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RADIOFREQUENCY ABLATION IN OSTEOID OSTEOMA – A CASE REPORT

Orthopaedics

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ABSTRACT

Objective: Few cases of osteoid osteoma have been reported in literature till date. **Case Report:** We report a case of a 23-year-old housewife with osteoid osteoma involving sacroiliac joint presenting with pain over right buttock. The patient was treated with radiofrequency ablation of the osteoid osteoma and showed resolution of symptoms at 1 month follow-up. **Conclusion:** Radiofrequency ablation of osteoid osteoma results in thermal destruction of tumour tissue under precise guidance of CT scan becomes an easy and safe procedure.

KEYWORDS

Osteoid osteoma, sacroiliac joint, radiofrequency ablation. We are reporting this case being a rare anatomical location and preference of radiofrequency ablation over surgical excision.

INTRODUCTION

Osteoid osteoma is a benign bone tumour of undetermined etiology firstly described by Jaffe in 1935. Osteoid osteoma is a benign bone-forming tumor with hallmark of tumor cells directly forming mature bone. Osteoid osteoma accounts for around 5% of all bone tumors and 11% of benign bone tumors with a male predilection [(1)]. Osteoid osteoma accounts for 2-3% of all bone primary tumours with an incidence of 10-12% among all benign skeletal neoplasms. It is more frequent in adolescents and young adults with 50% of patients being aged between 10 and 20 years and it predominates in male, with a reported male-to-female ratio of 4:1[(2)]. Clinical presentation can vary depending on the location of the lesion.

Their presence has been reported in practically all the bones of the skeleton, including the cranium, face and spine. They only rarely occur in the pelvis: just 1 to 3% of all cases are located in this region, and the majority of pelvic lesions are found in the acetabulum. Alternatively, it may present with growth disturbances, bone deformity, painful scoliosis, and if located within a joint capsule, there might be joint effusion, synovitis, restricted joint motion, or contracture [(3)]. Macroscopically, they are characterized by a friable vascular niche (nidus) with sandy consistency, surrounded by sclerotic bone in association with thick vascular periosteum. Microscopically, the nidus consists of osteoid tissue, with vascular stroma surrounded by dense bone. The diagnosis can be made by means of simple radiography in 75% of the cases. The typical image comprises a nidus that appears in the form of a small oval or rounded focus that is generally radiotransparent. This is surrounded by a zone of variable density corresponding to reactive bone sclerosis and, on some occasions, this zone may be very intense and cause difficulty in viewing the nidus [(2)]. In such cases, bone scintigraphy, computed tomography or magnetic resonance can be used to determine the exact location of the nidus. Tc 99 scintigraphy is highly sensitive for detection of osteoid osteoma and a negative, scintigraphy should prompt a MR evaluation to look for other causes [(2)]. The typical clinical evolution is characterized by pain, predominantly during the night, probably because of increased synthesis of prostaglandins triggered by the tumour. In most cases, aspirin and other non-steroidal anti-inflammatory drugs (NSAIDs) that act by blocking prostaglandin synthesis provide transitory but significant pain relief. It is rare for the lesions to be painless. Regarding their location within the bone, subperiosteal, intracortical, endosteal and intramedullary lesions can be identified, among which intramedullary lesion are the least frequent.

Importance of reporting a case of osteoid osteoma in a 23-year-old housewife:

1. **Uncommon Presentation**: Although osteoid osteoma commonly affects young adults, reporting it in a 23-year-old housewife highlights how it may be overlooked in women, as it's more frequent in males.
2. **Atypical Or Delayed Diagnosis**: In women, especially in populations like housewives who may delay seeking medical care, symptoms such as night pain and response to NSAIDs might be underestimated or misattributed, leading to delayed diagnosis.
3. **Educational Value**: A detailed case report helps educate clinicians about recognizing typical features (e.g., nocturnal pain, relief with NSAIDs) and emphasizes the importance of imaging in diagnosis.
4. **Treatment Insights**: Reporting the management — whether surgical removal or minimally invasive techniques like radiofrequency ablation — helps build evidence on the best approaches and outcomes, especially in resource-limited or domestic settings.
5. **Contribution To Literature**: Each case adds to the global data on osteoid osteoma, helping refine epidemiological understanding, especially in underrepresented groups like young women or housewives.

Pain Scoring System

In the detailed anamnesis of the patients, the number of times a week they used nonsteroidal anti-inflammatory drugs (NSAIDS) and the scores they gave to their pain according to the Visual Analog Scale (VAS) were noted. After the procedure, the average number of times a week they used NSAIDs and the scores they gave for their pain in the first week and third month were noted according to the typical numerical pain scale of the VAS.

