

Case Report

Limb Salvage Reconstruction Using a Stemmed Acetabular Implant after Periacetabular Resection for Ewing Sarcoma: A Case Report

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Abstract: Ewing sarcoma of the pelvis represents a challenging condition because of its aggressive nature and the complexity of achieving adequate oncological resection while preserving limb function. We report the case of a 20-year-old man diagnosed with a localized Ewing sarcoma involving the acetabulum and the periacetabular region. Following neoadjuvant chemotherapy according to the VDC-IE protocol, the patient underwent limb-salvage surgery consisting of an Enneking Type II-III pelvic resection and reconstruction using an iliofemoral stemmed acetabular prosthesis (ice-cream cone prosthesis). Histopathological examination of the resected specimen revealed a poor histological response to neoadjuvant chemotherapy (Huvos grade I) and microscopic residual disease at the surgical margin (R1 resection). Adjuvant radiotherapy and chemotherapy were subsequently administered. The postoperative course was initially uneventful, with satisfactory early functional recovery. During follow-up, the patient developed a pelvic lymphocele, vincristine-induced peripheral neuropathy, and bone metastases eight months after surgery. Despite further oncological management, the disease progressed, and the patient died 12 months postoperatively. This case highlights the feasibility of reconstruction with an ice-cream cone prosthesis following periacetabular resection while emphasizing the prognostic impact of poor histological response and inadequate surgical margins in pelvic Ewing sarcoma.

Keywords: Ewing Sarcoma, Pelvic Tumor, Periacetabular Resection, Ice-Cream Cone Prosthesis, Limb-Salvage Surgery, Case Report.

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INTRODUCTION

Ewing sarcoma (ES) is the second most common primary malignant bone tumor in children and adolescents, following osteosarcoma [1, 2]. The pelvis represents the second most frequent anatomical site of involvement, accounting for approximately 19.9% of cases in the Mayo Clinic series [3].

Surgical management of pelvic Ewing sarcoma remains particularly challenging because of the complex anatomy of the pelvic ring and the proximity of critical neurovascular structures. According to the classification proposed by Enneking and Dunham, pelvic tumor resections are categorized into four types based on tumor location and extent [4].

Periacetabular resections, particularly those involving the acetabulum, may result in significant functional impairment and present substantial reconstructive challenges. Consequently, several reconstructive techniques have been developed,

including biological reconstructions, custom-made prostheses, saddle prostheses, and stemmed acetabular implants [5]. However, no consensus has yet been reached regarding the optimal reconstructive strategy. Among the available options, the ice-cream cone prosthesis has emerged as a promising solution, providing satisfactory mechanical stability and functional outcomes following periacetabular tumor resection.

We report the case of a 20-year-old male diagnosed with Ewing sarcoma involving the acetabulum who underwent limb-salvage surgery consisting of a Type II-III pelvic resection according to the Enneking and Dunham classification, followed by reconstruction using an iliofemoral stemmed acetabular prosthesis (ice-cream cone prosthesis).

CASE PRESENTATION

A 20-year-old man with no significant past medical history presented with progressively worsening

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mechanical pain of the right hip that had been evolving for several months. The patient was afebrile but reported unquantified weight loss and a deterioration in his general condition. Clinical examination of the hip was unremarkable, with no limitation of range of motion, palpable mass, or swelling. Plain radiographs were obtained and showed no abnormalities.

Given this clinical presentation, magnetic resonance imaging (MRI) of the hip was performed, revealing a poorly defined tumor infiltrating the hip joint and the surrounding periarticular soft tissues (Figure 1). A CT-guided biopsy was subsequently performed. Histopathological examination revealed a malignant small round cell tumor composed of cells with scant clear cytoplasm. Immunohistochemical analysis demonstrated strong diffuse expression of CD99. Although no molecular studies were performed, the histopathological and immunohistochemical findings were consistent with and confirmed the diagnosis of Ewing sarcoma. Staging investigations showed no evidence of metastatic disease.

The patient initially underwent neoadjuvant chemotherapy according to the VDC-IE protocol. Post-chemotherapy MRI demonstrated a marked reduction in tumor size, together with regression of its locoregional extension (figure 2).

