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Differential diagnosis and treatment of foot drop caused by an extraneural ganglion cyst above the knee: A case report

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Abstract

BACKGROUND

We report a case of foot drop following compression of the common peroneal nerve caused by an extraneural ganglion cyst. The patient presented with a right foot drop for one month. The electrodiagnostic examination revealed right incomplete common peroneal neuropathy. A cystic lesion compressing the common peroneal nerve was confirmed by ultrasonography and magnetic resonance imaging. The patient was treated using ultrasound-guided cyst aspiration to decompress the common peroneal nerve. Electrical stimulation and strengthening exercises of the dorsiflexors and evertors of the right ankle were performed. The patient was prescribed a posterior leaf spring ankle-foot orthosis to reduce foot drop. Foot drop, paresthesia, and electrodiagnostic results improved; however, the cyst grew again after eight weeks. Therefore, the cyst was surgically resected to prevent recurrence of compression of the common peroneal nerve. After surgery, the patient regained a normal gait pattern with mild sensory symptoms.

CASE SUMMARY

A 46-year-old man was hospitalized after he reported a right foot drop for one month. The patient visited another hospital before visiting our practice and was recommended rehabilitation treatment for foot drop due to suspected nerve damage; however, no

radiological examination was performed. He complained that he was about to fall down due to foot drop and experienced numbness, tingling sensation, and pain in the lateral aspect of the leg and dorsum of the right foot. Medical history taking revealed that he had been diagnosed with fibromyalgia and Addison's disease and had been consuming prednisolone, acetaminophen, and tramadol for over 8 years. There was no history of trauma that could be considered as the cause of foot drop. Manual muscle testing (MMT) revealed scores of 1/5 on dorsiflexion of the right ankle and toes, 4/5 on plantar flexion of the right ankle, and 5/5 on others. Hypoesthesia and paresthesia on the right lateral leg and foot dorsum were noted. The straight leg raise test was negative on both lower extremities. An electrophysiologic study was performed to localize the lesion (Table 1)

An electrodiagnostic study(EDX) was performed on the 37th day after symptom onset. Compound motor action potential (CMAP) of the right deep peroneal nerve (DPN) revealed 43% axon loss compared to CMAPs of the left DPN. Conduction velocity was decreased by 16% across the fibular head on the right DPN. Right superficial peroneal sensory nerve action potential was absent. Needle electromyography (EMG) study showed increased insertional activities, abnormal spontaneous activities, and a decreased motor unit potentials recruitment pattern with some positive sharp waves and fibrillation in the right tibialis anterior(TA), right peroneus longus(PL), extensor digitorum brevis(EDB), and extensor hallucis longus(EHL). These electrodiagnostic findings suggested right incomplete common peroneal neuropathy. Ultrasonography (US) demonstrated hypoechoic and edematous common peroneal nerve (CPN) compression by a cystic lesion measuring about 2x1 cm, located in the posterolateral area, 2 cm above the right knee crease (Figure 1).

To facilitate CPN decompression, 2 cc of sticky gelatinous material was aspirated from the cyst under ultrasound guidance. Electrical stimulation therapy was performed on the right TA, PL, and EDB, at 0.3 mA intensity and 60 Hz frequency for 20 minutes and twice a day thereafter to prevent muscle atrophy. Passive and assisted active ROM exercises of the right ankle and strengthening exercises for weak muscles using elastic

band were prescribed based on the change of muscle power. A posterior leaf spring ankle-foot orthosis (PLS AFO) was prescribed to assist the weak dorsiflexion of the ankle to prevent further foot drop and contracture of the ankle. After rehabilitation for four weeks, the strength of the extensors of the ankle and toe had improved gradually to grade 3+/5, as determined by MMT. Follow-up EDX was performed two months after aspiration. The CMAP of the right DPN showed an increased amplitude compared to that in the first EDX, and only 16% of the axonal loss remained. Positive sharp waves and fibrillations on the right TA, PL, EHL, and EDB were still observed. Follow-up US revealed that the cystic lesion was growing and was close to compressing the CPN again. Magnetic resonance imaging (MRI) demonstrated compression of the CPN by the cystic mass with a narrow and long stalk, which stretched out posterolaterally from the middle popliteal fossa (Figure 2).

The patient was referred to an orthopedic surgeon for resection of the cyst to prevent impending compression of the CPN. The posteromedial approach between the semimembranosus and gastrocnemius muscles revealed that the cyst compressing the CPN originated from the posterior capsule with a long stalk measuring 4 cm (Figure 3). The nerves in the operative field, including the articular branch of the CPN, were intact. The well-margined cystic mass was resected completely and confirmed by histopathological examination as a ganglion cyst without synovial lining cells (Figure 4).

