An osteoid osteoma located in the forefoot can be difficult to diagnose, and the diagnosis is frequently delayed. We present a clinical case of a patient with pain, erythema, and swelling of the left forefoot with no history of trauma. Although rarely seen in the metatarsal, osteoid osteoma should be included in the differential diagnosis of foot pain. Findings from radiographs, magnetic resonance images, and a detailed clinical history led to the diagnosis of osteoid osteoma of the left second metatarsal. The lesion was surgically excised using curettage. This process significantly weakened the lateral cortex of the metatarsal shaft. To correct this surgically induced stress riser, an external fixator was applied to provide stability, allow for callus distraction, and allow the patient to walk as early as possible. We review osteoid osteoma, including the classic clinical presentation and treatment associated with this benign bone tumor. (J Am Podiat Med Assoc 97(5): 405-409, 2007)

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nation, an osteoid osteoma ranges from reddish brown to chalky white or gray. The lesion also has a gritty, granular appearance.1, 2

Treatment of an osteoid osteoma consists of surgical excision of the nidus.4 Owing to the progressive nature of the pain, by the time the bone tumor is diagnosed, most patients are more than ready to have the lesion removed surgically. Curettage of the lesion and removal of any reactive adjacent soft tissue is curative.1 The surgeon must be careful not to leave any portion of the nidus. Otherwise, recurrence of the tumor, along with the severe nocturnal pain, is possible.

**Case Report**

A 42-year-old man presented to the Des Moines University Foot and Ankle Clinic, Des Moines, Iowa, with the chief complaint of intense redness, swelling, and pain in his left forefoot. He did not report any trauma or injury. The foot had been painful and swollen for several days before the patient sought medical care. Physical examination revealed that vascular and neurologic systems were intact. Muscle strength and range of motion of all of the joints were within normal limits. No skin openings or signs of bacterial infection were present. Pain was elicited on palpation of the left second metatarsal. In addition, there was +2 pitting edema of the left forefoot.

Radiographs were taken and laboratory tests (complete blood cell count, erythrocyte sedimentation rate, and uric acid measurement) were performed to confirm the diagnosis of cellulitis. All of the laboratory test results were within normal limits. Three views of the left foot were taken, but they were not read or interpreted until the next day. The patient was treated for cellulitis, was given oral antibiotics, and began taking hydrocodone for pain. In addition, the patient was instructed to ice and elevate his foot and was given a protective boot to wear.

No relief was obtained from these modalities, and the patient returned to the clinic 4 days later. He stated that he had experienced a severe pain and had heard an audible snap in his left foot while at work. He rated his pain as 7 on a 10-point scale. The radiographs revealed the presence of a bone tumor in the diaphysis of the left second metatarsal. The radiographs demonstrated the classic appearance of an osteoid osteoma, with fusiform cortical thickening surrounding an osteopenic nidus (Fig. 1). Magnetic resonance imaging (MRI) revealed the tumor in the lateral cortex of the left second metatarsal (Fig. 2). Surgical and conservative therapies were discussed in detail with the patient, and he elected to attempt conservative therapy one last time.

The patient continued to experience significant pain, rated 6 on a 10-point scale, and reported that he could no longer fulfill his job duties as a construction worker. The patient stated that his pain was somewhat relieved by nonsteroidal anti-inflammatory drugs and that the pain persisted at night despite rest and elevation of the extremity. After several weeks, the patient decided that he could no longer tolerate the pain, and he returned to discuss surgery.

Surgical excision of the tumor was performed under general anesthesia. A longitudinal incision was placed over the second metatarsal shaft to allow for maximum exposure. Using a sagittal saw, the lateral...
cortex was windowed out to expose the lesion (Fig. 3). Once visualized, the osteoid osteoma was excised using a curette to remove all traces of the nidus and sclerotic bone. The lesion was reddish brown and had the characteristic gritty, granular consistency (Fig. 4).

To address the surgically induced cortical weakness, a synthetic bone graft (OsteoMax; Orthofix Inc, McKinney, Texas) was packed into the cavity to stimulate bone regeneration, provide optimal osteoconduction, and minimize the time needed for the metatarsal shaft to regain its structural integrity. An external fixator (MiniRail; Orthofix Inc) was applied while carefully avoiding the bone graft to provide stability and strength to the metatarsal (Fig. 5). Using this method, the patient could bear weight earlier, which enhanced bone production. Last, a bone stimulator was applied around the postoperative dressing to further enhance osteogenesis.