Following neoadjuvant chemotherapy, the patient underwent en bloc tumor resection through a combined ilioinguinal and Kocher–Langenbeck approach (figure 3). The procedure consisted primarily of an Enneking Type II–III pelvic resection involving the acetabulum, pubis, and ischium, with extension to the

inferior portion of the iliac wing. Reconstruction of the periacetabular defect was subsequently performed using an iliofemoral stemmed acetabular prosthesis (ice-cream cone prosthesis). The iliac stem was implanted into the residual iliac bone to provide primary mechanical stability, and a total hip arthroplasty was completed using a femoral stem and prosthetic head (figure 4). Intraoperative assessment confirmed satisfactory implant positioning and hip stability.

The resected specimen was submitted for histopathological examination to assess the surgical margins and evaluate the response to neoadjuvant chemotherapy. Histopathological analysis demonstrated a poor response to neoadjuvant chemotherapy, corresponding to Huvos grade I. Microscopic examination confirmed negative surgical margins; however, the closest margin measured less than 1 mm, consistent with an R0 resection. Given the poor histological response and the close surgical margins, the patient subsequently received adjuvant radiotherapy in combination with adjuvant chemotherapy.

Postoperatively, the patient was mobilized with a hip brace and permitted weight-bearing as tolerated. No early postoperative complications, including wound infection, prosthetic dislocation, or neurovascular injury, were observed. During follow-up, the patient developed a pelvic lymphocele and vincristine-induced peripheral neuropathy, both of which were managed conservatively. Eight months after surgery, imaging investigations revealed the development of bone metastases. Despite further oncological treatment, the patient's condition progressively deteriorated, and he died 12 months after surgery.

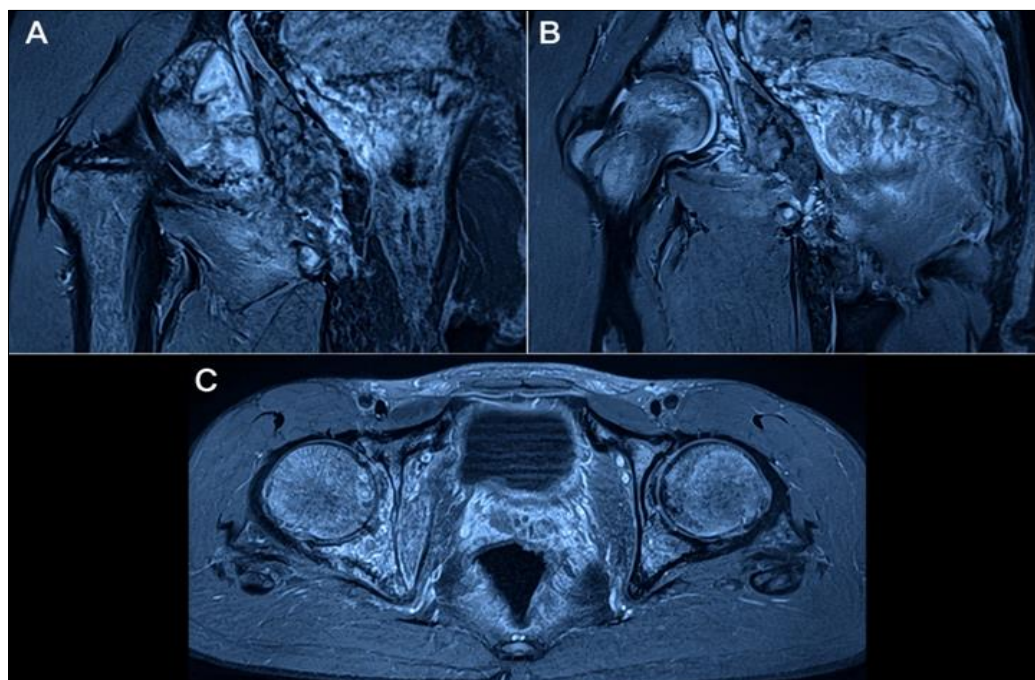


Figure 1: Pre-treatment magnetic resonance imaging (MRI) demonstrating a periacetabular tumor involving the right acetabulum with extension to the surrounding periarticular soft tissues, consistent with Ewing sarcoma

