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ORIGINAL STUDY

Acute leg compartment syndrome after CT-guided core needle biopsy of a giant cell tumor of the proximal fibula

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Imaging-guided percutaneous core needle biopsy (CNB) is the preferred diagnostic method for bone and soft tissue tumors. In less than 1% of cases, complications are clinically significant and include mainly haema-toma and bleeding. We present a case of acute compartment syndrome (ACS) following CNB of the proximal fibula.

A 26-year-old female patient was referred to our sarcoma center with a suspicion of giant cell tumor (GCT) of the proximal fibula. The CT-guided CNB under local anesthesia had caused transient severe pain irradiating to the foot, rapidly subsiding after correction of the needle trajectory. The patient was discharged on the same day without residual symptoms. She presented at the emergency department 48 hours later with severe leg pain and swelling. Compartment pressure was elevated. Urgent fasciotomies were performed, revealing muscle edema, without significant haematoma. Postoperatively, paresthesia improved progressively and the patient regained a normal neurologic status within 4 months. Pathologic analysis confirmed the diagnosis of GCT, which was resected after neoadjuvant denosumab therapy. At the 2-year follow up visit, the patient still presented pain at exertion, but had no objective neurological sequela.

ACS is not a well-known complication of CNB in the diagnosis of bone tumors. This rare complication might be diagnosed too late, or even missed, due to pre-existing pain, which can sometimes be severe in GCT, and to the usually short post-procedure surveillance in an outpatient procedure.

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Keywords : Compartment syndrome ; giant cell tumor ; core needle biopsy ; bone tumor.

INTRODUCTION

Percutaneous core needle biopsy (CNB) is the preferred diagnostic tool for bone and soft tissue tumors, with an accuracy of more than 90% in soft tissue and more than 80% in bone tumors *(1,2)*. It is generally performed under imaging guidance, using CT or ultrasound. The reported complications rate of percutaneous bone and soft-tissue biopsies is between 0 and 10% *(3-8)*. In less than 1% of cases, complications may be clinically significant and include mainly haematoma and bleeding *(8-10)*.

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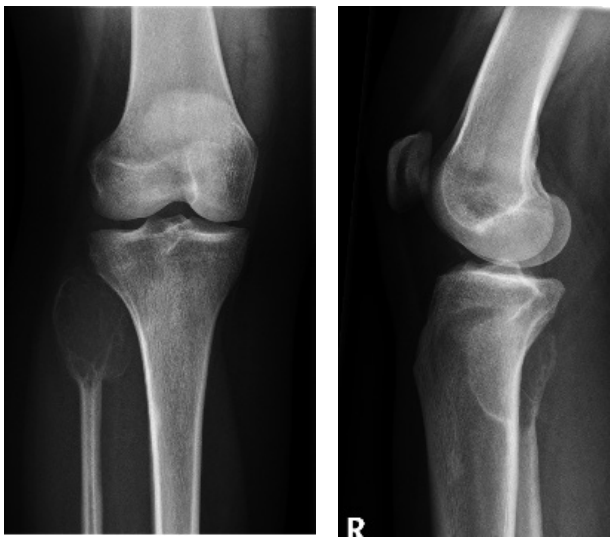

Figure 1. — 26-year old woman with standard right knee X-ray in a) anteroposterior and b) lateral view. The proximal fibula shows an expansive lytic meta- and epiphyseal lesion.

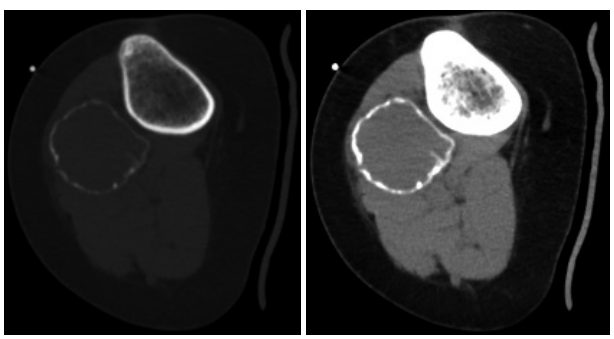

Figure 2. — Computed Tomography in axial view of the right proximal leg in bone (left) and soft tissue (right) windows shortly before the CNB: note the osteolytic lesion of the proximal fibula and the absence of soft tissue swelling or infiltration.