Postoperatively, the pathology report stated that the specimen demonstrated fragments of cortical and trabecular bone with a central nidus of vascular woven bone with closely opposed osteoid trabeculae. The diagnosis of osteoid osteoma was confirmed. A photomicrograph of the specimen demonstrated a large quantity of blood vessels in the tumor (Fig. 6). The patient returned to the clinic 4 days after surgery. Despite having postoperative pain, the patient reported relief of the tumor-related pain.

**Discussion**

Osteoid osteomas rarely occur in the metatarsal bones. Owing to the progressive nature of these tumors, cure is possible only with surgical excision involving complete removal of the nidus. Once the nidus has been completely excised, patients frequently describe a sense of relief, despite the expected postoperative pain. The patient stated that he felt better very quickly after surgery. This finding is consistent with the literature, which states that pain relief from removal of the tumor is almost instantaneous.1, 4

Surgical excision of the tumor, however, creates a stress riser and results in a significantly weakened cortex. There are numerous ways to address this problem, including external fixation, bone grafting, and application of a bone stimulator. We chose to use all three methods in this patient. To our knowledge,
this combination has never been reported after re-
moval of an osteoid osteoma.

Preoperative planning is a vital part of the treat-
ment process. Magnetic resonance imaging allows
the surgeon to visualize the size and extent of the
tumor and the amount of bone that will have to be re-
sected to fully excise the nidus. Using MRI, we antici-
pated that a significant portion of the lateral cortex of
the second metatarsal would have to be resected to
completely remove the nidus. Thus the surgery was
designed around three factors. The first factor was
the possibility that by removing the tumor the meta-
tarsal would be weakened so significantly that there
would not be enough bone remaining to support even
mild weightbearing. Second, we acknowledged the
possibility that the metatarsal would be significantly
shortened after surgery. Third, given the patient’s oc-
cupation and active lifestyle, we wanted to provide
him with an early return to weightbearing. Taking all
of these factors into account, we decided to use an
external fixator (MiniRail), a synthetic bone graft,
and a bone stimulator to accomplish the preoperative
surgical goals.

If the involved cortex is significantly weakened, a
corticotomy or osteotomy through the weakened area
of the bone is an option. This will shorten the bone to
some extent. However, an external fixator can be
placed over the corticotomy site to allow for callus
distraction. The bone will eventually regain its original
length while simultaneously gaining strength at the ex-
cision site. This technique is commonly used to treat
brachymetatarsia.16 If this technique is chosen, we
prefer to use a corticotomy, as opposed to an osteoto-
my, owing to the preservation of the surrounding pe-
riosteum and accompanying blood vessels.

Despite being prepared for a corticotomy in this
patient, we chose to apply an external fixator without
a corticotomy. This method was chosen because the
metatarsal was weakened during excision of the tumor;
yet there was still adequate bone remaining to pro-
vide a moderate amount of strength and structural in-
tegrity. To allow for faster healing and early return to
daily activities, a MiniRail was applied to provide sta-
ibility and strength to the metatarsal shaft. The Mini-
Rail also prevented pathologic fracture of the meta-
tarsal.

OsteoMax synthetic bone graft was packed into
the excision site after removal of the tumor. Osteo-
Max synthetic bone filler sets quickly and is com-
pounded of a triphasic microstructure with three differ-
ent calcium salts. The different salts allow for staged
resorption of bone and full integration into the exci-
sion site. We believe that using a bone graft with the
simultaneous application of a bone stimulator is a vi-
able surgical option. Evidence exists in the literature
that demonstrates that using a bone stimulator com-
bined with a bone graft has a synergistic effect on os-
teogenesis.17, 18 We believe that using a synthetic bone
graft in addition to the bone stimulator provides opti-
mal healing and a quick recovery.

Surgical excision allows the surgeon to address
the weakening of the involved bone before the pa-
tient leaves the operating room. Surgical excision is
an open technique, however, and there will be a peri-
od of relative nonweightbearing for the patient. Other
methods of treatment, such as radiofrequency abla-
tion, exist and are less invasive. Yet these techniques
are not specific for removal of the tumor nidus and
carry the risk of not completely removing the tumor.
Furthermore, radiofrequency ablation is technically
difficult to perform in the metatarsals, and subse-
quent fracture is a concern.

Conclusion

This case was an unusual presentation of forefoot
pain caused by an osteoid osteoma in the diaphysis of
the second metatarsal. Although this tumor is a rare
finding in a metatarsal, osteoid osteoma should be in-
cluded in the differential diagnosis of atraumatic fore-
foot pain, especially when the pain persists at night
and is somewhat relieved by nonsteroidal anti-inflam-
matory drugs. After a diagnosis of osteoid osteoma
has been made, the surgeon must plan to address the
surgically induced stress riser that follows excision of
the tumor. We presented a case report and review of
osteoid osteoma, along with a viable treatment plan
for this benign bone tumor.
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References