CASE REPORT

Ultrasound-Guided Aspiration and Injection of an Intranural Ganglion Cyst of the Common Peroneal Nerve

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Abstract *Background:* Intranural ganglion cysts are rare, benign, mucinous lesions that occur within neural sheaths and are thought to involve cystic fluid exiting from nearby synovial joints. They often present as tender masses causing paresthesias in the distribution of the involved nerve, muscle weakness or cramping, or localized or referred pain. *Case Description:* We present a case of a patient who initially presented with foot drop due to an intraneural ganglion cyst of the common peroneal nerve. This cyst was successfully treated using ultrasound guidance to aspirate the cyst and inject corticosteroid to prevent further inflammation. *Literature Review:* Standard of care has previously involved surgical resection, but this has been associated with a high frequency of recurrence. Due to the risks of nerve and vessel damage, there have been efforts to find alternative ways of resolving these cysts. *Purposes and Clinical Relevance:* Aspiration and injection of corticosteroid is a useful and

minimally invasive alternative to surgery for managing intraneural ganglion cysts.

Keywords intraneural ganglion cyst · common peroneal nerve · ultrasound-guided aspiration · denervation edema · foot drop

Introduction

Intranural ganglion cysts are rare, benign, mucinous lesions often found near joints affecting neighboring nerves or vessels. Extranural cysts are more common and extrinsically compress nerves, whereas intraneural ganglia are located within the perineurium or epineurium and most commonly found at the fibular neck involving the common peroneal nerve [7]. Although these cysts are often palpable asymptomatic masses, patients with intraneural ganglion cysts often complain of motor weakness, paresthesias, muscle cramping, and/or atrophy with localized or referred pain [7].

Cross-sectional imaging studies aid in both the diagnosis and treatment of these lesions and include magnetic resonance imaging (MRI), ultrasound, or arthrography. Ultrasound can aid in distinguishing cystic versus solid lesions and guide intervention. MRI allows visualization of the cystic lesion and the ability to precisely evaluate regional anatomy, while arthrography is useful for confirmation of potential articular communication.

Surgical decompression is the standard of care, but this has been associated with a 30% rate of recurrence [8]. Additionally, surgery can be invasive and challenging with a high risk of complications including permanent nerve damage, vessel injury, and potential infection. Aggressive surgical removal of adjacent joints to eradicate the potential synovial connection has also been reported in literature [1, 8]; however, there are no long-term supportive data. We present a case of an intraneural ganglion cyst of the common peroneal nerve arising from the adjacent tibiofibular joint in a patient who presented with foot drop, and successfully managed via ultrasound-guided aspiration and injection of corticosteroids.

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Fig. 1. AP radiograph of the right knee demonstrates mild degeneration of the tibiofibular joint with marginal osteophyte formation.

Case Description

A 64-year-old man presents with a 4-month history of progressively deteriorating right foot drop and paresthesias in the right lateral leg with no history of trauma or palpable mass.

Based on the clinical presentation, common peroneal nerve pathology was suspected.

Knee radiograph revealed mild tibiofibular joint degeneration manifest by small osteophytes (Fig. 1). MR axial inversion sequences demonstrated an intraneural ganglion cyst of the common peroneal nerve with denervation edema of the anterior leg compartment (Fig. 2a–d). Ultrasound demonstrated the intraneural ganglion as a well-circumscribed, tubular anechoic lesion of the right common peroneal nerve adjacent to the tibiofibular joint (Fig. 3a) with hyperechoic anterior compartment musculature reflecting denervation edema (Fig. 3b). A needle EMG study performed on the patient shows markedly decreased motor activity in the right peroneal nerve distribution relative to the normal left side with a reduced compound muscle action potential of 0.9 mV above and below the fibular head with normal velocity of 46 m/s, suggesting mainly an axonal neuropathy (Fig. 4).

Using ultrasound guidance following a selective nerve block of the peroneal nerve (Fig. 5a), three 20-gauge spinal needles were advanced into the cyst along its length (Fig. 5b). Approximately 1 ml of thick gelatinous material was aspirated. Complete aspiration was difficult due to fluid viscosity (Fig. 5c). Subsequently, triamcinolone was injected into the common peroneal nerve sheath and into the tibiofibular joint using ultrasound guidance. There were no postprocedural complications.

Two-month clinical follow-up demonstrated no significant change in symptoms. The patient's primary complaint of foot drop did not progress and was being successfully managed with

Fig. 2. **a** Axial inversion recovery sequence demonstrates a cyst tracking around the fibular head along the course of the common peroneal nerve with denervation edema of the anterior compartment. **b** Sagittal inversion recovery sequence demonstrates the common peroneal nerve ganglion cyst coursing around the fibular head. **c** Coronal inversion recovery sequence shows the common peroneal nerve ganglion cyst in another plane. **d** Axial inversion recovery sequence reveals denervation edema of the anterior compartment just distal to the common peroneal intraneural ganglion.

