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Case Report

Cryotherapy of acetabular osteoid osteoma under fluoroscopic guidance using the XperGuide System

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ABSTRACT

Osteoid osteoma represents 10%-12% of all benign bone tumors, and is composed by osteoid tissue and reticular and immature bone tissue. Acetabular involvement is very rare ($\leq 1\%$).

In this case report, we describe the treatment of an osteoid osteoma of the acetabulum of a young man using cryotherapy under fluoroscopic guide with the new XperGuide system which is used to reduce X-ray radiation dose and to have a more accurate localization of the lesion compared to computed tomography-guided or surgical ablation.

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Case report

A 35-years-old male presented to the Department of Radiology of our Institution with left hip nocturnal pain appeared 9 months before. He described the pain as relieved by salicylates and increased during night time.

In a previous magnetic resonance imaging (MRI) of the hip, a hypointense lesion in T1-weighted images on the left acetabulum was noted (Fig. 1).

A computed tomography (CT) was performed showing a bone lesion with a hyperdense central nidus surrounded by sclerotic reactive bone. These features were consistent with osteoid osteoma [1,2] (Fig. 2).

After multidisciplinary evaluation and with the patient's written informed consent osteoid osteoma was treated with cryotherapy using the XperGuide (Philips, Best, The Netherlands) system using a Diagnostic 5 tilt fluoroscopic system (Philips, Best, The Netherlands).

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Competing Interests: The authors declare that they have no conflict of interest.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

Consent for publication was obtained for every individual person's data included in the study.

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Fig. 1 – T1 weighted image showing an hypointense lesion (round circle) on the acetabular roof.

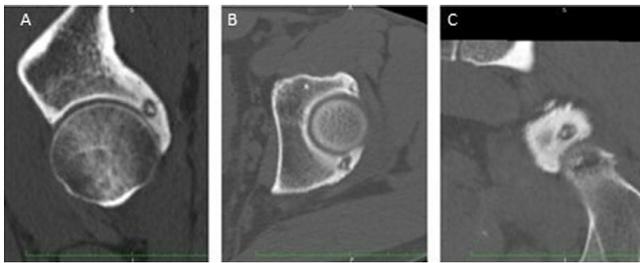


Fig. 2 – Coronal (A), axial (B), and sagittal (C) CT images showing an hyperdense nidus surrounded by bone sclerosis and cortical thickening caused by endosteal and subperiosteal new bone formation.

Patient was treated in surgical aseptic conditions, under local anesthesia with lidocaine 4 mL and periosteal anesthesia with naropine 7.5% 4 mL.

The patient was positioned supine with arms crossed on his head. After disinfection of the skin, the region to be treated was isolated using sterile teleries.

Then a 180° rotational acquisition was performed on the pelvis to obtain images in axial, coronal, and sagittal planes and 3-dimensional reconstructions, where the interventional radiologist marked the lesion to be treated and the access point of the needle on the patient's skin.

The XperGuide software, therefore, automatically traces the trajectory that the operator must follow to reach the lesion. The trajectory is displayed as a green line (Figs. 3 and 4).

Under fluoroscopic guidance the operator introduces a Jamshidi trocar (13 G) following the guide traced by the software to reach the nidus of the lesion. The trocar stylet is removed and a cannula was inserted coaxially to perform a biopsy (Fig. 5). Biopsy specimen was interpreted after the cryoablation.

Subsequently, the cryoablation needle (Cryoprobe) is inserted coaxially. Three freezing cycles (10 minutes each) and 3 thawing cycles (5 minutes each) were performed (Fig. 6). The trocar was removed and careful skin disinfection was performed with compressive band placement.



Fig. 3 – Axial, sagittal, and coronal reconstructions of the rotational acquisition obtained during the cryoablation procedure. The “green line” is the driving trajectory developed by the XperGuide software that connects the skin surface and the Osteoid Osteoma nidus. (Color version of figure is available online.)

