Management of osteoid osteoma

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An osteoid osteoma is a benign bone tumour which can cause severe pain. Diagnosis is often delayed, as it may mimic other musculoskeletal conditions. The most pertinent investigations for diagnosis are a bone scan and computed tomography of the area of increased uptake. Treatment with minimally invasive techniques allows early return to full function.

An osteoid osteoma is a benign bone tumour characterized by an osteoid-rich nidus in a highly vascular connective tissue stroma (Mirra et al, 1989). Its size (<2 cm) distinguishes it from an osteoblastoma. It occurs most commonly between the ages of 5 and 40 years and has a propensity for involvement of long bones, with the femur, tibia and humerus being the sites most commonly involved. This tumour comprises about 3% of primary bone tumours and has a male to female ratio of 2:1.

SYMPTOMS AND SIGNS

Pain is the usual presenting symptom. This is frequently dull and aching in nature. It may be exacerbated by exercise but is not relieved by rest. Early in the course of the condition, the symptoms may be intermittent but gradually become more severe and persistent. Without analgesic medication, patients report that the pain can build up to an unbearable intensity. A characteristic feature is night-time waking because of the pain. Another feature that is consistently observed is the good response to non-steroidal anti-inflammatory drugs (NSAIDs).

Frequently, there is little to find on examination. If the tumour is close to a joint, there may be joint stiffness from the local muscle spasm or an effusion may be present. Where the bone involved is subcutaneous, there may be localized swelling, and this is usually tender. Left untreated, the tumour can cause symptoms related to synovitis, bone overgrowth and scoliosis (Norman and Dorfman, 1975; Kirwan et al, 1984; Yamamura et al, 1994). There is some evidence that these tumours are non-progressive and that they may resolve spontaneously in the fullness of time (Kneisl and Simon, 1992). However, the problem for the patient is the severe persistent pain and the intolerance to NSAIDs that may develop. Because symptoms may be rather non-specific, there is often a significant delay until the diagnosis is made, with an average delay of 14 months.

INVESTIGATION

Laboratory studies are usually normal, with a normal white blood cell count, erythrocyte sedimentation rate, C-reactive protein, protein electrophoresis and bone chemistry. A plain X-ray of the affected bone is usually quite characteristic. However, here there is a caveat. Pain in the proximal femur and hip, which are common sites for these tumours, is often referred to the knee, so plain radiographs may be taken of the knee which miss the lesion altogether.

The characteristic radiographic feature is of a thick, smooth, convex, homogeneous periosteal density with a small central nidus. The nidus itself may be entirely radiolucent but more frequently has a radiodense centre surrounded by a lucent ring (*Figure 1*). When the osteoid osteoma arises in cancellous bone, the host bone reaction may be less intense, and consequently the lesion may not be so easily visible. This is particularly the case in the spine, where the many overlapping landmarks of the vertebral bodies may easily obscure the lesion. Some tumours develop in a subperiosteal location and these tend not to elicit much of a reaction.

In cases where the radiographical features are not typical or are obscured, a radionuclide bone scan is an extremely useful investigation. This is a very sensitive investigation, if not specific, and should be considered in any young patient complaining of persistent pain where radiographs are negative. A single photon emission computed tomography (SPECT) scan allows further localization of the lesion, particularly in difficult areas, such as the spine and acetabulum.

Once the location has been identified, further delineation of the lesion is best performed by fine cut computed tomography (CT) scans.

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These show the anatomy of the nidus more clearly and allow planning of therapeutic intervention. Although these lesions are also visible on magnetic resonance imaging (MRI) scans, the appearance may be somewhat misleading owing to the marked localized oedema that is usually present. The author has found CT a much more useful investigation.

DIFFERENTIAL DIAGNOSIS

Infection is probably the condition most commonly confused with an osteoid osteoma. A Brodie's abscess, where there is a focal collection of inflammation or pus in which the host bone has encapsulated the lesion by dense fibrous tissue and reactive bone, may look rather similar, but the osteolytic area is usually larger and more irregular than that associated with an osteoid osteoma. An osteoblastoma is virtually indistinguishable pathologically but is larger (2–10 cm) and tends to expand the affected bone.

