Skeletal Radiology
https://doi.org/10.1007/s00256-020-03489-7

CASE REPORT

Giant intraosseous ganglion of the fibula: multimodality imaging

Najoi Chatt[1] · Aline François[2] · Souad Acid[1] · Bruno Vande Berg[1] · Thomas Kirchgesner[1]

Received: 8 March 2020 / Revised: 18 May 2020 / Accepted: 25 May 2020

Abstract
Intraosseous ganglia around the knee are most commonly located in the proximal tibia and limited to the epiphyseal-metaphyseal region. We report the case of a giant intraosseous ganglion of the fibula. MRI demonstrated the fluid avascular content of the lesion. CT arthrography of the knee demonstrated partial opacification of the lesion through a cortical bone defect. The lesion was treated with curettage and bone grafting. Anatomopathological examination confirmed the medical imaging diagnosis of intraosseous ganglion. This case highlights the value of joint opacification with CT arthrography to demonstrate the communication between the articular cavity and the ganglion.

Keywords Knee · Bone · Intraosseous · Ganglion · Cyst · MRI · CT arthrography

Introduction

Ganglia or ganglion cysts are benign cystic lesions within the peri-articular soft tissues or within the juxta-articular bone [1]. Histologically, they contain a myxoid substance with fibroblasts and collagen located at the periphery of the lesion [2]. Pathologists use the term "ganglion" rather than "ganglion cyst" because of the absence of epithelial lining. However, we used the term ganglion cyst in the current report to emphasize the cystic aspect of these lesions at medical imaging.

In the knee, intraosseous ganglion cysts are usually located in the proximal tibia, small, and limited to the epiphyseal-metaphyseal region [3–5]. We report the case of a 59-year-old woman referred to our center for an extensive bone tumor of the proximal fibula found at knee MRI. Multimodality imaging including contrast-enhanced MRI and CT knee arthrography was consistent with an intraosseous ganglion cyst. Anatomopathological examination confirmed the diagnosis.

✉ Najoi Chatt
najoi.chatt@uclouvain.be

[1] Department of Radiology, Cliniques universitaires Saint-Luc – Institut de Recherche Expérimentale et Clinique (IREC), Université Catholique de Louvain, Avenue Hippocrate 10, 1200 Brussels, Belgium

[2] Department of Anatomical pathology, Cliniques universitaires Saint-Luc, Brussels, Belgium

This case report highlights the possible diagnostic value of medical imaging in the management of atypical intraosseous ganglion cysts and emphasizes the value of joint opacification with CT arthrography to demonstrate the communication between the articular cavity and the cyst.

Case report

A 59-year-old woman without relevant medical history was referred to our oncological orthopedic surgeon for a bone tumor of the right fibula. Indeed, MRI of the right knee performed in another medical center because of chronic lateral knee pain had demonstrated a lesion of the proximal fibula as well as a tear of the lateral meniscus (Fig. 1).

Radiographs of the right lower limb showed a lytic bone lesion of the fibula extending from the proximal epiphysis to the lower third of the diaphysis (maximal length of 22.2 cm). The lesion was multilocular with thin sclerotic borders in its proximal part and cortical thinning in its distal part (Fig. 2). There was no intralesional calcification, no periosteal apposition, and no bone expansion. Differential diagnosis of this extensive lytic bone lesion in a middle-age patient included bone metastasis, atypical cartilaginous tumor, and atypical cystic lesions (giant degenerative subchondral cyst or giant intraosseous ganglion cyst).

