# Cutaneous Metastasis of Osteosarcoma in the Scalp

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**Abstract:** As a primary malignant bone tumor, osteosarcoma is second only to chondrosarcoma. Although it commonly metastasizes and is aggressive in nature, it rarely colonizes the skin. This is a report of a 22-year-old male with osteosarcoma of the pelvis and metastasis to the lungs and chest wall who developed a clinically unsuspected solitary cutaneous metastasis in the scalp. Instead of the expected cyst, incisional biopsy disclosed a solid tan nodule of chondro-osseous sarcoma. Although rare, cutaneous metastases from osteosarcoma may appear in skin, especially the scalp, or in skin over the primary tumor. New skin lesions in a patient with a history of osteosarcoma warrant investigations including imaging and biopsy.

**Key Words:** cutaneous metastasis, osteosarcoma, scalp

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## INTRODUCTION

Osteosarcoma, a highly aggressive malignancy arising in bone, has metastasized in 20% of patients at the time of initial presentation.[1] In adults, osteosarcoma is the second most common primary bone cancer accounting for 28% of cases.[2] Some neoplasms metastasize to skin with facility, for example, renal cell carcinoma; osteosarcoma is not one of them. Although osteosarcoma commonly metastasizes to the lungs, bones, and kidneys, cutaneous metastatic lesions are rare[3] occurring in only 5%–10% of patients with internal malignancy.[4] This case inclusive review of the literature found 15 cases with 23 total cutaneous metastases from osteosarcoma. Cutaneous metastases from osteosarcoma have been found in 6 women and 6 men and in 3 other patients of unspecified gender (Tables 1, 2). To our knowledge, this is the first case in which a primary osteosarcoma of the pelvis has shed a solitary metastasis to the scalp.

## CASE REPORT

A 22-year-old male presented with pain and significant weakness of the right lower extremity, including numbness of the right foot, in January 2007. Initial evaluation included computed tomography (CT) scan that revealed a 12.7-cm pelvic mass centered on the posterior ilium encroaching on sacrum, with anterior and posterior soft-tissue extension and invasion of the right iliopsoas muscle (Fig. 1). A core biopsy revealed a partly necrotic malignant spindle cell neoplasm associated with a fine lattice of sarcomatous osteoid (Fig. 2). Immunohistochemically, the tumor cells were negative for muscular (desmin and smooth muscle actin), epithelial (pancytokeratin), and vascular, CD34, melanocytic, and neuronal (S100) differentiation. Additional imaging 1 month later disclosed a 9.6-cm mass in the right chest wall with destruction of the right third rib. Multiple small metastases were found in the lungs. The patient was diagnosed with high-grade stage IV osteosarcoma.

In October 2007, the patient underwent wide resection of the metastatic right chest wall mass, including resection of ribs 2–4, portions of muscle and wedge resection of the right lung. At this time, the patient began chemotherapy with cisplatin and doxorubicin followed by radiation therapy to the pelvic tumor. After 30 cycles of radiation therapy, high-dose methotrexate was substituted for doxorubicin. The patient was monitored with serial CT scans that revealed increasing bilateral pulmonary and pleural nodules but stable disease in the pelvis. A relapse with recurrent multiple pulmonary nodules prompted R1507 initiation in July 2008. The patient entered into SARC011 trial with IGFR-1[5] antibody in October 2008. For a period of 3 months, the disease did not progress.

On September 23, 2008, the patient was referred to a dermatologist for what was deemed clinically to be a "cyst" of the left parietal scalp, unrelated to the bone tumor. It was a single erythematous dome-shaped lesion with hair loss (Fig. 3A). Upon incision, it consisted of solid gritty tan tissue that felt like cartilage to the dermatologist (Fig. 3B). A wedge biopsy was done rather than excision and revealed osteosarcoma in the dermis and subcutaneous layer of the scalp (Fig. 4). Reticular dermis was replaced by a pleomorphic population of sarcoma cells producing malignant osteoid and chondroid. The 4-cm mass was subtotally re-excised on October 17, 2008. The aggregate of chondro-osseous sarcoma (Fig. 5) extended from the epidermis to the fascia and no further. Underlying bone was uninvolved.