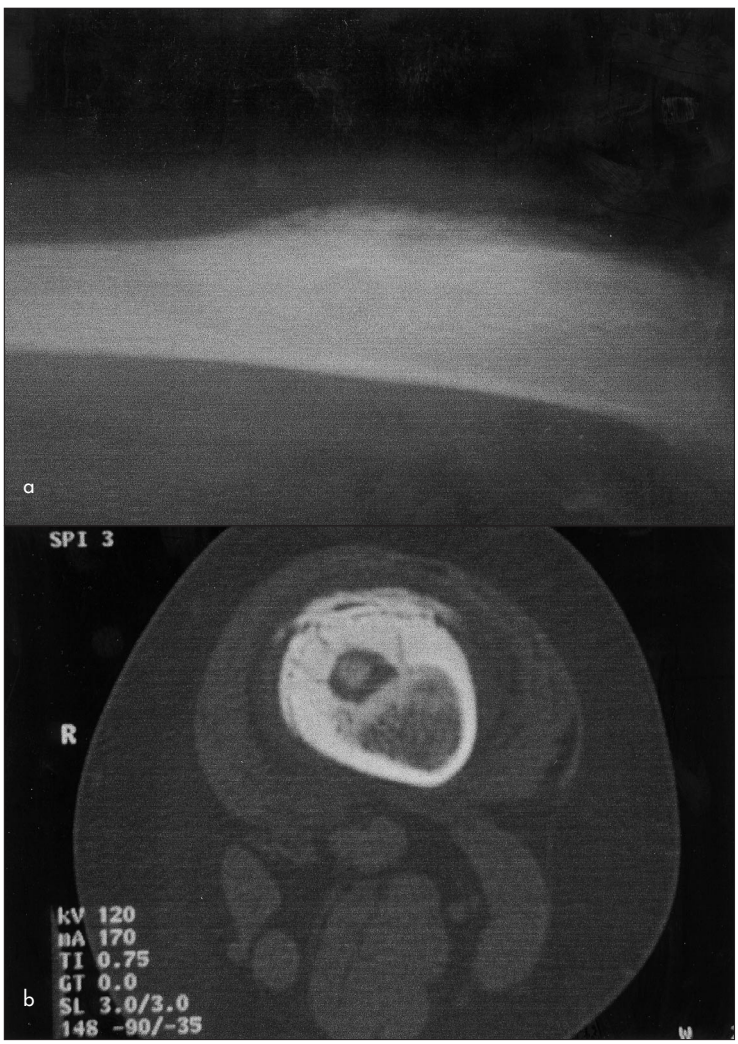

Figure 1. a. Radiograph and (b) computed tomography scan of an osteoid osteoma in the distal femur showing the marked periosteal new bone formation and a typically calcified nidus.

PATHOLOGY

Grossly, the nidus appears reddish or reddish-brown with chalky white or grey central areas of a gritty consistency. Histologically, the centre portion of the nidus typically shows a predominance of immature bone formation. There may be areas of osteoid tissue formation mixed with this immature bone. Irregularly mineralized bone trabeculae are usually separated by loose connective tissue from the very hyperaemic capillary blood vessels so prominent in the nidus of an osteoid osteoma. Surrounding the nidus histologically is very mature sclerotic bone with typical haversian systems.

TREATMENT

The surgical options include wide excision with surrounding normal bone (Healey and Ghelman, 1986; Gitelis and Schajowicz, 1989), unroofing the nidus and currettage (Ward et al, 1993; Campanacci et al, 1999) or a variety of less invasive techniques, such as CT-guided core drill excision (Sans et al, 1999), radiofrequency ablation (De Berg et al, 1995; Rosenthal et al, 1998) or interstitial laser photocoagulation (ILP) (Witt et al, 2000). Traditionally, surgical removal of the entire nidus has been the standard treatment. This involves removing a block of bone containing the nidus. The disadvantages are that the nidus can be extremely hard to find and that removing a section of bone significantly weakens it and may require internal fixation or a prolonged period of protected weight bearing.

More recently, the minimally invasive techniques have been shown to be equally effective and have the advantage of minimal morbidity and accurate localization. Radiofrequency treatment and ILP are similar modalities in that they both involve heating the nidus thereby causing necrosis. Because of the nature of transmission of heat within bone, the effect of one fibre in the centre of a lesion is to cause necrosis approximately 1 cm in diameter. These procedures are usually carried out under general anaesthetic in the CT scanner.

