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An Alternative Surgical Method for Treatment of Osteoid Osteoma

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Background: An osteoid osteoma is a benign bone tumor that tends to be <1 cm in size. The tumor is characterized by nighttime pain that may be relieved by aspirin or other non-steroidal anti-inflammatory drugs. Osteoid osteoma can be treated with various conservative and surgical methods, but these have some risks and difficulties. The purpose of the present study was to present an alternative treatment method for osteoid osteoma and the results we obtained.

Material/Methods: In the period from 2010 to 2014, 10 patients with osteoid osteoma underwent nidus excision by using a safe alternative method in an operating room (OR) with no computed tomography (CT). The localization of the tumor was determined by use of a CT-guided Kirschner wire in the radiology unit, then, in the OR the surgical intervention was performed without removing the Kirschner wire.

Results: Following the alternative intervention, all the patients were completely relieved of pain. In the follow-up, no recurrence or complication occurred.

Conclusions: The presented alternative method for treating osteoid osteoma is an efficient and practical procedure for surgeons working in clinics that lack specialized equipment.

MeSH Keywords: Bone Cysts • Bone Wires • Osteoma, Osteoid • Tomography Scanners, X-Ray Computed

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Background

Osteoid osteoma is a common benign bone tumor characterized by night-time pain that may be relieved by aspirin or other non-steroidal anti-inflammatory (NSAI) drugs [1]. Osteoid osteoma was first described by Jaffe in 1935 and accounts for 10% of all benign bone tumors [2]. The tumor is most common in long bones such as the femur and tibia. This tumor is most common between the ages of 7 and 25 years, and it occurs approximately 3 times more frequently in males than in females [2,3].

The diagnosis can be readily established by the presence of pain that becomes severe at night and is relieved by salicylates. Radiographs show a round lucency, containing a dense sclerotic central nidus surrounded by reactive sclerosis. For the diagnosis and differential diagnosis of lesions with atypical findings and localizations, computed tomography (CT), bone scintigraphy, and magnetic resonance imaging (MRI) can be used [4].

Surgical therapy is aimed at resection or damage of the nidus. Conventionally, the nidus is extirpated by either en bloc resection or curettage. Recently developed advanced methods, such as percutaneous CT-guided nidus drill ablation or thermo-coagulation with a laser can also be used [1,5]. These advanced methods can be done in the radiology unit, but require specialized surgical equipment and are expensive.

The purpose of this study was to present a simple, inexpensive, and efficient alternative method for the surgical treatment of osteoid osteoma and the results we obtained with this method.

Material and Methods

The study began after the study plan was approved by the Ethics Committee of our hospital on June 2, 2015. We retrospectively studied data on 10 patients with osteoid osteoma who were followed up and underwent surgical therapy with the new method in the YüzüncüYil University Hospital in the period from 2010 to 2014. The diagnosis of osteoid osteoma was established with anamnesis and radiographic and CT findings. No preoperative biopsy was performed for diagnosis. All the patients gave written informed consent before the surgical intervention. The decision for surgery was based on the presence of pain escalating at night and need for NSAI drugs and characteristic presence of cortical thickening and nidus of osteoid osteoma in direct radiography and CT.

The data in Table 1 show patient age, sex, affected extremity, length of follow-up, length of hospitalization, presence of nidus in excised bone, length of medication use, and results of pathological examination. The patient population included 3 females and 7 males, and the mean age was 14 years (range, 4–23). The tumor was localized in the tibia in 2 patients and

Table 1. General characteristics, treatment and follow-up period of patients.