The VAS was used to evaluate pain scoring. Numbers 0–10 were written on the horizontal line. 0 is account for no pain, 10 is account for excruciating pain. For the value to be measured, the patient was asked to mark the point felt and thought. According to this system, a pain score of 7 and above corresponded to severe pain.

The pre-procedure mean VAS pain score is 8 points. The mean VAS pain score was 0.53 points at the first week after the procedure. The 3[rd] month post-procedure mean VAS pain score was 0.53 points. Post-procedure pain scores at the 1[st] week and 3[rd] month after the procedure decreased significantly ($p<0.01$) compared to the pre-procedure. The frequency of NSAID use after the procedure decreased significantly ($p<0.01$) compared to the pre-procedure

The pre-procedure NSAID use of our patients included in the study was average 6.93 per week, the NSAID use in the 3[rd] month post-procedure controls was average 0.53 per week

A significant decrease in VAS score and absence of pain two years after the procedure is considered as "clinical success." Imaging findings suggestive of successful ablation include resolution of bone oedema and perilesional synovial reaction, presence of bone remodelling and "ring sign". [(2)]

The "ring sign" is seen on MRI as presence of central hypointensity indicating necrosis with surrounding hyperintense rim suggestive of the demarcation zone between the healthy and necrotic tissue.

Presence of this sign after the procedure indicates ablation within the tissue and is usually seen up to 6 months. [2]

Case Report

The patient was a 23-year-old female housewife. Her pain started in the lumbar and sacroiliac region, with intermittent irradiation to the right buttock, i.e. a picture similar to pain of sciatic origin. she underwent clinical treatment with physiotherapy and analgesics for one year, without any satisfactory result. Imaging examinations on the lumbar spine showed normal results. There was a partial improvement through using NSAIDs, but the pain worsened through exertion relating to her household work. He described nocturnal pain and insomnia. Simple radiography on the pelvis in AP view showed a lesion with central radiopacity in the iliac bone near SI joint, with an intense sclerotic halo. The diagnosis was confirmed by means of computed tomography.

Imaging

X-ray is the initial imaging modality in case of osteoid osteoma is suspected. Plain radiograph typically shows a round or oval radiolucent nidus, usually smaller than 1 cm in diameter, surrounded by a variable but regular fusiform area of bone sclerosis [4]. In larger lesions, a central nucleus of bone mineralization within the nidus can also be observed. Sometimes the peripheral rim of reactive bone sclerosis is so extensive that the underlying radiolucent nidus may result obscured.

Computed Tomography Scanning (CT) is the imaging technique of choice for osteoid osteoma, being advantageous for detection and characterization of both the nidus and the peripheral sclerosis. It is particularly helpful for small osteoid osteoma, for those lesions which show less peripheral bone sclerosis (especially medullary and subperiosteal types), and in all those cases where standard radiographs are not clearly conclusive. On CT scan the nidus appears as a small well-defined radiolucent area with soft-tissue attenuation values, which shows early vascular contrast enhancement (even if intravenous contrast administration is generally not necessary for definitive diagnosis). A variable degree of central nidus mineralization, sometimes punctate, is often seen. Moreover, the presence of thin vascular grooves surrounding the lesion has been demonstrated to be highly specific for distinguishing osteoid osteoma from other radiolucent bone tumours on CT.

Treatment

Historically, surgical intervention consisted of en-block resection or open curettage of the nidus. [4]

Percutaneous radiofrequency ablation (RFA) has been proposed as a new interventional technique for symptomatic patients with Osteoid osteoma. It has widely and rapidly been accepted as a valid minimally invasive alternative to traditional orthopaedic surgery, so much to be emerged as today the treatment of choice for osteoid osteoma [2], especially for those located in difficult areas for surgery.

Percutaneous ablation is reported to be a safe and cost-effective treatment, with a superior long-term efficacy and a significant reduction in hospitalization cost and duration when compared to other surgical techniques [5]. It has a reported success rate close to 100% and a recurrence rate of about 5% with almost negligible post-procedural complications [4].