The nidus is localized, and frequently the outer cortex of the bone requires a fine drill to penetrate it. Following this, a laser fibre can be introduced down a 19G needle or in the case of radiofrequency, the probe can be directly introduced. Once confirmation that the tip is in the centre of the lesion has been obtained, treatment only takes a few minutes (*Figure 2*). Patients routinely leave hospital the same or following day and would typically notice an improvement in their pain within a few days. The success rate

for minimally invasive techniques is in the region of 85%, and this increases to 95% if the initial failures are re-treated. This compares favourably with open methods, where reports of success range from 75 to 100% (Freiberger et al, 1959; Cohen et al, 1983).

A potential drawback of this type of treatment is that histological material is not routinely obtained. In general, this type of procedure is not undertaken unless an experienced musculoskeletal radiologist and orthopaedic surgeon are in agreement that the history and radiological appearances are typical for an osteoid osteoma.

CONCLUSION

An osteoid osteoma is a rare tumour which can cause a variety of symptoms and signs and may therefore go unrecognized for a long period of time. The diagnosis usually becomes apparent on plain X-ray but may require a bone scan to localize the lesion before more detailed imaging clarifies the diagnosis. Treatment is largely an exercise in pain management, and one of the minimally invasive techniques should now be considered as the method of choice. HM

Conflict of interest: none.

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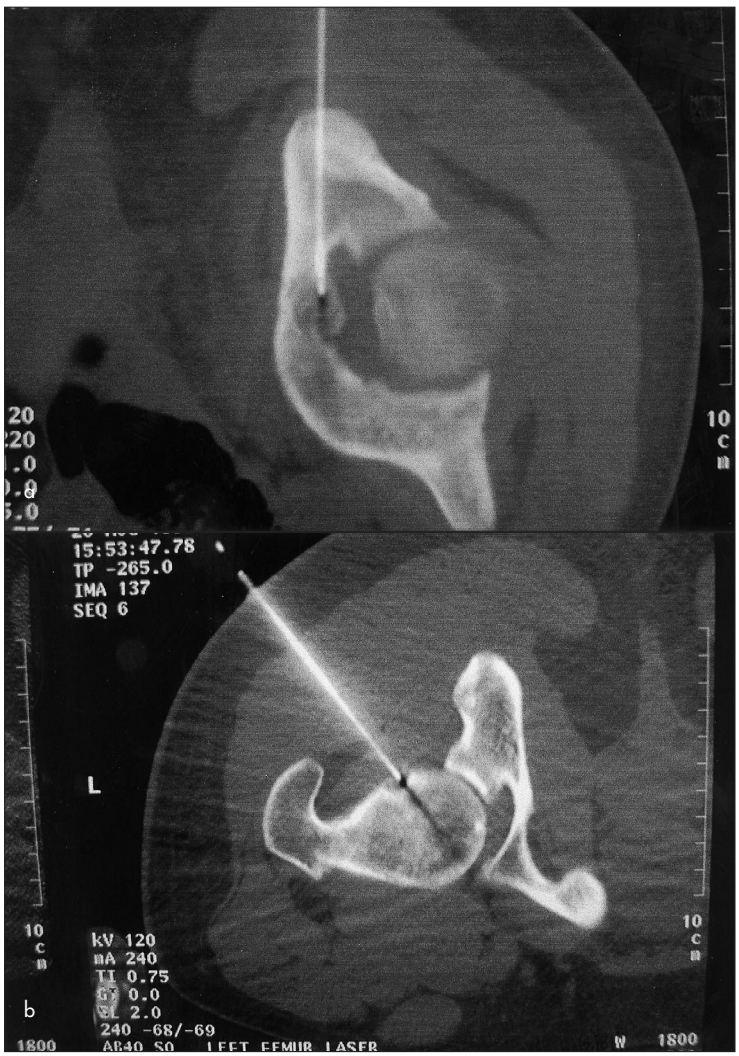
Figure 2. Images illustrating the treatment of osteoid osteomas in very awkward locations. a. Tumour in the medial wall of the acetabulum. b. Tumour in the posterior aspect of the femoral head.



KEY POINTS

- An osteoid osteoma is a benign bone tumour.
- Pain produced by the tumour may mimic many other conditions.
- A bone scan followed by computed tomography is the most precise way of localizing the lesion.
- The differential diagnosis is usually from infection.
- Minimally invasive therapies, such as radiofrequency or interstitial laser photocoagulation, are now the treatment of choice.