

# Iliofemoral Arthrodesis as a Reconstructive Surgical Technique in the Management of Malignant Periacetabular Tumors: Case Series

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## Learning Point of the Article:

With good preoperative planning, iliofemoral arthrodesis can be employed as a reliable cost-effective reconstructive surgical management option for malignant of periacetabular tumors.

## Abstract

**Introduction:** Reconstructive options for surgical malignant of periacetabular tumors include endoprosthesis reconstructions, biologic reconstruction, hip transposition, hip rotationplasty, and iliofemoral arthrodesis. In this case series, we discuss the outcome of iliofemoral arthrodesis as a reconstruction option in the management of malignant periacetabular tumors.

**Case Report:** A 45-year-old woman with complaints of right hip pain for 4-year duration was evaluated to have a well-defined radiolucent osteolytic lesion with calcifications localized around the right acetabulum diagnosed to be chondrosarcoma later on. Another 44-year-old woman with complaints of left hip pain for 2-year duration was evaluated to have fibrosarcoma of left gluteus maximus, piriformis, and gemelli extending to quadratus femoris. Wide resection was planned for both patients, and iliofemoral arthrodesis was performed. Both patients did not receive any adjuvant treatment. Both the patients demonstrated good functional outcomes at 2-years follow-up without any recurrence or distant metastasis.

**Conclusion:** Iliofemoral arthrodesis serves as a cost-effective reconstructive option in the management of malignant periacetabular tumors. Meticulous dissection and wide resection remain key to preventing recurrence or complications.

**Keywords:** Malignant tumor, arthrodesis, acetabulum, fibrosarcoma, chondrosarcoma.

## Introduction

Primary sarcomas of the pelvis are a relatively rare entity. Surgical management of these tumors necessitates the resection of bone and soft-tissue structures, resulting in significant morbidity to the patient [1, 2]. Enneking and Dunham classified the resection based on the region of pelvic bone being resected as shown in Fig. 1 [3, 4]. The periacetabular resection (PII) presents a unique surgical challenge where no reconstruction method has been proven to be superior to the other [5]. There is still an ongoing debate on the best reconstructive options in their management. The available surgical options include endoprosthesis

reconstructions [6, 7, 8], hip transposition [9, 10], biologic reconstruction [11, 12], hip rotationplasty [13], and iliofemoral arthrodesis [14, 15]. These reconstructive procedures are associated with a higher rate of complications such as non-union, infections, implant breakage, problems associated with wound healing, and tumor recurrence [2, 16, 17]. The reported complication rate ranges from 15% to 65% [8]. The choice of the procedure should be weighed on its functional outcome against the risk of its associated complications.

Limb salvage using iliofemoral arthrodesis is a rare entity and less often mentioned in literature [15]. The selection of an optimal

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Website:  
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DOI:  
<https://doi.org/10.13107/jocr.2023.v13.i09.3882>

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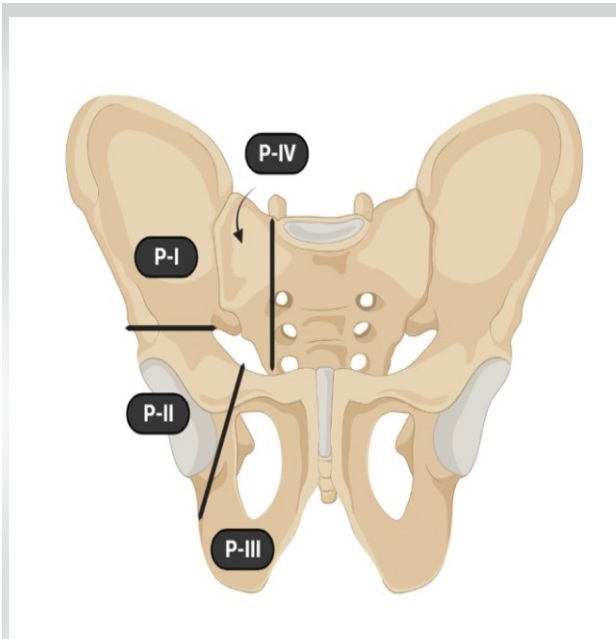
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Submitted: 06/06/2023; Review: 26/07/2023; Accepted: Aug 2023; Published: September 2023

DOI: <https://doi.org/10.13107/jocr.2023.v13.i09.3882>

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**Figure 1:** Enneking and Dunham resection classification system.