Patient #	Age	Sex	Limb	Localization	Drug and duration (month)	Hospitalization duration (day)	Follow-up period (month)
1	16	Female	Right tibia	Proxsimal Cortical	NSAID, 12	2	53
2	18	Male	Left femur	Subtrochanterc Cortical	Aspirin, 7	4	49
3	7	Female	Left femur	Subtrochanterc Cortical	NSAID, 8	3	36
4	5	Male	Right femur	Subtrochanterc Cortical	NSAID, 18	3	19
5	4	Male	Right femur	Diaphis Cortical	NSAID, 12	2	32
6	15	Female	Right femur	Subtrochanterc Cortical	NSAID, 4	2	25
7	22	Male	Left femur	Subtrochanterc Cortical	Aspirin, 2	1	7
8	14	Male	Right tibia	Diaphis Cortical	Aspirin, 12	1	14
9	23	Male	Left femur	Subtrochanterc Cortica	NSAID, 12	1	13
10	16	Male	Right femur	Subtrochanterc Cortical	NSAID, 24	2	15

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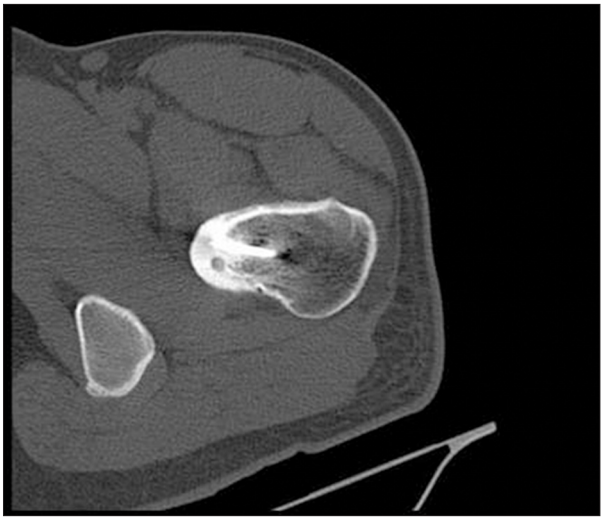

Figure 1. Determination of tumor localization with guided Kirschner wires and computed tomography.

in the femur in 8 patients. The mean durations of hospitalization and follow-up were 2.1 (range, 1–4) days and 26.3 months, respectively.

The patients received postoperative oral antibiotic therapy and were discharged from the hospital with the recommendation of putting their weight onto the operated side as much as they can tolerate in the first postoperative days, and then to put their whole weight on the extremity starting at 7–10 days after surgery. In the preoperative period the patients were asked to score the intensity of pain, particularly at night, on the VAS pain scale. In the postoperative period, pain control was assessed at months 1, 3, 6, and 12 by again using the VAS pain scale. The patients were on which day post-surgery they could put their whole weight on the operated side and control their joint movements.

Surgical method

The surgical method was performed in 2 steps under regional anaesthesia. The first step took place in the CT unit and the second step in the OR. In the CT unit, following the skin preparation, avoiding vessel and neural structures, the nidus was targeted in 3-mm CT sections and a Kirschner (K) wire was advanced with a burr drill. At 0.5 mm, the cortex wire advancement was stopped, and the localization of the tumor was determined by measuring the distance between the nidus area and K wire (Figure 1).

The localization of the nidus was determined according to tomography section and the edge of K wire status (Figures 1–5). The next stage occurred in the OR. With a small incision, the tip of the K wire penetrating the cortex was found (Figure 6). By measuring the tip, the possible nidus area was marked and from this area, a 1×1 cm bone cortex was extirpated to an appropriate depth with drill and osteotome (Figure 7). The nidus was found, extirpated, and sent for pathological examination. All patients underwent postoperative radiographs (Figure 8). The operation was ended following debridement and irrigation of the wound area, appropriate closing of the tissues, and applying an elastic bandage.

Results

For relief of pain, 7 patients had used NSAI drugs and 3 patients had used aspirin. The mean interval between the start of pain and surgical intervention was 11.1 (range, 2–24) months. The mean preoperative VAS pain scale score was 8.3 (range, 7–9) and the mean post-operative VAS pain scale score was 0.5 (range, 0–1), and this difference was statistically significant (p=0.004). The nidus tissue could be directly seen in bone excisions in 8 patients during surgery, and in 2 patients the pathological examination revealed the presence of the nidus and led to the diagnosis of osteoid osteoma. The tumor was located in the bone cortex in all patients (Table 1).

