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# Clinical and morphological characteristics of osteoid osteoma and osteoblastoma: a retrospective single-center analysis of 204 patients ☆

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ABSTRACT

Osteoid osteoma and osteoblastoma are histologically similar, benign bone-forming tumors. In this retrospective study, we aimed to evaluate the natural history; clinical, pathologic, and radiologic findings; and treatment results in 204 patients between 1959 and 2006 in a single institution. According to the World Health Organization's definition, tumors ≤1 cm in diameter were classified as osteoid osteoma, and those ≥2 cm, as osteoblastoma. For tumors between 1 cm and 2 cm, other criteria, such as the bone involved, the site, the presence of a nidus, and presence of peripheral sclerosis, were used for diagnosis. There were 131 patients with osteoid osteoma (93 male, 38 female) and 73 patients with osteoblastoma (40 male, 33 female). The mean age in the osteoid osteoma and osteoblastoma groups was 16.4 ± 7 and 19.6 ± 9.9 years, respectively. The osteoid osteoma cases were mostly localized in the extremities, whereas the osteoblastoma cases involved the vertebral column and sacrum. The nidus size varied between 0.2 and 1.5 cm in osteoid osteoma cases, and the tumor size range was 1.3–10 cm in the osteoblastoma cases. The pain was encountered in 89% of osteoid osteoma and 45% of osteoblastoma patients. Histopathology was similar in both cases. The treatment of choice was conservative surgery for both diagnoses. In conclusion, osteoblastoma is clinically and radiologically more aggressive than osteoid osteoma.



## 1. Introduction

Osteoid osteoma (OO) and osteoblastoma (OB) are histologically similar, benign bone-forming tumors [1–4]. The differential diagnosis of these two entities is made according to the World Health Organization (WHO) definitions [5]. An OO is a benign osteoblastic lesion characterized by a well-demarcated core (nidus) of usually less than 1 cm and by a distinctive surrounding zone of reactive bone formation, whereas an OB is a progressively growing lesion of a larger size, is sometimes painful, and is characterized by the absence of any reactive perilesional bone formation [5,6].

Until Jaffe recognized and described five cases as a distinct pathologic entity in 1935, only sporadic OO cases were reported [7]. OB was first described in 1932 by Jaffe and Mayer, who considered it to be an osteoid matrix-forming tumor [6,8,9]. It was not until 1956 that Lichtenstein and Jaffe independently described OB as a clinical and morphological entity [10,11]. Although there is similarity in the histopathological appearance of OO and OB, these tumors are two distinctively different entities. This distinction is essentially based on the clinical and radiological differences, that is, frequently lacking characteristic pain pattern and reactive bone formation, and the larger size of benign OB in comparison to OO. However, the distinction is not always clear, and the differential diagnosis is still uneasy [12].

Although pathology and clinical characteristics of OO and OB have been reported in literature [1–6], there is no extensive and large series reported from Turkey. In this retrospective case series study, we aimed to present our series of 204 patients with OO or OB to evaluate the clinicopathological findings and characteristics of these two tumors. This is the first large series of OO and OB reported from Turkey.

## 2. Materials and methods

This is a retrospective case series study in which 204 patients with OO or OB who were diagnosed in the Department of Surgical Pathology of Ege University Medical School between 1959 and 2006, and evaluated by a specialized bone pathologist (FO) were included. The study was approved by the Institutional Ethics Committee, and

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**Table 1**
Demographics of patients with osteoid osteoma and osteoblastoma

| | | Osteoid osteoma | Osteoblastoma |
|---|---|---|---|
| Number of patients | | 131 | 73 |
| Gender | Male | 93 (70.9%) | 40 (54.8%) |
| | Female | 38 (29.1%) | 33 (45.2%) |
| | Male/female ratio | 2.3/1 | 1.2/1 |
| Mean age | | 16.4 ± 7 (3–40) | 19.6 ± 9.9 (3–53) |
| Age at diagnosis | <20 y | 97 (74.04%) | 34 (46.57%) |
| | 20-30 | 28 (21.37%) | 31 (42.46%) |
| | 30-40 | 5 (3.81%) | 5 (6.84%) |
| | 40-50 | 1 (0.76%) | 1 (1.36%) |
| | >50 | 0 | 2 (2.73%) |

informed consent was not required due to retrospective nature of the study.

According to the WHO definition, tumors ≤1 cm in diameter were classified as OO and those ≥2 cm as OB. For tumors between 1 cm and 2 cm, other criteria, such as the bone involved, the site, the presence of a nidus, and presence of peripheral sclerosis, were used for diagnosis [5].

The patients' age, gender, tumor site, symptoms, and clinical and radiologic findings were noted from the hospital files. The pathological samples that were stained with hematoxylin-eosin (H&E) were reviewed, and the histopathological findings were noted.

The study data were presented with descriptive statistics such as frequency, percentage, mean ± standard deviation, and range (min–max).

## 3. Results

### 3.1. Study population

A total of 131 patients with OO (male/female ratio, 2.3/1; mean age, 16.4 ± 7 years) and 73 patients with OB (male/female ratio, 1.2/1; mean age, 19.6 ± 9.9 years) were included in the study. In total, 93% of cases were diagnosed before the age of 30. Most OO cases presented in the second decade (55.7%), and most OB cases presented in the third decade (42.5%) (Table 1).

