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CASE REPORT

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Parosteal lipoma of the left femur: A case report

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Key Clinical Message

Multidisciplinary team collaboration in the diagnosis of rare tumors such as parosteal lipoma is highly important, especially when suspicious of malignancy. The use of radiological and physical examinations is imperative to monitor recurrence and quality of life.

KEYWORDS

oncology, orthopedics, pathology and laboratory medicine, radiology and imaging

1 | INTRODUCTION

Parosteal lipomas are rare and unique benign neoplasms composed of mature adipose tissue in close proximity to the periosteum.[1,2] They account for 0.3% of all lipomas, can affect either sex, and occur more frequently in middle-aged patients (40–60 years old).[2] Parosteal lipomas require complex diagnostic workup—extensive collaboration is required between surgeons and pathologists to rule out malignant neoplasms. Most patients tend to be asymptomatic or may only complain of recent swelling or growing mass. Despite their rarity, the prognosis tends to be very favorable—there have been no proven reports of malignant transformation and only one report of a local recurrence in the most recent literature.[2,3]

2 | CASE HISTORY

A 60-year-old female with a past medical history of hyperlipidemia, basal cell carcinoma, and diabetes mellitus presented with a 2.5-year history of a left thigh soft tissue mass attributed to a prior trauma. The mass had suddenly enlarged and become intermittently painful. She noted that certain activities such as bending, kneeling, and exercise aggravated the pain. She denied any constitutional symptoms as well as numbness or paresthesia.

Physical examination of the left thigh revealed a large, firm, nontender soft tissue mass measuring 18×15 cm. No swelling was observed. Sensation of the thigh was intact, and motor strength was noted to be 5/5. There was painless active range of motion of the ipsilateral hip and knee. The remainder of the physical examination was unremarkable.

3 | METHODS

A CT scan of the left thigh revealed an 18×9.5×8.2 cm heterogeneous lipomatous mass within the left vastus intermedius muscle abutting the anterior cortex of the femur with near replacement of the normal musculature (Figure 1). There appeared to be a periosteal reaction with ossification within the mass. An MRI with and without contrast of the left thigh revealed a large soft tissue mass with T1 fat signal mixed with T2 high fluid signal and

heterogenous enhancement, concerning for a soft tissue sarcoma (Figure 2).

CT-guided needle biopsy of the mass was performed, which revealed a bland-appearing spindle cell proliferation with adipocytic differentiation, scattered atypical nuclei, and extensive myxoid matrix (Figure 3).

Immunostaining for S100 labeled adipocytes, and additional staining for MDM2 weakly labeled a few nuclei. Fluorescence In Situ Hybridization (FISH) analysis was negative for MDM2 gene amplification and DDIT3 gene rearrangement. Multidisciplinary team discussion was concerned for sampling error. Due to the size, MRI findings and periosteal reaction, the decision was made to perform wide resection of the soft tissue mass with *en bloc* partial ostectomy of the medial femoral cortex with reconstruction using cortical allograft. Postoperative imaging is shown in Figure 4.

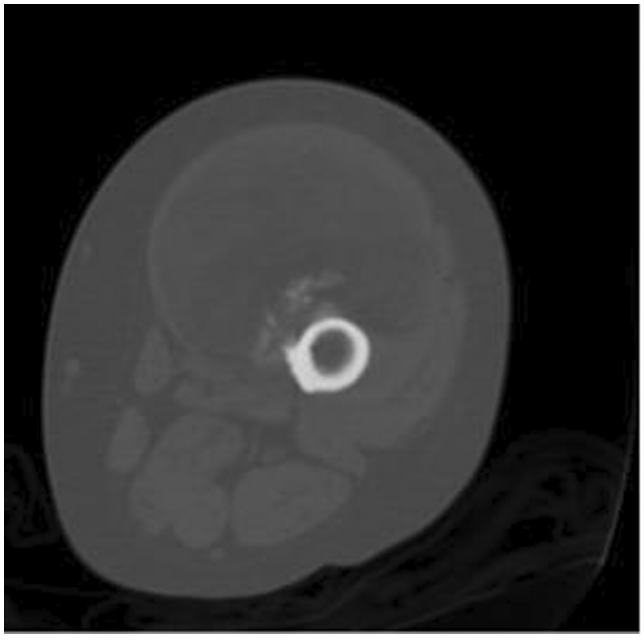

FIGURE 1 Axial CT scan showing the large soft tissue mass abutting the anterior femoral cortex with associated periosteal reaction and internal ossification adjacent the periosteal surface.

