CASE REPORT

Pelvic sacral and hemi lumbar spine resection of low grade pelvic chondrosarcoma: A multistage procedure involving vascular bypass, spine fixation and vascular exclusion

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Summary Peripheral chondrosarcoma is a rare tumor particularly insidious when arising from the pelvis, becoming symptomatic later in time when surgery may be too difficult and dangerous due to this complex area. In the present case, the tumor arose from an exostosis located on the medial surface of the left iliac wing. Its diameter was 25 cm × 20 cm × 15 cm, adhering to the last three vertebrae, involving the left iliac vein and artery, displacing the left ureter. In a similar case, a hindquarter amputation is indicated but, if the patient refuses, a resection remains possible. In this paper, we describe a multistage technique consisting of an extra-anatomic vascular bypass, a lumbar stabilization, a neurovascular bundles anterior isolation and a posterolateral resection of this mass. After a five-year follow-up, the patient is alive and able to stand and walk with support, after undergoing twice lung metastasis removal.

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Introduction

Peripheral chondrosarcoma (PCS) is a rare tumor arising from the peripheral bone usually from a pre-existing exostosis [1]. The bones of the pelvis are the common sites of involvement (39% in the Rizzoli Institute series), particularly insidious when arising from the inner side, becoming symptomatic later in time when surgery is difficult and dangerous due to the complex anatomy of the area and the presence of neurovascular bundles [1]. Moreover, surgical resection is the only available treatment since the usual adjuvant treatments are ineffective [1–3]. The precocious involvement of the iliac vessels is the main problem. When to separate them from the mass is not possible, vascular bypass is mandatory in performing a wide resection, even when from an oncological perspective amputation is the safer option. The involvement of the acetabular roof, the sacroiliac joint and the lumbar spine renders resection more complicated and may lead to spine, pelvis and hip instability. The aim of the current study was to present a multistep strategy to allow a wide resection of an enormous PCS 25 cm × 20 cm × 15 cm in diameter, adhering to the left iliac vessels, to the left ureter and to the last three vertebrae.

Case report

A 47-year-old male was referred to our department complaining of the presence of a large mass in his abdomen. Six months before, because of the worsening of the symptoms and the onset of an irradiated pain to his left leg, a lumbar CT scan was performed. It highlighted the presence of a significant mass that developed from a suspected pre-existing exostosis located in the medial area of the left wing just above the acetabular roof, involving the left iliac vessels and adhering to the left ureter and to the last three hemibodies of the last three lumbar vertebrae (Fig. 1).

The imaging and symptoms suggested a primitive sarcoma; consequently, a CT-guided trocar biopsy was performed using an 8G needle through the lateral part of Enneking incision. The following histology exam confirmed clinical suspicion of a low-grade chondrosarcoma. An open biopsy was excluded in order to reduce the risk of contamination even if a cartilaginous tumor was clinically suspected. The urography showed the dislocation of the left ureter.

Based on the low-grade histology and the absence of distant metastases, a hindquarter amputation was proposed, however, the patient refused, therefore, a wide resection was scheduled to be carried out over several operations. The first operation consisted in performing an extra-anatomic cross line ilio-femoral arterial bypass using Dacron prosthesis to guarantee blood supply to the left inferior limb from the right. The venous return was reconstructed with the end of distal controlateral saphena vein and anastomosed to the left femoral vein. Both bypasses were placed anteriorly to the superior part of the symphysis pubis to separate them from the main access. After two weeks, a second surgery was carried out, consisting of a L1 to S1 posterior transpedicular unilateral right stabilization as showed in a postoperative X-ray (Fig. 2). Two weeks later the third operation was done by using the trans-peritoneal anterior approach, carrying out a

Figure 1 A CT-scan showing the tumor mass arising from the medial aspect of the iliac bone from a preexisting exostosis, adhering to the last three vertebrae and dislocating the iliac vascular bundle. In the square, it is possible to see the left iliac vessels in complete adherence to the mass. In addition, the right iliac vessels are hidden by the right ilio-psoas muscle and the mass.

