Tips & Tricks: Atraumatic Foot Drop, A Case Report of an Intraneural Peroneal Ganglion Cyst

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Introduction

Intraneural ganglion cysts are mucinous, fluid-filled formations that collect within the epineurium of peripheral nerves.[1] These cysts have been reported in peripheral nerves of the upper and lower extremity, but most frequently occur within the common peroneal nerve. [2,3] Accumulation of cystic fluid within the nerve can cause direct pressure leading to a compressive neuropathy presenting with motor or sensory deficits, most notably a foot drop, or with pain about a palpable mass.[4-6]

Intraneural ganglion cysts in the lower extremity are rare, particularly in the pediatric population.[5] With prompt diagnosis and surgical decompression of the nerve and cystic fluid, prognosis is good with near full recovery of motor strength reported in all cases. However, intraneural ganglion cysts can also be difficult to diagnose as they can be overlooked or misdiagnosed on imaging. Here, we report a case of a rapidly progressive atraumatic foot drop in a 13 year old boy who was initially diagnosed with a nerve sheath tumor based on MRI imaging, but intraoperatively was found to have an intraneural ganglion cyst of the common peroneal nerve.

Case Report

History

The patient presented to clinic at the age of 13 with approximately four months of left leg and ankle pain. He played football as a lineman and reported pain worse with activities such as running The pain had been preceded by paraesthesias in the left foot, however he did not seek medical evaluation at that time. One month prior his clinic visit, he was participating in a football game when he suddenly developed an atraumatic foot drop in his left foot. He was pulled from the game and evaluated by the team's athletic trainer. He was then referred to physical therapy and completed two sessions, however there was a concern for peroneal nerve dysfunction and was referred for orthopeadic evaluation.

Examination

On exam, he had a palpable, cord-like, and non-compressible mass proximal to the fibular head extending to the popliteal fossa with associated tenderness. There was no erythema or concomitant swelling. There was full range of motion at the knee without pain. On motor examination, he had profound weakness in foot dorsiflexion and eversion with 1out of 5 strength in the tibialis anterior (TA), extensor hallucis longus (EHL), extensor digitorum longus (EDL), and peroneal muscles. He exhibited full muscle strength in gastrocnemius-soleus complex, flexor hallucis longus, flexor digitorum longus, and posterior tibialis muscles. He had decreased sensation in the peroneal distribution to the first webspace and dorsal foot. Tibial and saphenous nerve distributions intact. There was no clonus or hyperreflexia.

Imaging

Given the palpable mass, neurologic deficit, and normal xrays, he underwent MRI examination of the left lower extremity including a modified combination of tumor and neurography protocols. The MRI revealed a T2-weighted hyperintense lesion along the course of the left common peroneal nerve extending into the lower sciatic nerve measuring up to 11.6 cm in length, extending from the level of the distal femoral diaphysis to the proximal fibular metaphysis (Figure 1A). The lesion appeared to course around the head of the fibula and to involve the lateral sural cutaneous nerve (Figure 1B, D). The lesion was fusiform in character and demonstrated mild peripheral enhancement concerning for a soft tissue mass involving the common peroneal nerve and was diagnosed as a nerve sheath tumor.

Management

Given concern for a lesion compressing the common peroneal nerve, the decision was made to proceed with open biopsy followed by possible surgical excision. With the patient in the prone position, a posteriolateral approach to the left knee was performed. The common peroneal nerve was identified just over the lateral condyle of the femur and appeared significantly enlarged. An epineurotomy was performed, draining a gelatinous-type material similar to a ganglion cyst. A small portion of the surrounding epineurium was resected for pathology review and frozen section confirmed the clinical diagnosis of an intraneural ganglion cyst. The nerve was then

Figure 1. MRI images of left knee. **(A)** Coronal, **(B)** sagittal, and axial **(C, D)** T2-weighted imaging showing cystic appearing lesion in the region of the common peroneal nerve (arrows) with connection to the proximal tibial-fibular joint "tail sign" (arrow head).

completely exposed, extending all the way to the bifurcation of the common peroneal nerve distally, and to the bifurcation of sciatic nerve proximally, and a neurolysis was performed for mobilization (Figure 2A). The epineural incision was further extended to decompress the entire intraneural ganglion. The articular branch of the peroneal nerve was identified and then followed to the proximal tibial-fibular joint where it was ligated (Figure 2B). This branch was enlarged throughout its course and the epineurium was thickened. Given the epineural defects from the ganglion decompression, a 6.5cm synthetic conduit was used to wrap the nerve to allow for axonal regrowth though the common peroneal nerve. Finally, extensive irrigation was performed and hemostasis was obtained. The wound was closed in anatomic layers and the patient was placed in a CAM boot.

