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A rare cause of 'drop foot' in the pediatric age group: Proximal fibular osteochondroma a report of 5 cases

Arda Çınar[a,*], Feridun Yumrukçal[a], Ahmet Salduz[b], Yalın Dirik[a], Levent Eralp[b]

[a] Memorial Şişli Hospital, Orthopaedics and Traumatology, Piyalepaşa Bulv. 34385 Okmeydanı, Şişli, İstanbul, Turkey
[b] Istanbul University, Istanbul School of Medicine, Orthopaedics and Traumatology, Turgut Özal Millet Caddesi, Çapa Tıp Fakültesi, Pk 34098 Çapa-Cerrahpaşa, Fatih, İstanbul, Turkey

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ABSTRACT

INTRODUCTION: The fibular nerve is the most frequent site of neural entrapment in the lower extremity and the third most common site in the body, following the median and ulnar nerves. The peroneal nerve is commonly injured upon trauma. Additionally, a dropped foot might be a symptom related to the central nervous system or spinal pathologies in pediatric patients. Entrapment of the peripheral nerve as an etiologic cause should be kept in mind and further analyzed in orthopedic surgery clinics.
PRESENTATION OF CASE: In this study, the evaluation and treatment results of five patients with no history of trauma, who underwent diagnostic procedures and treatment in various clinics (physical therapy and rehabilitation and neurosurgery), are reported. The patients underwent several treatments without diagnosis of the primary etiology. Upon initial consultation at our department, osteochondroma at the proximal fibula was detected after physical examination and radiologic assessment. During surgery, the peroneal nerve was dissected, starting from a level above the knee joint. Following nerve release, the osteochondroma was removed, including its cartilage cap. Consequently, recovery was observed in all five cases after surgery.
DISCUSSION: Many factors may cause non-traumatic neuropathies. However, due to their rare occurrence, lesions such as osteochondromas may be overlooked at non-orthopedic clinics. Nerve entrapment due to proximal fibular osteochondroma is rare. Surgical treatment planning plays a critical role in nerve entrapment cases.
CONCLUSION: Despite its frequent occurrence, a drop foot associated with peroneal nerve entrapment by an osteochondroma is not easily remembered and diagnosed. Especially in pediatric cases, inadequate clinical consultation and a lack of appropriate radiologic studies may result in a delay in diagnosing peroneal nerve lesions.

1. Introduction

Peroneal nerve entrapment is the most frequent nerve entrapment in the lower extremities and the third most common entrapment in the body, following the median and ulnar nerves.[1,2] Peroneal neuropathies often develop after trauma, direct injury or upon entrapment during the course of the nerve proximal or distal to the fibular head.[3] Mechanical entrapment by an osteochondroma in this anatomic region is a rare occurrence. In this study, five patients with a drop foot resulting from osteochondroma of the proximal fibula who did not receive a proper diagnosis in neurosurgery and physical therapy clinics are presented. We report our diagnostic and radiologic findings along with our surgical treatment results.

2. Presentation of cases

2.1. Case 1

A 2.5-year-old boy presented to the neurosurgery clinic with the complaint of limping that started shortly after beginning to walk. The patient had no history of trauma. His neurologic background history and examination included cranial and comprehensive spinal MRI for embolisms and congenital anomalies. All test results were negative for etiologic factors and the patient was referred to a physical therapy and rehabilitation clinic for six months. During the physical examination, simple gait analysis revealed missing dorsiflexion of the right foot. According to the

* Corresponding author. Tel.: +90 2123146666x4320; fax: +90 2123146612; mobile: +90 5057768230.
E-mail addresses: arda.cinar@memorial.com.tr (A. Çınar), feridun.yumrukcal@memorial.com.tr (F. Yumrukçal), ahmetsalduz@gmail.com (A. Salduz), yalin.dirik@memorial.com.tr (Y. Dirik), drleventeralp@gmail.com (L. Eralp).