Four weeks after the operation, the strength of the muscles innervated by CPN improved to grade 4/5, and the patient could walk safely without PLS AFO, with only mild residual numbness. In the follow-up physical examination after one year, his muscle power was preserved, and he showed a normal gait pattern. Follow-up EDX one year after surgery revealed that the CMAP of the right DPN amplitude was within the normal limit. Positive sharp waves and fibrillations were observed only in the right TA. This case study was approved by the Institutional Review Board of Kwangju Christian Hospital (No. KCHIRB-RE2021-002), which waived the requirement for informed consent owing to the retrospective nature of this study.

CONCLUSION

Compressive common peroneal neuropathy by an extraneural cyst is rare and is therefore commonly not diagnosed or misdiagnosed. A ganglion cyst should be considered as a differential diagnosis of CPN lesions, and electrophysiologic examination, US, and MRI are useful diagnostic method to evaluate the various possible causes. Early decompression by aspiration and revision surgery has been reported to allow a better prognosis for patients with foot drop due to compression of the CPN caused by a space-occupying lesion such as a mass, ganglion cyst, or synovial cyst. Therefore, a precise diagnosis and immediate treatment are important in cases of compressive common peroneal neuropathy caused by an extraneural cyst

Key Words: foot drop; extraneural ganglion cyst; common peroneal neuropathy

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Core Tip: Nerve compression by ganglion cyst is less common compared to other complications. Compression of the tibial nerve by Baker's cyst has been frequently reported. Cases of compression of the common peroneal nerve alone by intraneural ganglion cyst have been reported sometimes. In our case, peroneal nerve was compressed by an extraneural ganglion cyst, making it a very rare occurrence.

INTRODUCTION

Foot drop is a clinical condition wherein the foot drags on the ground during the swing phase due to weakness of dorsiflexors of the ankle & foot. Common peroneal neuropathy is the most common cause of foot drop

CASE PRESENTATION

Chief complaints

Right Foot drop

History of present illness

A 46-year-old man was hospitalized after he reported a right foot drop for one month. The patient visited another hospital before visiting our practice and was recommended rehabilitation treatment for foot drop due to suspected nerve damage; however, no radiological examination was performed

History of past illness

Medical history taking revealed that he had been diagnosed with fibromyalgia and Addison's disease and had been consuming prednisolone, acetaminophen, and tramadol for over 8 years

Personal and family history

There was no specific family history.

Physical examination

Manual muscle testing (MMT) revealed scores of 1/5 on dorsiflexion of the right ankle and toes, 4/5 on plantar flexion of the right ankle, and 5/5 on others. Hypoesthesia and paresthesia on the right lateral leg and foot dorsum were noted

Laboratory examinations

There was no abnormal findings in laboratory examinations

Imaging examinations

Knee Ultrasonography and MRI

FINAL DIAGNOSIS

common peroneal neuropathy by an extraneural ganglion cyst.

TREATMENT

cyst aspiration under ultrasound guidance.

resection of the cyst by orthopedic surgeon.

OUTCOME AND FOLLOW-UP

Four weeks after the operation, the strength of the muscles innervated by CPN improved to grade 4/5, and the patient could walk safely without PLS AFO, with only mild residual numbness. In the follow-up physical examination after one year, his muscle power was preserved, and he showed a normal gait pattern

DISCUSSION

The CPN is the most commonly injured nerve in the lower part of the body^[4]; it is ² susceptible to compression or injury due to its superficial location in the subcutaneous space, directly over the unyielding fibula, tethered by tight fascial bands. It also has a relatively high nerve fascicle to connective tissue ratio, making it vulnerable to injury^[2,5,7]. The CPN ³ can be injured at any location along the thigh to the fibular head region by various types of trauma, including bullet wounds, lacerations, and femur fractures, or by compression secondary to habitual leg crossing, precipitous weight loss, or maintaining the squatting position for extended periods of time. Secondary causes also include space-occupying lesions such as ganglia, cysts, and vascular abnormalities. Malghem *et al*^[3] classified cysts around the knee as ganglion, synovial, and meniscal

