Foot Drop Secondary to Intraneural Ganglion Cyst of the Common Peroneal Nerve

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Abstract

Intraneural ganglion cysts, though rare, can cause significant neurological symptoms, with the common peroneal nerve (CPN) at the fibular neck being the most commonly affected site. We present the case of a 43-year-old female with acute foot drop and pain over the lateral knee, associated with a progressively enlarging swelling. MRI revealed an intraneural ganglion cyst of the CPN, extending proximally from the superior tibiofibular joint. Surgical intervention included cyst decompression, excision, articular branch ligation, and curettage of the proximal tibiofibular joint. Postoperatively, the patient showed significant motor and sensory recovery by 2 months, with full functional improvement at 12 months. This case underscores the importance of early diagnosis using imaging modalities and targeted surgical treatment. Addressing the articular connection and decompressing the cyst are critical to achieving optimal outcomes and minimizing recurrence.

Keywords
- common peroneal nerve
- foot drop
- intraneural ganglion cyst
- tibiofibular joint

Introduction

Ganglion cysts are benign mucin-filled lesions that commonly develop near joints. Due to their location and size, they can exert pressure on adjacent nerves, potentially causing neurological symptoms. Ganglion cysts can be intraneural or extraneural. Intraneural ganglion cysts are rare and are located within the substance of the nerve and cause direct nerve compression. Extraneural ganglions are more common, which compress nerves from outside.[1] The common peroneal nerve (CPN) at the fibular neck is the most commonly affected, but other nerves can also be involved, including the tibial, suprascapular, posterior interosseous, median, ulnar, and radial nerves.[2,3]

The exact cause of this condition is still unclear. Spinner et al introduced the unifying articular theory, emphasizing the significant role of the articular branch in the development of an endoneural ganglion cyst. According to this theory, the cyst originates from a nearby joint. Through a capsular defect (traumatic or degenerative), synovial fluid enters the articular branch via a one-way valve mechanism and travels proximally, dissecting the epineurium until it reaches the main nerve trunk.[1] MRI can elucidate the pathogenesis of these cysts. The key aspect of understanding the spread of peroneal intraneural cysts is the articular branch, which acts as a conduit for cyst fluid. This fluid tracks from the superior tibiofibular joint and, depending on intra-articular pressures, usually ascends the CPN and occasionally

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into the sciatic nerve, rather than tracking down into the terminal branches of the peroneal nerve.[4] In sudden-onset atraumatic foot drop, a meticulous diagnostic and therapeutic approach is essential, and effective management requires a multidisciplinary team to ensure appropriate treatment.[5]

The aim of this article is to detail the clinical and radiological characteristics of peroneal intraneural ganglion cysts and highlight the most effective treatment options for managing this condition.

Case Report

A 43-year-old female patient with no other comorbidities presented with pain in the left knee and the lateral side of the left calf, and weakness in the left foot. Pain occurred intermittently during the past 1 week. It was persistent and progressively worsening. Weakness of dorsiflexion of the right foot developed 3 days prior to her seeking consultation. She also has complaints of swelling in the left leg proximal aspect, on the anterolateral aspect. The swelling has been progressively increasing in size. There was no history of trauma, fever, weight loss, or loss of appetite.

On clinical examination, it was observed that no thickening of the CPN was found, but there was a boggy swelling of around $5 \times 3 \times 2$ cm in the anterolateral aspect of the knee. A neurological examination revealed profound motor weakness in the left foot. The extensor hallucis longus (EHL), extensor digitorum longus (EDL), and tibialis anterior (TA) muscles were graded as 1/5 on the Medical Research Council (MRC) scale, indicating minimal muscle contraction without any visible movement of the big toe, lesser toes, or foot dorsiflexion, respectively. In addition, reduced sensation was observed in the left first interdigital space, corresponding to the region innervated by the deep peroneal nerve. Also, a high-stepping gait was noted because of left-sided foot drop. MRI of the Lumbo-sacral spine revealed spondylotic changes with no significant nerve root or thecal sac compression. Preoperative electrodiagnostic studies (►**Table 1**) confirmed a severe left CPN neuropathy with conduction block at the fibular neck, consistent with cyst compression. Postoperative studies demonstrated significant recovery of motor conduction and reinnervation at 2 months. MRI of the leg was performed, which showed a large, oblong-shaped, well-defined T1 iso and T2/STIR hyperintense fluid collection in the peroneus longus proximally extending to the myotendinous junction up to its origin in the fibular head and partly involving the origin of the extensor digitorum muscle. Proximally, there is a tail-like extension of the lesion into the proximal tibiofibular joint, suggestive of an intraneural ganglion cyst of the CPN (►**Fig. 1**).