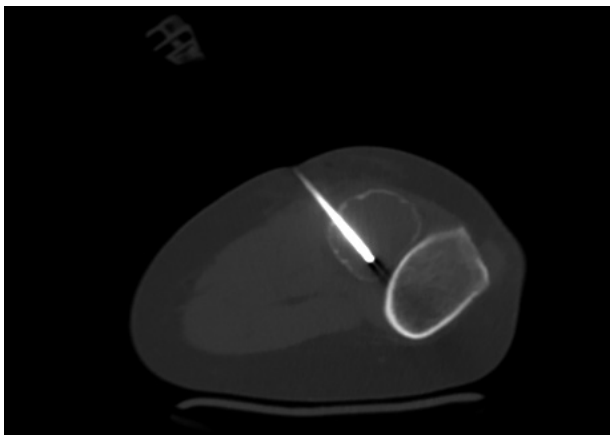

Figure 3. — Computed Tomography in slightly oblique axial view to guide core needle biopsy of the proximal fibula by extracompartmental anterolateral approach.

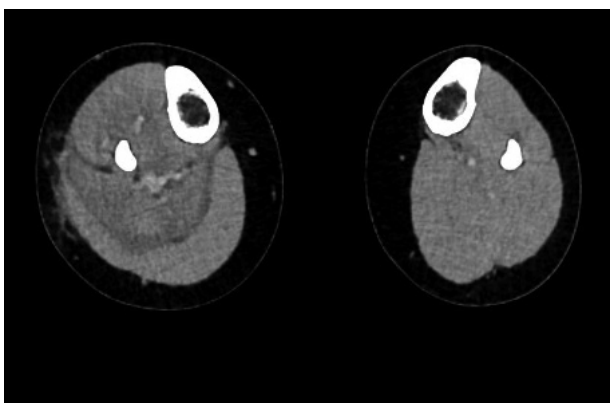

Figure 4. — Computed Tomography 48 hours after core needle biopsy showing muscular edema of anterior, lateral and profound posterior compartments, and partially of the superficial posterior compartment of the right leg compared to a normal left leg.

Haematoma and bleeding can cause an acute compartment syndrome (ACS), which is a well-established complication of fractures, particularly of the lower limb *(11)*. Patients who develop an ACS without associated fracture have a greater risk of delayed diagnosis and late sequela *(12)*.

We present a case of acute compartment syndrome of the leg after CT-guided core needle biopsy of the proximal fibula.

A 26-year-old female patient with no other medical history was referred to our sarcoma center with progressive lateral knee pain. Plain films showed a well-defined expansive lytic lesion of the proximal fibula (figure 1). MRI and CT scan were suggestive of a giant cell tumor of bone (GCT), without soft-tissue involvement (figure 2). CT-guided CNB was performed under local anesthesia (figure 3). The procedure was described by the patient as extremely painful, with the occurrence of transient excruciating pain irradiating to the foot and toes. The symptoms improved completely within one hour and the patient was discharged on the same day. Progressive

pain and swelling of the leg and calf appeared less than 24 hours after CNB and the patient presented at the emergency department 48 hours after the procedure. Passive motion of ankle and toes caused extreme pain. Plantar and dorsal foot paresthesia had appeared. Due to the unusual presentation, a contrast enhanced CT scan was performed : it displayed diffuse muscular edema of anterior, lateral and deep posterior compartments, and partially of the superficial posterior compartment, without any sign of active bleeding. Massive swelling and extra-compartmental adipose tissues infiltration were present as well (Figure 4). Pressure was measured at 40 mmHg in the anterior compartment, confirming the diagnosis of ACS. Urgent fasciotomy of all four compartments confirmed muscle edema, without significant haematoma. Pain improved dramatically after the fasciotomies, but the patient presented residual paresthesia of the fibular and tibial nerves for 4 months before full recovery.

