

## Conservative Treatment for Patients with Osteoid Osteoma: A Case Series

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**Abstract.** *Background:* Osteoid osteoma is one type of benign bone tumor that may respond to conservative treatment. *Patients and Methods:* A retrospective study of 11 patients with osteoid osteoma was performed. Initially, patients were treated with non-steroidal anti-inflammatories (NSAIDs), unless they continued to have intolerable pain, or if the patient requested surgical resection and radiofrequency ablation (RFA). *Results:* Conservative therapy was successful for five patients. Three patients were treated with NSAIDs and the mean duration of pain was 22 months. The other two patients went into remission without medication by 9 and 24 months, respectively. Four patients underwent surgery after an average of 12 months. Two patients were treated with RFA after 47 and 11 months, respectively. *Conclusion:* Osteoid osteoma can be treated conservatively. Surgical resection and radiofrequency ablation should also be taken into consideration as an option when the results of conservative treatment are poor.

Osteoid osteoma is a benign tumor that mainly occurs in long tubular bones and accounts for 4% of all primary bone tumors (1). Patients with osteoid osteoma are typically young; osteoid osteoma is mostly diagnosed in the second decade of life and rarely diagnosed in individuals over 40 years of age (1-3). These tumors reportedly have a tendency to cause severe pain, which characteristically worsens at night, but which can also be markedly relieved by non-steroidal anti-inflammatory agents (NSAIDs) (1, 2). Generally, the

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recommended medical treatment for osteoid osteoma is complete removal of the tumor *via* surgical resection, percutaneous (4-7), or other radiofrequency coagulation methods. However, spontaneous healing of tumors while treating with NSAIDs (4, 8, 9) has been documented.

It is sometimes difficult to identify a nidus during an operation, even if the surgery is carefully planned (4) and then the operative procedure can sometimes be extensive (10). Prevailing concerns about complications that may be associated with surgery, such as infection, bleeding, brittle fracture (11), and gait disorder encourage attempts of conservative medical treatment through administration of NSAIDs (4-8) for osteoid osteoma. However, this type of conservative treatment probably requires longer treatment periods than do more invasive treatments (11).

During this study, patients with osteoid osteoma were initially treated with NSAIDs; however, if the pain continued to be intolerable, or the patient opted for it, their treatment was changed to surgery or radiofrequency ablation (RFA).

The main purpose of this study was to review the patients with osteoid osteoma we treated and to use our therapeutic experience to gain further insights into the effectiveness of administering conservative treatment.

### Patients and Methods

Thirteen patients that were diagnosed with osteoid osteoma from 1999 to 2012 at the Nagoya City University Department of Orthopedics were included in the study. The medical treatment methods were investigated retrospectively using available medical records. Osteoid osteoma was defined by reactant bone sclerosis around a nidus detected on plain radiographs, computed tomography (CT), or magnetic resonance imaging (MRI).

At the outset, conservative treatment was initiated for all patients *via* administration of NSAIDs. If conservative treatment was not effective in alleviating the pain associated with osteoid osteoma as assessed by the patient, the treatment was changed to surgical resection or RFA. Surgery *via* en-bloc excision was performed and specimens collected during surgery were histologically-assessed.

Table I. An overview of the status of patients based on the study treatments received.