In the control group, the patients reported no pain and no need for NSAI drugs, their VAS pain scale score was 0.5, and they could put their whole weight onto the operated limb starting on postoperative day 1 with no limited joint movement. Moreover, no complications or recurrences were reported.

Discussion

Surgical excision of the nidus is considered the criterion standard in the treatment of osteoid osteoma [16]. Treatment options of osteoid osteoma includes en bloc resection, open intralesional curettage, CT-assisted percutaneous en-bloc excision, CT-assisted percutaneous radiofrequency, CT-assisted percutaneous thermocoagulation, CT-assisted percutaneous laser photocoagulation, CT-assisted percutaneous radiofrequency ablation, and CT-assisted percutaneous en bloc excision [17].

In this article we presented an alternative surgical technique that begins with determination of tumor localization by CT-guided K wire in the CT unit, followed by performance of a mini-incision and excision in the OR, along with the results of this technique for treating osteoid osteoma.

Although it has been reported that long-term use of NSAI drugs may cause spontaneous regression in osteoid osteoma, surgical excision avoids the adverse effects of these drugs and can be used to establish histological diagnosis [1].

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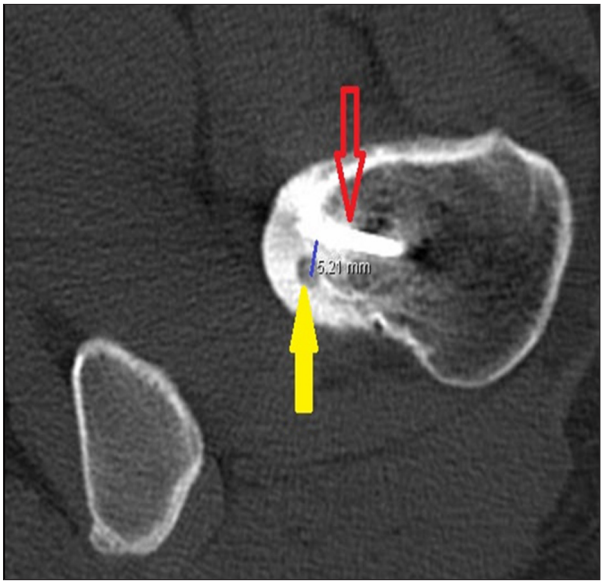

Figure 2. Measurement of the distance between K wire and center of nidus on axial view of CT image. Red arrow: View of K wire; Yellow arrow: View of nidus; Blue line: Distance between K wire and center of nidus.

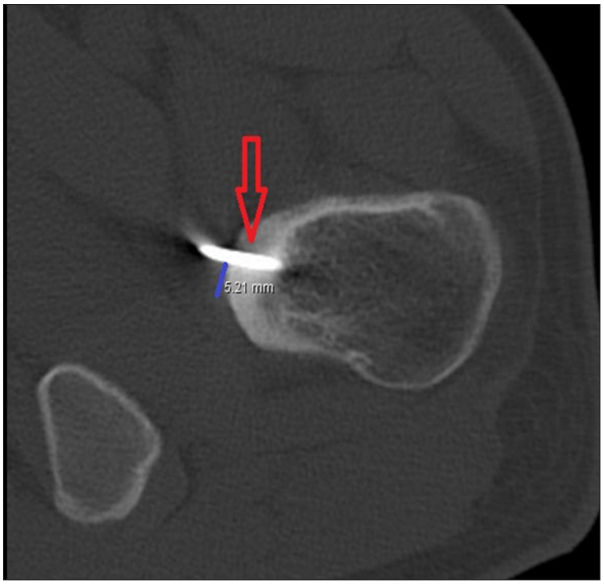

Figure 3. Blue line: The distance from the starting point of the K wire to the nidus projection.