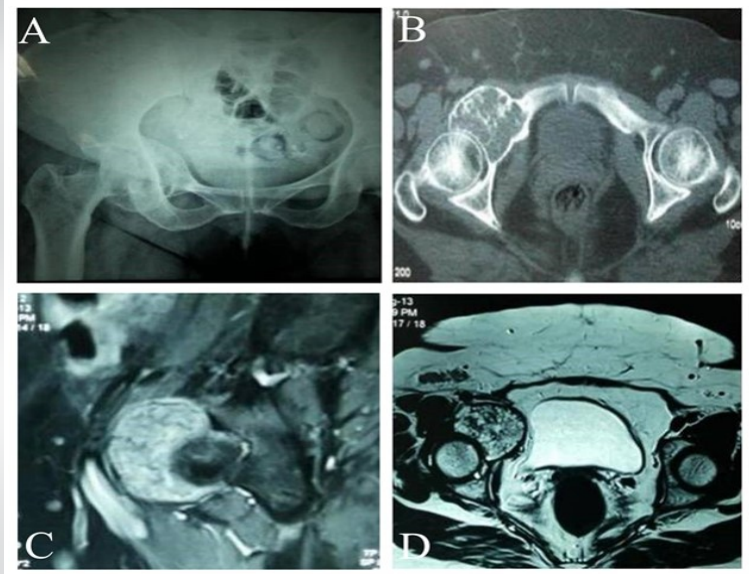
procedure for these patients is a complex process involving factors such as the nature of the disease, residual host bone quality, patient demand, affordability, and risk of complications [5, 6]. The purpose of our study was to assess the clinical and functional outcome of iliofemoral arthrodesis as a reconstructive option in the management of malignant periacetabular tumors. We report our experience with iliofemoral arthrodesis for two cases of primary malignant periacetabular pelvic tumors.

## Case Report

### Case 1

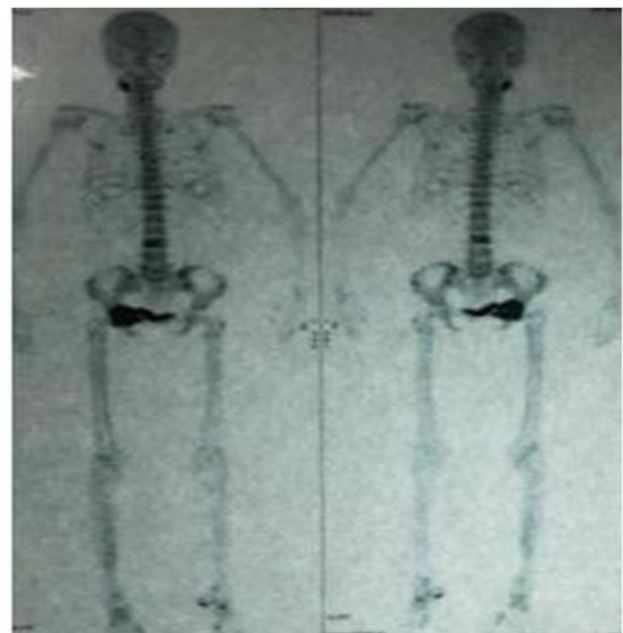
We present the case of a 45-year-old woman with complaints of chronic pain in her right hip for the past 4 years. She had no relevant history of trauma, infection, or other constitutional symptoms. On examination, there is a gross restriction of all ranges of movements involving the right hip. Radiological evaluation with radiographs, computed tomography (CT), and magnetic resonance imaging (MRI) was performed to show a radiolucent osteolytic lesion in the periacetabular region with thin sclerotic rim and speckles of calcification, suggestive of low-grade chondrosarcoma as shown in Fig. 2. Further, a bone scan was performed, and the lesion did not have any metastatic secondaries elsewhere in the body as shown in Fig. 3.