Restaging of the patient showed new metastases in the lungs, the base of the neck and lymph nodes. He was treated for pneumonia when he went in for a routine chemotherapy treatment 3 months after scalp biopsy. On February 19, 2008, he entered a randomized phase III trial of deforolimus (AP23573) as "maintenance therapy" for metastatic soft tissue and bone sarcomas 2 weeks later. He was seen again the next month and was stable.

Five and a half months after the complete re-excision of the scalp metastasis, the patient was admitted to the emergency room with hematemesis and hospitalized overnight. The patient left the hospital the next day against medical advice and hematemesis resumed. He was found by paramedics having lost multiple liters of blood and developed cardiogenic shock en route to the emergency room where he arrived in complete asystole and was unable to be resuscitated.

## DISCUSSION

The national incidence of osteosarcoma is roughly 900 cases per year in the United States.[6] In its advanced stages, osteosarcoma characteristically metastasizes to various regions

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**TABLE 1.** Cutaneous Metastases of Osteosarcoma Case Reports

| Case Report | Patient Age/Sex | Primary Site | Duration to Skin Metastasis | Skin Metastasis Site | Other Metastasis | Information of Interest |
|---|---|---|---|---|---|---|
| Finnerud[6] | 43-year male | Right humerus | 14 mos | 1 Scalp, 1 Left submaxilla | Lung, pleura | — |
| Jeffree et al[7] | Unknown | Femur | Unknown | Subcutaneous | Lung | — |
| | Unknown | Femur | Unknown | Subcutaneous | Lung | — |
| | Unknown | Tibia | Unknown | Scalp | Lung | — |
| Myhand et al[8] | 21-year male | Right clavicle | Initial | Over primary | Lymph node | h/o Hodgkin's w/radiation, age 14. over area |
| Setoyama et al[9] | 20-year male | Right humerus | 4 years | Scalp | Lung | — |
| Harkel et al[10] | 14-year male | Right femur | 4 weeks | Scalp | Brain | — |
| Collier et al[11] | 75-year female | Right tibia | 8 months | Over primary | Lung | — |
| | 46-year female | Right femur | 24 years | Scalp | Lung, nerve | — |
| Herman and McAllister[12] | 12-year female | Right femur | Initial | Abdomen | Muscle | Multifocal synchronous |
| Ouseph et al[1] | 25-year male | Right femur | 3 years | 5 scalp<br>1 neck<br>1 chest<br>1 abdomen | Lung | — |
| Ragsdale et al (current report) | 22-year male | Pelvis | 21 months | Scalp | Lung | — |

**TABLE 2.** Cutaneous Metastases of Extraskeletal Osteosarcoma

| Case Report | Patient Age/Sex | Primary Site | Duration to Skin Metastasis | Skin Metastasis Site | Other Metastasis | Information of Note |
|---|---|---|---|---|---|---|
| 2000; Pillay et al[13] | 56-year female | Scalp | Initial | Scalp | None | Lost to f/u |
| 2003; Covello et al[14] | 83-year female | R breast | 18 months | Scalp | Lung, liver, spine, pelvis, brain | — |
| 2008; Lee et al[4] | 48-year female | Mediastinum | 2 months | Scalp | Lung, pleura, paranchyma | — |

of the body. Metastatic lesions are found incidentally in 20% of cases at the time of presentation although about 30%–40% of the remaining cases develop metastatic lesions subsequent to diagnosis.[2] Thus far, cutaneous metastasis has only been found as a secondary manifestation of osteosarcoma. In a study of the metastatic patterns of osteosarcoma, Jeffree et al[15] note a positive correlation between radiotherapy and tumor recurrence and metastasis due to the difficulty of controlling the primary tumor and for the apparent resistance to treatment of later-occurring lung metastases.[16] Among the reported instances of cutaneous metastases (this case inclusive), chemotherapeutic treatments preceded metastasis in 75% of osteosarcoma cases.