Postoperative Course

His postoperative course was uncomplicated and he was discharged from the hospital on postoperative day one. The patient was seen at two weeks postoperatively for a wound check and suture removal. At that time, he continued to have residual weakness in TA, EHL, EDL, and peroneals with 2 out of 5 muscle strength as well as decreased sensation in the common peroneal nerve distribution. He was transitioned to a custom made AFO and physical therapy for ankle and knee stretching and strengthening was initiated. By 5 weeks postoperatively, he had significant recovery of motor function and was able to discontinue use of the AFO. At 7 weeks postoperatively, he had almost full motor strength of his left lower extremity with 4 out of 5 strength in TA, and 3 out of 5 strength in EHL, EDL, and

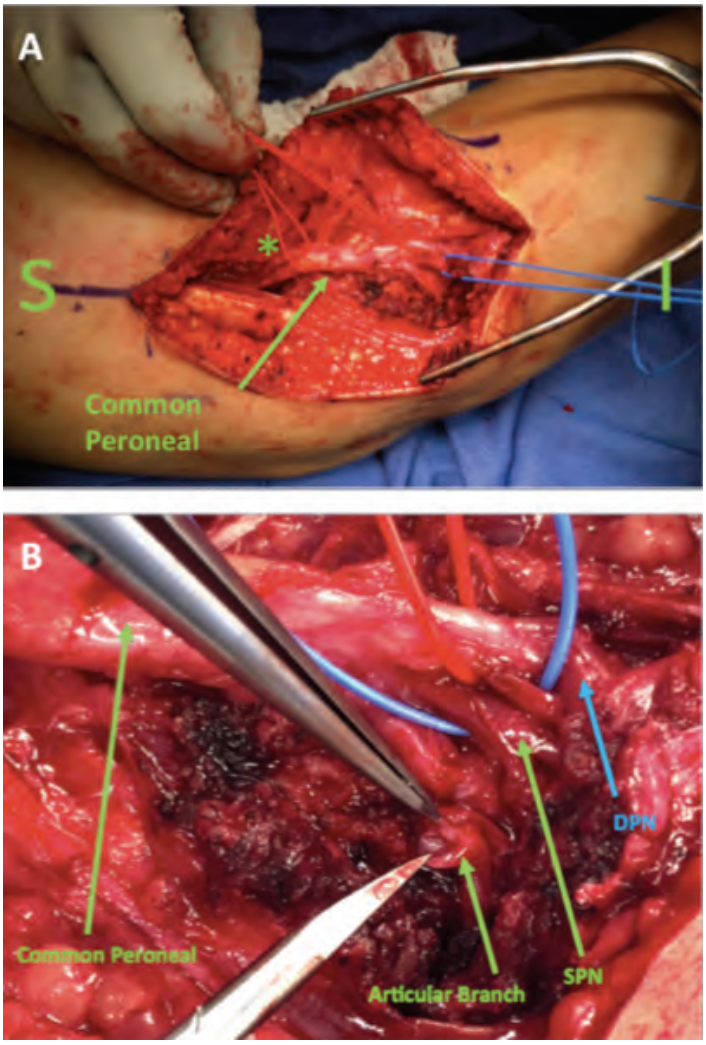

Figure 2. Intraoperative clinical photographs. **(A)** Decompression of common peroneal nerve (*) and isolation of the DPN and SPN **(B)** The common peroneal nerve was identified and followed distally to identify the articular branch that was ligated. S= superior, I= inferior, DPN= deep peroneal nerve, SPN=superficial peroneal nerve.

peroneal muscles. He continued to have diminished sensation to light touch within the common peroneal nerve distribution and reported some paraesthesias in the first webspace, but overall felt that it was improving. He was most recently seen four months postoperatively and had near complete motor strength recovery with 4 out of 5 strength in EHL and EDL and 5 out of 5 TA. Sensation remained decreased in the first web space but continues to improve. He has returned to full activities and sports without restrictions.