4 | CONCLUSION AND RESULTS

Final pathology demonstrated 16.5 cm lipomatous neoplasm composed predominantly of mature adipose tissue and bland-appearing spindle cells with extensive myxoid matrix and areas of bone and cartilage at the periphery where the mass was interdigitated with the femur (Figure 5).

No significant cytologic atypia, increase in mitotic activity, or tumor necrosis was observed. Immunohistochemical stains showed variable positivity for RB, focal positivity for CD34, and negativity for p53 and MDM2. The Ki67 proliferation index was less than 1%. This was most consistent with a diagnosis of parosteal lipoma.

Nine-month follow-up showed the patient was pain free and ambulating with no assistive device. Radiographic imaging showed internal incorporation of the cortical allograft without structure failure (Figure 6). She continues to be free of local recurrence.

5 | DISCUSSION

Parosteal lipomas are rare benign fat-containing tumors that are closely related to the periosteum. They account for 0.3% of all lipomas, occur mostly in middle aged patients, and are equally frequent in males and females.[1,2] These neoplasms often present in the diaphysis of long bones, most commonly in the femur, radius, tibia, and humerus.[1,2]

Most patients present with an asymptomatic slowly growing palpable mass. Vascular and neurological disturbances may be reported if adjacent structures are compromised.[1,4] Disruption of adjacent structures depends on the size and location of the lesions, but has most commonly been reported in association with lipomas of the forearm resulting in posterior interosseous neuropathy.[5]

Magnetic resonance imaging (MRI) is considered the modality of choice for soft tissue masses, especially for preoperative planning.[5–7] Computed tomography (CT)

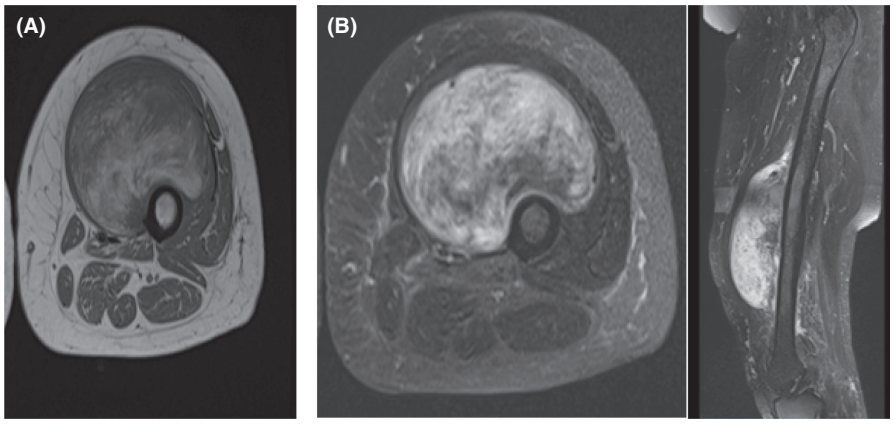

FIGURE 2 (A) Axial T1 MRI showing heterogeneous mixed intensity fat signal within the mass. (B) Axial and sagittal T2 fat saturated MRI with contrast showing high fluid signal within the mass and heterogeneous contrast enhancement without intramedullary marrow involvement.

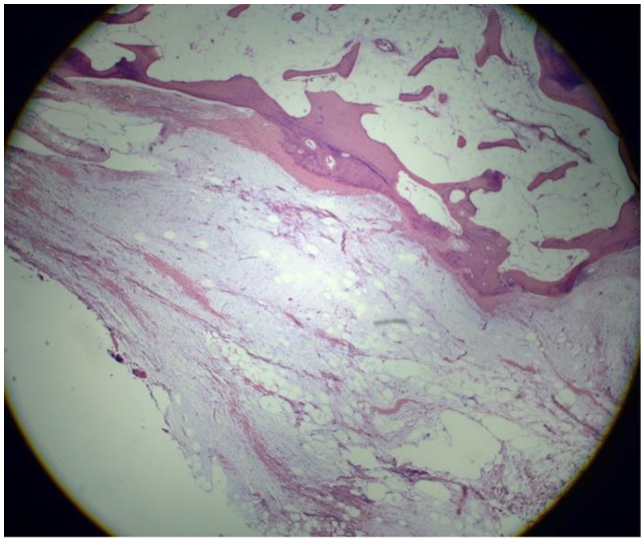

FIGURE 3 Histology showing spindle cell proliferation with adipocytic differentiation (top), scattered atypical nuclei, and extensive myxoid matrix (center).