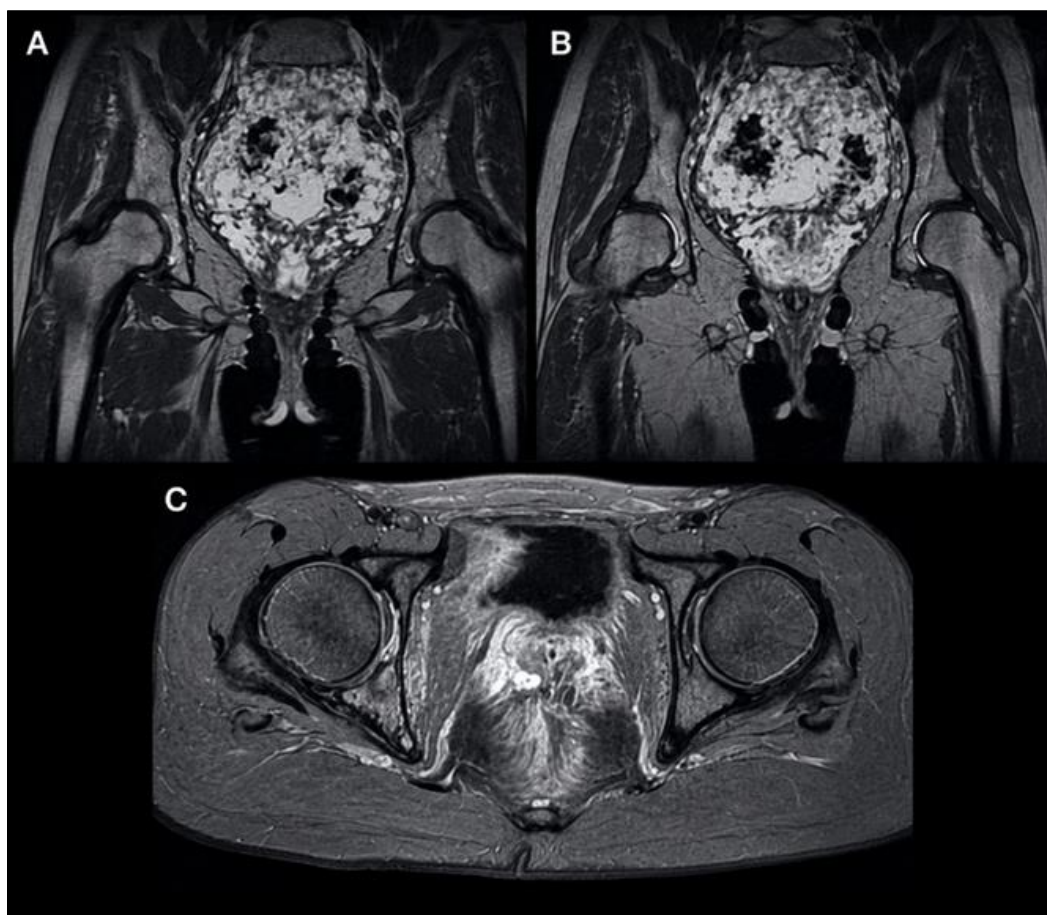


Figure 2: Post-neoadjuvant chemotherapy MRI demonstrating a marked reduction in tumor size and locoregional extension following treatment according to the VDC-IE protocol

