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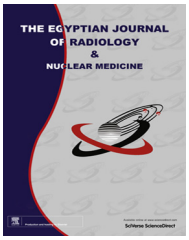

ORIGINAL ARTICLE

Factors affecting time to pain relief in patients with osteoid osteoma treated by computed tomography (CT)-guided percutaneous radiofrequency ablation (RFA)

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KEYWORDS

Computed tomography (CT)-guided percutaneous radiofrequency ablation (RFA);
Osteoid osteoma (OO);
Pain relief;
Sclerosis;
Visual analogue scale (VAS)

Abstract *Background:* Osteoid osteoma (OO) is a readily treatable, painful benign bone tumor that preferentially afflicts young patients. Computed tomography (CT)-guided percutaneous radiofrequency ablation (RFA) treatment has been accepted since 1992 as a noticeably safe and minimally invasive treatment option for OO.
Objective: To prospectively analyze the factors that may affect time to pain relief post CT-guided percutaneous RFA treatment of OO. These factors include patient's age, sex, amount of sclerosis surrounding the nidus, the relation to nearby joint and the number of muscles that have to be traversed.
Materials and methods: This study was conducted on 30 patients diagnosed to have OO on the basis of clinical and radiological criteria. All patients were treated by CT-guided percutaneous RFA. Pain was evaluated after the procedure daily for one week using a visual analogue scale (VAS) with 0 denoting no pain and 10 the worst pain imaginable. Moreover, time to pain relief was analyzed in relation to patient's age and sex, the amount of sclerosis surrounding the nidus, the relation to nearby joint and the number of muscles that have to be traversed to reach the lesion.
Results: There was a highly significant statistical difference ($p = 0.001$) between the mean time to pain relief in OOs with variable amount of sclerosis surrounding the nidus. On the contrary, there was no significant statistical difference considering patient's sex ($p = 0.654$), relation to nearby joint ($p = 1.0$) or number of muscles that have to be traversed ($p = 0.108$) in relation to time to pain relief. Considering patient's age, there was a significant positive correlation ($p = 0.013$) and ($r = 0.446$) between patient's age and time to pain relief. In addition, there was a highly significant positive correlation ($p = 0.0001$) and ($r = 0.636$) between the amount of sclerosis surrounding the nidus and time to pain relief. Eventually, the amount of sclerosis surrounding the nidus was shown to be a highly significant independent factor affecting time to pain relief.

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Conclusion: The amount of sclerosis surrounding the nidus of osteoid osteoma is the most effectual factor for time to pain relief post CT-guided percutaneous radiofrequency ablation treatment.

1. Introduction

Osteoid osteoma (OO) is a painful benign bone tumor of the young (1). It can affect any bone (2). The condition was first described in 1930 by Bergstrand (3) and Jaffe (4) first characterized osteoid osteoma as a discrete clinical entity in 1935. Osteoid osteoma is the third most common benign bone tumor (5) representing approximately 12% of benign bone tumors (6).

Surgery, conservative treatment with non-steroidal anti-inflammatory drugs (NSAIDs) and percutaneous interventions are potential options for the treatment of OO. Surgery is frequently associated with major morbidity and a prolonged period of recovery (especially after en-bloc resection of osteoid osteoma in weight bearing bones), while, long-term drug administration may result in gastrointestinal side effects and is not well tolerated by patients (7).

Alternatively, Rosenthal et al. (8) described in 1992 the first successful clinical application of computed tomography (CT)-guided radiofrequency ablation (RFA) in the treatment of osteoid osteoma. RFA aims at the precise delivery of heat to the target tissue. High-frequency alternating current transmitted through the radiofrequency ablation electrode induces local ionic agitation and frictional heat resulting in coagulation necrosis (9). Currently, CT-guided RFA has been accepted as a demonstrably safe, minimally invasive and cost-effective treatment for OO (10).

There are many studies assessing the clinical outcome of CT-guided percutaneous RFA in osteoid osteoma. Nevertheless, to the best of our knowledge, there is lack of studies concerning the factors affecting time to pain relief post CT-guided RFA treatment of osteoid osteoma. To target this veiled issue, we aimed in this study to analyze the following factors in relation to time to pain relief: patient's age and sex, the amount of sclerosis surrounding the nidus, the relation to nearby joint and the number of muscles that have to be traversed to reach the lesion.

2. Materials and methods

2.1. Patients

This prospective study was conducted from April 2012 to June 2014 in which 30 eligible consecutive patients were enrolled. These patients were diagnosed to have OO on the basis of clinical and radiological criteria. The clinical criteria included focal bone pain at the tumor site that was worse at night and pain relief after administration of oral non-steroidal anti-inflammatory drugs (NSAIDs) (e.g., aspirin). This was in addition to joint functional impairment in the form of decreased range of movement if the lesion was related to nearby joint. The typical radiological criteria comprised clear depiction of a radiolucent nidus equal to or smaller than 1.5 cm in diameter with surrounding bony sclerosis and cortical thickening on CT (Fig. 1).

The exclusion criteria in this study were diagnoses other than OO and insufficient patient data. Additionally, patients who had previously undergone surgical procedures for the lesions were excluded from our study and patients with lesions located in the hand or in the posterior neural arch of the vertebrae were excluded because of the risk to injure the adjacently located neural structures. We did not perform biopsy prior to or during the RFA procedure. Our study protocol was approved by the Committee of Ethics. All patients or their legal guardians gave written informed consent after extensive explanation of the planned therapeutic intervention.

2.2. CT-guided percutaneous RFA technique

Before the procedure, we confirmed that prothrombin time and international normalized ratio (INR) obtained within 24 h of the procedure were normal. All patients underwent physical examination immediately prior to treatment to determine the site of focal bone pain. An anesthetist's evaluation was also carried out. For lesions in lower limbs, RFA was performed under spinal anesthesia, whereas, general anesthesia was preferred for lesions in upper limbs. Dispersive grounding pads were applied on the patient's thighs, in proper alignment with each other and with good skin contact; both pads were placed at approximately equal distance from the site of ablation and as close to the ablation site as possible so as to allow the shortest current path through the patient. Towels were placed between the trunk and the patient's arms on either side and between the legs to reduce the risk of skin to skin contact burns.

All RFA procedures were performed in the CT room under CT guidance (Hi-Speed CT system, GE Medical Systems). Patients were positioned on the CT table in a prone, oblique

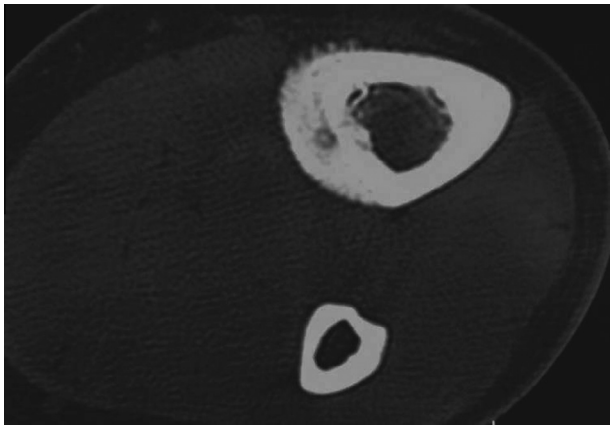

Fig. 1 Axial CT of the leg shows a cortical osteoid osteoma located along the posterior aspect of the tibia with a clearly seen radiolucent nidus surrounded by marked sclerosis and thickened cortex.