Surgical exploration was done under a tourniquet under loupe magnification. Multiloculated cystic swelling was noted extending into the muscular plane (►**Fig. 2**). Thick mucoid fluid was noted in the cyst. The cyst was excised, and the intramuscular extension into the peroneus longus was also excised. The CPN was located and traced to its bifurcation. Both the common and deep peroneal nerves were found to be edematous. The articular branch was also identified and traced from its origin near the deep peroneal nerve up to the proximal tibiofibular joint. The articular branch was ligated and transected. The CPN extension of the cyst was decompressed, and neurolysis of the CPN was done (►**Fig. 3**). The superior tibiofibular joint was incised and curetted.

Postoperatively, the patient was managed with a foot drop splint and initiated on physiotherapy. At the 2-month follow-up following surgical decompression, significant clinical improvement was noted, with muscle strength graded as 5/5 for the tibialis anterior, 4/5 for the EHL, and 4/5 for the EDL on the MRC scale. Additionally, there was a complete restoration of sensation in the first web space of the foot. At the 12-month follow-up, the patient demonstrated excellent functional recovery.

Discussion

Foot drop is a pathological condition that requires a multidisciplinary approach for comprehensive evaluation and management. Accurate identification of the underlying cause is crucial when considering surgical intervention.[6] Intraneural ganglion cysts are infrequently reported in the literature, with the CPN being the most frequently affected site, followed by the ulnar and tibial nerves.[7] Several hypotheses, including recurrent trauma,[8] intraneural hemorrhage,[9] mucoid degeneration,[10] and de novo formation from hamartomatous cell rests,[11] have been proposed to explain this pathology. However, the articular theory described by Spinner et al remains the most widely accepted. In the present case, intraoperative findings confirmed and allowed for the tracing, ligation, and resection of the articular branch. Spinner et al also introduced dynamic aspects of cyst formation, suggesting that intra-articular pressure changes can lead to variations in the cyst's trajectory, including ascent, crossover, or descent to distal nerve branches.[12] While intraneural ganglia often manifest with progressive weakness, acute foot drop—as seen in our case—may result from sudden intracystic pressure changes or dynamic cyst extension. This

Table 1 Pre- and postoperative electrodiagnostic findings

Parameter		Preop findings	Postop (12-month) findings
Nerve conduction study	Common peroneal nerve	Conduction block at fibular neck	Improved latency; improved amplitude
	Motor conduction velocity	Reduced	Normalized
Electromyography	Tibialis anterior	Fibrillations, reduced recruitment	No fibrillations, full recruitment
	Extensor digitorum longus	Positive sharp waves	Normal insertional activity