Patient	Age (years)/gender	Treatment group	Location in body	Treatment and regularity of medication	Reason for operation or RFA	Duration of pain (months)	Prognosis	Histology
1	12/M	Conservative	L tibia	Indomethacin (orally) occasionally	--	34	Resolved	NA
2	13/M	Conservative	R tibia	Aspirin (orally) occasionally	--	30	Resolved	NA
3	4/M	Conservative	R tibia	Diclofenac (orally) only when necessary	--	(Unknown)	Lost to follow-up	NA
4*	14/M	Conservative	R femur, L femur	Loxoprofen (orally), regularly	--	2	Resolved	NA
5	16/M	Conservative	L femur	Loxoprofen only when necessary, felbinac topica, when necessary	--	>15 (Unknown)	No remarkable change and lost to follow-up	NA
6	9/F	Conservative	L femur	No medication	--	9	Resolved	NA
7	30/F	Conservative	R first phalanx proximalis pedis	No medication	--	24	Improved	NA
8	21/M	Operation	L talus	Indomethacin regularly	Patient's request	23	Resolved	Osteoid osteoma
9	18/M	Operation	L femur	Viscosupplementation + loxoprofen when necessary	Severe pain	17	Resolved after operation	Osteoid osteoma
10	17/M	Operation	L femur	Loxoprofen only when necessary	Severe pain	8	Resolved after operation	Bone island
11	6/M	Operation	L femur	No medication	Tumor growth (No pain)		Resolved after operation	Bone abscess
12	13/M	RFA	R tibia	No medication	Severe pain	11	Resolved after RFA	NA
13	49/M	RFA	L femur	Loxoprofen only when necessary	Patient's request	47	Resolved after RFA	NA

F, Female; M, male; L, left ; R, right; NA, not available; RFA, radiofrequency ablation. \*Two nidi on each side in the proximal femur

The primary reason for the study was to determine whether osteoid osteoma can be successfully-treated using a conservative treatment approach. Successful treatment was defined as no complaint of pain at follow-up and no further use of NSAIDs. The duration of pain from first medical examination was assessed.

Statistical analysis was performed using statistical software (SPSS version 19, IBM, Chicago, IL, USA). Duration of pain was compared among the conservative-treatment group, the surgical resection group and the RFA group using One-way analysis of variance.

**Results**

Thirteen patients were diagnosed with osteoid osteoma. The average age at baseline was 17.5 years (range=4.9-49.5 years). Clinical symptoms experienced included sharp pain in 12 patients (92%) and night pain in nine patients (69%). One patient, who was diagnosed with osteoid osteoma unexpectedly, experienced no symptom. The nidus was observed in all of the patients. The locations of tumors were as follows: femur in eight patients, tibia in four, talus in one, and first proximal phalange of foot in one. No tumor of the upper limbs was observed.

Two patients were lost from the study because they relocated. Of the remaining 11 patients (Table I), five patients completed conservative medical treatment. Among them, three patients were treated with NSAIDs and the mean duration of pain was 22 months (range=2-34 months). Two other patients went into remission without using NSAIDs within 9 and 24 months, respectively.

Four patients underwent surgery on average 12 months after the first medical examination. The reasons for surgery were intense pain in two cases, patient's request in one case, and tumor growth in one case. After surgery, all patients reported relief from their pain.

Two patients underwent RFA because of sharp pain and at their own request. The treatment was performed 11 and 47 months, respectively, after the first medical examination. Subsequently, all patients reported relief from sharp pain.

Only four patients received a pathological diagnosis. Osteoid osteoma was confirmed in specimens from two patients, and a bone island and bone abscess were confirmed in another two patients, respectively.

Regarding the duration of pain, a significantly statistical difference was not detected after performing a One-way analysis of variance among the data collected from patients receiving conservative treatment, surgery, or RFA ( $p=0.66$ ).

In relation to complications associated with conservative medical management, there were no reports of gastrointestinal bleeding, renal dysfunction, motility disturbance, or a discernible difference in the length of extremities. There was no recurrence and subsequent intervention after surgery and RFA.

*Osteoid osteoma cases. Patient number 1:* A 10-year-old boy presented with left lower extremity pain. The pain appeared to occur spontaneously and had a tendency to be more remarkable during the night. The boy's previous orthopedist



Figure 1. Images of the lower leg taken of a male patient (patient number 1) at the first medical examination: (a) radiograph, (b) magnetic resonance image, T2-weighted sequence. Based on radiographic findings, osteoid osteoma was suspected.

