Case Report

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Surgery Section

Posterior Midline Soleus Splitting Approach for Tibial Nerve Schwannoma Resection: A Case Report

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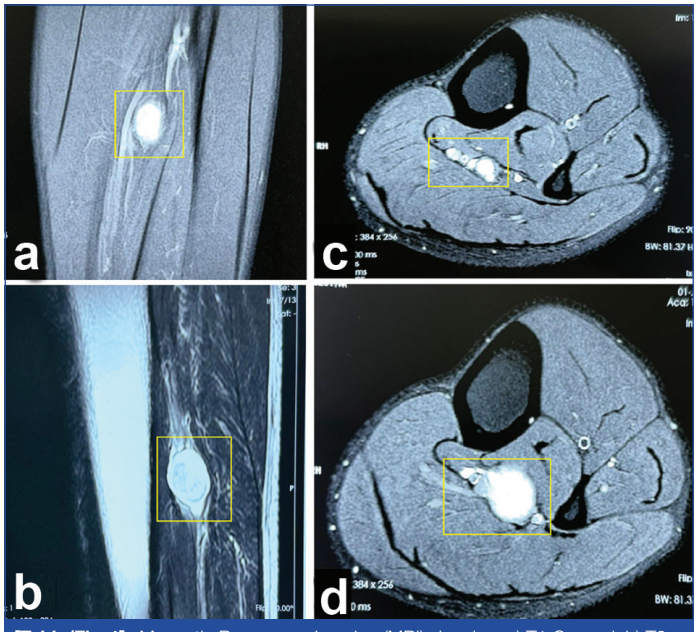
ABSTRACT

Assessment of tibial nerve lesions is challenging for surgeons when accessing tumours without damaging adjacent tissues. Careful planning of the surgical incision is paramount in any surgical procedure. Selecting the precise location to ensure optimal visualisation while considering anatomical landmarks and potential postoperative morbidity is crucial. Additionally, the size and placement of the incision are critical factors for aesthetic outcomes. Accessing tibial nerve lesions surgically is particularly difficult, especially if the lesion is located beneath the belly of the soleus muscle. The ideal method to access the tumour should avoid damage to the adjacent musculature and be ergonomic to allow dissection under magnification. In the present report of a 27-year-old male, the posterior midline soleus splitting approach to a case of tibial nerve schwannoma at the mid-tibial level is presented. In this method, the patient was placed in a prone position and approached via the posterior aspect of the calf muscle. This approach involves splitting the two heads of the soleus, dissecting the tibial nerve and reaching the tumour. This approach has the advantage of accessing the tibial nerve lesion through an avascular plane, thereby avoiding the morbidity associated with soleus dis-insertion.

Keywords: Benign, Nerve tumours, Neurilemmoma, Peripheral nerve tumours, Tumour management

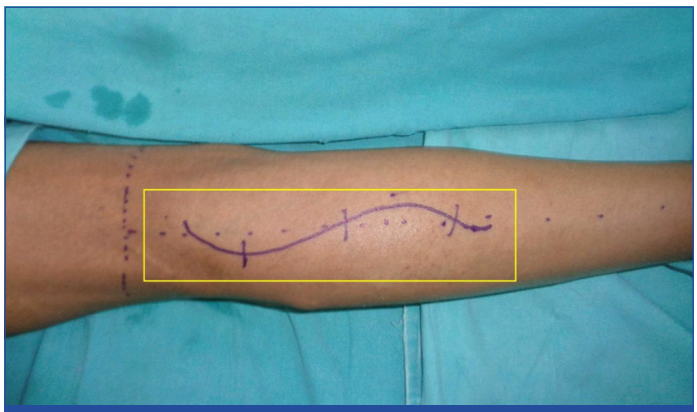
CASE REPORT

A 27-year-old male presented with dull, aching pain over the left medial mid-calf region for two years. The pain was associated with numbness at the base of the second and third toes and its severity gradually increased. Mild tenderness was noted on deep palpation, at mid-calf level medially, approximately 14 centimetres distal to the medial tibial condyle. The remainder of the lower limb and systemic examination were unremarkable and the patient had no associated family history. Magnetic Resonance Imaging (MRI) revealed a fusiform, well-circumscribed tibial nerve lesion at the mid-tibial level, which was suggestive of a benign tibial nerve lesion [Table/Fig-1]. A plan was devised to perform neurolysis of the tibial nerve and excise the lesion. Differential diagnoses such as tibial neuropathy, lumbosacral radiculopathy, sciatic nerve impingement and Morton neurinoma were ruled out with the help of clinical assessment and MRI.