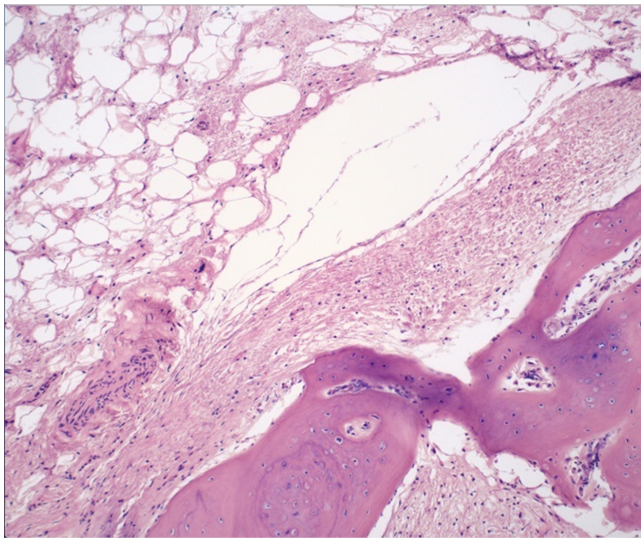

FIGURE 5 Pathology specimen showing mature adipose tissue (top left) and bland-appearing spindle cells and areas of bone and cartilage at the periphery.

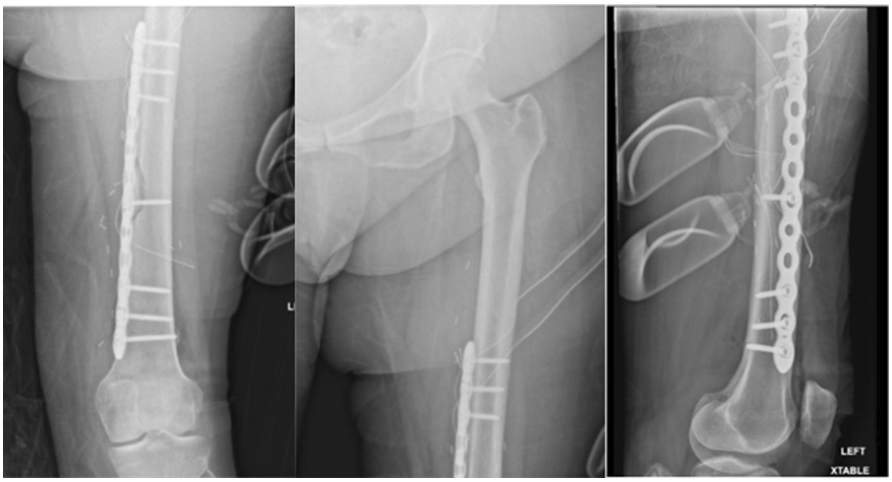

FIGURE 4 Immediate postoperative imaging showing final reconstruction with cortical allograft and a medial femoral plate.

may be indicated to define more detailed characteristics of the bone and matrix structure.[6,7] Parosteal lipomas usually appear identical to other soft tissue lipomas upon imaging, which appear as encapsulated lesions that are isointense to subcutaneous adipose tissue on MRI imaging.[7] On CT, they appear as circumscribed, homogeneously low density masses.[7] Hyaline cartilage or fibrous tissue may be visualized, which appear as intermediate T1 and high T2 intensity, and low T2-weighted intensity on MRI, respectively. Most commonly, these types of lipomas are reported in the femoral or radial regions.[7]

The cytogenetic and molecular profiles of parosteal lipomas have been scantly reported but are supported by some common findings with other soft tissue lipomas. Up to 60% of soft tissue lipomas have an abnormal karyotype, with translocations involving chromosome 12q13-q15 being the most common. Its most frequently translocated partner is chromosome 3q27-q28, which represents up to 25% of translocations with 12q13-15.[8,9] The genes involved in this translocation have been identified as the HMGI-C gene at 12q15 and the LPP gene at 3q27-28.[8] In soft-tissue lipomas, all other chromosomes have also been noted to be involved in translocations partnered with chromosome 12.[8,9] Parosteal lipomas have been noted to contain the *t*(3;12) translocations noted in other soft tissue lipomas, supporting a common pathogenesis.[8–10] Cytogenetic studies for these mutations were not performed in our case.

Cytogenetic studies to rule out malignancy were performed in our case. FISH analysis for MDM2 and DDIT3 rearrangements were negative, ruling out atypical lipomatous tumor and myxoid liposarcoma, respectively.