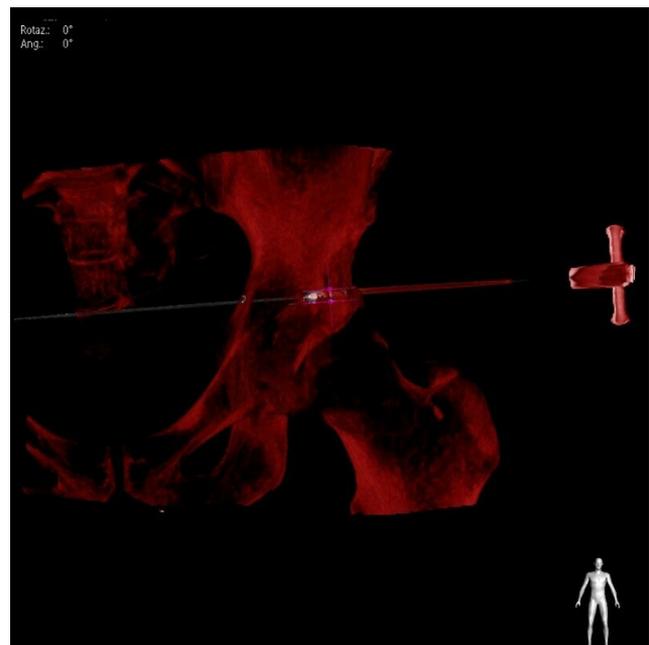


Fig. 4 – Three-dimensional reconstruction elaborated by the XperGuide software. The Jamshidi needle is visible with the distal end inserted inside the Osteoid Osteoma lesion.

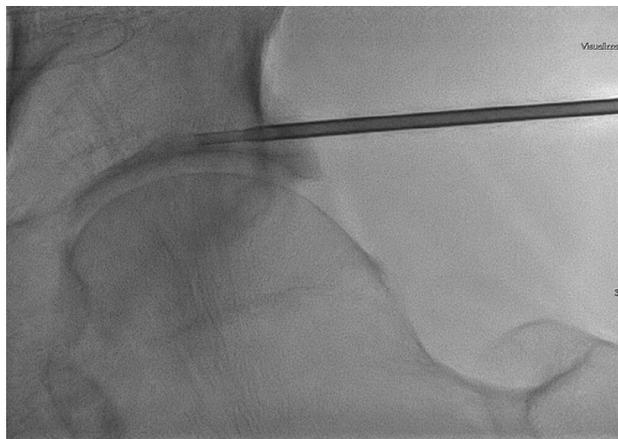


Fig. 5 – Fluoroscopic image showing biopsy needle inserted coaxially into the cannula to perform biopsy.

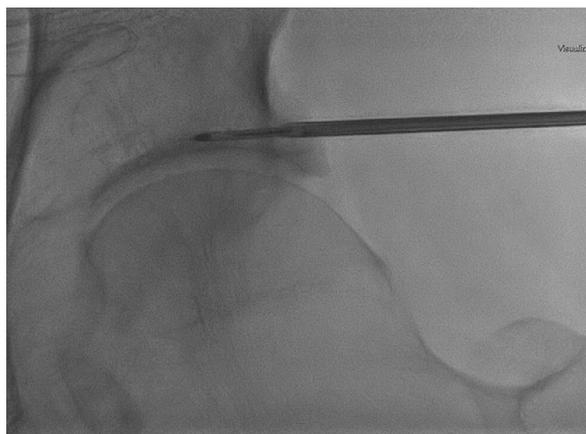


Fig. 6 – Fluoroscopic image showing cryoprobe inserted through the Jamshidi needle reaching the osteoid osteoma.

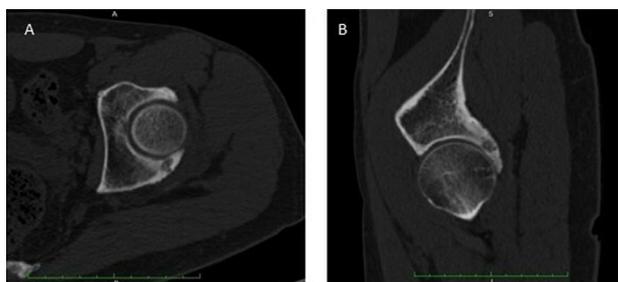


Fig. 7 – Axial (A) and Sagittal (B) CT images after 2 months from the ablation procedure. Nidus no longer recognizable.

