Neurology Asia 2026; 31(3) : 1181 – 1185

A rare cause of femoral neuropathy: Giant cell tumor mimicking a femoral nerve sheath tumor

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Abstract

Femoral neuropathy is an uncommon peripheral neuropathy typically caused by compression, trauma, or iatrogenic injury, while tumor-related involvement is rare. Giant cell tumors are mesenchymal lesions that rarely involve peripheral nerves and may mimic nerve sheath tumors on imaging, creating diagnostic challenges. We report a 33-year-old woman presenting with a two-month history of progressive right thigh pain, weakness, and muscle atrophy, initially misdiagnosed as a musculoskeletal condition without improvement on conservative therapy. Neurological examination revealed mild weakness (MRC 4/5) and reduced patellar reflex, while electrodiagnostic studies confirmed femoral neuropathy. Pelvic magnetic resonance imaging (MRI) demonstrated a well-defined ovoid lesion (0.7 × 1.3 × 3.1 cm) along the right femoral nerve, initially suspected to be a nerve sheath tumor. The patient underwent surgical tumor debulking, and histopathological as well as immunohistochemical analysis (positive for smooth muscle actin, vimentin, and CD68) confirmed giant cell tumor. Postoperatively, the patient showed improvement in neuropathic pain with gradual motor recovery. This case highlights a rare cause of femoral neuropathy and underscores the importance of a comprehensive diagnostic approach integrating clinical evaluation, electrodiagnostic studies, imaging, and histopathology to ensure accurate diagnosis and appropriate management.

Keywords: Electromyography, femoral neuropathy, histopathology, magnetic resonance imaging, peripheral nerve sheath tumor, giant cell tumor

INTRODUCTION

The femoral nerve is the largest branch of the lumbar plexus, arising from the ventral rami of the L2–L4 nerve roots. It divides into anterior and posterior branches that provide motor innervation to the sartorius, pectineus, and quadriceps muscles, as well as sensory innervation to the anteromedial thigh and medial leg via the saphenous nerve.[1] Femoral nerve injury, or femoral neuropathy, typically presents with weakness of hip flexion and knee extension, pain, sensory disturbances over the anterior thigh and medial leg, and diminished or absent patellar reflex. The most common etiologies include compressive lesions (approximately 40%) and perioperative stretch injuries (approximately 35%).[2] Mass lesions arising from adjacent pelvic or soft tissue structures may compress or encase the femoral nerve along its anatomical course through the iliopsoas compartment and beneath the inguinal ligament, resulting in progressive neurological deficits.

Various lesions in the pelvic or hip region, including hip joint cysts and other soft tissue masses, may be detected incidentally on imaging and are often asymptomatic. However, when sufficiently large, these lesions may exert a local mass effect, leading to compression of nearby neurovascular structures. Because the initial presentation may resemble common musculoskeletal disorders of the hip or thigh, diagnosis can be delayed until progressive nerve involvement becomes clinically apparent.[3]

Giant cell tumors are mesenchymal lesions characterized by proliferating stromal cells with associated histiocytic and multinucleated giant cells.[4] These tumors most commonly arise

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Date of Submission: 23 April 2026; Date of Acceptance: 26 April 2026

https://doi.org/10.54029/2026aee

from synovial structures such as tendon sheaths, bursae, and joints, particularly in the extremities. Giant cell tumors are generally benign but may exhibit locally aggressive behavior depending on their size and anatomical location.[5] Direct involvement of peripheral nerves is exceedingly rare and may mimic peripheral nerve sheath tumors on imaging studies[6], posing a diagnostic challenge prior to histopathological evaluation. We report a rare case of a giant cell tumor presenting as progressive femoral neuropathy, which was initially suspected to represent a femoral nerve sheath tumor.

CASE REPORT

A 33-year-old female presented with a two-month history of progressive right thigh pain beginning in August 2025. The pain was initially localized to the lateral aspect of the thigh without radiation and was accompanied by progressive weakness and visible atrophy of the right thigh. Initial neurological evaluation in September 2025 demonstrated tenderness over the right iliotibial band and gluteal region, and the patient was diagnosed with iliotibial band syndrome, for which conservative treatment with nonsteroidal anti-inflammatory drugs and muscle relaxants was initiated. However, the symptoms persisted.

Subsequent orthopaedic assessment revealed tenderness over the tensor fascia lata region. The patient was referred for physical rehabilitation, but the pain persisted and progressive weakness of the right lower limb became evident, occasionally worsening following therapy.