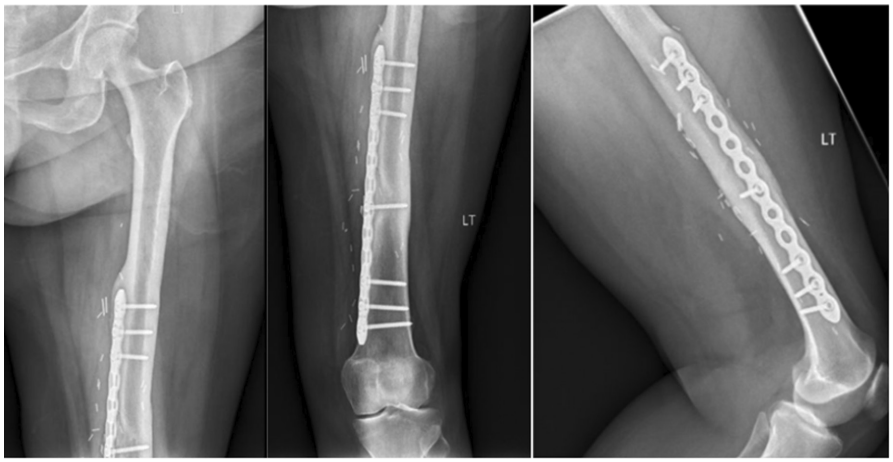

FIGURE 6 Nine-month follow-up imaging showing allograft healing without signs of hardware failure.

Histological examination showed bland-appearing spindle cell proliferation with adipocytic differentiation, scattered atypical nuclei, and extensive myxoid matrix. Given its proximity to the femur, this description is consistent with a benign parosteal lipoma as classified by the World Health Organization.[11]

Given the difficulty in eliminating atypical lipomatous tumor and other lipomatous malignancies based on morphology alone, diagnosis of malignancy is now usually guided by cytogenetic studies. Many different gene abnormalities have been identified, but there are a few that are most used based on the frequency of the abnormality.

Well-differentiated liposarcoma/Atypical lipomatous tumor (WDL/ALT) is the most common type of liposarcoma, accounting for up to 45% of liposarcoma.[12] This tumor is also commonly referred to as atypical lipomatous tumor when it is present in the extremities. Its diagnosis is currently guided by the amplification of MDM2 and CDK4 immunohistochemistry.[13] In our case, MDM2 amplification was not identified, ruling out WDL/ALT.[12]

The absence of DDIT gene amplification was used to eliminate myxoid liposarcoma (MRCL),[14] which is a highly specific finding.[12] Our case stained positive for S100 and was variably positive for CD34 and Rb. Recent literature review revealed that loss of Rb is found in 57% of lipomatous neoplasms, and expression of CD34 and S100 is found in 64% and 40% of similar neoplasms, respectively.[15] Mutations of p53 have been found to play a critical tumor suppressive role in several different bone and soft tissue sarcomas, including pleomorphic liposarcoma,[16] and are useful for the identification and targeted treatment of these neoplasms. The absence of p53 mutations in our case allowed for supporting evidence to rule out malignancy. Finally, a Ki-67 index of less than 1% adds further evidence to the working-diagnosis of a benign lipomatous neoplasm with favorable prognosis, evidenced by the low-grade mitotic activity.[17]

The treatment of choice for parosteal lipoma is surgical resection. Because these tumors grow deep to fascia and close to the bone, they can become quite large before the patient notices them. The mass was intimately associated with the anteromedial cortex of the femur, leading to difficulty separating it from the bone. After a multidisciplinary team discussion, we performed a more aggressive resection due to the size and MRI findings without significant added morbidity. The patient was ambulatory the following day and had no weight-bearing restrictions. While there are no reported cases of malignant transformation in the current literature, the importance of a complete resection must also be emphasized due to the recent case report of a local recurrence due to a presumed incomplete index resection.[3] Ultimately, such cases should be referred to care centers where a multidisciplinary team approach to cases are established.

Parosteal lipomas are rare and benign neoplasms that should be evaluated in a multidisciplinary team approach including musculoskeletal radiologists, musculoskeletal pathologist and orthopedic oncologists. Obtaining the correct diagnosis through tissue sampling is the gold standard as imaging studies can mistakenly mislead physicians to a malignant diagnosis. Complete surgical resection is the treatment of choice, and we show a case where partial *en bloc* resection of the bone with reconstruction can be performed without undue morbidity.

AUTHOR CONTRIBUTIONS

James P. Waters: Data curation; writing – original draft; writing – review and editing. **Sydney Horenstein:** Data curation; writing – original draft; writing – review and editing. **Austin Egger:** Data curation; writing – original draft; writing – review and editing. **Parker Johnsen:** Data curation; writing – original draft; writing – review and editing. **Tae Won Kim:** Conceptualization; data curation; supervision; writing – original draft; writing – review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors, their immediate families, and any research foundations with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

DATA AVAILABILITY STATEMENT

The data supporting the conclusion of this study may be obtained from the corresponding author upon reasonable request.

CONSENT

The patient presented in this case was informed that the data concerning their clinical presentation was going to be collected and submitted for publication. They agreed to this collection and submission.

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