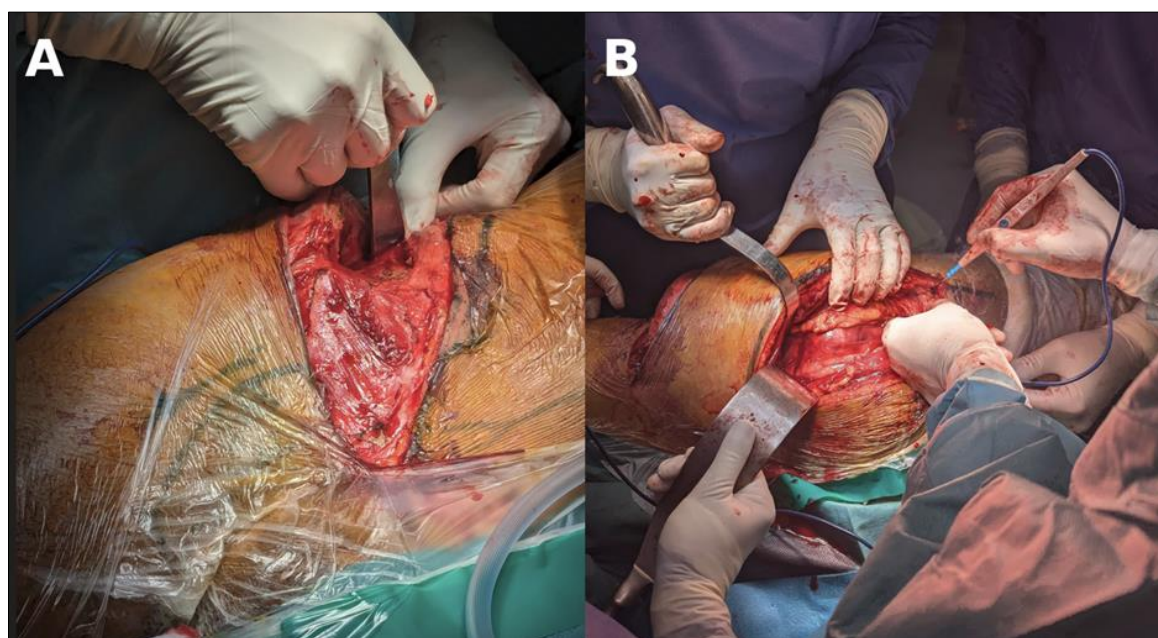


Figure 3: Intraoperative photographs illustrating the surgical exposure obtained through a combined ilioinguinal and Kocher–Langenbeck approach for resection of the periacetabular Ewing sarcoma. (A) Anterior exposure through the ilioinguinal approach. (B) Posterior exposure through the Kocher–Langenbeck approach



Figure 4: Anteroposterior postoperative radiographs demonstrating satisfactory positioning of the ice-cream cone prosthesis used for reconstruction following Type II–III pelvic resection

DISCUSSION

Reconstruction after periacetabular tumor resection remains a major challenge because of the complex anatomy of the pelvis and the need to balance oncological safety with functional preservation. Although several reconstructive techniques have been proposed, no consensus has yet been reached regarding the optimal method. Among the available options, the iliofemoral stemmed acetabular prosthesis (ice-cream cone prosthesis) has emerged as a promising alternative; however, the available literature remains limited, particularly in patients undergoing reconstruction following resection for primary malignant bone tumors [6,7].

Achieving adequate oncological margins remains one of the primary objectives of pelvic tumor surgery. In periacetabular lesions, obtaining safe margins frequently requires extensive bone resection, resulting in substantial acetabular defects and creating significant reconstructive challenges. Several reconstructive strategies have been described following periacetabular tumor resection, including hip transposition, allograft-prosthetic composites, custom-made prostheses, and more recently 3D-printed implants. While each technique offers specific advantages, all are associated with considerable complication rates, including infection, mechanical failure, aseptic loosening, and dislocation [5-9].

In the present case, reconstruction was performed using an iliofemoral stemmed acetabular implant, commonly referred to as an ice-cream cone prosthesis. This implant offers several advantages, including technical simplicity, shorter operative time compared with custom-made prostheses, immediate mechanical stability through fixation within the residual iliac bone, and the possibility of early weight bearing. Furthermore, preservation of adequate iliac bone stock following resection made this reconstructive option particularly suitable for our patient. Another advantage of this implant is its greater availability and lower manufacturing requirements compared with patient-specific custom-made or 3D-printed prostheses.

Zoccali *et al.*, reported satisfactory functional outcomes and acceptable implant survival rates following reconstruction with stemmed acetabular implants after periacetabular tumor resection [6]. Similarly, our patient achieved early mobilization without postoperative complications and demonstrated satisfactory short-term implant stability during follow-up.

Histopathological examination revealed a poor response to neoadjuvant chemotherapy, corresponding to Huvos grade I. In addition, microscopic residual disease was identified at the surgical margin, resulting in an R1 resection. Both poor histological response and positive surgical margins have been associated with less

favorable oncological outcomes in Ewing sarcoma. Although adjuvant radiotherapy and chemotherapy were administered to improve local disease control, the patient subsequently developed bone metastases eight months after surgery and died 12 months postoperatively. This unfavorable oncological course highlights the aggressive biological behavior of pelvic Ewing sarcoma and the importance of achieving both adequate surgical margins and an optimal response to systemic therapy whenever possible.

In the end, and despite the limited evidence available in the literature, the ice-cream cone prosthesis appears to be a reliable reconstructive option following selected periacetabular resections, offering satisfactory functional recovery while preserving limb function [10].

CONCLUSION

The management of pelvic Ewing sarcoma requires a multidisciplinary approach combining systemic therapy, oncological resection, and appropriate reconstruction. In the present case, the ice-cream cone prosthesis provided satisfactory reconstruction following Type II–III pelvic resection, allowing limb preservation and early mobilization. Although the oncological outcome was unfavorable, the implant provided adequate mechanical stability and facilitated postoperative rehabilitation. Larger studies are required to further evaluate the role of this reconstructive technique following periacetabular tumor resection.

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