We planned for a Type II wide pelvic resection as per Enneking and Dunham, followed by iliofemoral arthrodesis using bone grafting and plating. Upon exposing the tumor through the

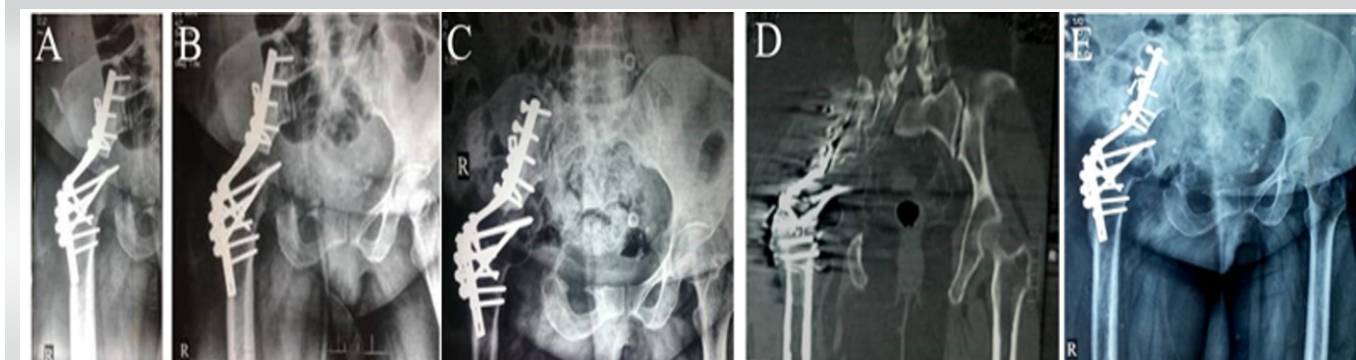


**Figure 2:** Radiological evaluation of the lesion. (a) showing the radiograph with a periacetabular lesion, (b) showing the computed tomography localization of the lesion, (c), magnetic resonance imaging (MRI) showing the sagittal extent of the lesion, (d) MRI showing the axial dimensions of the lesion.

lateral Hardinge approach, a grayish-pink tissue was identified after hip joint exposure. Following wide excision of the lesion, to achieve successful iliofemoral arthrodesis, one needs to achieve the apposition of arthrodesis surfaces and obtain rigid internal fixation. The articular surface is prepared until the subchondral surface is exposed to promote fusion. The position maintained in this patient for optimal function and limited effect on adjacent joints was 30° of flexion, 0° adduction, and 10°



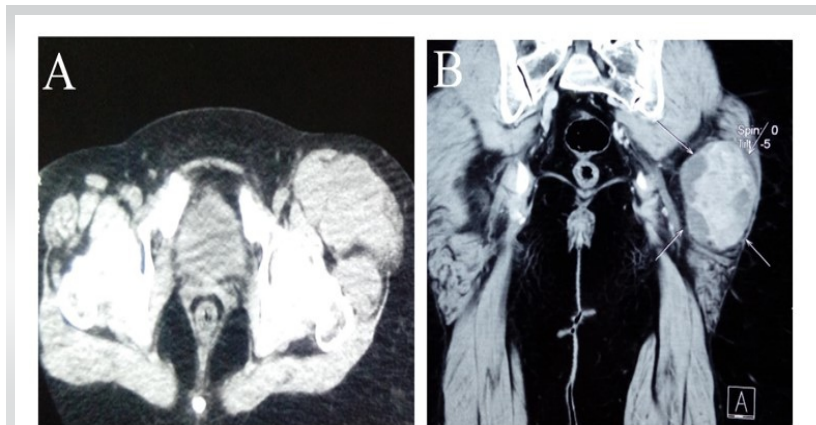
**Figure 3:** Bone scan findings of the patient to rule out distant metastasis of the lesion demonstrating the non-metastatic primary confined to the right periacetabular region.