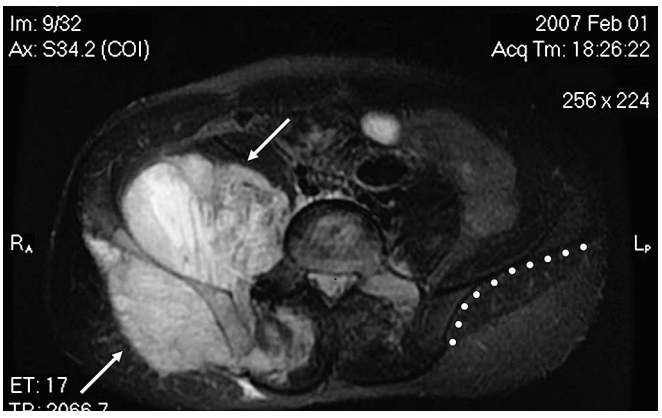


**FIGURE 1.** Magnetic resonance imaging of the pelvis at presentation demonstrating a 12.7-cm mass (arrows) consisting of massive soft-tissue extensions on both sides of the tumor epicenter in ilium. The dotted line indicates the external cortex of the uninvolved left ilium.

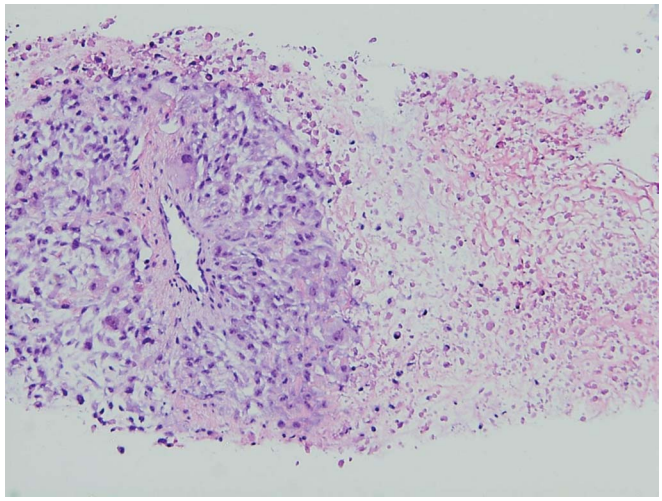

**FIGURE 2.** Core biopsy of primary osteosarcoma of the ilium. A fine lattice of eosinophilic osteoid is best seen in the necrotic background (right upper quadrant) (×200).

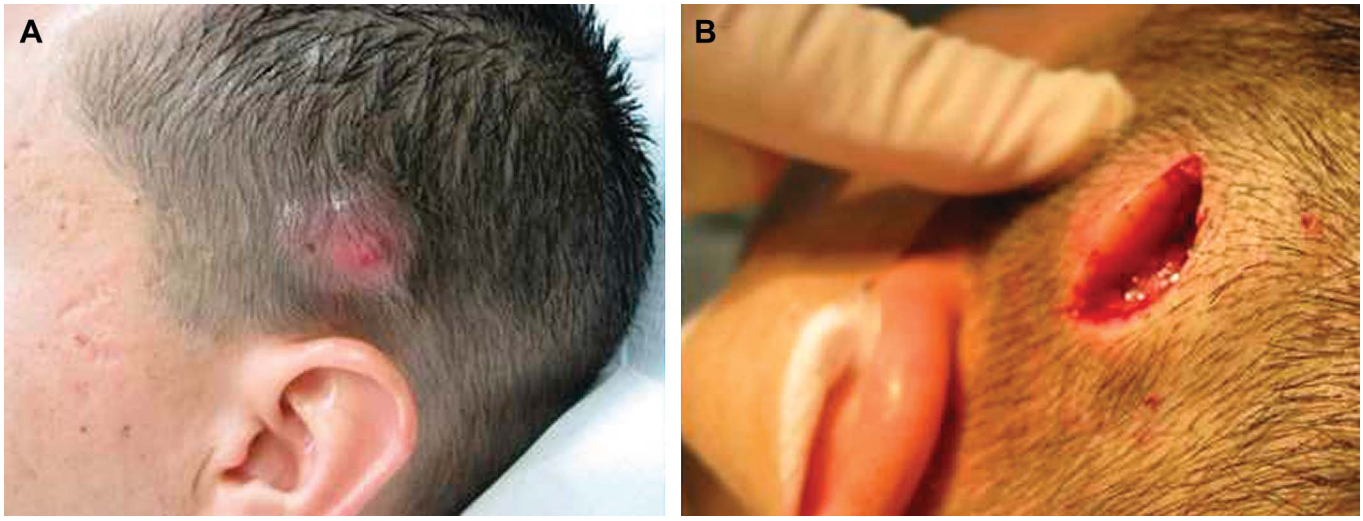


**FIGURE 3.** A, Left parietal scalp nodule clinically suspected to be a common epithelial cyst. B, Attempted incision and drainage found solid tan tumor.

