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(CASE REPORT)

Treatment of a locally advanced diaphyseal osteoblastic osteosarcoma: resection and reconstruction (A case report)

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Abstract

Strictly diaphyseal osteosarcoma is rare and poses complex challenges for intercalary reconstruction following tumor resection. We report the case of a 20-year-old female patient presenting with a locally advanced osteoblastic osteosarcoma of the left femoral diaphysis. Imaging revealed a 9 cm mass infiltrating adjacent soft tissues without neurovascular involvement. The staging workup was negative for metastasis. Faced with the dilemma of reconstructing a massive bone defect, a wide oncological resection followed by defect filling with surgical cement and locked plate osteosynthesis was preferred. Histopathological examination confirmed clear margins and tumor necrosis evaluated at Huvos grade II [2]. This two-stage approach (Masquelet-type technique) provides immediate mechanical stability while minimizing the risk of biological graft loss in the event of local recurrence [4].

Keywords: Osteoblastic Osteosarcoma; Femoral Diaphysis; Oncological Resection; Intercalary Reconstruction; Surgical Cement; Locked Plate

1. Introduction

Osteosarcoma is the most common primary malignant bone tumor in young adults. Although it predominantly develops in the metaphyses of long bones, strictly diaphyseal locations account for approximately 10% of cases. Management relies on neoadjuvant chemotherapy followed by surgical resection with clear margins. [1,4] In the diaphysis, oncological resection creates massive intercalary bone defects, the reconstruction of which remains a true surgical challenge. Several options exist (autograft, massive allograft, vascularized fibula, intercalary prosthesis) [5], each presenting specific advantages and complications (pseudarthrosis, infection, fracture, recurrence) [3]. We report the case of a locally advanced femoral diaphyseal osteosarcoma treated by wide resection and reconstruction using a cement spacer reinforced with a plate [2], and we discuss the rationale for this therapeutic choice.

2. Clinical Observation

This is a 20-year-old female patient with no notable medical history, initially admitted for the investigation of a progressively evolving, painless swelling in the left thigh.

Initial clinical examination revealed a palpable mass in the thigh, without overlying inflammatory signs or downstream neurovascular deficits. A standard radiograph was requested, revealing a lytic lesion at the junction of the middle and distal thirds of the femoral diaphysis, with invasion and cortical breakthrough on the medial side [Figure 1].

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Figure 1 Standard radiograph of the femur showing an osteolytic lesion

To better characterize the lesion, magnetic resonance imaging (MRI) was prescribed. It demonstrated a bone mass of tumor-like appearance extending over 12 cm in height. The lesion infiltrated the adjacent soft tissues, notably the adductor magnus muscle and part of the vastus medialis, and came into contact with the femoral pedicle without invading it. The MRI did not show any skip metastases [Figure 2, 3].

Figure 2 Sagittal MRI view demonstrating an osseous mass with soft tissue infiltration

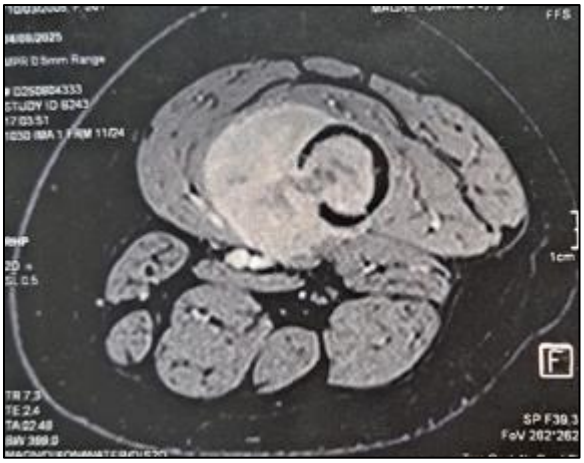

Figure 3 Axial view demonstrating the tumor abutting the femoral neurovascular bundle without invasion

A surgical biopsy was performed, concluding to an osteoblastic osteosarcoma of the femoral diaphysis. The staging workup, including a thoraco-abdominopelvic CT scan, revealed no abnormalities, ruling out any secondary localization.