A second MRI examination (Magnetom Skyra 3.0 T, Siemens, Germany) was performed to image the entire fibular lesion. MRI acquisition protocol included T2-weighted Dixon

Published online: 10 June 2020

Fig. 1 Coronal fat-suppressed proton density-weighted MR image of the right knee demonstrating a multiloculated lesion with high signal intensity in the proximal fibula (arrow) and a lateral meniscal tear (arrowhead)

Fig. 2 Anterior-posterior radiograph of the right leg demonstrating an osteolytic fibular lesion extending from the proximal epiphysis to the diaphysis with a length of 22.2 cm. In the fibular head, a thin sclerotic peripheral rim is present (arrow) indicating that the lesion is slow- or non-growing. In the distal part of the lesion, endosteal bone resorption with cortical thinning and no sclerotic border (arrowhead) can be seen and may favor a more active process. Note the absence of intralesional mineralized matrix and the absence of periosteal reaction

sequences in the transverse plane (TE, 77 ms; TR, 6540 ms; slice thickness, 6 mm) and coronal plane (TE, 73 ms; TR, 5732 ms; slicethickness, 4 mm) and a transverse T1-weighted sequence (echo time (TE), 11 ms; repetition time (TR), 416 ms; slice thickness, 6 mm) after intravenous contrast material injection(gadoterate meglumine 2 ml/kg, Dotarem, Guerbet, France). The lesion was multilocular with homogeneous low signal intensity on T1-weighted images and high signal intensity on T2-weighted images (Fig. 3). Thin peripheral enhancement was seen after contrast material injection. Continuity between the proximal tibiofibular joint and the lesion was not seen at MRI. Soft tissues around the fibula were normal. Differential diagnosis of this "cystic" bone lesion in a middle-age patient included cartilage or fluid containing bone lesions, atypical cartilaginous tumor, and atypical cystic lesions.

A presumptive diagnosis of giant intraosseous ganglion cyst was considered and a CT arthrography of the knee was performed to demonstrate the presence of a pedicle between the articular cavity and the fibular lesion. CT acquisition (120 kV; 245 mAs; slice thickness, 0.6 mm; SOMATOM Definition AS 40, Siemens, Germany) was performed 15 min after intra-articular knee injection of 10 ml of iodinated contrast material (Omnipaque 300 mg I/mL, GE Healthcare, United States of America) under fluoroscopic guidance with a lateral subpatellar approach. CT arthrography demonstrated opacification of the proximal tibiofibular joint and partial opacification of the proximal part of the fibular lesion (Fig. 4). Cartilage of the proximal tibiofibular joint was normal. The communication between the joint space and the lesion through a cortical bone defect confirmed the diagnosis of intraosseous ganglion cyst.

The referring orthopedic surgeon performed surgical curettage of the lesion followed by bone grafting. Anatomopathological examination of the curettage material showed fibrous tissue with myxoid changes consistent with the medical imaging diagnosis of ganglion cyst (Fig. 5).

Discussion

Intraosseous ganglion cysts are solitary cystic lesions involving the juxta-articular extremities of bone [1]. The etiology and pathogenesis of intraosseous ganglion cysts are not determined [1, 3, 4]. However, several hypotheses have been proposed to explain their etiology: intramedullary metaplasia followed by mucoid degeneration with intraosseous cyst