The conventional en bloc excision of a nidus may also result in the loss of normal bone tissue caused by long-term avoidance of putting weight onto the operated extremity, and in pathologic fractures. Due to the wide surgical exposure, this classical method also carries the risks of soft-tissue damage, formation of a wide scar, and delayed wound healing. The localization and extirpation of a nidus is difficult. In some cases, nidi that cannot be surgically extirpated may cause problems worse than preoperative pains, as well as recurrences.

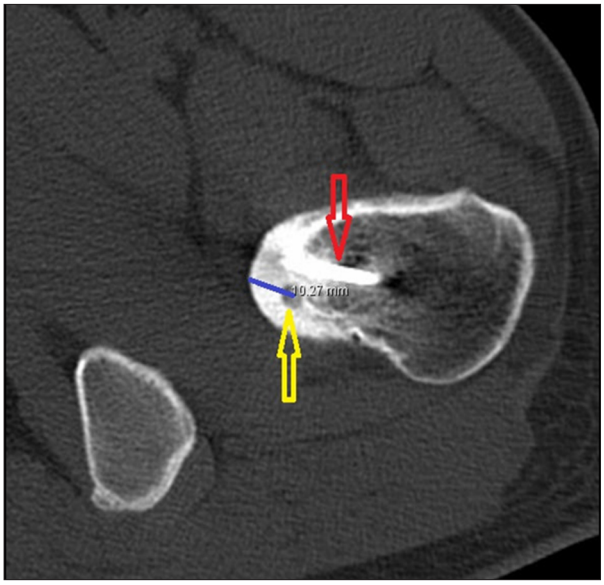

Figure 4. Blue line: The distance between the center of the nidus andthe tip of the cortex (depth of nidus).

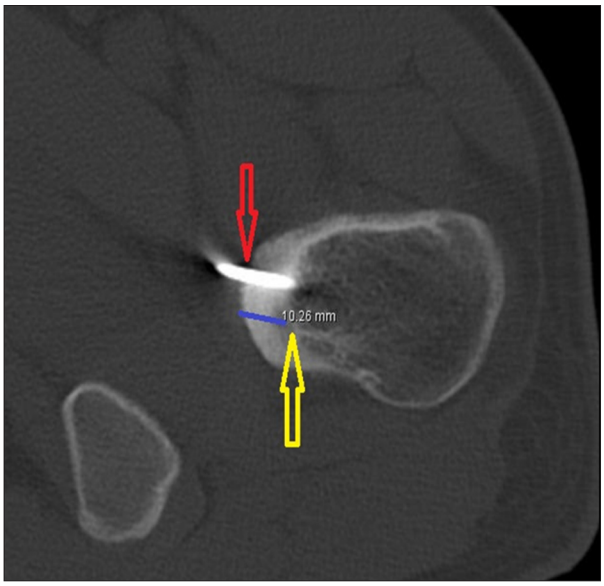

Figure 5. Blue line: The distance between the center of the nidus and tip of the cortex (depth of nidus).

Sometimes bone grafts are used to fill in the space left by the extirpated nidus, thus potentially causing damage in other parts of the body. In conclusion, conventional methods cause long-term limitation of patient activities [6]. Sluga et al. studied 106 treated patients and reported the rates of local recurrence as 4.5% in en block resection and 12% in curettage patients, and rates of postoperative fracture as 4.5% in en block resection and 3% in curettage patients [7].

In this study we excised about 1×1 cm of bone tissue, which is too small to cause a pathological fracture; therefore, patients

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Figure 6. Finding the tip of the K wire exiting the cortex through the skin incision.

Figure 7. Image of the nidus and bone tissue in the area of the removed tumor with the help of drill and osteotome.