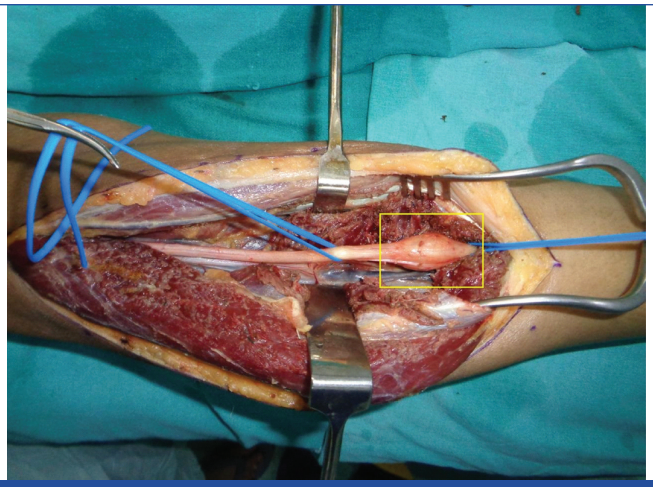


[Table/Fig-1]: Magnetic Resonance Imaging (MRI) showing: a) T1 Coronal; b) T2 Sagittal; c,d) Axial position, showing a well-defined, fusiform-shaped, intermuscular vividly enhancing solid lesion noted posterior to the mid tibia.

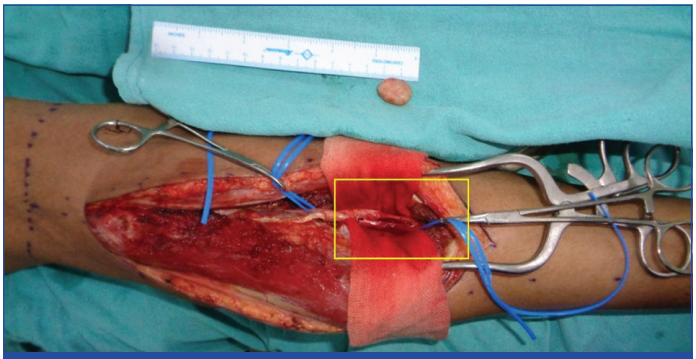
The lesion was accessed via a posterior calf midline incision while the patient was in the prone position. A lazy 'S' incision [Table/Fig-2] was made, extending from the lower end of the popliteal fossa to 16 centimetres distally. Dissection progressed in the avascular plane between the two bellies of the gastrocnemius muscle, preserving the sural nerve and the accompanying vessels, thereby exposing the tibial nerve at the popliteal fossa. The dissection continued in the same avascular plane, further exposing the tibial nerve until the lesion was identified. As the dissection was performed in the avascular plane under tourniquet control, minimal blood loss was incurred. The tibial nerve [Table/Fig-3] and the soleus muscle were dissected between their two origins for further exposure. This approach aimed to facilitate faster recovery and minimise muscle weakness in the postoperative period. In contrast, a medial approach to expose the nerve would necessitate disinsertion of the soleus, potentially leading to an extended postoperative recovery and long-term muscle weakness. The tumour was well encapsulated and was excised in toto with the assistance of nerve hooks and microsurgical dissection [Table/Fig-4]. The excised specimen measured 24×15×16 mm and exhibited a well-defined, fusiform shape [Table/Fig-5]. The wound was closed in layers and a below-knee slab was applied for one week after surgery. The postoperative course was uneventful.



[Table/Fig-2]: Image showing the posterior aspect of the affected calf with the planned and marked incision.



[Table/Fig-3]: Image showing the tibial nerve exposed with the tumour marked pre-excision.



[Table/Fig-4]: Image showing post-dissection and excision of tumour status with intact tibial nerve and tumour excised in toto.