In October 2025, the patient reported increasing pain radiating from the right thigh to the knee, with a visual analogue scale (VAS) score of 7/10. This was accompanied by noticeable thigh atrophy and increasing difficulty with knee extension, prompting hospital admission for further evaluation. Neurological examination demonstrated weakness in hip flexion and knee extension (Medical Research Council [MRC] grade 4/5), hypoesthesia in the anterior femoral cutaneous nerve distribution, allodynia, and reduced right patellar reflex, raising suspicion of femoral nerve involvement. Whole-spine magnetic resonance imaging (MRI) showed no evidence of spinal cord pathology or compressive radiculopathy. Given the clinical suspicion of peripheral neuropathy, electromyography (EMG) and nerve conduction study (NCS) was obtained (Table 1-2), and demonstrated fibrillation potentials and positive sharp waves of the femoral-innervated muscles with prolonged motor unit potential (MUP) duration and reduced recruitment, consistent with femoral neuropathy.

Table 1: Motor summary of the NCV study

Stim Site	NR	Onset (ms)
Left femoral motor (Vastus Med)		
Above inguinal ligament		3.9
Below inguinal ligament		13.8
Right femoral motor (Vastus Med)		
Above inguinal ligament		NR
Left peroneal motor (Ext Digitorum Brevis)		
Maleolus medial		3.0
Fibularis brevis		10.1
Right peroneal motor (Ext Digitorum Brevis)		
Maleolus medial		2.3
Fibularis brevis		9.8
Left tibial motor (Abd Hallucis Brevis)		
Ankle		4.3
Knee		12.7
Left tibial motor (Abd Hallucis Brevis)		
Ankle		5.7
Knee		14.1

Ext: extensor; Abd: abductor; Med: medial; NCV: nerve conduction velocity; NR: no response

Table 2: EMG study of the right lower extremity

Side	Muscle	Nerve	Root	Ins Act	Fibs	PSW	Amp	Dur	Poly	Recrt	Int Pat
Right	Ant Tibialis	Dp Br Fibular	L4-5	Nml	None	None	Nml	Nml	0	Nml	Nml
Right	Fibularis Long	Sup Br Fibular	L5-S1	Nml	None	None	Nml	Nml	0	Nml	Nml
Right	Vastus Lat	Femoral	L2-4	Nml	2+	3+	Nml	>12 ms	0	Reduced	25%
Right	Vastus Med	Femoral	L2-4	Nml	2+	3+	Nml	>12 ms	0	Reduced	25%

Amp: amplitude; Ant: anterior; Dp Br: deep branch; Dur: duration; EMG: electromyography; Fibs: fibrillation potentials; Int Act: insertional activity; Int Pat: insertional pattern; Lat: lateral; Med: medial; Nml: normal; Poly: polyphasic potentials; PSW: positive sharp waves; Recrt: recruitment pattern; Sup Br: superficial branch

Subsequent pelvic MRI (Figure 1-2) revealed a well-defined ovoid lesion measuring approximately 0.7 × 1.3 × 3.1 cm along the course of the right femoral nerve, appearing continuous with the lumbosacral plexus at the L4 level. The lesion demonstrated heterogeneous internal characteristics with associated diffusion restriction and post-contrast enhancement, raising suspicion for a nerve sheath tumor, most likely schwannoma or neurofibroma. Based on these findings, the patient was referred to the neurosurgery department for further management.

The patient underwent laparotomy with tumor debulking in November 2025. Immunohistochemical staining demonstrated positivity for smooth muscle actin (SMA), vimentin, and CD68, while S100, myogenin, desmin, and p63 were negative. The Ki-67 proliferation index was approximately 8-10%. These findings supported the diagnosis of a giant cell tumor involving the femoral nerve. At follow-up, the patient reported improvement in neuropathic pain, with gradual motor recovery, although residual sensory deficit in the femoral nerve distribution persisted. The patient continued neuropathic pain therapy and rehabilitation, with progressive symptomatic improvement.

DISCUSSION

Femoral neuropathy caused by pelvic masses represents an uncommon but clinically diagnostic challenges. When a lesion is identified along the anatomical course of the femoral nerve, the initial radiologic impression frequently favors a peripheral nerve sheath tumor (PNST) such as schwannoma or neurofibroma. However, several non-neural soft tissue tumors may occur adjacent to major nerves and mimic PNSTs on imaging, creating significant diagnostic uncertainty prior to histopathological confirmation.[6]

MRI plays a central role in the evaluation of peripheral nerve tumors. Several imaging characteristics have been described that suggest a true nerve sheath origin. These include the entering and exiting nerve sign, which demonstrate continuity between the lesion and the parent nerve, as well as the fascicular sign, reflecting multiple small ring-like structures corresponding to nerve fascicles within the tumor. Another characteristic feature is the split-fat sign, in which a rim of surrounding fat outlines the lesion, typically observed in benign PNSTs

