J Shoulder Elbow Surg (2014) 23, e1-e7

ELSEVIER

Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

Treatment of osteoid osteoma of the elbow by radiofrequency thermal ablation

Ugo Albisinni, MD[a], Alberto Bazzocchi, MD, PhD[a,b], Graziano Bettelli, MD[c], Giancarlo Facchini, MD[b], Emanuela Castiello, MD[c], Michele Cavaciocchi, MD[c], Giuseppe Battista, MD[b], Roberto Rotini, MD[c,*]

[a]*Diagnostic and Interventional Radiology, Rizzoli Orthopaedic Institute, Bologna, Italy*
[b]*Department of Specialized, Diagnostic, and Experimental Medicine, University of Bologna, Sant'Orsola–Malpighi Hospital, Bologna, Italy*
[c]*Shoulder and Elbow Surgery Unit, Rizzoli Orthopaedic Institute, Bologna, Italy*

Background: This article presents the experience at the Rizzoli Orthopaedic Institute in the treatment of intracapsular osteoid osteoma (OO) of the elbow by computed tomography–guided percutaneous radiofrequency thermal ablation (RFA).
Materials and methods: Our team performed more than 800 RFA procedures to treat OO up to 2010. In 27 cases, the lesion site was the articular area of the elbow (humerus in 13 cases, ulna in 13, and radius in 1). These patients were reviewed and assessed for eradication rate, incidence of complications, and functional results measured by the Mayo Elbow Performance Score. The outcome was evaluated after a mean follow-up period of 67.4 ± 35.3 months (range, 24-128 months).
Results: The mean duration of symptoms at the time of diagnosis was 31.0 ± 19.8 months (range, 5-72 months). All patients complained about pain, and in 24 of 27 cases (88.8%), the joint function was significantly impaired by the presence of OO (pretreatment score, 54.8). After RFA, the Mayo Elbow Performance Score improved by a mean of 37.7 ± 14.8 points, with 25 of 27 patients (92.5%) scoring 90 to 100 points at final follow-up. OO recurred in only 1 patient (3.7%), 5 months after the procedure. However, this was successfully retreated by RFA. No adverse effects were observed, and all patients were free of disease at the final follow-up.
Discussion: The RFA procedure can be technically challenging in difficult sites such as the elbow joint. The low invasiveness of RFA compared with traditional surgery allows excellent functional recovery. RFA of elbow OO is effective and safe, and it should be considered the first-choice treatment for this disease.
Level of evidence: Level IV, Case Series, Treatment Study.

Keywords: Osteoid osteoma; RFA; elbow; benign bone lesion; treatment efficacy; elbow pain

Osteoid osteoma (OO) is a benign osteoblastic tumor that was first described by Jaffe[15] in 1935. Histologically, it consists of a central core of highly vascularized and innervated connective tissue with a diameter usually ranging from a few millimeters to 1.5 cm.[5] It contains a

The study was approved by the Ethical Committee of the Rizzoli Orthopaedic Institute.

*Reprint requests: Roberto Rotini, MD, Shoulder and Elbow Surgery Unit, Rizzoli Orthopaedic Institute, Via G. C. Pupilli 1, I-40136 Bologna, Italy.
E-mail address: roberto.rotini@ior.it (R. Rotini).

1058-2746/$ - see front matter © 2014 Journal of Shoulder and Elbow Surgery Board of Trustees.
http://dx.doi.org/10.1016/j.jse.2013.08.011

variable amount of osteoblastic cells and a peripheral thin or thick area of dense bone.[15,23,30]

OO represents about 10% of all benign bony lesions. In about 70% of cases, it appears in the long bones, mainly in the diaphysis or the proximal metaphyseal area, typically at the femur or tibia. It is found in the bones of the hands and feet in 20% of cases and in the vertebrae in 10%. The elbow location is considered to be rare, accounting for about 3% of all OOs.[3,5]

The typical age of presentation is between 7 and 25 years; however, OO also can be diagnosed in middle-aged and elderly patients, even in the eighth decade of life.[41] The male-female ratio is about 2.5:1 to 3:1.[5,9]

The characteristic clinical feature of OO is a sharp pain, mainly at night, that usually disappears 20 to 30 minutes after administration of systemic nonsteroidal anti-inflammatory drugs (eg, aspirin). Other potential symptoms include swelling and tenderness in the surrounding soft tissues.[14] The clinical manifestation and limitations in the activities of daily living can vary according to the location of OO. When it occurs intra-articularly (inside the articular capsule), the patient complains about joint pain, joint effusion, synovitis, and decreased range of movement. Intracapsular lesions often determine a strong inflammatory reaction that can mimic an erosive arthropathy, crystal arthropathy, or septic arthritis. These features of ''articular OO'' are all present in cases in which OO is located in the elbow, with an intense synovial reaction determining a progressive painful reduction of active and passive flexion, extension, pronation, and supination.