[Table/Fig-5]: Excised specimen with measurement reference.

The patient was able to ambulate without any mobility restrictions by postoperative day 10. There were no short- or long-term complications at the one-month follow-up.

DISCUSSION

Surgical access to any lesion should follow natural avascular planes, provide clear visualisation and ergonomics, avoid morbidity and be easily replicable. Lesions of the nerves require neurolysis, which involves micro-dissection of the nerve fascicles under magnification using either surgical loupes or microscopes. The surgical access to such lesions should provide a clear field of view and sufficient space to manipulate micro-vascular instruments for dissection [1]. Tibial nerve lesions, which lie in the deep compartment of the leg, are particularly challenging to access. They are not amenable to palpation; however, depending on the size of the tumour and the tone of the muscle, some cases have reported patients presenting with palpable swelling and non specific symptoms [2,3]. Kumar R et al., have utilised this method for managing tibial nerve schwannoma through a vertical medial leg incision via a conventional approach and have highlighted the challenges faced, such as limited exposure and the risk of muscle disinsertion [2]. These factors can, in turn, prolong the recovery period, in contrast to the posterior approach employed in the present case, which can help achieve direct visibility and lessen the need for extensive retraction and manipulation of adjacent tissues.

The medial approach to the leg typically involves dis-insertion of the soleus and flexor digitorum longus muscles, which originate from the posterior aspect of the tibia along the soleal line, resulting in a restricted field of vision, a need for retraction and difficulties in patient positioning as well as in positioning the surgeon and the surgical microscope [4,5]. The lateral approach's dis-insertion of the soleus muscle can lead to extended immobilisation and a longer recovery period postoperatively. In the present case, the authors placed the patient in a prone position and approached the lesion via the posterior aspect of the calf. This method involves splitting the two heads of the soleus muscle, allowing for dissection of the tibial nerve and access to the tumour. In this report, we propose using a posterior midline soleus muscle-splitting approach for such lesions.

The choice of surgical approach is a critical decision influenced by the nature of the pathology and the surgeon's judgement. For mid-tibial nerve lesions, a vertical medial leg incision, positioned posterior to the tibia and anterior to the gastrocnemius-soleus bulk, is typically described [3,5]. A case report by Chalik N et al., involving a tibial nerve schwannoma modified the incision to optimise access while maintaining nerve integrity. This report suggested that adjustments to the size and orientation of the incision could improve overall surgical outcomes [6]. This assertion is supported by an educational resource from Washington University, which outlines that a posterior midline incision can facilitate the preservation of neurovascular structures as well as posterior tibial nerve decompression and tumour excision with minimal damage [4].

During the procedure, the patient lies supine with the leg externally rotated. The gastrocnemius is retracted and the soleus muscle is split away from its attachment to the tibia to access the lesion. Theoretically, splitting the muscle away from its origin could lead to postoperative morbidity [6]. Additionally, there is a need for constant retraction to adequately expose the tibial nerve for neurolysis under magnification [7].

The dissection is performed in an avascular plane between the medial and lateral gastrocnemius bellies. The tibial nerve can be traced in an avascular plane from the popliteal fossa and the soleus muscle is split above this plane until the lesion is accessible [4]. The advantages of this approach are multifaceted, including the avoidance of stripping any muscle from its origin (resulting in less morbidity), adequate exposure without the need for active retraction, comfortable patient positioning and improved ergonomic positioning for the surgeon along with the operative microscope [7-9]. The posterior midline approach for mid-tibial nerve lesions is less damaging, leading to faster postoperative recovery and reduced muscle weakness. In contrast, a medial approach necessitates more dissection and active retraction, is ergonomically suboptimal and can result in a longer recovery period and potentially higher morbidity due to soleus muscle disinsertion [2,4,6].

CONCLUSION(S)

Tailoring the surgical approach to tibial nerve lesions should consider the location of the tumour, the avoidance of excessive dissection and retraction, the optimal positioning of the patient and surgeon and the minimisation of postoperative morbidity. The posterior approach

to mid-tibial nerve lesions is beneficial in terms of exposure, minimal muscle dissection and postoperative recovery.

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