Figure 2 Posterior L1 to S1 hemistabilization, surgical aspects and postoperative X-ray.
Multistep procedure to resect a giant lumbar-pelvic chondrosarcoma

Figure 3 Arteriography performed one month after extra-anatomic cross line ilio-femoral bypass showed revascularization of the left inferior limb.

Figure 4 The mass was isolated before removal; on the right, there is the head of the patient. It is possible to see the posterior aspect of the left iliac wing and the tumor arising from this site. In the left square, the operative field after tumor removal is shown and in the right square, the X-ray of the removed mass.

Figure 5 Postoperative X-ray showing left hip dislocation.

week showed the bypass to be functioning well and the left iliac artery completely excluded (Fig. 3). A fourth surgery had to be carried out two weeks later: two balloons were positioned, one in the inferior cave vein and the second one in the right iliac vein to immediately stop blood flow, in case of massive hemorrhage. The patient was positioned in a lateral right position; the Enneking incision was made plus a second one starting from the belly area, heading laterally towards the superior-anterior iliac spine. The tumor was removed together with part of the left iliac bone, the left sacroiliac joint and the last three left hemi-vertebrae, the left iliac artery and vein. The nerve roots from L2 to S1 were sacrificed as planned and the femoral and sciatic nerves cut (Fig. 4). During removal, the inferior cava vein was damaged, the balloons inflated and the vein repaired by a vascular surgeon without significant blood loss. The histology performed on the entire specimen revealed the presence of G2 areas in the mass. The postoperative X-ray evidenced a dislocation of the femoral head because the acetabular roof was partially resected during osteotomy (Fig. 5). This was taken care of with an extra skeletal traction consequently postponing the related therapy. The following postoperative days were characterized by wound infection and several revisions, so, after carefully examining the poor results, a vacuum assisted closure therapy was applied for six months. The wound healed completely by performing a skin grafting at seven months from surgery.

At 18 and 24 months follow-up, the patient had surgery to resect a lung metastasis. At 32 months follow-up, a further operation was carried out to stabilize the lumbar spine by right lumbar access, positioning the patient in a left lateral position. A mixed stabilization was performed by inserting a screw in the L2 vertebral body and in the medial part of the iliac wing that were linked by a rod and a fibular autograft with the morcellized homograft bone (Fig. 6). The fibular should have been vascularized nevertheless the anastomosis was impossible to perform. After having verified the arthrodesis, the patient was finally allowed to stand at 40 months of follow-up.

After a five-year follow-up, the patient is alive without evidence of local relapse but with other lung metastases; it is able to stand and walk with a support without baring any weight on his left inferior limb. The X-ray, performed at five years of follow-up, highlighted damage to the acetabular roof but no evidence of the left femoral head being displaced (Fig. 7). The Musculoskeletal Tumor Society score was 26.7%, however, the patient was particularly satisfied to be able to stand on his own and to have maintained his inferior left limb. It was advisable for the patient to undergo further surgery to stabilize the left hip dislocation; however, the quality of the tissues and the presence of several incisions and lung metastasis discouraged a possible arthrodesis.
in the abdomino-pelvic cavity [1]. The surgical approach is difficult presenting two main problems: the resection and the reconstruction; considering surgical margin as important prognostic factor, the primary surgical aim is complete tumor resection and secondary preservation of stability and lower limb function.

Wide margin might be more important in non-chemotherapy responsive tumors. Court et al. [4] report a recurrence percentage of 7% and 70% for adequate (wide and marginal) and inadequate margins respectively after surgical excision of bone sarcomas involving the sacroiliac joint. Even if some authors recommend marginal margins in low grade CS, we suggest adopting wide margins when possible to reduce the risk of local recurrence that are very difficult to treat in this location [5,6]. Wide margins are also difficult to achieve because of the presence of neurovascular bundles in the pelvic cavity so that when dissection is not possible and safe, a vascular bypass must be scheduled. Moreover, sacral and ilio-sacral joint involvement is an important risk factor for the onset of local recurrence [7], justifying posterior access, laminectomy, nerve roots bounding, section and then tumor removal.