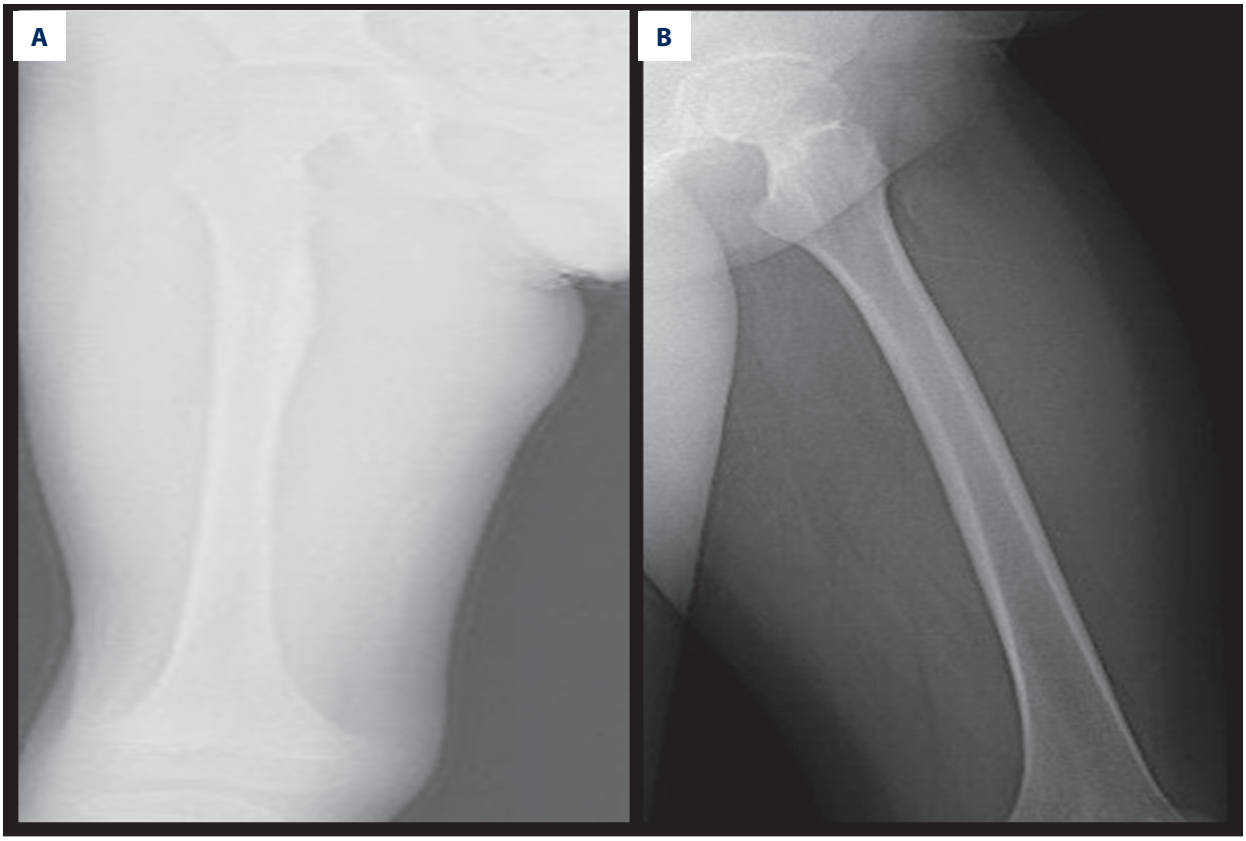

Figure 8. Postoperative anteroposterior (**A**) and lateral (**B**) radiographs of patients.

were mobilized by putting tolerable weight onto the operated extremity on postoperative day 1 and putting the entire weight on the extremity starting at postoperative days 7–10. Moreover, no patient required grafting. The patients returned to their preoperative activities by about 7–10 days after the operation. No residual tumor or recurrence was observed in follow-up. Thus, the method we used seems to be superior to en block resection because our method requires only a small incision, little excarnation of small soft tissue, less bone tissue excision, low fracture risk, and fast recovery of patients.