The procedure is performed in the CT room under aseptic conditions; patient position was prone depending on the location (SI joint) of the lesion. Two grounding pads are properly positioned on patient skin and connected to the RF generator. Local anaesthesia is generally sufficient to control pain for all the duration of the procedure, however the possibility to use general, spinal or epidural anaesthesia is always discussed with the anaesthesiologist (who is present in the CT room during the entire procedure), according to the patient collaboration and clinical conditions. CT scan is obtained to precisely localize the lesion and multiplanar reconstructions are used to plan the optimal trans-cutaneous approach. Close attention must be paid to adjacent blood vessels and nerves, since these structures must carefully be avoided. A penetration cannula with an inner stylet is introduced through the skin and soft tissue according to the previous established access route.

New CT images are then obtained to verify the correct position of the cannula. Computed tomography has an extraordinary spatial resolution, but it carries the disadvantage that it cannot be used in real-time guidance; for this reason, CT-fluoroscopy is increasingly adopted. Once ensured the distal end of the cannula is well positioned on the bone surface, the inner stylet is removed. Bone penetration is then accomplished by inserting through the cannula a Kirshner wire gradually tapped until the centre of the nidus. Automatic orthopaedic drill represents a feasible and helpful alternative for this step. Once within the nidus, the Kirshner wire is replaced with the ablation electrode and, after another accurate CT control of the electrode tip position, the electrode is connected to the RF generator. When the electrode is documented to be exactly within the nidus, RFA starts. The lesion is generally heated to 90°C for a time of 5-6 minutes, which are widely reported to be the optimal ablation parameters [2]. Lower temperatures would be ineffective or would significantly increase the ablation time. Higher temperatures can lead to tissue vaporization, a circumstance that would limit proper heat propagation through the lesion. Once the procedure is terminated, a last CT scan is obtained to exclude possible soft tissue damage. The electrode and the cannula are removed, local anaesthetic is administered, and sterile dressing is applied to the skin entry site. The entire procedure can be performed in approximately 60 minutes. After a brief period of observation, the patient discharged from hospital on the same day, with 30 days scheduled follow-up visit. Daily activities may immediately be resumed, with the exception for driving. Post-procedural complications are rare, and may include skin burn, muscular hematoma, infection and nerve injury.

MATERIALS AND METHODS :

1. X-ray
2. CT scan
3. Biopsy needle
4. RFA machine
5. Source Of Data

23 years old female admitted in IPD of Dr. D.Y. Patil medical college hospital and research institute, Kadamwadi, Kolhapur

6. Study Period: 6 months

7. Study Design: Case Report

Why RFA For Osteoid Osteoma Is A Day Care Procedure:

1. **Minimally Invasive Technique:**
   - Performed through a small skin incision (often <1 cm).
   - Uses CT guidance to precisely target the tumor (nidus).
   - No large surgical wound or bone resection.
2. **Short Procedure Duration**:
   - The entire ablation typically takes 30–60 minutes.
   - Additional time for imaging and preparation.
3. **Anaesthesia**:
   - Performed under local anaesthesia with sedation or general anaesthesia, depending on age and lesion location.

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- No need for prolonged postoperative monitoring.

4. **Quick Recovery**:
- Most patients are discharged within a few hours after the procedure.
- Pain relief is often noticed within 24–48 hours.
- Normal activities (except heavy exercise) are usually resumed in a few days.

5. **Low Complication Rate**:
- Compared to open surgery, there is less blood loss, lower infection risk, and minimal tissue damage.
- Rare complications may include skin burns, minor infections, or temporary nerve irritation.

6. **No Hospital Stay Required**:
- Patients go home the same day with instructions for pain management and follow-up imaging if needed.

DISCUSSION

Osteoid osteoma is a benign bone neoplasm with a reported incidence of 2-3% among all bone primary tumours. Although it is a small and benign lesion, it is often cause of patient complaint and discomfort. It is generally characterized by a long lasting, unremitting pain that typically exacerbates at night, often leading to sleep deprivation and functional limitation of the skeletal segment involved, with a significant reduction of patient daily life activities and consequent worsening of the overall quality of life [4]. In the last years, new percutaneous ablation techniques, especially radiofrequency ablation, have been reported to be a safe and effective alternative to classical surgery, with a low complication and recurrence rate, and a significant reduction in hospitalization cost and duration [4]. The aim of this article is to provide an overview about the radio frequency thermal ablation procedure in the treatment of osteoid osteoma.