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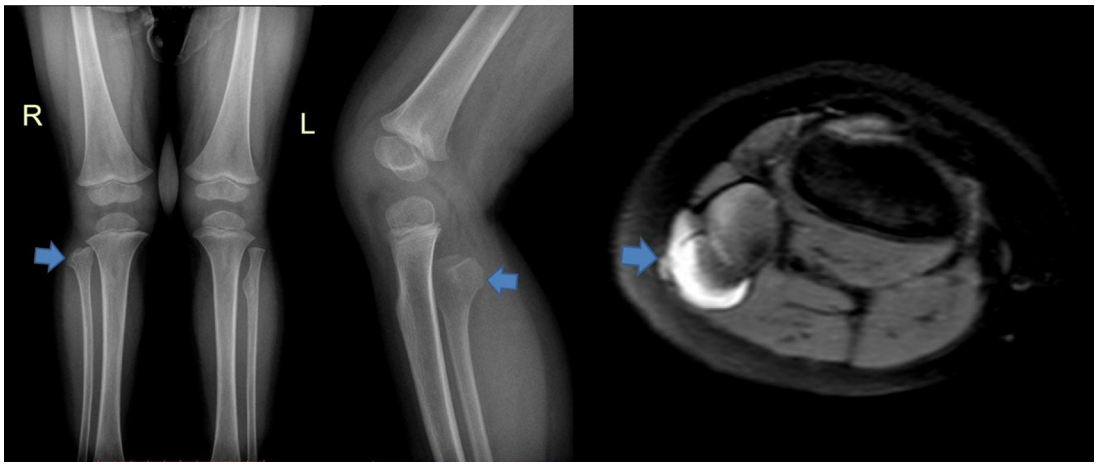

Fig. 1. Plain X-rays and MRI demonstrating posterolateral osteochondroma of the proximal fibula.

Medical Research Council (MRC) scale, the ankle and foot dorsiflexion grades were zero. No other sensory or motor deficiencies could be found in the lower extremity. Entrapment neuropathy of the peroneal nerve excitations was detected by electrophysiological studies. Further radiologic evaluation by plain x-rays, computerized tomography (CT) and magnetic resonance imaging (MRI) displayed a posterolateral exostosis on the fibular neck (Fig. 1).

Surgery was performed, and an osteochondroma, including its cartilage cap, was removed. Epineurolysis was applied to the peroneal nerve. Pathologic examination revealed an osteochondroma with a thin, 2-mm cartilage cap. In the early post-operative period, ankle and toe extension of 2–3/5 could be identified by physical examination. Electrostimulation and active and passive range of motion (ROM) exercises were initiated. Within three months following surgery, full recovery of motor functions was observed. One year after surgery, electromyogram results indicated normal excitations, and recurrence of the tumor was not noted (Table 1).

2.2. Case 2

A 15-year-old boy presented to the physical therapy and rehabilitation center (PTRC) complaining of inability to dorsiflex his left toe for five months. No improvement was detected with vigorous PTRC; therefore, the patient was referred to a neurosurgery clinic, where spinal MRI studies were conducted. The tests also did not reveal any pathology, and PTRC was continued.

No improvement of the condition was observed, and the patient was referred to our department. The patient was examined, and dorsiflexion of the ankle and toe was determined as MRC grade 1 without any sensory deficit. Denervation of the extensor hallucis longus was observed by electrophysiologic studies (Fig. 2). Radiologic assessment detected compression of the peroneal nerve due to an osteochondroma of the proximal fibula and fatty degeneration of the proximal musculotendiosis area of extensor hallucis longus.

Extirpation of the osteochondroma and peroneal neurolysis were performed. During surgery, hourglass constriction of the peroneal truncus at the level of the fibular neck by an osteochondroma was observed. Pathologic specimens depicted an osteochondroma. Within the first 24 h following the surgery, muscle strength started to return. Electrical stimulation, accompanying active and passive range of motion exercises, was started. At the end of the post-operative first month, 5/5 muscle strength was achieved. Full recovery was observed with normal electromyogram studies at the end of 24 months.

2.3. Case 3

An 11-year-old girl presented to the neurosurgery clinic complaining of gradual weakness of foot dorsiflexion, which was first noted 4 months prior to admission. She was evaluated for possible intervertebral disk pathology, but the radiologic studies were normal. She was referred to a physical therapy and rehabilitation clinic. By the time she consulted with our department, her ankle and toe extensors were assessed as MRC grade 2 without any sensory deficit. Electrophysiologic studies revealed degeneration of the peroneal nerve. Radiologic examination showed osteochondroma that was accompanied by a bursitis at the level of the proximal fibula, causing peroneal nerve entrapment. Extirpation and neurolysis were performed. Throughout the surgery, hourglass constriction of the peroneal truncus was observed. Pathologic evaluation showed osteochondroma. By the third week following surgery, gradual increase of the muscle strength was noted. Follow-up ended with full recovery and normal electromyogram signs.