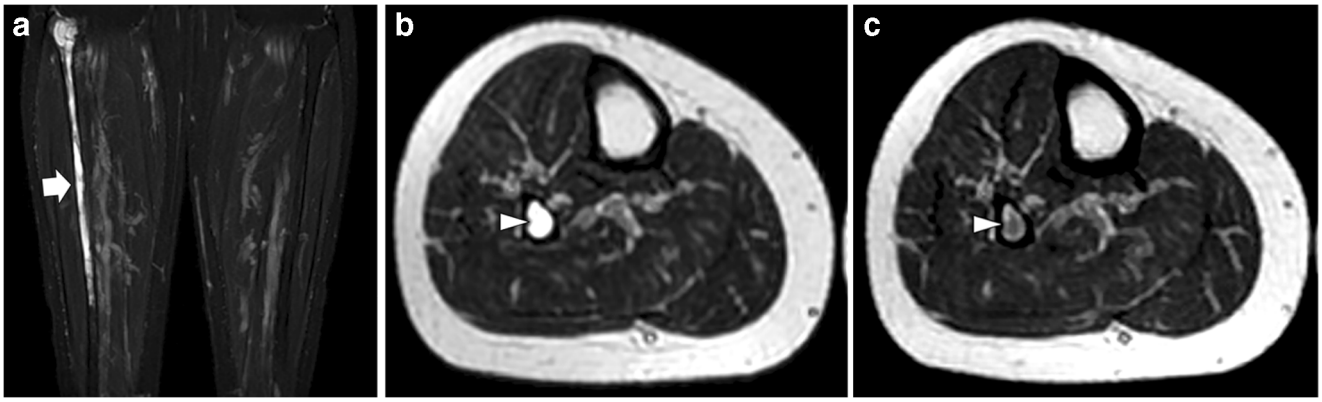

Fig. 3 **a** Coronal fat-suppressed T2-weighted, **b** transverse T2-weighted and **c** transverse contrast-enhanced T1-weighted MR images of the right leg. The extensive lesion (arrow) demonstrates homogeneous high signal intensity on T2-weighted images (arrowhead) and a thin peripheral enhancement after contrast material injection (arrowhead) compatible with a cystic lesion

formation, repeated microtrauma of the juxta-articular bone leading to local vascular disturbance and aseptic necrosis or penetration of a soft tissue ganglion cyst into the underlying bone [3]. Another theory is that intraosseous ganglion cysts arise from the adjacent articular space with migration of synovial fluid into the bone [6].

Typical intraosseous ganglion cysts around the knee are small and located in the proximal tibial epiphysis [3–5]. The differential diagnosis of intraosseous ganglion cysts includes primary lesions of epiphyseal and/or subchondral topography like chondroblastoma, giant cell tumor, and degenerative subchondral cysts [1–3]. Due to the normal appearance of the proximal tibiofibular joint on radiographs, MRI, and CT arthrography, the likelihood of a degenerative subchondral bone cyst was very limited [7].

The juxta-articular topography of the reported lesion, its non-aggressive character, the absence of chondroid calcification at imaging, and its cystic aspect at MRI supported the hypothesis of an intraosseous ganglion cyst despite the lack of obvious communication between the lesion and the joint at MRI. Indeed, cortical defect and communication with the joint are inconstantly present at MRI [3]. However, we acknowledge that performances of high-resolution MRI focused on the proximal part of the lesion could have increased the likelihood to depict a pedicle between the cyst and the joint [8, 9].

Identification of the communication between intraosseous ganglion cysts and adjacent joint is inconstant and varies depending on the imaging technique, from 17% of the cases with conventional MRI to 57% with conventional CT [3]. Diagnostic performances of MR and CT arthrography to detect the communication between intraosseous ganglion cysts and adjacent joint remain unknown. However, when present, the communication demonstrated by the opacification of the lesion at CT or MR arthrography is a very strong argument in favor of the diagnosis of ganglion cysts [6, 9–12]. In our case, the opacification of the cyst through a marginal cortical bone