When extensive resection is done, reconstruction is required to avoid severe functional disabilities [8,9]. Several techniques are described in literature, and are based on the sites and the extent of the resection. Some authors suggest the use of an allograft to restore lumbar-sacral and pelvic stability [10,11] and vascularized autograft [12—14], others propose the use of a complex prosthesis or bone cement [15]. Nevertheless, reconstruction procedures increase the infection rate so the choice whether to reconstruct or not or what kind of reconstruction to be carried out must be based on the following factors: the entity of resection, the risk of infection, the need of the patient to undergoing a chemotherapy, the quality of the skin and the risk of wound necrosis [7,8,16]. Some authors recommend the use of autograft to decrease the risk of infection [17]. The use of fixation devices is an important risk factor for postoperative wound infection. Court et al. [4] report a postoperative infection rate of 40% in patients undergoing sacroiliac tumor resection.

An original sequential multistep procedure was scheduled with an additional unexpected step, before tumor resection, by positioning two endovascular balloons, one in the inferior cave vein and the other in the left iliac vein [18,19]. During the fourth surgical step, that consisted in tumor removal, after performing osteotomies, the cava vein was damaged and the inflation of the two balloons allowed a safe repair so that the total amount of vascular bleeding was only 2700 mL, that is almost low considering the operation lasted seventeen hours.

Considering the hip dislocation and the partial stability of the lumbar spine, two other operations would have been necessary to complete the surgical program. A hip arthrodesis was decided to be avoided because of the poor quality of the left tissue and to the limitation in accessing the site. The same access problem emerged when stabilizing the lumbar spine on the left side; therefore, in this case, the right lateral approach was the only possible option, despite being a more biomechanical than contralateral disadvantage.

The onset of two pulmonary metastases suggested postponing the surgery after their removal when the biological

![Figure 6](image1.png)

**Figure 6** Postoperative X-ray showing the two screws in L1 and in iliac right wing linked by a rod and the fibular autograft.

![Figure 7](image2.png)

**Figure 7** X-ray performed at 5 years of follow-up showing the damaged left acetabular roof not suitable to bearing weight.

The study was authorized by the local ethical committee and was performed in accordance with the Ethical standards of the 1964 Declaration of Helsinki as revised in 2000. The need for an informed consent was waived by the ethical committee since rights and interests of the patients would not be violated and their privacy and anonymity would be assured by this study design.

**Discussion**

When PCS is located in the pelvic medial surface as in the current case, it can become large in size, growing indolent
aggressiveness of the disease was clarified. Finally, at 32 months of follow-up from the primary mass removal, spine stabilization was performed.

Only one former study reports a combined resection of posterior pelvis and lumbar spine [20]. The authors describe the outcome of 18 patients with pelvic sarcoma (13 high grade sarcomas) who had undergone hemipelvectomy, from those 11 had a hemivertebrectomy of L5 and 7 had an L4–L5 hemivertebrectomy [20]. At a mean follow-up of 56 months, 12 out the 18 patients were alive without disease [20].

Although modern techniques permit several complex operations to be performed, pelvic resection must only be undertaken once the surgeon can ascertain that the removal of the tumor will be as radical as in a hindquarter amputation. To guarantee better results thorough planning is mandatory.

When resection of a pelvic tumor and reconstruction is done in one step, the percentage of complications increases considerably as demonstrated in literature. This is particularly the case with regards to infection versus surgical time and blood lost. Thus, we suggest to divide complex operations into diverse steps taking into account the patient’s conditions, the amount of anaesthesia needed and the surgeon’s preferences and to be sure the wound of the previous access was completely healed before performing another one [7,21]. This extreme surgery is more indicated for low-grade tumors where a wide resection can change the prognosis of the patient.

Disclosure of interest
The authors declare that they have no conflicts of interest concerning this article.

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References