Discussion

Intraneural ganglion cysts are uncommon, typically occurring in adult men and involving the common peroneal nerve at the level of the fibular neck.[7,8] The pathogenesis of these cystic formations remains controversial, but the prevailing unified articular theory proposed by Spinner et al [9] describes a one way communication between the anterior proximal tibial-fibular joint and the articular branch of the common peroneal nerve. Synovial fluid from the joint dissects

along the articular branch through the path of least resistance, ascending proximally to the common peroneal nerve. With increasing pressure, the fluid can tract to the sciatic bifurcation of the common peroneal and the tibial nerve and can either ascend proximally along the sciatic nerve or descend distally along the tibial nerve.[10]

Patients typically present with a palpable mass about the lateral knee with associated pain, and motor/sensory deficits in the common peroneal nerve distribution. Electromyography and nerve conduction testing, if performed, often show decrease in distal motor amplitudes in the muscles innervated by the deep peroneal nerve.[11] Standard radiographs are typically normal. Magnetic resonance imaging is the next imaging study of choice, and often shows a cystic-appearing, homogeneous, T2 hyperintense mass in the region of the common peroneal nerve at the level of the knee. Diagnostic of an intraneural ganglion of the common peroneal nerve is the "tail sign" which represents the connection of the proximal tibial-fibular joint and the dilated articular branch.[12]

Timely surgical treatment is recommended for consistent recovery of motor and sensory function, and should involve complete decompression of the nerve and exploration and resection of the articular branch communication with the proximal tibial-fibular joint. In a clinical series of 24 patients with intraneural ganglion cysts of the common peroneal nerve that were surgically treated as described above, there were no reported recurrences at 1 year follow up. This was contrasted with 3 patients who only underwent decompression of the nerve, with all experiencing recurrence of the intraneural ganglion at 1 year.[9]

There have been 8 case reports of intraneural ganglion cysts involving the common peroneal nerve in the pediatric population.[5] In the reported cases, all those that underwent surgical decompression of the lesion and ligation of the articular branch showed excellent neurologic outcomes with full motor recovery recorded between 2 weeks and 14 months postoperatively.[3, 5] Additionally, these cases all showed timely diagnosis of the intraneural ganglion via MRI or alternative imaging. Residual motor deficits could be devastating in his age group, making proper and rapid diagnosis paramount.

Here, we report a case of an intraneural ganglion cyst of the common peroneal nerve in a 13-year-old boy. He presented with many weeks of lateral knee pain with a palpable mass, and ultimately, developed an atraumatic foot drop, prompting him to seek orthopaedic evaluation. MRI imaging showed a fusiform, T2-weighted hyperintense lesion along the course of the common peroneal nerve and wrapping around the head of the fibula, however intraneural ganglion was not considered as a potential diagnosis. Instead, he was thought to have a nerve sheath tumor and was planned for resection and reconstruction of the nerve. Intraoperatively, the common peroneal nerve appeared dilated and cystic, with viscous, clear fluid released upon epineurotomy, and was found on frozen pathology to be an intraneural ganglion cyst. He underwent decompression of the nerve and ligation of the articular branch, but did not require extensive resection of the common peroneal nerve, and has recovered nearly full strength and function at 4 months postoperatively. This case highlights the importance of considering intraneural ganglion cysts as a potential diagnosis and recognizing its characteristic features on imaging as patients can reliably recover motor strength with appropriate surgical decompression.

Conclusion

Intraneural ganglia are uncommon in the pediatric age group. Although any nerve can be affected, intraneural ganglia of the common peroneal nerve are believed to arise from the articulating branch at the proximal tibial-fibular joint, and present with foot drop, pain, sensory deficits, or simply the presence of a palpable mass. This case highlights the importance of including intraneural ganglion cyst in the differential diagnosis of new onset peripheral neurologic deficit in the pediatric population. Early recognition and surgical decompression of intraneural ganglia within the common peroneal nerve with exploration and ligation of the articular branch is paramount for improved functional recovery.

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