Case Report International Journal of Paediatric Orthopaedics 2017 Jan-June;3(1):20-23

Osteochondroma Arising from the Head of the Fibula: A Rare Cause of Drop Foot in Pediatric Age

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Abstract

Background: The common peroneal nerve (CPN) or external popliteal nerve is the most frequently involved nerve in entrapment syndromes in the lower extremities. Its proximity to the head of the fibula makes it particularly susceptible to damage by different injury mechanisms. Osteochondromas arising from the proximal fibula are a rare cause of common peroneal nerve injury.

Methods: We report a case of a 13-year-old Caucasian male patient referred to our hospital with drop foot and palpable mass in the head of the right fibula. Physical examination revealed a severe paresis, grade 2 objectified by the scale of the Medical Research Council (MRC) in the extensor hallucislongus, extensor digitorumlongus and tibialis anterior muscles and hypoesthesia in the dorsal surface of foot and portions of the anterior, lower-lateral leg. In magnetic resonance imaging (MRI) a tumor in the head of the fibula compressing the CPN is observed. Electromyographic studies confirmed the presence of severe partial axonotmesis of the right peroneal nerve.

The patient underwent surgery for decompression of the peroneal nerve and resection of the proximal fibula osteocartilaginousexostosis. The histopathological analysis confirmed the diagnosis of osteochondroma.

Results: At the 12-month postoperative follow-up the patient recovered sensitivity and presented, according to the MRC scale, muscle strength of 4 out of 5 in thepreviouslynamed muscles, being able to walk without orthotic devices. In the electromyography, subacuteaxonotmesis with important signs of active reinnervation observed

Conclusions : Osteochondroma in the head of the fibula is a rare cause of CPN injury, that can go easily unnoticed and has to be considered in the differential diagnosis of the drop foot in pediatric ages. Diagnosis and treatment should not be delayed to get a good neurological recovery because, otherwise, it could be irreversible.

Keywords: Drop foot, peroneal palsy, osteochondroma, tumor, nerve injury, surgery, nerve decompression, tumor of the fibula, pediatrics

Introduction

The common peroneal nerve (CPN) is the most frequently affected by entrapment syndromes in the lower limbs [1]. Its proximity to the head of the fibula makes it particularly susceptible to damage by different injury mechanisms (fibular fractures, direct trauma, proximal tibiofibular joint cysts, hematomas, ischemic neuropathies, or neoplasms) [2, 3, 4]. The incidence of primary bone tumors in the fibula is 2.5%, with nearly a third of them with benign characteristics [5, 6, 7]. Osteochondroma located in the proximal fibula is a rare etiology of damage to the CPN [1, 8]. We report a case of a patient in pediatric age with peroneal nerve injury due to the presence of an osteochondroma in the head of the fibula.

Materials and Methods

We report the case of a 13-year-old Caucasian male patient, referred to our center with drop foot and presence of a tumoral mass at the head of the right fibula. The growth of the tumor had been gradual over the past 5 years without referring episodes of trauma or infection in the affected limb.

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Physical examination revealed a palpable mass of approximately 5 cm × 5 cm in the fibular head, hard, painless, and with no signs of inflammation. It also revealed a severe paresis, Grade 2 by the scale of the Medical Research Council (MRC) [9], in the extensor hallucis longus, extensor digitorum longus and tibialis anterior muscles, and hypoesthesia in the dorsal surface of foot and anterior, lower-lateral leg, with no other neurological or vascular pathological findings.

In conventional X-ray and magnetic resonance imaging (MRI) of the right lower limb, we observed an exophytic formation with broad base implementation arising from the proximal portion of the fibula and compressing the origin of the CPN (Fig. 1 and 2). Electromyographic studies confirmed the presence of severe partial axonotmesis of the right peroneal nerve due to compression at the proximal fibula with 65% of axonal loss in comparison to contralateral side, important acute denervation in the muscles innervated by the CPN and absence of distal conduction.

Given the progressive deterioration of limb function and the

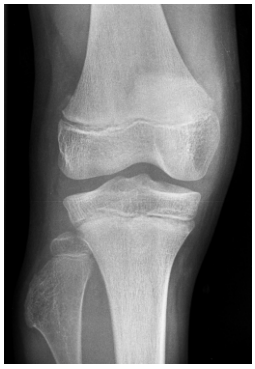

Figure 1: Right knee conventional X-ray: Tumor arising from the proximal fibula

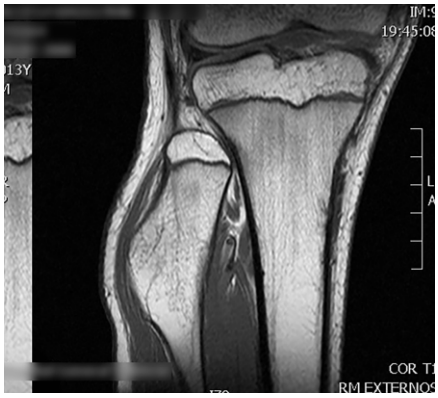

Figure 2: Right knee magnetic resonance imaging (T1 sequence): Compression of the peroneal nerve by the tumor.