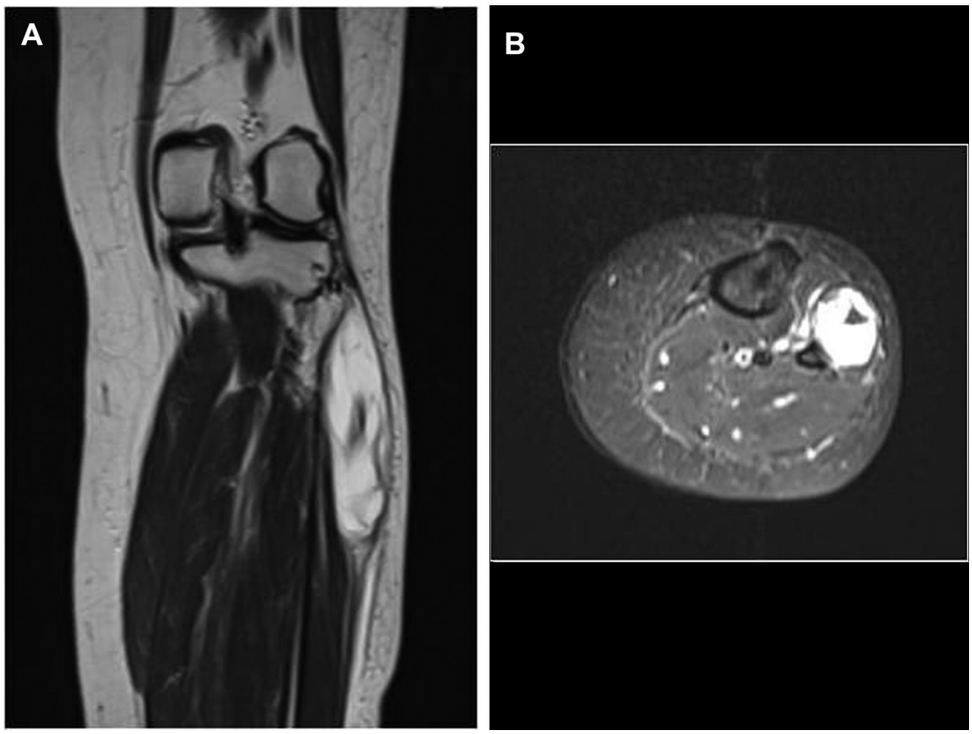

Fig. 1 (A) Coronal section. (B) Axial section. Large, oblong-shaped, well-defined T1 iso and T2/STIR hyperintense fluid collection in the peroneus longus proximally extending to the myotendinous junction up to its origin in the fibular head and partly involving the origin of the extensor digitorum muscle. Proximally, there is a tail-like extension of the lesion into the proximal tibiofibular joint.

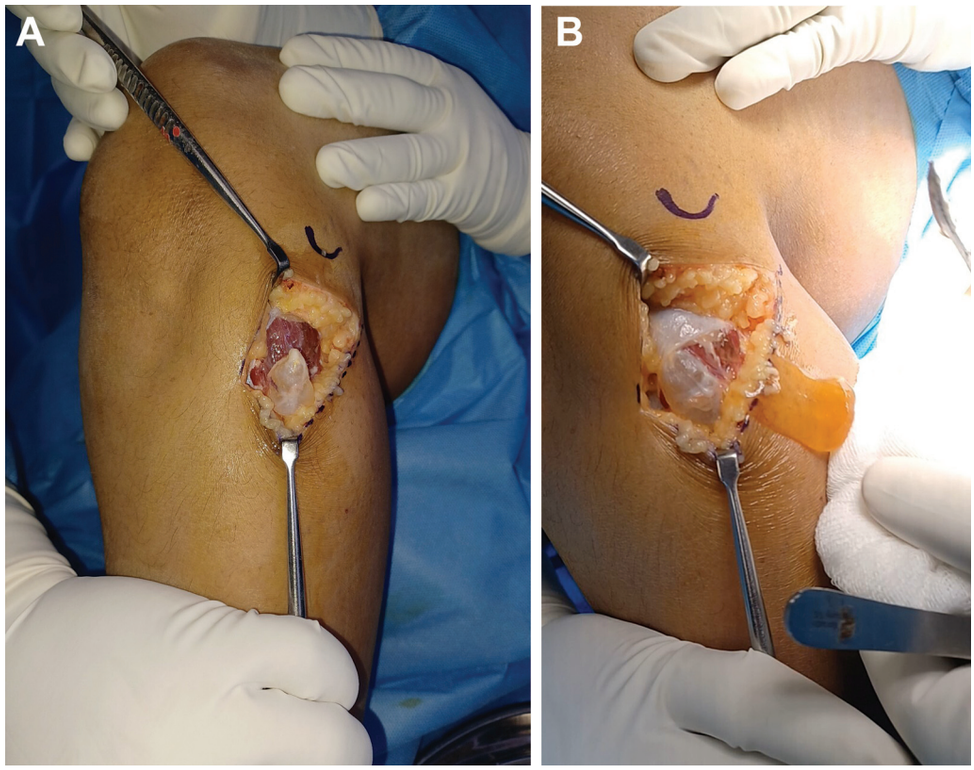

Fig. 2 (A) Multiloculated cystic swelling was noted extending into muscular plane. (B) Thick mucoid fluid was noted in the cyst.