Metastatic lesions from osteosarcoma favor the lungs (95%), bone (50%), and kidney (12%).[2] Only 14 previous cases of cutaneous metastases of osteosarcoma have been reported. The femur is the most common primary site of osteosarcomas that metastasize to the skin (26%). Cutaneous metastases frequently cluster as multiple nodules in the vicinity of the primary tumor; however, distant metastases are not uncommon (39%).[11]

Although cutaneous metastatic osteosarcoma is a rare event metastases show an anatomical bias for the upper body, particularly the head and neck region (70%). The first report of cutaneous metastasis of osteosarcoma was recorded by Finnerud[6] in 1924 describing a primary tumor of the right humerus that disseminated to the scalp and submaxillary region.[7] The previously reported 14 patients had 22 cutaneous lesions. Their distribution of location includes 13 in the scalp, 2 in skin overlying the primary osteosarcoma site, and 7 metastatic skin lesions located elsewhere (Table 3). The location of the other lesions includes the neck, maxilla, abdomen/chest, and unspecified subcutaneous position. The lesion described in the present patient was on the scalp bringing the prevalence of cutaneous metastases on the scalp to 61%.

Three of the cases of cutaneous metastases of osteosarcoma to the scalp have come from primary extraskeletal osteosarcoma (ESOS) (Table 2). In 2000, Pillay et al[13] reported a case of primary ESOS in the scalp followed by a locoregional metastasis.[12] Covello et al[14] reported ESOS in the breast with a metastasis to the scalp with further metastases in the lungs, liver, spine, pelvis, and brain. In 2008, Lee et al[4] described a primary ESOS in the mediastinum with metastasis to the scalp.

Osteosarcoma escape from the bone is deemed to be hematogenous[2] rather than through the lymphatic system as bone is devoid of lymphatic vessels.[15] Therefore, the predilection for metastasis to the scalp (and the lung) is likely due to the generous supply of fine capillaries in this region.

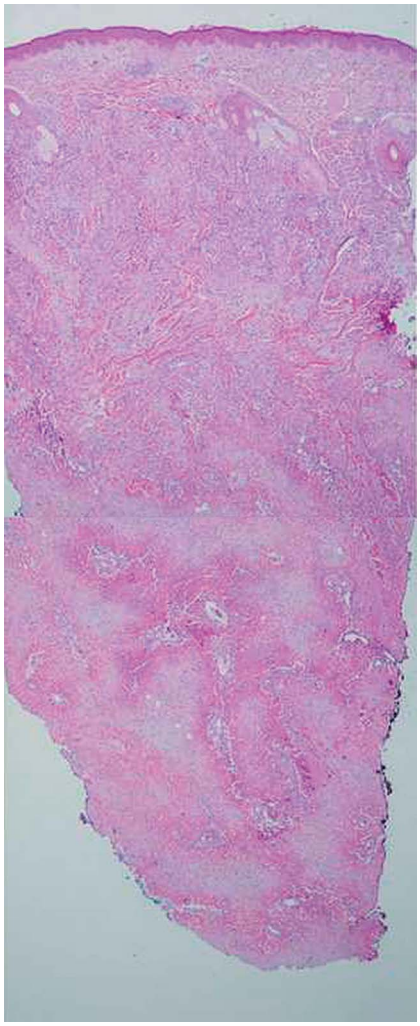

**FIGURE 4.** A portion of the wedge biopsy specimen has predominantly cellular tumor in upper dermis (top) and chondro-osseous matrix predominating in the depths (bottom) (×20).