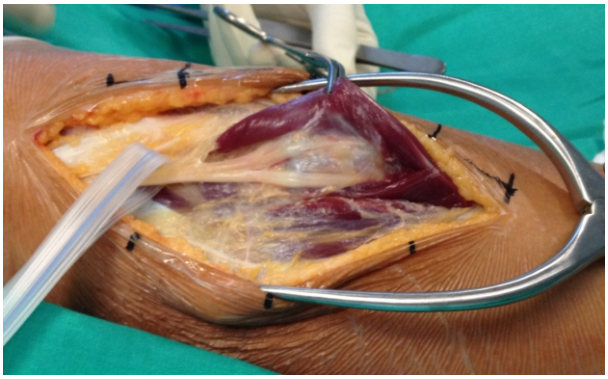

Figure 3: Intraoperative image: Compression of the deep branch of the peroneal nerve by the tumor.

presence of the tumor in the head of the fibula, the patient underwent surgery for decompression of the peroneal nerve and resection of the proximal fibula osteocartilaginous exostosis. Under general anesthesia, the patient was placed in left lateral decubitus. We proceded to the exsanguination of the member by lifting it 3-5 min, and ischemia was maintained by inflating a tourniquet at thigh level. A longitudinal approach on the proximal third of the right fibula was done in line with the tendon of the biceps femoris, carrying out the dissection until external popliteal nerve was located next to the fibular head. Severe compression of the deep branch of the nerve between two projections of the exostosis was observed (Fig. 3). The nerve was released and rejected anteriorly after being referenced with a Penrose drain. Subperiosteal dissection of the proximal fibula was performed with resection of the exostosis, preserving enough part of the fibular head (Fig. 4). We proceeded to suture the surgical wound, interposing triceps surae muscle fascia and periosteum at the proximal fibula osteotomy plane between the injury and the peroneal nerve. The resected tumor was sent for histopathological analysis, which confirmed the diagnosis of osteochondroma.

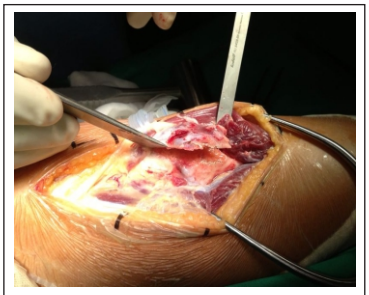

Figure 4: Resectionof the tumor while preserving the fibular head.

Results

In the immediate post-operative period foot sensitivity was recovered but remained the motor deficit previously described, so the patient required an ankle-foot orthosis (AKO) for active ambulation. 4 weeks after surgery he started to regain mobility for ankle dorsiflexion, with signs of active reinnervation and improvement in motor nerve conduction in peroneal electromyographic tests.

At the 6-month post-operative follow-up, he recovered the ankle range of motion against gravity completely but remained the paresis in the extensor hallucis longus muscle. 9 months after surgery, the patient walked without the AKO and presented, according to the MRC scale, muscle strength of 4 out of 5 in the extensor hallucislongus and extensor digitorumlongus muscles, and 5 out of 5 on the tibialis anterior muscle. In the electromyography, important signs of active reinnervation with voluntary tracings within normal limits were observed. At the 12-month post-operative follow-up, the patient walked symmetrically without orthotic aids but persisted mild claudication in the extensor muscles of the foot and ankle during running sports.

Discussion

Benign tumors are usually asymptomatic and discovered incidentally in children [10, 11]. They occur most frequently in the first decade of life [12]. Osteochondroma, first described in 1818 by Sir Astley Cooper as a benign tumor that forms cartilage, develops in the form of an exostosis in the outer surface of the bone by endochondral ossification around the physis. It represents 34% of benign cartilaginous tumors and 8% of all bone tumors, affecting more frequently males (1.5:1) [13]. The incidence of primary bone tumors in the fibula is 2.5% being the osteochondroma the most common tumor, followed by giant cell tumor, osteosarcoma and Ewing's sarcoma [5, 7].

The tumor is covered by a layer of cartilage, composed mostly of hyaline cartilage without cellular atypia. This layer, wider in children, it decreases progressively with age being <1 cm thick in adults and is responsible for tumor growth that will cease with the skeletal maturation [14].

Regarding etiology, it may appear spontaneously and as an isolated form in 90% of cases, after radiotherapy or related to hereditary multiple osteochondromas (HMO), causing angular bone deformities and short stature if epiphyseal

involvement occurs [3, 15, 16].