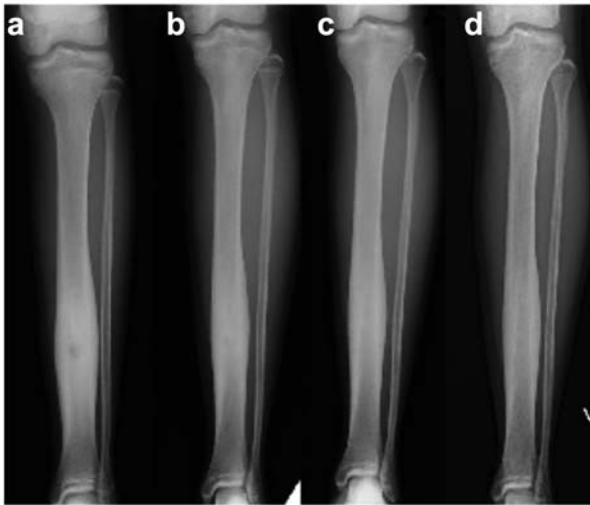


Figure 2. Radiographs taken of the lower leg of a male patient (patient number 1) following treatment: a: One year after treatment (11 years old); b: three years after treatment (13 years old), at which time the patient experienced relief from the pain; c: five years after treatment (15 years old); d: seven years after treatment (17 years old). Simultaneously, the nidus became less prominent and reactant bone sclerosis became thinner.

had detected a neoplastic lesion using plain radiography, and the boy was subsequently referred to our Hospital. During the first medical examination, a plain radiograph of the femur revealed an 8 mm radiolucent area at its greatest



Figure 3. Images of the femur of a male patient (patient number 11): a: radiograph; b: magnetic resonance imaging (MRI) T1-weighted sequence; c: MRI T2-weighted sequence. Based on radiographic findings, osteoid osteoma was suspected.

diameter, surrounded by reactant bone thickening (Figure 1). Moreover, the region of low signal, considered to be calcification, was encircled by an intermediate signal intensity on a T2-weighted sequence using MRI. Based on the clinical findings, osteoid osteoma was suspected, and conservative treatment with indomethacin (via external application) was started. The analgesic effect of this drug was so effective that a more invasive treatment was not necessary. The boy returned for follow-up every six months. Gradually, the nidus became less conspicuous and his symptoms disappeared completely within 34 months of starting medical treatment (Figure 2).

**Patient number 11:** The mother of a five-year-old boy became aware that her son had an abnormal lump in his right knee. When he was 6 years old, the boy suffered from allergic purpura. During the time he was hospitalized for his condition, a pediatrician examined the lump. By chance, a bone deficit was detected in the left shaft of his femur and he was referred to our hospital. During the first medical examination, the swelling on the posterior side of the right

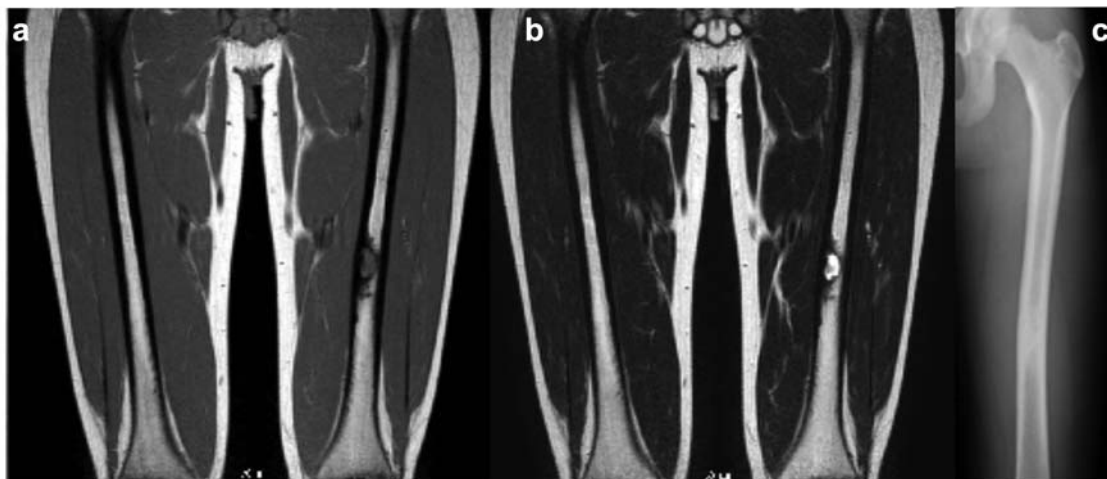


Figure 4. Images of the femur of a patient (patient number 11). a: Magnetic resonance imaging (MRI) T1-weighted sequence; b: MRI T2-weighted sequence; c: a radiograph two months after operation.