**Table 2**
Distribution of osteoid osteoma and osteoblastoma by site

| Localization | Osteoid osteoma (n = 131) | Osteoblastoma (n = 73) |
|---|---|---|
| Femur | 42 (32.1%) | 12 (16.4%) |
| Tibia | 32 (24.4%) | 4 (5.7%) |
| Humerus | 3 (2.3%) | 5 (6.8%) |
| Talus | 9 (6.8%) | 4 (5.5%) |
| Radius | 3 (2.3%) | 3 (4.1%) |
| Fibula | 3 (2.3%) | 2 (2.7%) |
| Wrist and hand bones | 13 (9.9%) | 3 (4.1%) |
| Foot | 9 (6.8%) | 1 (1.4%) |
| Skull bones | - | 5 (6.8%) |
| Jaws | - | 2 (2.7%) |
| Vertebral column and sacrum | 8 (6.1%) | 29 (39.7%) |
| Cervical region | 2 | 5 |
| Thoracic region | 2 | 7 |
| Lumbar region | 4 | 9 |
| Sacrum | - | 8 |
| Mandible | 2 (1.5%) | - |
| Olecranon | - | 1 (1.4%) |
| Rib | - | 1 (1.4%) |
| Sternoclavicular region | - | 1 (1.4%) |
| Calcaneus | 1 (0.7%) | - |
| Patella | 1 (0.7%) | - |
| Acetabulum | 1 (0.7%) | - |
| Ulna | 1 (0.7%) | - |
| Glenoid | 1 (0.7%) | - |
| Unknown | 2 (1.5%) | - |

### 3.2. Tumor localization

The OO cases were mostly localized in the extremities (Table 2). In total, 59% of the OOs were localized in the long bones of the lower extremities. Twenty-five of the 42 cases involving the femur were located at the upper end of the femur, principally at the neck and trochanter. The OOs placed in the vertebral column usually involved the posterior elements. One hundred sixteen cases were located within the cortex, 11 cases were in medullary part of bone, and 4 cases were in the subperiosteal region. There were 4 cases near or within joints, and in 5 cases, the adjacent synovial tissue showed a chronic villous synovitis. Of the tumors that occurred in the long bones, 54.8% were metaphyseal, 38.1% were diaphyseal, and the remaining 7.1% were located within the epiphysis. In 5 cases, there were multiple nidi in one bone. The nidus size varied between 0.2 and 1.5 cm.

In OBs, the vertebral column and sacrum were involved in 39.7% of all lesions (Table 2). OBs in the vertebral column tended to involve the posterior elements. The long bones of the lower extremities were the second most common site of the OB (23.3%). Seventeen cases were found in the diaphysis, 5 cases in the metaphysis, and 1 case was localized in the epiphysis. Except for 2 cases, all OB cases were found in the medullary part of the bone. The 2 periosteal cases were located in the humerus and femur. The tumor size range was 1.3 to 10 cm.

### 3.3. Clinical characteristics

Reliable data for clinical evaluation were only obtained in 97 cases of OO and 47 cases of OB. In OOs, the most common symptom was pain (89%). The pain usually worsened at night and was relieved by aspirin. In OBs, the most common symptom was also pain (45%)

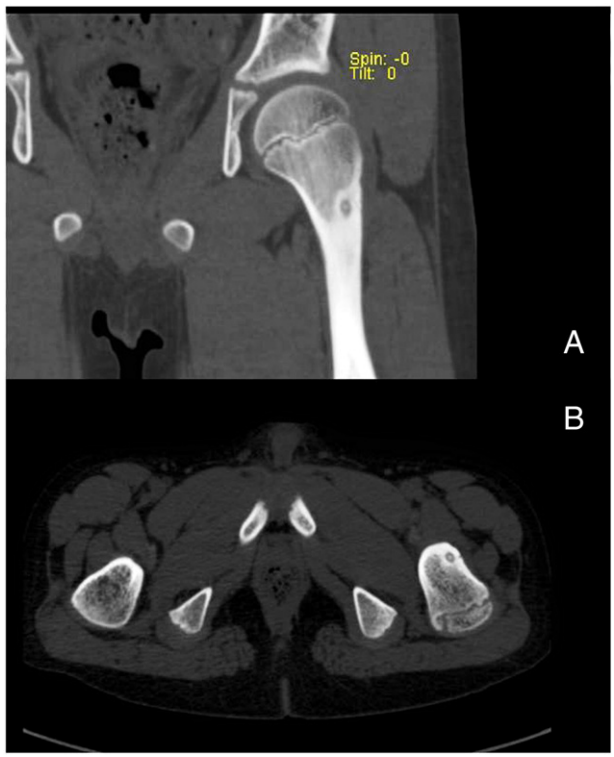


**Fig. 1.** Coronal reconstruction computed tomography showing an osteoid osteoma nidus in the neck of the left femur with calcification and prominent sclerosis (A). Pelvic computed tomography showing a subcortical osteoid osteoma in the neck of the left femur surrounded by sclerosis (B).