TITLE : DOPPLER DUPLEX COLOR IN THE DIAGNOSIS OF OSTEOID OSTEOMA.

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Abstract: We present two cases of osteoid osteomas in a 16 and 17 year- boys at the proximal metaphysis in the left tibia and femoral diaphysis. Doppler duplex color study demonstrated clearly the highly vascular nidus and its feeding artery in one of them, and only its feeding artery in the second. We believe that they are the first cases in the literature of osteoid osteomas essessed with Doppler duplex color, which also was used as guidance for the percutaneous biopsy or localization.

Key words: Osteoid osteoma. Ultrasound. Doppler duplex. Color Dppler.

Introduction

Osteoid osteoma is a distinctive benign lesion of unknown origen, which contains a highly vascular central nidus, surrounded by a zone of reactive sclerosis(1).

Its radiographic features in plain film, computed tomography, angiography, scintigraphy and magnetic resonance imaging have been widely described in the literature, however, the ultrasound characteristics of this tumor, as in other bone lesions, have hardly been described.

We report the color Doppler characteristics of two osteoid osteomas, which in our knowledge, have not been described so far in the literature

Cases report

Case 1:

A 16 year-old boy, otherwise in good health, with a 2-month history of chronic pain in his left popliteal space. This pain was slightly worse at night and partially relieved with non-steroid antiinflamatories. On physical examination the patient had a moderate limitation at flexion in his left knee. Plain film radiogram showed a one-centimeter radiolucent oval cortical lesion in the posterior margen of the proximal metaphysis of the left tibia, with scarce surrounded sclerosis (fig.1A). Computed

tomography depicted better the same findings: a small subperiostial lytic lesion with mild peripheral sclerosis, expending slightly the thin cortical without breaking it (Fig. 1B). Magnetic resonance imaging, on T2 weighted image, showed a lytic cortical isointense image with large peripheral edema(fig.1C).

Comparative ultrasound examination of the popliteal area was perfomed, and an irregularity of the cortical bone, surrounded by an echogenic area due to edema was observed (fig. 1D).

In color Doppler duplex study an evident Doppler signal was found within the cortical irregularity with clear arterial flow(fig. 1E).

Ultrasound guided percutaneous biopsy was performed and osteoid osteoma was the diagnosis(fig.1F). The histological diagnosis was comfirmed at surgery.

Case2:

A 17 year-old boy, complained about diffuse pain in his left knee. An IRM of both knees was performed and considered normal. The patient continued with his complaints but refered to a more cranial level, a plain film of both legs was carried out and an extensive sclerosis on the lateral margin of his left femoral metaphysis, with a small notch in its center was found. (fig. 2A) .CT scanner depicted an important sclerotic reaction at the mentioned area, with a 3mm. size nidus in it. On

comparative ultrasound scanner study, we could see an irregular cortex in the affected area and an interruption of the cortical corresponding to the notch observed at the plain film (fig. 2B). On the Doppler duplex color study we observed an arterial vessel entering into the notch. The spectral characteristics were exactly as in the previous case(fig. 2C). We could not see the nidus or surrounding edema.

An ultrasound guided wire localization of the notch was performed,(fig. 2D) in order to facilitate finding it at surgery and, in this way, decrease the ablation of normal bone. The pathologist confirmed the presence of osteoid osteoma.

Discussion

Osteoid osteoma is a common benign bone tumor which was first identified as a distinctic pathologic entity by Jaffe in 1935(2).

Osteoid osteoma represents approximately 10% of all benign bone tumors. It consists of a well-vascularized nidus, size ranged between 0.5 and 2.0 cm., of connective tissue and interlacing trabeculae of osteoid and calcified bone surrounded by osteoblasts. Reaction of surrounding bone is variable(3).

It occurs more commonly in males than females in an aproximate proportion of 2:1. Most osteoid osteomas appear in the first three decades of life, with aproximately 75 per cent occurring in the period from 5 to 20 years, as in our cases(4).