Postprocedural CT examination, performed after 2 months revealed the complete disappearance of central nidus, with a residual surrounding sclerotic reactive bone (Fig. 7).

After a period of 6 months, no recurrence of symptoms was reported by the patient.

Discussion

Osteoid osteoma is a benign bone tumor, described for the first time by Jaffe in 1935 [3]. It represents 10%-12% of benign bone tumors; it usually affects individuals during the first 3 decades of life, with predominance in males [4]. It is characterized by the presence of a central hypervascular nidus which may calcify and a mixture of mineralized osteoid spans whose size does not exceed 15 mm. An osteosclerosis reaction may surround the nidus.

Osteoid osteoma usually localizes in the diaphysis of long bones near the metaphyseal junctions, especially in lower limbs [5]. Clinical characteristics are night pain relieved by salicylates. In our case, the symptoms were typical and associated with lameness. The pain is probably related to high levels of prostaglandins in the nidus [6].

Conventional radiographs can show intracortical lacuna, containing sometimes a punctuated matrix surrounded by a sclerotic reaction. In juxta-articular forms, the peripheral reaction is low and there is often a synovial thickening revealing intra-articular effusions, which can mislead the diagnosis [7]. In the case of our patient, plain radiographs did not highlight the lesion.

CT is the gold standard for diagnosis because it provides thin sections of 1-2 mm thickness [8] and, in this case, confirmed the diagnosis of osteoid osteoma.

The use of MRI can be justified especially in cases of unusual localizations, such as juxta-articular or intramedullar. With MRI not only the nidus but also the inflammatory reactions in the bone marrow and surrounding soft tissue can be depicted. The use of dynamic sequences after gadolinium injection improves the sensitivity of MRI (92%) making it similar to that of CT [9].

Treatment of osteoid osteoma is usually surgical. Bloc resection has been the standard therapy for the past several years. Issues in the nidus identification with imaging techniques, result in a wide bone resection compared to the small size of the lesion. Open surgical treatment is effective when the nidus is resected completely, but remains a relatively invasive technique weakening the bones, especially long bones, which can imply the use of bone graft or internal fixation osteosynthesis and postoperative immobilization [10].

Percutaneous treatment of osteoid osteoma is gradually replacing surgery due to advances in CT imaging techniques and development of percutaneous surgery tools which are applicable in the vast majority of locations of osteoid osteoma. These tools, such as the XperGuide system we used, allow intraoperative control of needle placement with high accuracy, lower complication rates, faster recovery, radiation dose reduction, and probably a reduction in recurrences [11].

XperGuide enables the operator to see the trajectory of the needle in real-time along a user-defined trajectory. The live fluoroscopic image is superimposed on the images of the soft tissues and constitutes a live 3D guide.

It is possible to plan the needle trajectory in 2 ways: drawing a virtual trajectory or defining the entry and arrival points on different XperCT, RM, or TC layers. XperGuide automatically calculates the optimal arc projections and parallax. It also supports multiple needle trajectories. XperGuide also

adapts in real-time to changes in angulation and rotation of the C-shaped arc, of the field of view and of the source-image distance.

The mean fluoroscopy time was 4.3 minutes, with a DAP of 13.4 Gy*cm².

This finding, according to the literature [12], demonstrate that cryotherapy under fluoroscopic guide, using the Xper-Guide system expose the patient to a reduced radiation dose compared to traditional CT systems compared to conventional CT.

Histological evidence of the presence of a nidus within the resected bone core is reported in 50%-100% of cases [13].

Pain usually disappears after 24 hours in most cases, but it may persist for a month [14]; in this patient we had a complete disappearance of pain after 36 hours.

Conclusion

Cryotherapy under fluoroscopy with the new XperGuide system can be considered a useful tool for the treatment of osteoid osteoma because of the combination of real-time needle orientation and spatial resolution. It allows perioperative control with high precision, lower complication rates, low x-ray radiation dose [12] and reduced postoperative times for recovery.