Fig. 3. **a** Longitudinal ultrasound image of the proximal lower leg at the level of the tibiofibular joint demonstrates the cyst of the common peroneal nerve (*arrowheads*) adjacent to the fibular head (*arrow*). **b** Transverse ultrasound image of the anterior compartment of the lower leg shows increased echogenicity of the musculature (*arrow*) compatible with denervation edema as seen in Fig. 2c with comparative normal sonographic appearance of the musculature (*arrowhead*).

orthotics. A 4-month follow-up MRI demonstrated absence and lack of recurrence of the intraneural ganglion cyst (Fig. 6a) with slightly diminished edema in the anterior compartment with only mildly diminished muscle bulk (Fig. 6b). At 12-month clinical follow-up, the foot drop, paresthesias, and pain had resolved.

Discussion

Although the common peroneal nerve is said to be the most common location for involvement of intraneural ganglia, few

cases have been reported in previous literature [2]. Intraneural ganglion cysts involving the common peroneal nerve often present with foot drop [2]. The development of these cysts is still currently debated, while the most supported theory is the unified articular theory, which states that the cystic fluid exits following a path of least resistance from the neighboring synovial joint through capsular defects via articular branches of nerves to a final position within a sheath of a major nerve [7]. In the case of an intraneural ganglion cyst within the common peroneal nerve, fluid is thought to originate from the adjacent tibiofibular joint and to travel along the course of the articular branch of the common peroneal nerve [8].

On MRI, the cysts demonstrate homogenous or complex cystic signal primarily manifest as low signal on T1-weighted images and high signal on T2-weighted images [8]. With contrast administration, there is often mild peripheral enhancement in the wall of the ganglia. Intraneural ganglia are often described as tubular and “string-like” and follow the course of the nerve, as opposed to the “mass-like” shape of extraneural ganglia [8]. Muscle atrophy and edema in the corresponding muscle compartment can be seen due to denervation [8]. In our case, a tubular cystic structure arising from the tibiofibular joint followed the course of the common peroneal nerve associated with denervation edema of the anterior compartment musculature. Ultrasound performed at the time of intervention confirmed the findings on MRI.

Symptomatic intraneural ganglion cysts are often treated with surgical resection that has a recurrence rate of 30% [8]. An alternative and minimally invasive way of decompressing the cyst is to aspirate the cyst using ultrasound guidance. This method is able to reduce nerve compression allowing reinnervation and recovery of function in involved muscles. Although there have been cases utilizing ultrasound guidance for aspiration of intraneural ganglia of the tibial nerve [3] and ganglia at other sites of the body [4, 6], there is no published literature of a successful aspiration of an intraneural ganglion cyst within the

Fig. 4. A needle EMG study performed on the patient shows decreased motor activity in the right peroneal nerve distribution relative to the left peroneal nerve distribution.

Fig. 5. **a** Short-axis ultrasound image demonstrating a perineural injection of the common peroneal nerve used for procedural nerve block. **b** Long-axis ultrasound image guides a 20-gauge spinal needle to its position within the intraneural cyst for aspiration. **c** and **d** Photographs of the thick gelatinous fluid that was aspirated from the cyst which totaled approximately 1 ml.

Fig. 6. **a** Axial inversion recovery images in the proximal leg demonstrate absence of the perineural cyst with persistent denervation effect and mild muscle atrophy on the *left* in comparison to the preprocedural MRI on the *right*. **b** Axial inversion recovery images taken at the level of the mid leg demonstrate slightly diminished denervation edema and muscle bulk of the anterior compartment compared to the preprocedural MRI on the *right*.

common peroneal nerve. In our case, the cyst was successfully aspirated under ultrasound guidance followed by corticosteroid injection into the decompressed ganglion and the tibiofibular joint. Depending on the size, complexity, and location of the intraneural ganglion cyst, an 18- or 20-gauge spinal needle is preferred for this procedure due to fluid viscosity which makes aspiration difficult. One should also consider performing a regional nerve block, as was done in this case to the common peroneal nerve to decrease pain. Additionally, steroid injection into the adjacent joint can aid in decreasing potential inflammatory or synovial reaction and help improve the patient's symptoms if a communication between the cyst and nearby synovial joint is present [5].

Potential shortcomings of this minimally invasive procedure include cyst recurrence, vessel or nerve injury, and infection. Surgical resection, although more invasive and with a higher risk of complication, is considered the definitive standard of care. In addition, it has been suggested that the dissection and removal of the articular branches of the peroneal nerve and nearby tibiofibular joint is necessary to eradicate the potential synovial connection in order to decrease the potential for recurrence of the cyst [8]. However, this surgical technique increases the risk of potential nerve damage and has not had sufficient literature to support it.

In conclusion, we have demonstrated that percutaneous therapy involving intraneural cyst aspiration followed by corticosteroid injection has a low risk of complications and a fast recovery, and may obviate the need for surgical resection of symptomatic intraneural ganglia cysts of the common peroneal nerve. As such, aspiration and injection of corticosteroid is a useful and minimally invasive alternative to surgery for managing intraneural ganglion cysts.

Disclosures

Conflict of interest: Teresa Liang, BSc; Anukul Panu, MD; Sean Crowther, MB BCH; Robert Lambert, MB BCH; and Gavin Low, MBChB, have declared that they have no conflict of interest.

Human/Animal Rights: All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008 (5).

Informed Consent: N/A

Required Author Forms Disclosure forms provided by the authors are available with the online version of this article.

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