Typically the patients complain about dull pain, worse at night, that often disappears almost instantly after administration of salicylates(3).

More than half of these tumors are located in the femur and tibia. When located in long bones, more than half are diaphyseal; metaphyseal localization is not uncommon(3,4).

The radiological features include a lytic lesion, nidus, it is small and varies in size from 1 to 15-20 mm. Larger lesions are considered osteoblatomas(3,4). The nidus contains some mineralization in more than half of the cases. However in more than one third of cases, it is completely osteolytic(3). Reactive sclerosis is almost invariably present when the lesion is cortical. Nevertheless, this reactive sclerosis and periostitis may be minimal or non-existent, especially in intracapsular and subperiostal tumors as in the first case(3-7).

Display intraosseous and extraosseous edema and synovitis is a feature of osteoid osteoma moreover when they are located close to or within joints, these characteristics can be assessed on magnetic resonance imaging(7,8) or on ultrasound scan(9), as we could see in case 1.

The nidus is typically highly vascular, as a result of this marked vascularity a hypertrophic artery feeds the nidus. This characteristic has been used to demonstrate and diagnose osteoid osteoma on angiography and scintigraphy.

Due to the capability of the Doppler study to recognize vascular flow, this technique could be used, in these cases to assess the vascularity of the nidus or its feeding artery.

In the first case, the Doppler signal was able to depict clearly, not only the feeding artery, but also the nidus itself. This clear Doppler signal within the nidus was probably due to the very peripheral location and the thin margin of the nidus.

In both cases, we performed comparative Doppler- duplex color ultrasound scan at the contralateral area, and we did not observe a bone feeding artery which could confuse the pathologic artery that feeds the nidus.

We did not perform any measurement such a peak systolic or telediastolic velocity, as well as any index, however the morphology of the spectral analysis showed an arterial flow of middle resistivity in both cases.

Identifying the highly vascular nidus or the feeding artery can help make differential diagnosis with other lesions which can mimic osteoid osteoma, such as Brodie's abscess and Langenhans cells granuloma(3), where the central vascular area does not exist.

We have studied another 2 cases with radiological image and symptoms which could correspond to an osteoid osteoma in which an exhaustive Doppler duplex color study failed to find any pathologic vessels or flow within the suspicious image of

nidus. The final diagnosis were osteomielitis and fibrous cortical defect.

In conclusion, due to the ability of the color Doppler duplex ultrasound scan to detect subtle changes in the vascular flow, that typically occur in the osteoid osteoma, this technique can be used in diagnosis and guide percutaneous treatment of osteoid osteomas, especially of the peripherally located. More experience is needed to demonstrate the usefulness of this technique in detecting and diagnose osteoid osteoma. We encourage radiologists to use this cheap, non-invasible and free of radiaton technique in similar lesions to those described previously.

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Captions for illustrations

Fig. 1(case 1) **A** Conventional radiograph shows a geographic radiolucent lesion(arrows) in the posterior marge of the left proximal metaphysis tibial. **B** Plain CT scan shows a one-centimeter well-defined lytic cortical lesion, with scarce surrounding sclerosis. The cortex was sligtly bulky but not

broken. **C** Axial T2 weighted MR image (TR/TE= 825/25, FA25º) shows isointense cortical lesion with peripheral hiperintense tissue due to edema. **D** Comparative sagital Us scan of the both poplital espace. On the left one, we can see irregularity of the cortex, the echogenic area represents intense peripheral edema. **E** Doppler duplex color study shows a arterial spectral imaging within the nidus. **F** Percutaneous needle(arrows) biopsy was performed with ultrasound guidance.

Fig. 2(case 2). **A** Plain film of left tight showed an large sclerosis at the metaphysis with a small notch (arrows).**B** Ultrasound scanner: irregular cortex of the metaphysis of the left femur with a notch (arrows). **C** Doppler duplex color analysis domonstrated an arterial vessel entering the notch (arows). **D** Wire localization ultrasound guided, radiological verification.