**Figure 4:** Postoperative radiographs of the patient. (a and b) show the immediate post-operative status, (c and d) show the non-union status at 6-month follow-up in radiograph and computed tomography scan, (e) shows the complete union at 2-year follow-up.

external rotation. Care is taken to avoid abduction as it creates pelvic obliquity and increased back pain. One must try to preserve the abductor complex and avoid injury to the superior gluteal nerve during exposure for instrumentation in the iliac crest. Cobra plating with autologous iliac crest bone grafting was done. Further fixation with narrow dynamic compression plate and reconstruction plates in the iliac crest was done as shown in Fig. 4a and b. The patient was maintained in non-weight-bearing in hip spica for 6 weeks and partial weight bearing till 12 weeks and allowed to weight bear later on. However, on further evaluation at 6 months, since the fixation was going for non-union as shown in Fig. 4c and d, bone grafting was supplemented to accentuate bone union. At 2-year follow-up, the patient demonstrated complete union without any sign of recurrence as shown in Fig. 4e. The patient had a 2 cm shortening of the limb. The patient did not receive any adjuvant chemo- or radiotherapy. The functional ability was evaluated with the musculoskeletal tumor society (MSTS) scoring system [18]. She can meet her daily needs, and the patient scored 63% MSTS score with a satisfactory functional outcome.

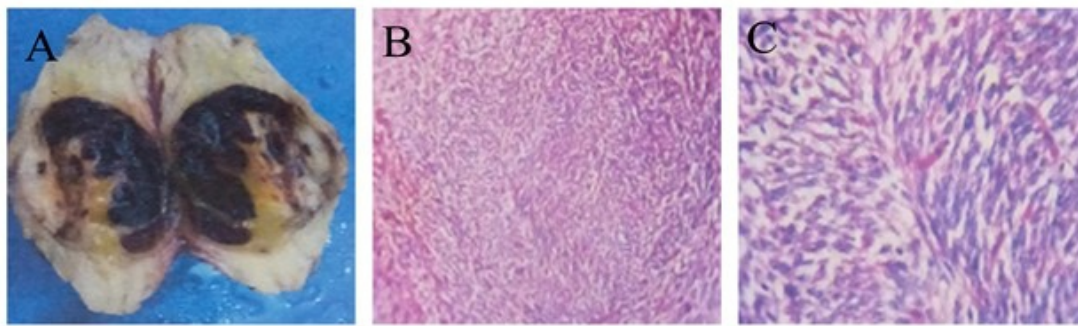
## Case 2



**Figure 5:** (a and b) Radiological evaluation and localization of the lesion with computed tomography and magnetic resonance imaging scan.

We present the case of a 44-year-old woman with the complaints of chronic pain in the left hip for the past 2 years with associated swelling in the left gluteal region and stiffness of the hip joint. She had no relevant history of trauma, infection, or other constitutional symptoms. On examination, a swelling of size 7 × 5 cm was located in the gluteal region with gross restriction of all ranges of movement involving the left hip. Radiological evaluation with CT and MRI was performed to demonstrate a fibrosarcoma involving the left gluteus maximus, piriformis, and gemelli extending till quadratus femoris as shown in Fig. 5. Biopsy confirmed the diagnosis as shown in Fig. 6b and c.

