Introduction

Osteoid osteomas are the commonest benign bone tumours. They most frequently occur in the lower extremities of children and young adults with a male to female predominance of 3–1. About 10% of osteoid osteomas occur in the spine where they usually involve the posterior elements.

Osteoid osteomas are usually small lesions less than 1 cm in diameter. They have a central radiolucent nidus with a variable amount of surrounding reactive bone sclerosis. Osteoblastomas are pathologically similar lesions that traditionally have been distinguished from osteoid osteomas by having a diameter greater than 1.5 cm. In fact osteoblastomas have distinct radiological features other than their size which distinguishes them from osteoid osteomas. They less frequently produce reactive bone sclerosis can extend from the bone to involve the adjacent soft tissues and frequently involve the posterior elements of the spine.

Clinical and radiological features

The classical presentation of osteoid osteoma is a child or young adult with constant pain worse at night relieved by aspirin or other non-steroidal anti-inflammatory drugs (NSAIDs). Response to NSAIDs can be a useful diagnostic test whilst the patient waits for appropriate radiological investigations. The response to NSAIDs is due to the high levels of prostaglandins found within the nidus of the lesion which is also thought to account for the surrounding reactive sclerosis. Intra-articular osteoid osteomas may cause synovitis and present with a non-specific arthropathy that frequently results in a delay in the diagnosis (Fig. 1). These lesions are usually sub-periosteal and may have little if any sclerosis. Osteoid osteomas in the spine may present with a painful scoliosis (Fig. 2).
Plain radiographs are the initial investigation of choice and can be characteristic in long bones when the central radiolucent nidus is identified (Fig. 3). When the osteoid osteoma occurs within the diaphysis of a long bone it usually lies intra-cortically and the surrounding sclerosis results in thickening of the cortex. Unfortunately the nidus is frequently not identified on radiographs and the appearances can be mistaken for a stress fracture (Figs. 4 and 5).

When the osteoid osteoma occurs in flat bones or intra-articularly there may not be any surrounding sclerosis (Figs. 6 and 7).

Radioisotope bone scans are almost invariably positive and the characteristic appearance is an intense area of uptake representing the nidus surrounded by a less intense halo that is the hyperostosis. With intra-articular lesions the appearances may be non-specific and suggest an arthropathy. A positive isotope bone scan helps to target a CT examination that in most cases shows such specific appearances that pathological confirmation is not required. As the nidus can be very small thin 1.0 mm sections are required so the CT has to be targeted to a specific area guided either by the plain radiograph or isotope bone scan. A thin section CT of a whole long bone would result in several hundred images and a significant radiation dose.

With the increasing availability of magnetic resonance imaging (MRI) many patients with bone and joint pains are having MRI as the first line investigation. MRI shows intense oedema that can involve the adjacent soft tissues (Fig. 8). Whilst a nidus is frequently seen on MRI it may not always be apparent depending on the thickness of the slices the obliquity of the sections through the nidus and partial volume effects. The bone and soft tissue oedema can be non-specific and suggest infection or stress reaction and the radiologist must always consider the diagnosis of an osteoid osteoma and perform a CT when necessary.

Treatment

The natural history of osteoid osteoma is for spontaneous resolution so medical management with NSAIDs is an option for some patients. Spontaneous resolution however can take many years and surgical intervention is frequently performed. In the past this involved an open surgical procedure with an en bloc resection or a burr down technique with curetting of the nidus. The procedure could result in a relatively large amount of bone being removed requiring post-operative immobilisation. Furthermore as an intra-articular location in the hip is a frequent site many osteoid osteomas are relatively inaccessible.

In 1998 Rosenthal et al. reported their series of CT guided radiofrequency thermal ablation with equivalent success rates to the open surgical procedure. In 2004, the national institute for health and clinical excellence (NICE) approved the procedure for use in the UK. An information sheet for patients can be downloaded from the NICE website which explains the procedure and indicates the success rate of 90%. Laser photocoagulation has also been described with comparable results to radiofrequency ablation. However radiofrequency equipment is commonly found in many hospitals where it is used for ablation of neural tissue by neurosurgeons and pain clinicians so this is the more common technique.

The procedure is performed as a day case under a general anaesthetic. A hand held drill bit with an outer diameter of just 1.7 mm is used. This is an eccentric drill that drills a
Figure 2  Mild sclerosis of the left T8 pedicle within the concavity of a thoracic scoliosis. Strongly positive radioisotope bone scan confirms the presence of an osteoid osteoma.

Figure 3  Periosteal thickening (white arrows) and a radiolucent nidus (black arrow).
Figure 4  There is cortical thickening of the mid tibia without an apparent nidus.

Figure 5  Tibial stress fracture. There is cortical thickening of the anterior cortex with a central lucent area (black arrow). The lucent area extends from the surface of the anterior cortex and is linear.
Figure 6  There is enlargement of the lesser trochanter on the left without cortical sclerosis.

Figure 7  Sagittal reformat CT scan of the ankle. There is a thin sclerotic line surrounding the central nidus. The nidus shows central calcification that is an occasional feature of osteoid osteomas.

Figure 8  Coronal STIR (8a) and coronal T1-weighted (8b) MRI (same patient as Fig. 6). There is intense oedema within the lesser trochanter with oedema of the adjacent soft tissues. The nidus (white arrow) is seen as an area of high signal within the low signal cortex.
hole slightly larger than its own diameter allowing a 1.8 mm
diameter guide to follow the drill through the cortex. CT
guidance is used to locate the nidus and plan the safest
route. This may be through the opposite cortex but since the
hole is so small there is no risk of subsequent fracture
(Fig. 9). It is possible to biopsy the nidus with a Jamshidi
type biopsy needle passed down the guide. The imaging
features are so characteristic usually more so than the
histology and the author has abandoned the biopsy stage
opting instead to simply drill out the nidus and then pass the
radiofrequency probe through the guide into the centre of
the nidus (Fig. 10). This is heated to 90°C for 4 min. The
outer guide can be withdrawn slightly from the tip of the
probe to prevent heat conduction to the skin. Mild skin burns
are the only relatively frequent complication of the
procedure.

The ablation necroes a 1.0 cm diameter volume of tissue
so if the nidus is greater than 1.0 cm in diameter the probe
will need to be positioned in several sites to cover the whole
nidus. Very occasionally an osteoid osteoma is multifocal

Figure 9  Axial CT showing the radio frequency probe within
the nidus (same case as Figs. 6 and 8). The safest approach is to
drill through the lateral cortex into the lesser trochanter
avoiding the neurovascular structures anteriorly which are in
the line of an antero-medial approach and the sciatic nerve in
line of the posteromedial approach.

Figure 10  The radiofrequency probe is passed down the guide into the nidus.

Figure 11  Coronal reformat CT of the femur demonstrating a
multifocal nidus which was successfully ablated by three
separate ablations. Surgical treatment would have involved
removal of a large amount of the femoral cortex.
and each separate nidus can be ablated (Fig. 11). Soft tissue structures that fall within the 1.0 cm diameter field of the ablation will also be necrosed. For this reason there has been reluctance to perform the procedure in the spine because of the close proximity to neural tissue; however it can be performed provided a safe margin is present.4

Following the procedure the patient can immediately weight-bear without risk of fracture. Post-procedural pain can be controlled with simple analgesics and most patients are entirely pain-free with resolution of their osteoid osteoma pain within 24 h. In approximately 10% of cases recurrence of pain may occur over the next few months if the nidus has not been completely ablated but the procedure can be repeated.

References