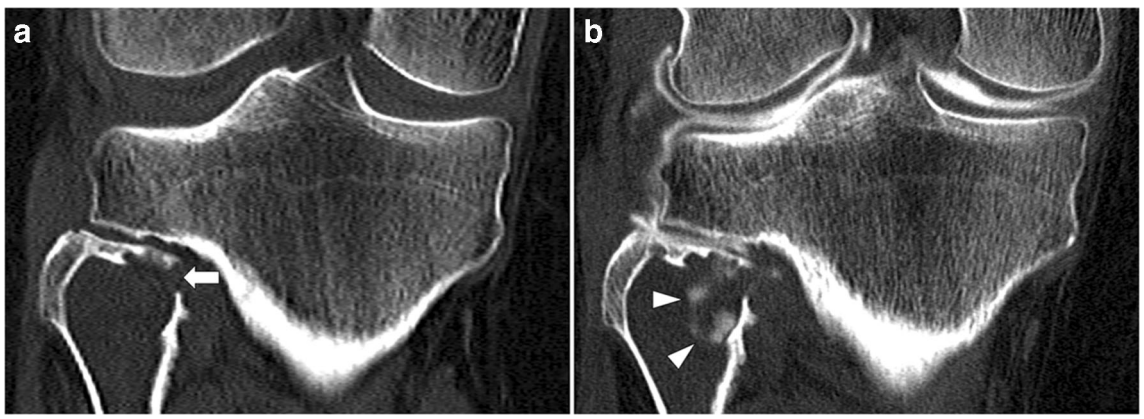

Fig. 4 **a** Coronal CT reformat of the knee obtained before knee arthrography demonstrates the lack of increased X-ray attenuation in the fibular lesion as well as a cortical defect (arrow). **b** Coronal CT reformat after knee arthrography demonstrates increased attenuation within the fibular lesion (arrowheads) due to contrast material pouring in the lesion from the proximal tibiofibular joint through the cortical defect. The communication between the lesion and the joint through a marginal cortical bone defect confirms the diagnosis of intraosseous ganglion cyst

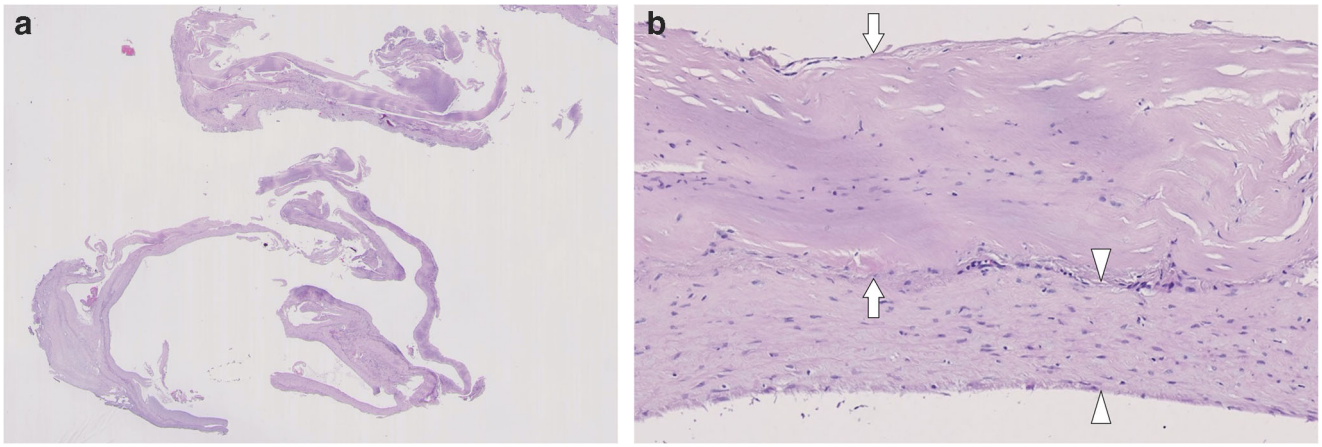

Fig. 5 Anatomopathological examination of curettage fragments (hematoxylin and eosin staining) at **a** low and **b** high magnification power demonstrates a myxoid lesion with a fibrous wall composed of dense collagenous tissue (arrows) and reactional fibroblasts (arrowheads)

defect of the fibula occurred early after intra-articular injection of contrast material in the knee and was only partial. Indeed, the content of intraosseous ganglion cysts may not be pure "fluid" but viscous material which may be only partially opacified [11]. Delayed CT acquisition which was not obtained in the current observation can contribute to the diagnosis by demonstrating late opacification of the ganglion cyst when early opacification is absent [6, 10–12].

We did not perform direct opacification of the proximal tibiofibular joint, but opacification of the knee joint with lateral subpatellar approach and fluoroscopic guidance. Indeed, communication between femorotibial and proximal tibiofibular joints is frequent and occurs in 27.5 to 64% of the knees at MR arthrography [13, 14]. Moreover, in a series of twenty ganglion cysts of the knee investigated with CT arthrography by Malghem et al., communication between the femorotibial and proximal tibiofibular joints was demonstrated in all three cases of ganglion cysts communicating with the proximal tibiofibular joint [6].