2.4. Case 4

A 14-year-old boy presented to the neurosurgery clinic with weakness of foot dorsiflexion that was first noticed five months prior. Upon spinal examination for rehabilitation purposes, the patient was referred to the physical therapy and rehabilitation clinic. Upon admission, the ankle and toe extensor was evaluated as MRC grade 2 without sensory deficit. During the electromyogram, degeneration was detected in the nervus peroneus. Radiologic examination showed osteochondroma accompanied by a bursitis at the level of proximal fibula, causing peroneal nerve entrapment. Extirpation and neurolysis were performed. In the peroneal trunk, bursitis caused by osteochondroma was identified (Fig. 3). Pathologic evaluation showed osteochondroma. Two weeks after the surgery, the patient's muscle strength started to return.

2.5. Case 5

A 10-year-old girl presented to the physical therapy and rehabilitation center and neurosurgery clinic with spinal pathologies that started three months prior due to her complaint of right drop foot. The patient was examined and dorsiflexion of the ankle and toe was determined as MRC grade 1 without any sensory deficit. Electrophysiologic studies revealed degeneration of the peroneal nerve. Radiologic examination showed osteochondroma accompanied by a bursitis at the level of the proximal fibula, causing peroneal nerve

Table 1
Patients' clinically relevant data.

Patient	Age	Sex	Tm location	EMG	Clinical findings MRC	Perop findings	Time of diagnosis (months)	Recovery time (months)	Follow-up (months)	Recurrence
KE	2.5	M	Right fibular head	Denervation of N. peroneus	R Toe and ankle dorsiflexion MRC grad 0	OK of the fibular head + hourglass sign of the peroneal truncus	12	3	14	None
OK	15	M	Left	Denervation of EHL	L Toe and ankle dorsiflexion MRC 1grade	OK of the fibular head + hourglass sign of the peroneal truncus	5	1.5	24	None
AŞ	11	F	Right	Denervation of N. peroneus	R Toe and ankle dorsiflexion MRC grade 2	OK of the fibular head + hourglass sign in the peroneal truncus	4	1.5	50	None
TA	14	M	Right	Denervation of N. peroneus	R Toe and ankle dorsiflexion MRC grade 3	Bursitis due to OK around the peroneal trunk	5	1	36	None
MSE	10	F	Right	Denervation of N. peroneus	R Toe and ankle dorsiflexion MRC grade 3	Bursitis due to OK around the peroneal trunk	3	1	40	None

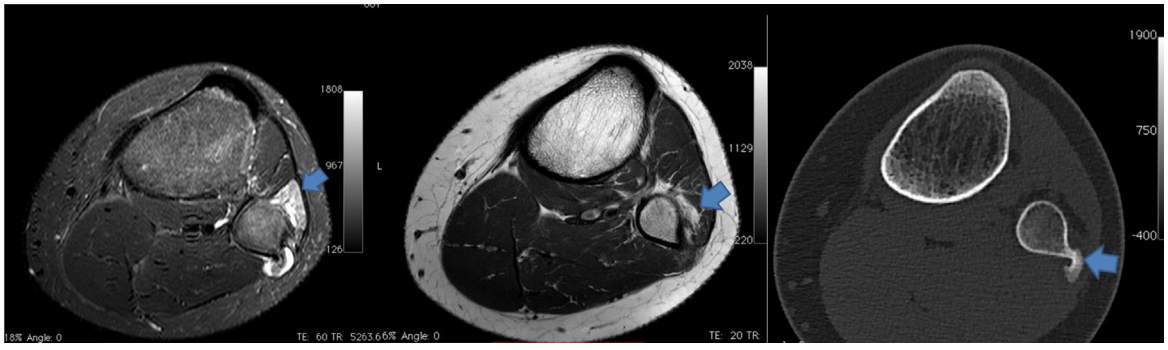

Fig. 2. MRI of the lower leg demonstrating fatty degeneration of the long peroneal muscle and CT of the same patient.