Therapeutically, the patient was scheduled for surgical resection followed by reconstruction. A real reconstruction dilemma arose preoperatively: should an immediate reconstruction using a bone graft fixed with a plate be performed, carrying the inherent risk of local recurrence and definitive loss of the graft, or should a cautious approach be opted for by filling the resection zone with surgical cement, with the possibility of a subsequent reoperation for a bone graft? [Figure 4].

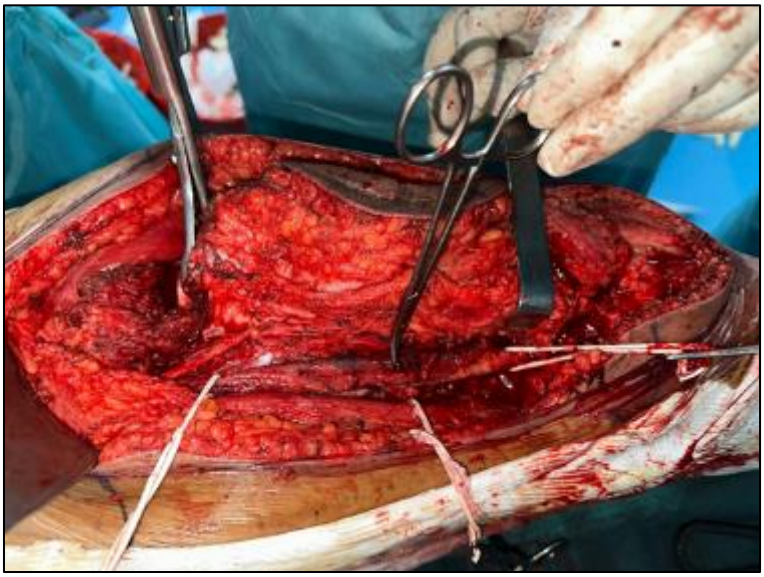

Figure 4 Wide oncological resection

The final decision consisted of a wide oncological resection with an osteotomy of the femoral diaphysis over a length of 9 cm, ensuring clear margins [Figure 5,6].

Figure 5 Intraoperative view post-resection

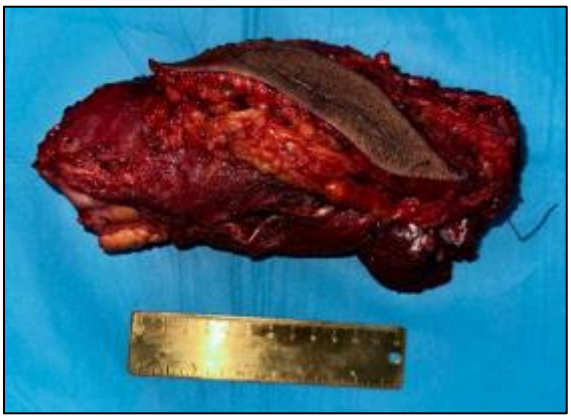

Figure 6 Tumor mass with the skin paddle"

The massive bone defect was filled with surgical cement (PMMA), and mechanical stability was ensured by the placement of a locked epiphysio-diaphyseal plate at the lower end of the femur [Figure 7].