Minimal invasive methods developed for therapy of osteoid osteoma, such as excision with percutaneous CT-guided drilling, MRI-guided cryotherapy and laser therapy, arthroscopic resection, CT-guided interstitial laser photocoagulation, and percutaneous ablation with radiofrequency probe, cannot be always

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used because they are expensive and the high cost is an important issue. In addition, these methods require specialized equipment that is not found in every clinic [8,11]. Etienne et al. reported a failure rate of 6% in their 35 patients with osteoid osteoma treated with interstitial laser photocoagulation and followed-up for about 40 months [12]. A retrospective study of 54 non-spinal osteoid osteoma patients treated with percutaneous CT-guided resection reported failure in 4 (7.4%) patients, who then had to undergo a second surgical intervention [13]. Raux et al. reported failure in 5 patients, femoral fracture in 2 patients, and recurrence in 1 of their 44 patients treated with percutaneous CT-guided resection [14]. Albisinni et al. treated 27 patients with elbow osteoid osteoma by using thermal ablation and obtained cure in 24 cases [15].

Successful results were obtained in all of our 10 patients with no requirement for a second intervention. Also, none of our patients had recurrence or complications, such as infection, fracture, or wound problems. When the results, cost, and practicality of our method are considered, it has more advantageous than other advanced methods. Additionally, this technique does not need specialized equipment, other than conventional orthopedic surgical materials, to safely removing the nidus.

When the risks of conventional techniques such as en bloc resection, and the cost of advanced techniques such as ablation are considered, our technique seems to be preferable.

The other treatment option of osteoid osteoma is percutaneous en bloc excision. In this method, a CT-guided K wire is forwarded toward the center of the nidus, and then the trephine is forwarded percutaneously through the wire and the thick cortical frame, including the nidus, is excised en bloc [18,19]. Towbin et al. treated 9 patients by using percutaneous en bloc excision and reported that recurrence occurred in only 1 patient. To remove 9 nidus, they used 11 tracks. All resected specimens were sent for pathologic examination, but histologic confirmation of the nidus was made in only 5 cases out of 9 [18]. Alemdar et al. treated 24 patients by this technique and reported success in 21 and a failure in 3 (these 3 patients were found to have wide-based nidus). One patient developed an incomplete tibial fracture 3 months after the operation. The histopathological evaluation of specimens from patients revealed non-specific findings in 4 patients (17%) [19].

The disadvantage of en block resection is that forwarding the K wire toward the center of the nidus is difficult, especially when the nidus is around the neurovascular area and it is necessary to choose an indirect route through the 2 cortices. Another disadvantage of this technique is that it requires power tools for removing the cortical frame when the bone is thick, when the nidus is wide-based, when the selected route is through 2 cortices, or when multiple tracks are needed. Another disadvantage of this technique is that, due to fracture risk, it requires a cast or splint and does not allow early mobilization by putting weight onto the operated extremity.

Our technique is more advantageous, practicable, safe, and comfortable because of the following: we excised only about 1×1 cm of bone tissue (too small to cause a pathological fracture), the technique does not require a cast or splint, it is not necessary to forward the K wire to the center of the nidus, and it allows histologic confirmation of the nidus in all specimens. Using this technique, the patients were mobilized by putting tolerable weight onto the operated extremity on postoperative day 1 and putting the whole weight on the extremity by postoperative days 7–10. Patients did not need a cast or splint and did not have to avoid physical activities. There were no complications such as fracture or recurrence.

Limitations of our study are that we had incomplete data because it was a retrospective study, and limited reliability due to the limited number of cases. Nevertheless, we think that our results are an important contribution to the relevant literature and can be an inspiration for future studies.

Conclusions

By using the presented method, we were successful in the localization and excision of nidi, with no complications. Thus, our method is an inexpensive, efficient, and safe alternative in the surgical treatment of osteoid osteoma.

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