knee was exposed. The patient did not complain of any pain on either side of his knees. Gait disturbance was not observed. A radiograph revealed a 4-mm radiolucent area at the widest diameter in the left shaft of the femur and the surrounding reactant bone in the image appeared to show thickening (Figure 3). Moreover, a low signal lesion was visible in both a T1-weighted sequence and a T2-weighted sequence the left distal femur. In the center of this lesion, there was a high-density polygonal-shaped lesion in the T2-weighted sequence. Based on radiographic findings, osteoid osteoma was suspected and the patient returned for follow-up every six months. No analgesic drug was prescribed.

When the patient reached 13 years, growth of the osteolytic lesion was noted *via* MRI (Figure 4) and he required a bone curettage. Pathological findings revealed a sequestrum-like bone fragment with fibroblasts that were organized similarly to granulation tissue with multiple cells, small adipose cells, macrophages, and osteoclasts being visible. The patient's diagnosis was changed from osteoid osteoma to a bone abscess. Two months after operation, bone union was almost achieved. The patient was able to return to school without thigh pain, even during sports activities.

## Discussion

During this study, conservative medical treatment was successful in 5 out of 11 patients (45.5%). Kneisl and Simon provide 12 examples of the treatment of osteoid osteoma using NSAIDs between 1985 and 1989 (4). Based on their report, pain was controlled using NSAIDs in only 6 out of 12 patients. The mean medication period was 33 months. Their research showed that a change of treatment from conservative to surgical was needed for three patients as a

result of the failure to control pain and upper gastrointestinal hemorrhage in one patient, and at the patient's request in the other two patients.

Goto *et al.* stated that successful treatment of osteoid osteoma was achieved in eight out of 12 patients with regular doses of NSAIDs (9). Patients were free of pain in an average of 18.3 months after initiating NSAIDs. Based on the results of this study with NSAIDs, the period required for the treatment of osteoid osteoma was 22 months (range=2-34 months) when treated regularly (one patient) or occasionally (two patients). There were no statistically significant differences in the healing period ( $p=0.776$  by Man-Whitney *U*-test).

The lack of histological diagnosis could be considered as a weakness of the present study. Although the patients who underwent conservative medical treatment were diagnosed with osteoid osteoma, the certainty of the diagnosis was questionable (11, 14-18). Two specimens excised during surgery turned out to be a bone island and a bone abscess. Sim *et al.* stated that two out of 54 examples excised during surgery were confirmed as a Brodie abscess and a juxtacortical osteosarcoma (19). It is important to keep in mind that the working diagnosis is sometimes inaccurate.

The advantage of surgical treatment over conservative treatment and percutaneous radiofrequency coagulation is that it allows for a histological diagnosis (1). If the progress of osteoid osteoma is determined to be unacceptable, as occurred with the rapid growth of the tumor in patient 11 and the poor response to NSAIDs for example, surgical treatment or a biopsy are recommended.

We documented the feasibility of conservative treatment for osteoid osteoma. However, long-term treatment with NSAIDs is not suitable, especially for children (19), because



of the likelihood of adverse events such as gastrointestinal bleeding, or renal dysfunction. If the response to conservative treatment is poor, the treatment plan should be revised. In the present study, there was no significant difference in the duration of pain between conservative treatment, surgical operation, and RFA ( $p=0.66$ ). It is suggested that regular re-evaluation of conservative treatment is needed for patients suffering from prolonged pain. Further investigation is needed to determine when to introduce surgical treatment or RFA. The treatment plan for patients with osteoid osteoma should, above all, be individualized (1).

## Conclusion

Osteoid osteoma can be treated with conservative treatment. Surgery and percutaneous radiofrequency coagulation should also be taken into consideration when the response to conservative treatment is poor, or the progress of the tumor is rapid.

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