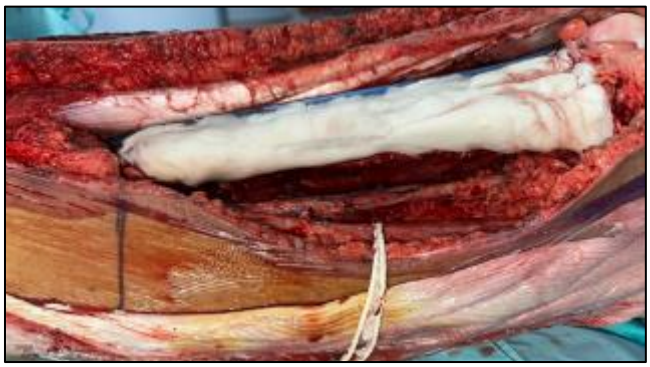

Figure 7 Reconstruction with bone cement and locked plate osteosynthesis

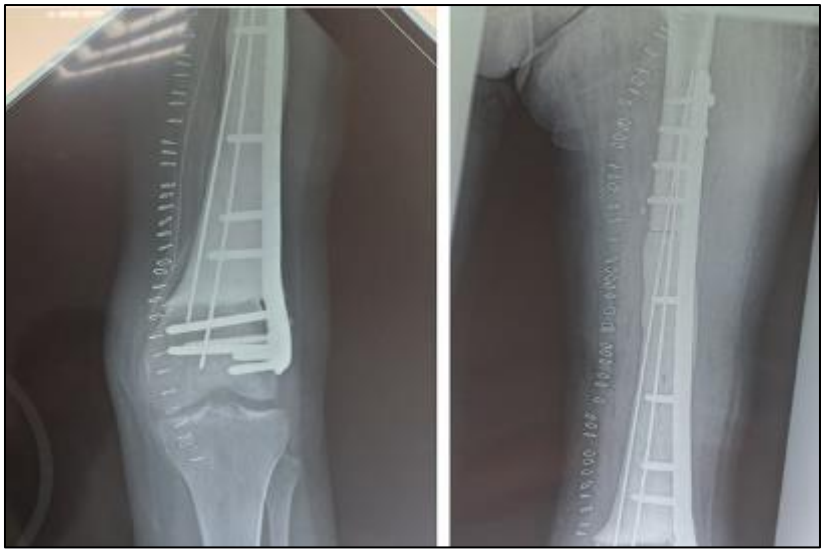

Figure 8 Postoperative plain radiograph

The immediate postoperative course was uneventful. Histopathological examination of the resected specimen revealed a spindle cell tumor proliferation with a morphological appearance compatible with a largely remodeled osteosarcoma (response evaluated at Huvos grade 2). The tumor focus measured 8 cm in its long axis. The cutaneous tissue was uninvolved, and the deep and lateral resection margins were confirmed to be clear.

3. Discussion

Diaphyseal osteosarcomas require intercalary resections that preserve the adjacent joints, which represents a major functional advantage compared to metaphyseal resections [5]. However, restoring bone continuity over a large defect (here 12 cm) represents a major difficulty.

The problem encountered with our patient illustrates the classic dilemma of massive bone substance loss in oncology. Immediate reconstruction with a massive allograft or a vascularized fibular graft offers the advantage of a single-stage bone procedure. However, in the context of a locally advanced tumor with significant soft tissue invasion (adductor magnus and vastus medialis), the risk of complications (infection under adjuvant chemotherapy, non-union, or the need for revision in case of local recurrence) is particularly high [3]. A recurrence would necessitate the excision of the previously implanted graft, leading to severe morbidity.

The alternative chosen in our case the use of a surgical cement spacer (Polymethyl methacrylate - PMMA) coupled with locked plate osteosynthesis meets a dual requirement. On the oncological level, it allows waiting for the definitive histological analysis of the surgical margins [1] and the evaluation of the percentage of necrosis (here, Huvos grade 2, indicating necrosis between 50 and 90%, justifying a cautious continuation of adjuvant treatments) [4]. On the biomechanical level, the construct using a locked plate and cement ensures immediate mechanical stability, allowing early rehabilitation.

Moreover, this approach corresponds to the first stage of the induced membrane technique (Masquelet technique) [2]. The cement prevents the invasion of the bone defect by fibrous tissue and promotes the formation of a pseudo-synovial membrane rich in growth factors and highly vascularized. This membrane will provide an optimal recipient bed for a secondary cancellous bone graft (autograft), once the critical period of recurrence risk and postoperative chemotherapy has passed.

4. Conclusion

The resection of a locally advanced diaphyseal osteosarcoma requires a delicate compromise between the imperative of oncological control (clear margins) and the preservation of limb function. The use of an acrylic cement filling associated with locked plate fixation constitutes a reliable temporary or definitive solution. It avoids the loss of valuable

biological material (graft) in case of complication or early tumor recurrence, while preparing the surgical site for a possible subsequent biological reconstruction in complete oncological safety.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

Ethical approval is not applicable for this case report.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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