REFERENCES

- [1] Greenspan A. Benign bone-forming lesions: osteoma, osteoid osteoma, and osteoblastoma. *Skeletal Radiol* 1993;22(7):485–500. doi:10.1007/BF00209095.
- [2] Noordin S, Allana S, Hilal K, Nadeem N, Lakdawala R, Sadruddin A, et al. Osteoid osteoma: contemporary management. *Orthop Rev (Pavia)* 2018;10(3):7496 eCollection 2018 Sep 5. doi:10.4081/or.2018.7496.
- [3] Jaffe HL. Osteoid-osteoma: a benign osteoblastic tumour composed of osteoid and atypical bone. *Arch Surg* 1935;31:709Y728.
- [4] Lucas DR. Dahlin's bone tumors: general aspects and data on 11,087 cases. *Am J Clin Pathol* 1996;106(5):693. doi:10.1093/ajcp/106.5.693.
- [5] Wu Bin, Xiao Yue-Yong, Zhang Xiao, Zhao Lei, Carrino John A. CT-guided percutaneous cryoablation of osteoid osteoma in children: an initial study. *Skeletal Radiol* 2011;40:1303–10. doi:10.1007/s00256-011-1119-1.
- [6] Mungo DV, Zhang X, O'Keefe RJ, Rosier RN, Puzas JE. Schwarz EM COX-1 and COX-2 expression in osteoid osteomas. *J Orthop Res* 2002;20(1):159–62.
- [7] Dookie AL, Joseph RM. Osteoid osteoma. *StatPearls, Treasure IslandFL: StatPearls Publishing; 2019. 2019 Jan 22. PMID:30725964.*
- [8] Mellado-Romero MA, Vilá-Rico J, Gallego-Herrero C, Sánchez-Herraéz S, Casas-Ramos P, Santos-Sánchez JA, et al. Diagnosis and treatment of hindfoot osteoid osteoma: a therapeutic method for each case. *Rev Esp Cir Ortop Traumatol* 2019 pii: S1888-4415(19)30006-2. doi:10.1016/j.recot.2019.01.004.
- [9] Liu PT, Chivers FS, Roberts CC, Schultz CJ, Beauchamp CP. Imaging of osteoid osteoma with dynamic gadolinium-enhanced MR imaging 1. *Radiology* 2003;227(3):691–700. doi:10.1148/radiol.2273020111.
- [10] Orth P, Kohn D. Diagnostics and treatment of osteoid osteoma. *Orthopade* 2017;46(6):510–21. doi:10.1007/s00132-017-3428-0.
- [11] Roqueplan F, Porcher R, Bousson V, Zouari L, Younan T, Hamzé B, et al. Résultats a long terme du traitement par résection percutanée et photo-coagulation au laser interstitiel des ostéomes osteoides. *J Radiol* 2005;86(10):1372–3. doi:10.1016/S0221-0363(05)75599-2.
- [12] Perry Brandon C, Monroe Eric J, McKay Tyler, Kanal Kalpana M, Shivaram Giridhar. Pediatric percutaneous osteoid osteoma ablation: cone-beam CT with fluoroscopic overlay versus conventional CT guidance. *Cardiovasc Intervent Radiol* 2017;40(10):1593–9 Epub 2017 May 11. doi:10.1007/s00270-017-1685-2.
- [13] Parlier-Cuau C, Nizard R, Champsaur P, Hamze B, Quillard A, Laredo JD. Osteoid osteoma of the acetabulum three cases treated by percutaneous resection. *Clin Orthop Relat Res* 1999;365:167–74. doi:10.1097/00003086-199908000-00022.
- [14] Miyazaki Masaya, Saito Kenichi, Yanagawa Takashi, Chikuda Hiroataka, Tsushima Yoshito. Phase I clinical trial of percutaneous cryoablation for osteoid osteoma. *Jpn J Radiol* 2018;36:669–75. <https://doi.org/10.1007/s11604-018-0768-6>.