Ganglion cysts may be responsible of clinical symptoms but are also frequently incidentally discovered on imaging examination [15]. Usual surgical treatment of symptomatic intraosseous ganglion cysts consists in surgical excision by curettage followed by bone grafting [16].

In conclusion, our report highlights the possible value of medical imaging in the non-invasive diagnosis of intraosseous ganglion cysts. Communication between the osseous lesion and the joint is a key imaging finding in favor of intraosseous ganglion cyst. This communication may not be conspicuous at conventional MRI and can be demonstrated after arthrography.

Acknowledgments The authors would like to thank Jacques Malghem for his valuable comments and suggestions.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

References

1. Bancroft LW, Peterson JJ, Kransdorf MJ. Cysts, geodes, and erosions. Radiol Clin N Am. 2004;42(1):73–87.
2. Pope TL Jr, Fechner RE, Keats TE. Intra-osseous ganglion. Report of four cases and review of the literature. Skelet Radiol. 1989;18(3):185–7.
3. Williams HJ, Davies AM, Allen G, Evans N, Mangham DC. Imaging features of intraosseous ganglia: a report of 45 cases. Eur Radiol. 2004;14(10):1761–9.
4. Perdikakis E, Skiadas V. MRI characteristics of cysts and "cyst-like" lesions in and around the knee: what the radiologist needs to know. Insights Imaging. 2013;4(3):257–72.
5. Marra MD, Crema MD, Chung M, Roemer FW, Hunter DJ, Zaim S, et al. MRI features of cystic lesions around the knee. Knee. 2008;15(6):423–38.
6. Malghem J, Vande berg BC, Lebon C, Lecouvet FE, Maldague BE. Ganglion cysts of the knee: articular communication revealed by delayed radiography and CT after arthrography. AJR Am J Roentgenol 1998; 170(6):1579–1583.
7. Tanaka H, Araki Y, Yamamoto H, Yamamoto T, Tsukaguchi I. Intraosseous ganglion. Skelet Radiol. 1995;24(2):155–7.
8. Neto N, Nunnes P. Spectrum of MRI features of ganglion and synovial cysts. Insights Imaging. 2016;7(2):179–86.
9. Spinner RJ, Edwards PK, Amrami KK. Application of three-dimensional rendering in joint-related ganglion cysts. Clin Anat. 2006;19(4):312–22.
10. Malghem J, Vande BB, Lecouvet F, Lebon C, Maldague B. Atypical ganglion cysts. JBR-BTR. 2002;85(1):34–42.
11. Omoumi P, de Gheldere A, Leemrijse T, Galant C, Van den Bergh P, Malghem J, et al. Value of computed tomography arthrography with delayed acquisitions in the work-up of ganglion cysts of the tarsal tunnel: report of three cases. Skelet Radiol. 2010;39(4):381–6.
12. Bouilleau L, Malghem J, Omoumi P, Barbier O, Simoni P, Vande Berg BC, et al. Pseudotumoral ganglion cyst of a finger with

unexpected remote origin: multimodality imaging. Skelet Radiol. 2010;39(4):375–9.
13. Dirim B, Wangwinyuvirat M, Frank A, Cink V, Pretterklieber ML, Pastore D, et al. Communication between the proximal tibiofibular joint and knee via the subpopliteal recess: MR arthrography with histologic correlation and stratigraphic dissection. AJR Am J Roentgenol. 2008;191(2):W44–51.
14. Bozkurt M, Yilmaz E, Atlihan D, Tekdemir I, Havitcioglu H, Gunal I. The proximal tibiofibular joint: an anatomic study. Clin Orthop Relat Res. 2003;406:136–40.
15. Guermazi A, Hayashi D, Roemer FW, Niu J, Yang M, Lynch JA, et al. Cyst-like lesions of the knee joint and their relation to incident knee pain and development of radiographic osteoarthritis: the MOST study. Osteoarthr Cartil. 2010;18(11):1386–92.
16. Sakamoto A, Oda Y, Iwamoto Y. Intraosseous ganglia: a series of 17 treated cases. Biomed Res Int. 2013;2013:462730.