We planned for a wide excision. Upon exposing the tumor through the posterior Southern Moore approach, a soft-tissue mass of grayish-white to brown color was identified as shown in Fig. 6a. Wide excision was done followed by iliofemoral arthrodesis with autologous iliac crest bone graft and fixation with a reconstruction plate and screws as shown in Fig. 7a and b. To begin with, we had intact articular acetabulum in this case; hence, we used serial reamers to prepare the fusion surface until subchondral bone before definitive fixation. Following preparation of the fusion surfaces, we packed iliac crest grafts in the joint space and used partially threaded cancellous screws to maintain the arthrodesis position which was augmented with the reconstruction plate. The patient was maintained in non-weight-bearing in hip spica for 6 weeks and partial weight bearing till 12 weeks and allowed to weight bear later on. At 2-year follow-up, the patient demonstrated complete union as shown in Fig. 7c and d, without any sign of recurrence. The patient had a 1 cm shortening of the limb. The patient did not receive any adjuvant chemo- or radiotherapy. The functional ability was evaluated with the MSTS scoring system. She can meet her daily needs, and the patient scored 67% MSTS score with a satisfactory functional outcome.



**Figure 6:** Macroscopic and microscopic examination of the lesion. (a) showing the macroscopic findings of the lesion in the cut section demonstrating a soft-tissue mass of grayish white-to-brown color, (b and c) showing the microscopic histological examination findings at  $\times 20$  and  $\times 100$ , respectively, showing herringbone appearance suggestive of fibrosarcoma.

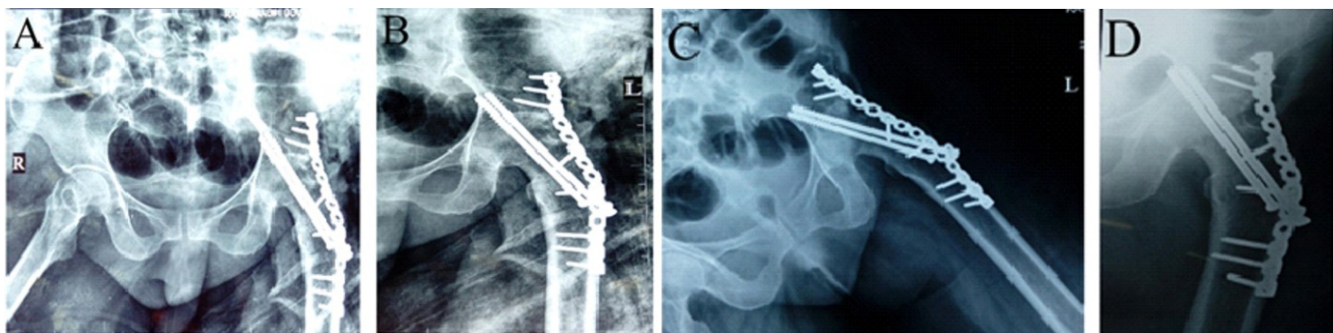
### Discussion

The management of tumors in the periacetabular region is a rare entity and is less often discussed. Limb-sparing surgery for periacetabular tumors is one of the most challenging procedures for surgeons [5]. There are no standard procedures indicated in these cases. Usually, the management is individualized for each patient. When adequate bone remains after resection, the proximal femur could be fused to the remaining ilium to produce a good functional outcome [15]. In our study, the clinical and post-operative characteristics are reviewed.

Avoiding post-operative complications is a major factor in the outcome of the patients. The surgical procedure should provide the adequate soft-tissue coverage and minimize non-biological materials. Most series show that failure in limb-saving surgeries is mainly due to inadequate soft-tissue cover, severe muscle loss, and dead space creation. Therefore, adequate soft-tissue coverage will reduce the dead space, decrease the chances of infection, and improve post-operative clinical outcome [6, 16]. After endoprosthetic replacement, most patients suffered major post-operative complications such as infection (36%) and dislocations (27%) [19]. Hip transposition had a lower incidence of infections, but severe limb length discrepancy requiring additional limb-lengthening surgeries [9].

