Rf ablation for treatment of osteoid osteoma in pediatric patients: Our experience and literature review

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Learning objectives

To highlight the usefulness of RFA to treat osteoid osteoma, demonstrating its safety and efficacy even in pediatric patients.

We report our experience and a literature review.
Background

Osteoid osteoma, a benign osteoblastic tumor tumour of the bone; characterized by an intracortical nidus, accompanied by cortical thickening and reactive sclerosis.

It is the third most common primary benign bone tumour, representing approximately 10-12% of benign bone tumours [1, 2]

The femoral and tibial metaphysis and diaphysis are affected most commonly, but multiple other anatomic locations have been reported [3,4,5].

It generally affects children and young adults. Approximately 80% of patients are between 5 and 24 years of age, with a male:female ratio of 3:1[2]

Osteoid Osteoma causes a dull, aching pain that can become severe, especially at night; this pain improves with NSAID's and the responsiveness to salicylates is suggestive of OO [3]

Patients who cannot tolerate the symptoms or nonsteroidal antiinflammatory drugs require intervention for pain relief and/or to prevent growth disturbance.[2]

Treatment involves three options:

1 Medical therapy: aspirin or other nonsteroidal-anti-inflammatory-drugs; it is a symptomatic treatment (pain recurs as soon as the medication is discontinued)

PROS:

- frequently provide effective pain control [1, 6]

CONS:

- not all patients respond
- contraindications to this therapy
- side effects and lack of response for long-term therapies

2 Surgical management: has historically been the treatment of choice for osteoid osteoma; but during open surgery the nidus of the tumour is often difficult to visualize and to prevent recurrence a wide resection margin may be required resulting in many complications

PROS:
- success rates of 88%-97% for en bloc open resection [7, 8, 9]

**CONS:**

- incomplete removal for failure localization
- surgery-related complications: haematoma, infection, and fracture [10]
- risk of pathological fractures (that may need internal fixation and bone grafting)
- long period of hospitalization (the average postoperative hospital stay is 3-5 days [7])
- delayed resumption of physical activity (weight-bearing on the affected limb is limited for 1-6 months after surgery) [7, 11]

**3 RF ablation therapy:** since Rosenthal et al. [7] reported the first percutaneous thermal ablation (PTA), several clinical trials have reported success rates close to 100 %, thus making PTA the treatment of choice

**PROS:**

- high success rates
- very low rate of complications: skin burn [12]
- hyperthermia, wound infection [2]; neural injury is of particular concern in spinal and hand osteoid osteoma [2, 6]

**CONS:**

- radiation exposure (Limiting radiation exposure is especially advantageous in the pediatric population) [13]
- incomplete response after a session (need of repositioning of the needle and performing multiple coagulations) [14, 15, 16]
- need to repeat the treatment (large osteomas tend to recur if not ablated completely) [17, 18]
- clinical success rate in children is lower than in patients with a wider range of age; as suggested by Vanderschueren et al. [19]
Findings and procedure details

Before to proceed to RFA treatment patients must be studied with imaging technics such as:

- **Radiographs**: a circular or ovoid cortical lucency representing the nidus (usually less than 1.5 cm in diameter) with a variable degree of surrounding sclerosis.

- **Computed Tomography (CT)**: the modality of choice for detecting osteoid osteoma; generally provides the best characterization of both the nidus and the surrounding cortical sclerosis [20] (Fig.1).

- **Magnetic Resonance (MR)**: nidus signal typically is isointense to that of muscle on T1-weighted images and is variable on T2-weighted images; signal hyperintensity is seen in the surrounding reactive zone on T2-weighted or short inversion time inversion-recovery images (imaging findings may be nonspecific) [6].

According to data literature all the procedures were performed under general anesthesia or deep sedation:

- Lesions were localized with CT guidance and the route planned so as to avoid nerve, vascular, and visceral structures;

- Each lesion did not exceed 1 cm of diameter;

- The skin entry point was disinfected and a sterile strip positioned;

- Local anesthesia (1% lidocaine) was performed with a fine needle (22 g) (Fig.2);

- A coaxial approach was used: a Kirschner wire (2 mm of diameter) was advanced until the cortical bone and with a drill was hole the cortical and reach the nidus (Fig.3);

- With a "custom made" plastic coaxial system the Kirschner wire was removed and an RF needle 17g was inserted in the plastic cannula, then the plastic cannula was withdrawn slightly so that its tip is at least more than 1 cm above the bare tip of the RF electrode; target ablation temperature was approximately 90°C with ablation time ranges from 4 to 6 min. (Fig.4).

- In 1 pz before RF ablation a 18 g biopsy needle was used (although OO often has characteristic clinical and imaging findings, other neoplastic and non-neoplastic conditions may have similar manifestations; hence, a biopsy of the lesion should be performed to help confirm the diagnosis and direct subsequent treatment [6]).
In our series no major or minor complications occurs, neither acute, as demonstrated by immediate CT scan after treatment (Fig.5) (patients were discharged after 1 day) nor delayed (clinical and imaging follow-up: 6 to 12 months).
Images for this section:

![Image](image_url)

**Fig. 1:** 12 years old woman with tibial osteoid osteoma 3mm of diameter

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Fig. 2: With CT guidance with a fine needle was performed local anesthesia

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Fig. 3: It is advanced a Kirschner wire until the cortical bone and with a electric drill has been perforated

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Fig. 4: With a coaxial system it was removed the Kirschner wire and replaced with RF needle 17 G. They were performed two sessions of ablation for 5 and 4 minutes each.

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**Fig. 5:** Immediate CT scan after treatment shows the track left by the needle

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Conclusion

Our experience, despite limited by the low number of patients, confirm the value of RFA in pediatric patients.

This approach allows to obtain a good clinical response reducing the risks, complications and hospitalization time related to surgery; thus allowing the young patients a faster recovery of normal daily activity.
References