Although osteoid osteoma can spontaneously regress in a period of time ranging from two to six years over decades complete surgical excision has been considered the classical treatment for all those patients who had unremitting pain despite conservative treatment or those who could not tolerate long-term NSAIDs therapy. En bloc surgical resection has a reported success rate between 88% and 100% but it carries several significant disadvantages. Firstly, for the orthopaedic surgeon it may be difficult to identify the precise location of the lesion and the exact amount of bone to resect; secondly, to be sure all the nidus is removed, a substantial volume of bone must be excised, potentially leading to bone weakness and consequent necessity of bone grafts, internal fixation and postoperative immobilization to prevent subsequent fractures. Nonetheless, recurrence rate remains significantly high (reported in literature to range from 4,5% to 25%) due to incomplete nidus excision over the last years.

Pioneer For RFA

Dr. Daniel I. Rosenthal is widely recognized as the pioneer of radiofrequency ablation (RFA) for treating osteoid osteoma. His groundbreaking work was conducted in the early 1990s at Massachusetts General Hospital (MGH), which is affiliated with Harvard Medical School in Boston, Massachusetts, USA.

How He Did It:

In his landmark 1992 paper, Rosenthal and his colleagues described using CT-guided percutaneous radiofrequency thermal ablation as a minimally invasive alternative to surgical resection.

Here's How He Did It:

1. **CT Guidance:** A CT scanner was used to precisely localize the nidus (the small tumor core).
2. **Percutaneous Access:** A small skin incision was made, and a needle was advanced under CT guidance to the lesion.
3. **Electrode Insertion:** A radiofrequency electrode was introduced through the needle to the nidus.
4. **Thermal Ablation:** The electrode generated high-frequency alternating current, heating the nidus to ~90°C for about 6 minutes, effectively destroying the tumor tissue.
5. **Outpatient Procedure:** Most patients were treated on an outpatient basis with minimal recovery time.

Key Study Details :

Number Of Patients: 4

Lesion Location: All patients had osteoid osteomas confirmed radiologically and clinically.

Technique: CT-guided percutaneous RFA using a heated electrode inserted into the nidus.

Temperature: Tissue heated to approximately 90°C for 6 minutes.

Anaesthesia: Local or general, depending on lesion location and patient age.

RESULTS:

Success Rate: 3 out of 4 patients experienced complete pain relief and required no further treatment.

Complications: Minimal — one patient required surgical excision due to incomplete ablation.

Conclusion: RFA was shown to be a safe and effective alternative to open surgery, offering shorter recovery time and minimal morbidity.

This pioneering study laid the foundation for the widespread adoption of RFA in managing osteoid osteoma globally.

CONCLUSION

CT guided RFA is proven to be a safe and effective procedure for the treatment of osteoid osteoma [5]. When compared to surgical excision, it shows a significant reduction in hospitalization cost and duration. With its almost negligible post-procedural complications and a low rate of recurrence, RFA is at the moment a simple, safe, minimally invasive, and highly effective treatment of choice for osteoid osteoma [3].

Technical success defined as placement of the active tip within the nidus, with the nidus border not exceeding the active tip by more than 5 mm. [3]

Clinical outcome – primary clinical success, defined as pain relief after one session of RFA. Secondary clinical success, defined as pain relief after more than one session of RFA. [3]

Global Centers Offering RFA for Osteoid Osteoma

United States

1. **Columbia University Medical Center, New York**
- Specializes in CT-guided RFA for osteoid osteoma, providing minimally invasive treatment with high success rates.
2. **Southern California Orthopedic Institute (SCOI), California**
- Offers RFA procedures for osteoid osteoma at their Van Nuys and Bakersfield locations.
3. **Dube Orthopedics, Nashville, Tennessee**
- Provides RFA treatment for osteoid osteoma across multiple locations in the Nashville area.

United Kingdom

1. **West of Scotland Orthopaedic Research Society (WOSORS)**
- Conducted studies on RFA outcomes for osteoid osteoma, indicating its efficacy and low morbidity.

Australia

1. **Australasian Teaching Centers**
- Reported successful treatment of osteoid osteoma with RFA over a 13-year period, demonstrating its effectiveness in the Austrasian context.

India

1. **Tata Memorial Hospital, Mumbai**
- A tertiary cancer center that has achieved high success rates in treating osteoid osteoma with CT-guided RFA.
2. **Citi Vascular Centre, Hyderabad**
- Offers advanced microwave ablation treatment for osteoid osteoma, providing a minimally invasive option with quick recovery.

Pakistan

1. **Aga Khan University Hospital, Karachi**
- Provides image-guided percutaneous RFA for osteoid osteoma, with studies showing high efficacy and safety.

2. Interventional Radiology and Clinical Care (IRCC), Pakistan

- Specializes in minimally invasive treatments for osteoid osteoma, including RFA, offering personalized care and symptom

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