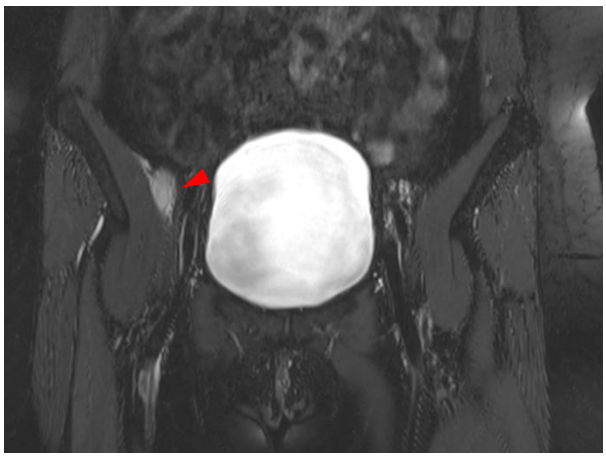

Figure 1. Coronal T2-weighted SPACE STIR MR images of the pelvis optimized for neurography (red arrow head)

located along intermuscular nerve pathways. The target sign, consisting of central low signal intensity and peripheral high signal intensity on T2-weighted MRI, is also frequently described in benign neurofibromas.[7,8]

Despite these characteristic findings, differentiation between PNST and non-neural musculoskeletal tumors remains challenging, particularly when lesions arise in close proximity to major nerves. Soft tissue tumors originating from adjacent structures, including synovial tumors, sarcomas, or proliferative lesions such as giant cell tumors may compress, displace, or partially encase a peripheral nerve. In these situations, imaging may falsely suggest that the tumor originates from the nerve itself. Recent radiologic studies emphasize that tumor-nerve spatial relationships on MRI alone are insufficient to determine tumor origin, and histopathological confirmation is often required.[9]

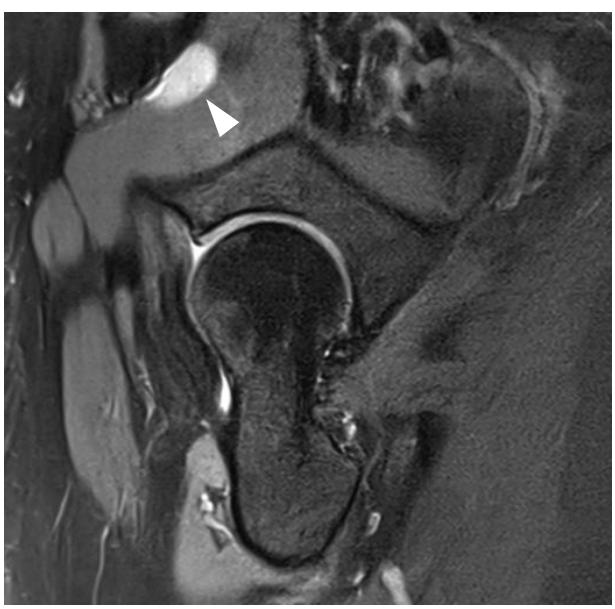

Figure 2. Coronal-oblique T1-weighted fat-suppressed post-contrast MRI of the right pelvis aligned along the femoral neck axis (white arrow head)

The present case highlights these diagnostic limitations. The lesion may initially interpreted as a femoral nerve sheath tumor due to its location along the femoral nerve trajectory and apparent continuity with the lumbosacral plexus on pelvic MRI. However, histopathological examination ultimately demonstrated immunohistochemical features consistent with a giant cell tumor, indicating the lesion likely originated from adjacent soft tissues with secondary involvement of the femoral nerve. Notably, this presentation is atypical, as giant cell tumors do not commonly arise in this anatomical region and are not typically found along peripheral nerve pathways, further contributing to the diagnostic challenge. Similar diagnostic pitfalls have been reported in radiologic series evaluating peripheral nerve tumors, where soft tissue masses located near neurovascular bundles can closely resemble PNSTs, particularly in deep anatomical compartments such as the pelvis.[10]

Another factor contributing to diagnostic delay is the overlap between early neuropathic symptoms and common musculoskeletal disorders. Patients may initially present with localized thigh or hip pain and are frequently treated for conditions such as tendinopathy, bursitis, or iliotibial band syndrome.[11] Although often asymptomatic at onset, the condition typically becomes progressively symptomatic over time, with the later emergence of motor deficits and reflex abnormalities, prompting electrodiagnostic testing and advanced imaging that ultimately reveal the underlying nerve involvement. This underscores the importance of considering compressive neuropathy due to deep pelvic masses when symptoms persist or progress despite conservative musculoskeletal management.[2,3]

Ultimately, this case illustrates the limitations of imaging alone in determining tumor origin when lesions arise adjacent to peripheral nerves. A multimodal diagnostic approach, incorporating neurological examination, electrodiagnostic studies, high-resolution MRI, and definitive histopathological evaluation, remains essential for accurate diagnosis and appropriate management of suspected femoral nerve tumors.

DISCLOSURE

Ethics: Ethical approval was not required for this case report in accordance with institutional policy. Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Data availability: All relevant data are included within the article. Additional data are available from the corresponding author upon reasonable request.

Financial support: None.

Conflict of interest: None.

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