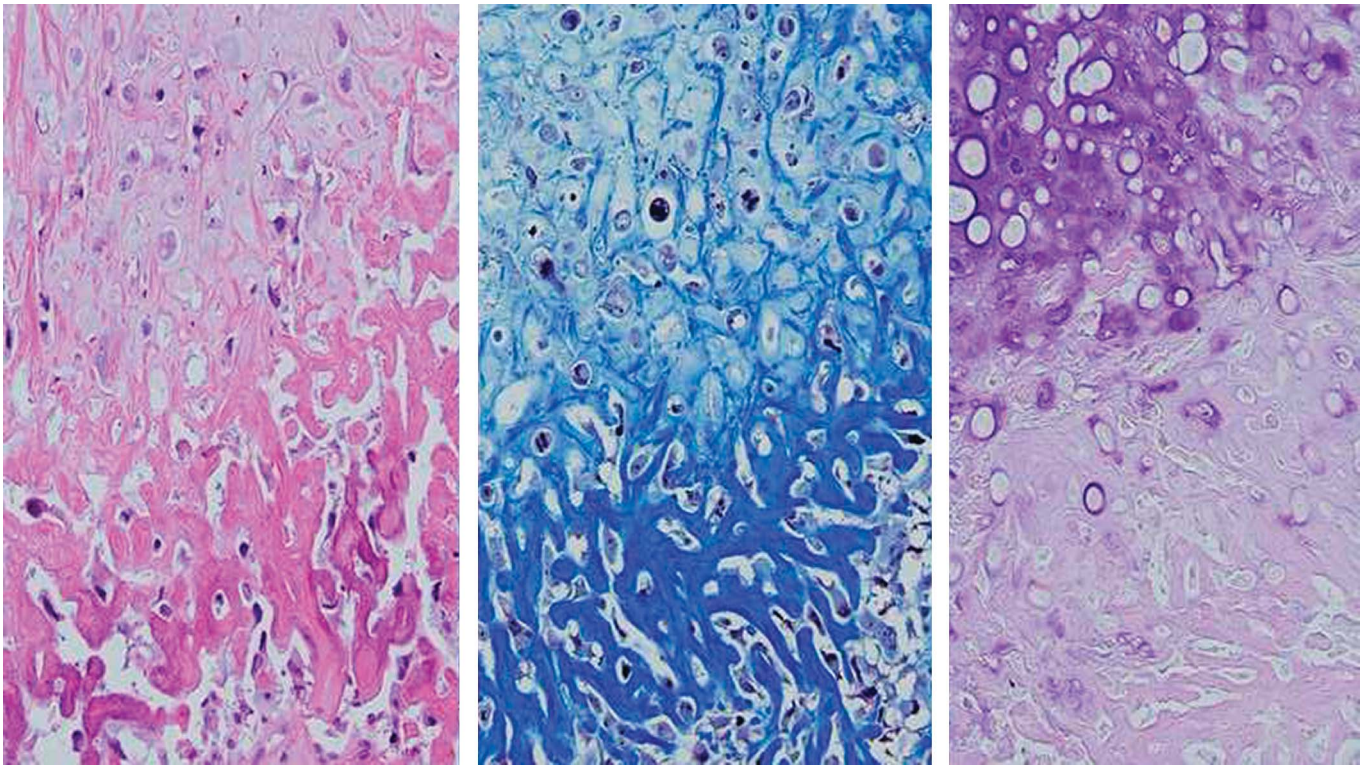

**FIGURE 5.** Left to right: H&E, trichrome, aldehyde fuchsin (×200). H&E: Cartilage is pale gray and osteoid is pink except where mineralized (before decalcification) it is purple. Trichrome: Collagen stains blue and cartilage is pale because there is less collagen. Aldehyde fuchsin at pH 1.0: Sulfated MPS, that is, cartilage, stains purple. Because there is not much sulfated MPS in osteoid, it is pale. MPS, Mucopolysaccharide.

**TABLE 3.** Anatomic Distribution of Cutaneous Metastases

| Location | Prevalence |
|---|---|
| Scalp | 14 |
| Chest/abdomen | 3 |
| Over primary | 2 |
| Subcutaneous | 2 |
| Maxilla | 1 |
| Neck | 1 |

In sum, one should be suspicious of cutaneous lesions in patients with osteosarcoma, particularly when located in the scalp, and regard new lesions as cutaneous metastases until proven otherwise.

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