Delays in establishing the correct diagnosis can therefore be conspicuous.[10,41] The orthopaedic surgeon should bear in mind the possible diagnosis of OO in a young patient with continuous elbow pain associated with functional impairment, restricted range of motion, and negative radiographic findings. In these cases, we think that before one accepts a generic diagnosis of rheumatic disease or nonspecific synovitis, a thin-slice computed tomography (CT) scan should be performed. CT represents the modality of choice for detecting OO and generally provides the best characterization of both the nidus and the surrounding cortical sclerosis.[16] A bone scan shows intense activity at the site of the nidus and relatively decreased activity in the surrounding reactive zone. On magnetic resonance imaging (MRI), the signal in the nidus typically is isointense to that of muscle on T1-weighted images and is variable on T2-weighted images. However, the imaging findings may be nonspecific (nidus not clearly seen on magnetic resonance sequences) and may mimic other diseases (stress fracture or osteomyelitis). Dynamic MRI with the use of gadolinium may provide increased overall diagnostic accuracy in cases with indeterminate findings on CT or plain MRI.[19]

In the past few decades, the use of surgery in the treatment of OO in many anatomic sites has been progressively replaced by less invasive CT-guided percutaneous procedures. A reduction of invasiveness is desirable in all OO locations but especially when OO occurs in joints and other challenging sites.[27] In 1992, Rosenthal et al[31] were the first authors to introduce radiofrequency thermal ablation (RFA) for treatment of OO, with excellent results. Since then, this procedure has gained more credit and its use has been extended to the treatment of other lesions[20,22,34,35] and in children.[1] In the years 2002 through 2010, about 800 patients underwent RFA for OO of all sites at the Rizzoli Orthopaedic Institute. This article presents the experience in the treatment with RFA of OO in the rare elbow location.

Materials and methods

Between March 2002 and July 2010, 27 patients affected by OO of the elbow were treated by RFA. In our series of about 800 OO cases, the elbow location represents about 4% of all cases (unpublished data, U. Albisinni, December 2012).

We included OO of the distal humerus, proximal radius, or proximal ulna when the lesion was intracapsular. The diagnosis of OO was suspected on the basis of the clinical history and presentation and was confirmed by imaging studies (radiograph, bone scan, thin-slice CT, and MRI). CT was performed to confirm the imaging diagnosis (Fig. 1). In all cases, a needle biopsy was performed at the same time as thermal ablation to obtain histologic proof of the lesion.

We considered each patient's clinical evaluation findings and collected the Mayo Elbow Performance Score (MEPS), which attributes a maximum of 45 points for pain, 20 for motion, 10 for stability, and 25 for function related to activities of daily living.

The treatment was preferably administered with the patient under regional anesthesia with an interscalene block. General anesthesia was used only in a few adolescents (4 patients) and in poorly cooperating patients (1 patient).

The thermal ablation procedure is performed under CT guidance (GE Healthcare, Milwaukee, WI, USA). After CT scan, the procedure is planned: the pathway, target point, and length of the active tip are determined. To target the OO nidus, we use the Bonopty set (Radi MS, Uppsala, Sweden) and Kirschner wire inside the 18-gauge needle as a guide. Before starting RFA treatment, we always try to obtain a biopsy sample, preserving the OO capsule (this is able to reflect the RFA and therefore to protect the surrounding structures and enhance the thermal effect inside). We place the electrode, with an active tip chosen according to the size, at the location of the lesion and position the needle electrode inside the nidus (monopolar, non-refrigerated [SMK; Radionics, Burlington, MA, USA]). Afterward, radiofrequency is gradually administered with a radiofrequency generator (RFG-3C; Radionics); the target temperature (85°C-90°C) is reached progressively to avoid or to reduce tissue carbonization (Table I, Fig. 2). During RFA, ice is placed around the trocar to avoid possible heating lesions of the subcutaneous and cutaneous layers at the most superficial OO location. To allow a faster recovery from the intense synovial reaction and to improve consequent functional recovery, we administer a slow-release steroid medication (triamcinolone acetonide, 40 mg; 1-3 mL) through the same trocar in an intracapsular manner.

At the end of the procedure, the needle and trocar are retrieved and the wound is cleaned and closed with sterile strips. Regional