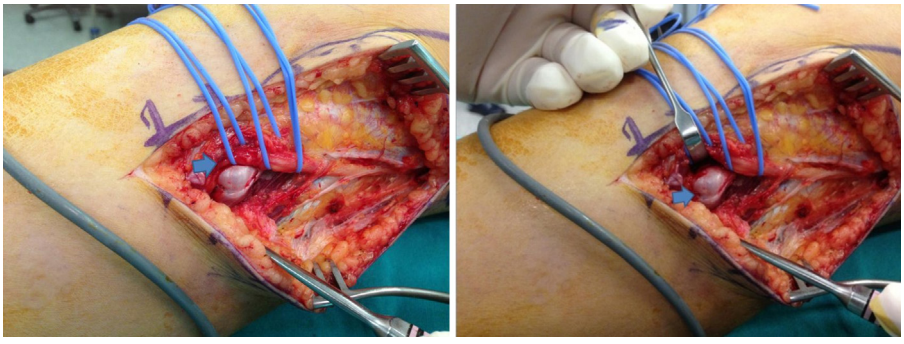

Fig. 3. Intraoperative picture showing the common peroneal nerve and osteochondroma.

entrapment. Extirpation and neurolysis were performed. In the peroneal trunkus, bursitis caused by osteochondroma was identified. Pathologic examination results indicated osteochondroma. A week after the surgery, the muscle began to gain strength. Follow-up ended with full recovery and normal electromyogram signs.

3. Discussion

The peroneal nerve is frequently constricted around the fibular neck.[4–6] The increasing number of fascicles in this area, expansion of epineural tissue, and nerve's unprotected surface transition play an important role in this pathology.[7] Moreover, the fibular head is quite dynamic. The peroneal nerve is connected to the fibular head and is subjected to the movements of the fibula.[7] Spur or tumoral structure formation of the tubular bones can potentially apply pressure to the surrounding structures.[8]

Many factors may cause non-traumatic neuropathies (Table 2).[6] Flores and Koerbel[15] reported a case of peroneal nerve compression resulting from fibular head exostosis. Only a few cases of compressions of the peroneal nerve by cartilaginous exostosis have been reported thus far. However, due to their rare occurrence,[9] lesions such as osteochondromas may be overlooked by non-orthopedic clinics. Osteochondroma is the most common benign bone tumor and can cause a variety of symptoms.[10]

Depending on the location of the lesion pain, a palpable mass, puffiness – (inflammation), and Tinel's sign might be significant clinical symptoms and findings. Furthermore, when an exositosis

Table 2
Reported etiology of non-traumatic peroneal neuropathies.

Anaphylactoid purpura
Baker cyst
Bed rest
Bony exostoses
Crossed-leg sitting
Fibrous arch
Ganglion
Hemangiomas
Knee stabilization by helicopter pilots
Lipoma
Schwannoma
Sesamoid bone of the lateral head of gastrocnemius
Venous thrombosis
Weight loss
Kneeling in prayer position

accompanying stiffness is diagnosed, hereditary multiple exositosis syndrome must be considered.[11,12]

Motor deficits are more common than sensory nerve lesions, which might be explained by the arrangement of the fascicles inside the common peroneal nerve. The motor fascicles run more medially, whereas the sensorial fascicles are located laterally. The exostosis grows from the bone surface to the periphery, compressing the motor fibers earlier. This is most likely due to medial placement of the motor branches within the nerve so that they are more prone to injury by a newly forming osteochondroma.[13]

Advanced knowledge of the peroneal nerve anatomy as well as the MRI and CT scan assessments of the lesion are key factors for preventing complications. A surgery for an osteochondroma causing peroneal nerve entrapment should be performed within three months; otherwise, the surgical success rate decreases.[6,8,14,15] Although the mean time that passed until the patients consulted with us was 5.7 months (range: 3–12 months), the loss of muscle strength in our cases fully recovered following surgery. The mean age of our patients was low, which could have played a role in the fast and complete neurological recovery (mean age 10.5 (2.5–15 years)).

4. Conclusion

In spite of its frequent occurrence, drop foot associated with peroneal nerve entrapment by an osteochondroma is not easily remembered and diagnosed. Especially in pediatric patients, drop foot can be overlooked during physical examination and may even be more difficult to detect in non-orthopedic clinics. With careful physical examination along with radiologic and electrophysiologic studies, nerve entrapment can be easily diagnosed, enabling surgeons to perform surgery in a timely manner, thus preventing further sequelae.

Conflict of interest

The authors declare that they have no competing interests.

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Nothing to declare.

Ethical approval

Written informed consent was obtained from each patient for the publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Author contribution

All authors have been equally involved in the collection of data and drafting of the manuscript.

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