Furthermore, most procedures described above require a good abductor function for restoring hip kinematics. In cases where the abductors cannot be preserved, iliofemoral arthrodesis gives good results with a stable painless hip [15]. Various studies mention the advantage of a durable pain-free stable hip with less length discrepancy with iliofemoral fusion. Fujiwara et al. [19] in their study compared the clinical outcomes of various surgical treatments for periacetabular tumors and found that the best results with iliofemoral arthrodesis, attributable to a good gait performance with a stiff hip. In their study, patients who had undergone pelvic reconstruction with endoprosthesis had poor functional results and higher post-operative complications. Patients who had undergone hip transposition surgeries had lower complications rate but had high limb length discrepancy rates [19].

Enneking [3] in their study recommend iliofemoral fusion as the reconstructive procedure of choice for periacetabular tumors. Similarly, Nagoya et al. [20] also had similar results with reconstructive hip arthrodesis with added vascularized fibular grafting. Angelini et al. [21] in their study recommend that pelvic resections should be followed by reconstructive techniques with the lowest complication rate and earliest functional recovery. Hence, we consider wide excision followed by reconstruction by iliofemoral arthrodesis an effective treatment in these patients. Patients in our series had no recurrence. In our study, we consider good pre-operative planning to assess the extent of the tumor-free resection margin



**Figure 7:** Post-operative radiological evaluation of the patient. (a and b) Immediate post-operative radiographs showing the iliofemoral arthrodesis with a reconstruction plate and screws, (b) follow-up radiography at 2 years showing complete union.

following meticulous dissection, adequate osteoinductive bone grating to facilitate bone union and arthrodesis, and adequate post-operative immobilization for 6–12 weeks remain the key factors that determine a recurrence-free survival with good functional outcome post- periacetabular tumor resection surgery.

The procedure is not without its own set of complications. In the immediate post-operative period, patients may present with infection, and implant failure and pseudo-arthrodesis, non-union later on. In the long term, the iliofemoral arthrodesis may result in low back pain, ipsilateral knee, and contralateral hip degeneration due to the altered biomechanics at play post-surgery [22]. Hence, this procedure cannot be considered in patients with degenerative changes in the lumbar spine, ipsilateral knee or contralateral hip degeneration, or contralateral total hip arthroplasty which increased its failure rate by 40% [19]. Further, pelvic sarcomas have overall 45% survival at 5-year post-surgery due to recurrence and other aforementioned complications [1, 23]. Total hip replacement or an endoprosthetic reconstruction could be considered a salvage option in such conditions depending on the extent of the lesion that needs to be excised during the revision scenario [24, 25, 26].

**Declaration of patient consent:** The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

**Conflict of interest:** Nil **Source of support:** None

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## Conclusion

Iliofemoral arthrodesis serves as a cost-effective reconstructive option in the management of malignant periacetabular tumors. Meticulous dissection and wide resection remain key to preventing recurrence or complications.

## Clinical Message

- Appropriate selection of reconstructive procedures for individual patients considering the amount of bone remaining after tumor resection and the amount of viable soft tissue to support the reconstruction is important
- Selection of patients with proper history, physical examination, radiographs, computed tomograms, and MRI is mandatory, with due consideration to the stage of the malignant tumor
- Surgeons should be aware that these procedures are technically demanding and we recommend experienced orthopedic surgeons familiar with the normal and abnormal anatomy of the acetabulum
- Wide resection followed by iliofemoral fusion decreases the chance of recurrence and helps in cost-effectively achieving a stable hip with decreased risk of infection
- Avoiding the postoperative complication rate is a major deciding factor to ensure a good functional outcome in these patients, which can be achieved by adequate soft-tissue coverage and minimizing non-biological materials.

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**Conflict of Interest:** Nil

**Source of Support:** Nil

**Consent:** The authors confirm that informed consent was obtained from the patient for publication of this case report

#### How to Cite this Article

Kuppan N, Saravanakumar TP, Muthu S. Iliofemoral arthrodesis as a Reconstructive Surgical Technique in the Management of Malignant Periacetabular Tumors: Case Series. *Journal of Orthopaedic Case Reports* 2023 September;13(9): 71-76.