cysts. Meniscal cysts are formed by accumulation of the synovial fluid in the meniscocapsular junction leaking through the tear or degeneration of the meniscus. Synovial cysts are defined as common cystic masses and are sometimes referred to as a Baker's cyst or popliteal cyst. These cysts are caused by the bulging of the gastrocnemiosemimembranosus bursa towards the posteromedial joint capsule. These cysts can be observed as regions of high signal on T2-weighted image and low signal on T1-weighted MRI image. Diagnosis is confirmed by observation of synovial lining on pathological examination. Zeng *et al* reported cases of patients with weakness of the peroneal nerve innervation muscles; using MRI, they confirmed that Baker's cysts compressed the peroneal nerve on the knee and performed surgical resection for cyst removal^[8]. Ganglionic cysts are soft-tissue masses caused by the myxoid degeneration of the connective tissue at the joint capsules and tendon sheaths^[9]. These show up as hyperintense regions on T2-weighted MRI images. In pathologic findings, the walls are composed of bland fibrous tissue without a specialized lining. It is often difficult to distinguish between ganglion and synovial cysts due to similarities in the site of origin. The principal difference between synovial and ganglion cysts comes from their different content and histologic features. A synovial cyst has, by definition, a synovial cell lining, while a ganglion cyst is delineated by dense fibrous connective tissue^[10]. Because of the low prevalence of peroneal nerve palsy caused by ganglion cyst, this condition is generally not easily diagnosed. Ganglion cysts causing compression of the CPN can be classified as either intraneural or extraneural lesions. Most previous reports have involved compressive common peroneal neuropathy by intraneural ganglion cysts related to trauma. Intraneural ganglion cysts are fluid-filled formations within the epineural sheath of peripheral nerves that can cause nerve compression^[3,6,9]. According to the articular theory^[11], the intraneural ganglion is formed by one-way communication between the proximal tibiofemoral joint and the articular branch of CPN. Nerve compression by extraneural ganglion cysts is rare. In this case, a patient with no history of trauma complained of foot drop for one month. During admission to a previous hospital, the medical impression was foot drop due to right sciatic or peroneal

nerve lesion, and he was recommended conservative treatment including rehabilitation to improve foot drop and sensory symptoms without radiologic examination to determine the cause. Upon presentation to our hospital, we conducted an EDX and diagnosed the patient with right incomplete common peroneal neuropathy. US was performed to examine the status of the CPN and surrounding structure, which demonstrated hypoechoic and edematous CPN, compressed by a cystic lesion. The patient's motor and sensory symptoms were improved after aspiration and rehabilitation. We later performed MRI after the cyst had regrown. MRI demonstrated compression of the CPN by a cystic mass with a narrow and long stalk, which stretched out posterolaterally from the middle popliteal fossa. US and MRI are useful diagnostic methods to evaluate the characteristics of space-occupying lesions such as cysts or tumors. MRI appears to be a superior choice for diagnosing a ganglion cyst. MRI was reported to be a non-invasive approach that shows the precise location of the lesion, the muscle innervated by the peroneal nerve, multiplanar images, and soft-tissue contrast^[6]. It was also reportedly helpful in planning surgical resection by allowing the comparison of T1-weighted images and high signals on T2-weighted images^[6]. Treatment of ganglion cysts involves cyst aspiration under ultrasound and surgical removal^[1]. In this case, rehabilitation treatment was performed following decompression of the CPN by aspiration of the cyst. The patient was prescribed ankle dorsiflexor strengthening exercises using elastic band, electrical stimulation for foot drop, and PLS AFO to assist weak dorsiflexors while walking. After rehabilitation for 2 mo, the ankle dorsiflexor recovered to grade 4 in the manual muscle test performed during a follow-up visit. In spite of improvement of symptoms, the cyst was surgically removed after it showed signs of recurrence at follow-up. The ankle dorsiflexor was sustained well at grade 4 in the manual muscle test of a patient who was followed up after one year. Aspiration of the cyst was effective to allow immediate decompression of the CPN, but the effect was temporary and did not prevent reoccurrence of the cyst. Therefore, surgical excision of the cyst following exact diagnosis is recommended.

CONCLUSION

Compressive common peroneal neuropathy by an extraneural cyst is rare and is therefore commonly not diagnosed or misdiagnosed. A ganglion cyst should be considered as a differential diagnosis of CPN lesions, and electrophysiologic examination, US, and MRI are useful diagnostic method to evaluate the various possible causes. Early decompression by aspiration and revision surgery has been reported to allow a better prognosis for patients with foot drop due to compression of the CPN caused by a space-occupying lesion such as a mass, ganglion cyst, or synovial cyst. Therefore, a precise diagnosis and immediate treatment are important in cases of compressive common peroneal neuropathy caused by an extraneural cyst

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