisted resection of neurilemmoma (N) of tibial nerve at distal part of right leg. The patient is in the supine position with the legs spread. The proximal posterior portal is the viewing portal, and the distal posterior portal is the working portal. An arthroscopic shaver (AS) is used as a blunt-ended dissector to dissect the neurilemmoma (N) from the surrounding soft tissue. (M, muscle.)

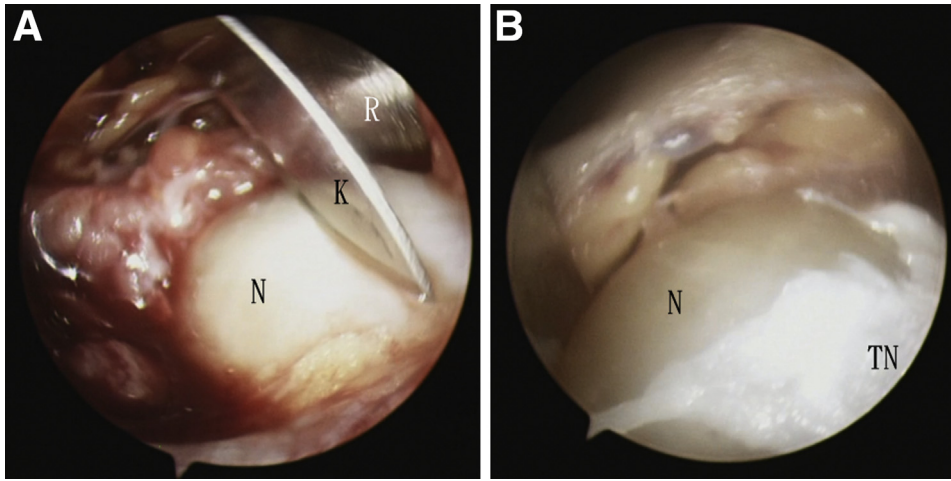


Fig 5. Endoscopy-assisted resection of neurilemmoma (N) of tibial nerve (TN) at distal part of right leg. The patient is in the supine position with the legs spread. The proximal posterior portal is the viewing portal, and the anterior portal is the working portal. (A) The epineurium of the TN is incised. (B) The neurilemmoma (N) is dissected out from the TN. (K, knife; R, small retractor.)

Fig 6. Endoscopy-assisted resection of neurilemmoma (N) of tibial nerve at distal part of right leg. The patient is in the supine position with the legs spread. (A) The neurilemmoma (N) is resected via the anterior portal (AP). (B) Specimen of neurilemmoma (N). (DPP, distal posterior portal; PPP, proximal posterior portal.)

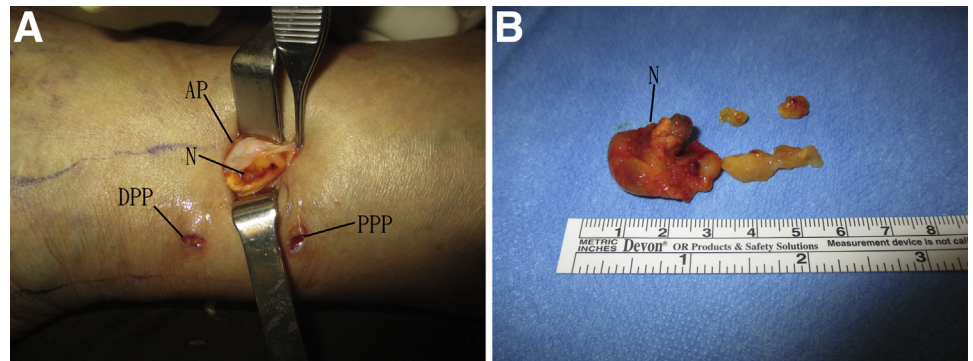


Table 2. Pearls and Pitfalls of Endoscopy-Assisted Resection of Neurilemmoma of Tibial Nerve at Distal Leg

Pearls	
Extensive release of the deep fascia can improve the manipulation freedom of the arthroscopic instruments during subsequent procedures.	
An arthroscopic shaver can be used as a round-tip dissector to free the neurilemmoma from the surrounding soft tissue.	
Pitfalls	
Preoperative assessment to exclude neurofibroma or malignant tumor is essential.	
The surgeon should prepare to convert to open surgery once the endoscopic view is not clear.	

Table 3. Advantages and Risks of Endoscopy-Assisted Resection of Neurilemmoma of Tibial Nerve at Distal Leg

Advantages	
Better cosmetic results	
Minimal soft-tissue dissection with less postoperative perineural fibrosis	
Fewer wound complications	
Accurate localization of tumor	
Dissection of tumor under magnified endoscopic view	
Risks	
Incomplete resection	
Injury to tibial nerve	
Injury to posterior tibial artery	
Injury to saphenous nerve	

Resection of Neurilemmoma

The neurilemmoma is resected through the anterior portal incision (Fig 6, Video 1, Table 2). The integrity of the tibial nerve is then checked. The wounds are closed with simple sutures.

Discussion

Neurilemmoma can usually be treated by enucleation, and intracapsular resection can minimize the risk of nerve injury.^{11,12} Resection of the tumor can be performed under microscopy; however, the risk of injury cannot be totally eliminated. In comparison with the microscopic view, endoscopic visualization could achieve better differentiation between the tumor mass and its capsule.¹²

In the described endoscopic approach, the dissection of the tibial nerve and its neurilemmoma is performed via the posterior portals. This can allow accurate assessment of the tumor and accurate localization of the anterior portal before its resection via the anterior portal. To remove the tumor, a larger incision is needed and the tamponade effect of the operative site is lost. This is the reason to convert the procedure to dry endoscopy during resection of the neurilemmoma.

The advantages of this minimally invasive technique include better cosmetic results, minimal soft-tissue dissection with less postoperative perineural fibrosis, fewer wound complications, accurate localization of the tumor, and dissection of the tumor under a magnified endoscopic view. The potential risks of this technique include incomplete resection, as well as injury to the tibial nerve, posterior tibial artery, or saphenous nerve (Table 3). This technique is technically demanding and should be reserved for the experienced foot and ankle arthroscopist.

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