Pathologic analysis confirmed the diagnosis of GCT. After healing of the surgical wounds, neo-adjuvant treatment with denosumab was initiated, followed 7 months later by "en bloc" excision of the proximal fibula and reattachment of the lateral tendino-ligamentous structures to the tibia. At the two-year follow up visit, the patient had no recurrence of the tumor. There was no muscle atrophy on MRI. There were no residual neurological symptoms or muscle contracture at physical examination, but the patient complained of persisting pain at exertion in the leg and calf. She was still restricted to daily life activities and had a maximum of 30 minutes walking distance.

DISCUSSION

To our knowledge, this is the first report on an ACS occurring after CNB of a primary bone tumor of an extremity.

According to the literature, complications of CNB are rare, and include haematoma and bleeding, neural injury, infection, fracture and needle breakage *(4)*. Rimondi et al. published a series of 2027 percutaneous CT-guided biopsies performed for bone tumors, 193 located in the leg. They found 22 complications (1.1%), namely 18 cases of transient neurological impairment and four haematomas. In all the cases, the treatment plan did not need to be adapted, nor was the outcome modified by the biopsy complication *(13)*. In our case, the pathological pathway leading to ACS remains unclear. The CT scan performed shortly before the fasciotomies revealed massive swelling and muscle edema of the four compartments of the leg, although only partially in the superficial posterior one. We were not able to find any sign of active bleeding either on the CT scan, or during the fasciotomies. Even in case of wrong needle trajectory during the CNB, an injury to all four compartments of the legs would be highly unlikely in the context of a procedure performed by a fellowship-trained musculoskeletal radiologist with four years of experience in imaging-guided procedures, and was certainly not present at review of the procedure records. During the procedure, the patient presented sudden and extremely severe pain during the biopsy, suggesting some direct contact of the needle with a sensitive nerve branch, and prompting the correction of the needle trajectory. The pain rapidly subsided and no neurological symptom persisted after the effect of local anesthesia had disappeared. Although the exact cause and pathophysiology of ACS remains uncertain in this case, its progressive development in the 24 hours after the CNB, in the absence of additional potential causative agent, makes the relation between CNB and ACS highly likely.

Clinical symptoms of GCT include pain and local tenderness, sometimes associated to redness and a palpable mass. Pain can be severe, either at rest or at exertion, and may have a nocturnal component. In the proximal fibula, Sun et al. found pain as the first symptom in almost 50% of the cases in their series of 52 bone tumors (including 7 GCT) *(14)*. In 11.5%, signs of peroneal nerve compression belonged to the presenting symptoms as well. Likewise, neurological impairment is known to be one of the potential complications, although rare, of CNB. In our case, these typical symptoms of a bone tumor may have been misleading to the emergency room physicians and delayed the diagnosis of ACS.

Clinical findings in ACS mainly consist in pain, which is typically out of proportion, and more

specifically with passive stretch. In our patient, pain began several hours after the biopsy and progressed slowly. The presentation was initially not convincing for an ACS, partly because it is not a known complication of CNB. Surgical intervention was done after the diagnosis was suspected because of intolerable pain and neurological symptoms had appeared, and confirmed through intracompartmental pressure measurement. Neurological impairment of both peroneal and tibial nerves disappeared progressively in the four months after the fasciotomies. On the contrary, pain at exertion and restriction of walking distance to less than 30 minutes persisted at the two-year follow up visit, highlighting the devastating potential of ACS if diagnosed too late.

CONCLUSION

Acute compartment syndrome is not a well-known complication of CNB in the diagnosis of bone tumors. This rare complication might be diagnosed too late, or even missed, due to pre-existing pain, which can sometimes be severe in GCT, and due to a short clinical surveillance in an outpatient procedure. The physician should recognize the clinical presentation of compartment syndrome rapidly to prevent from the development of late symptoms, as this condition can lead to severe definitive impairment.

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