It appears clinically as a painless mass, without inflammatory signs, progressive growth, and sometimes painful if trauma, fractures of the stem of the tumor, pseudoaneurysm formation, infection, necrosis, or malignant transformation occurs [3, 17].

The most common location is the distal femur, but it can also be found in proximal tibia, scapula, proximal humerus, ribs, or vertebrae [7, 18].

For diagnosing these tumors conventional X-ray, computerized tomography (CT) and MRI are used. CT and MRI will be useful to assess more accurately the degree of bone, vascular and soft tissue involvement [7].

It has been described that osteochondromas can alter the anatomical path of tendons, nerves and vessels with their growth, leading to compression syndromes, pseudoaneurysms and bone deformities [3, 7, 19, 20, 21].

CPN compression by cartilaginous exostosis, although described, is a rare entity and should be considered in the diagnosis of drop foot in childhood [1].

The anatomy of the peroneal nerve and its proximity to the head of the fibula makes it especially vulnerable to compression injuries at this level immediately before dividing into the superficial and deep branches, due to the increased number of fascicles in this area, the expansion of the epineural tissue and its unprotected surface. The clinic of a neuropathy of the CPN will manifest as a drop foot with difficulty for dorsiflexion and eversion of the ankle against gravity or resistance and steppage gait due to the involvement of the tibialis anterior muscle, which is the most common clinical presentation. In addition, paresthesias or hypesthesia on the dorsal surface of foot and portions of the anterior, lowerlateral leg may be associated. Plantar flexion, which involves posterior tibial nerve, and tendon reflexes are not altered. Pain in peroneal nerve neuropathies is usually a rare symptom [3,20, 21,22, 23].

The arrangement of nerve fascicles in the nerve explains why motor deficits are more common than sensitive deficits in cases like the present one: Motor fascicles are located medially, while sensitive are located laterally. Therefore, an osteochondroma growing from proximal fibula to the periphery will cause an early compression of motor fibers while the sensitive ones will remain intact until advanced stages. Electromyographic and nerve conduction studies will be of great help: Even in the acute phase, the reduction in the amplitude of motor and sensory response indicates in severe cases the presence of axonal damage [1, 3, 24, 25].

Although most osteocondromas can be treated conservatively by evolutionary clinical observation and radiological control, surgical excision would be indicated in cases of compressive syndromes affecting adjacent structures, deformity or suspected malignancy [3, 7, 26]. Malignant degeneration of osteochondroma is more common in adults and patients with HMO. It should be suspected in adults with cartilage thickness above 2 cm, tumor growth after skeletal maturation or increased pain symptoms. Similarly, we must be extremely vigilant in osteochondromas located in the spine, scapula, pelvis and proximal femur because they tend to transform more frequently into chondrosarcomas [3, 7, 27, 28].

Surgery of the osteochondroma that associates as a complication the involvement of the peroneal nerve should be carried out early, if possible in the first 3months since; otherwise, the success rates decline significantly [1, 3, 21, 23, 29].

Tumor resection should be performed, avoiding aggressive excisions that could lead to a destabilization of the proximal tibiofibular joint, and that can be avoided by careful pre-operative planning [5, 7].

The prognosis of these tumors is good, with growth during childhood and remaining stable in adulthood after the physeal closure. Favorable prognostic factors are the appearance in females, <5 affected regions and HMO caused by EXT2 mutation [30]. Recurrence after excision is usually rare, but it can occur in the case of incomplete excision of the tumor or the cartilaginous cap before physeal closure [7, 31].

Regarding prognosis of patients with paresis of the peroneal nerve, it will depend on the degree of neurological impairment at the time of surgery, remaining full recovery difficult in the cases with no active dorsiflexion and eversion of the foot. However, mild or moderate affection in active mobility would be enough to predict a good functional outcome after surgery [32].

Conclusions

Osteochondroma in the head of the fibula is a rare cause of CPN injury that can go easily unnoticed and has to be considered in the differential diagnosis of the drop foot in pediatric ages. Diagnosis and treatment should not be delayed to get a good neurological recovery because, otherwise, it could be irreversible.

Clinical relevance

Osteochondromais the fibular head is a rare etiology of injury to the peroneal nerve. However, it should be considered in the differential diagnosis of drop foot in childhood to prevent it from going unnoticed. Diagnosis and surgical treatment should not be delayed to get a good neurological recovery because, otherwise, it could be irreversible.

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Conflict of Interest: NIL
Source of Support: NIL

How to Cite this Article

Sergio PO, Blas-Dobón JA, Peralta-Nieto J, Gómez-Barbero POsteochondroma Arising from the Head of the Fibula: A Rare Cause of Drop Foot in Pediatric Age. International Journal of Paediatric Orthopaedics Jan-June 2017;3(1):20-23.