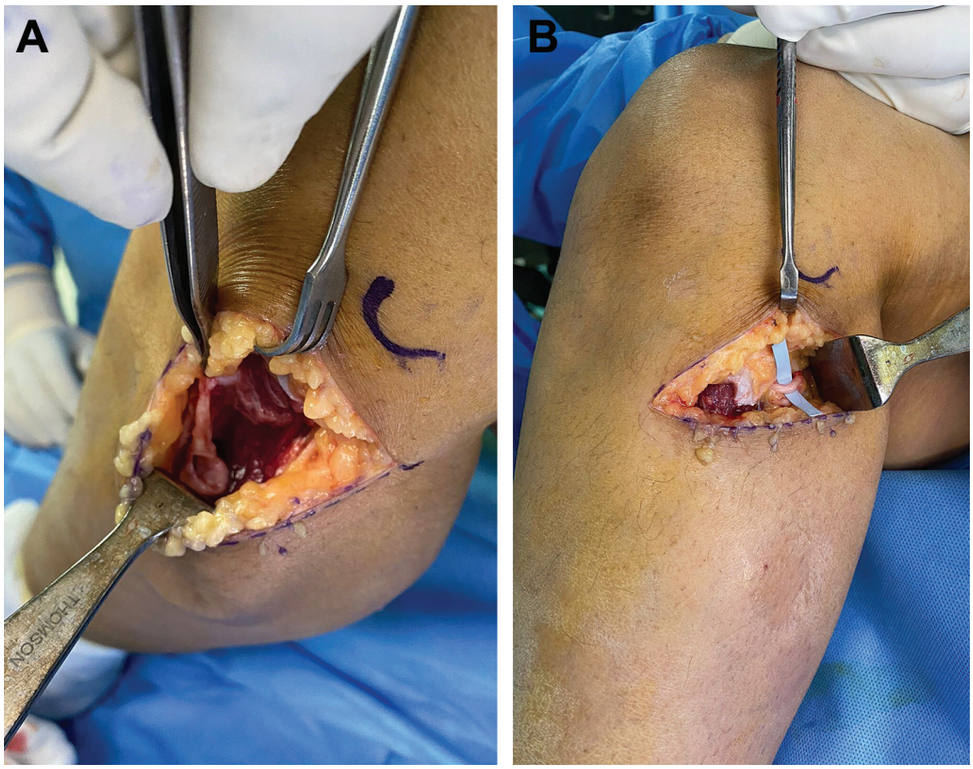

Fig. 3 (A) Intraneural ganglion cyst wall. (B) Common peroneal nerve after neurolysis.

aligns with Spinner et al's observations of "ascending" cysts causing abrupt conduction block.[12]

Patients with an intraneural ganglion cyst of the CPN typically present with pain localized to the fibular head, with or without an associated swelling. A positive Tinel's sign is commonly observed, along with sensory disturbances over the lateral aspect of the tibia and the dorsum of the foot. Muscle weakness in the anterior and lateral compartments of the leg may develop gradually or present acutely.[8,13,14] In the present case, the patient initially reported pain over the lateral aspect of the knee, followed by progressive muscle weakness 4 days later, accompanied by swelling. Consistent with existing literature, clinical examination revealed a positive Tinel's sign and diminished sensation in the first web space.

Desy et al conducted an extensive systematic review of literature and MR images on intraneural cysts. Their findings reinforced the unifying articular (synovial) theory and retrospectively identified joint connections in 27 out of 79 case reports that had not been previously recognized by the original authors.[7] Similarly, we could also establish the articular connection of the ganglion cyst in MRI. The possible differential diagnoses for these cysts include nerve sheath tumors, atypical Baker's cysts, and extraneural ganglions. Additionally, an atypical vascular or lymphatic malformation might also be considered.[15]

Surgical intervention is unequivocally the preferred treatment for a peroneal intraneural ganglion. No authors advocate for conservative management, as early surgical treatment typically yields successful outcomes.[16] Spinner et al introduced the 4D technique, which involves nerve dissection, tibiofibular joint disarticulation, cyst decompression, and articular branch disconnection.[17] In this case, we also performed nerve dissection, cyst decompression, articular branch disconnection, and disarticulation and fusion of the proximal tibiofibular joint. The resolution of conduction block and fibrillations (►**Table 1**) paralleled the patient's functional recovery, supporting timely surgical decompression for reversible axonotmesis.

Consales et al highlighted that reducing intraneural pressure plays a crucial role in managing postoperative pain, whereas motor function recovery is less predictable and influenced by various factors. Despite our patient presenting with significant functional impairment and near-total paralysis, notable motor recovery to near normal was observed at the 2-month postoperative follow-up, even with the persistent cyst size and the sudden onset of drop foot.[18]

Conclusion

Intraneural ganglion cysts, though rare, are well-documented in the literature and should be considered in the differential diagnosis of peripheral neuropathies. Advanced diagnostic modalities such as ultrasound, MRI, electromyography, and nerve conduction studies play a pivotal role in confirming the diagnosis and delineating the extent of nerve involvement. Early diagnosis and timely intervention are critical, as neurological deficits are often reversible with prompt treatment. Surgical management, including open decompression and meticulous handling of the articular

branch, combined with disarticulation or fusion of the proximal tibiofibular joint, is essential for achieving favorable clinical outcomes and minimizing the risk of recurrence.

Ethical Approval

Institutional research ethical committee approval was obtained for the study.

Informed Consent

Written informed consent was obtained from all subjects before the study. There is no information (names, initials, hospital identification numbers, or photographs) in the submitted manuscript that can be used to identify patients.

Conflict of Interest

None declared.

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