

Pelvic reconstruction with bone cement and total hip prosthesis after resection of chondrosarcoma.

Case report

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Abstract

Introduction. Chondrosarcoma is a malignant tumor of cartilaginous origin representing approximately 20-30% of all bone malignant tumors and occupying the second place in terms of their incidence. It usually affects adults between 40 and 60 years old, but can be encountered at older ages as well.

Materials and methods. We report the case of a 55-year-old male patient who presented to our department with 2 weeks-long right hip pain and partial loss of functionality in right limb. We performed X-rays, magnetic resonance imaging, computed tomography, bone scintigraphy, and angiography, which established the diagnosis of pelvic tumor. Biopsy of the tumor was performed by iliofemoral approach and its result showed moderately differentiated chondrosarcoma. Orthopaedic surgery was performed, with tumoral removal within oncological limits, pelvic reconstruction using acrylic bone cement impregnated with Vancomycin and total hip arthroplasty.

Results were assessed using the Musculoskeletal Tumor Rating Scale and a score of 23 out of 35 was obtained (the higher the better). Postoperative complications consisted in flap-skin necrosis that resolved within 2 months after surgery.

Conclusion. Bone defects repair using antibiotic impregnated cement drastically reduced the rate of postoperative infections, thus decreasing both morbidity and mortality. In spite of technological advancement, long-term prognosis remains reserved in chondrosarcoma, due to its specific aggressivity, resistance to chemo- and radiotherapy and high rate of recurrence.

Keywords: chondrosarcoma, radiotherapy resistant tumor, bone tumor, hip arthroplasty, bone cement

Introduction

Chondrosarcoma is a malignant tumor of cartilaginous origin representing approximately 20-30% of all bone malignant tumors and occupying the second place in

terms of their incidence. The tumor is primary in 90% of the cases, but it can also be secondary to malignant degeneration in preexisting conditions such as Ollier disease or Maffucci syndrome [1]. It usually affects adults between 40 and 60 years old, but can be encountered at

older ages as well [2].

The most common areas, in which chondrosarcoma occurs are the proximal femur and pelvis, especially the ilium and the area surrounding the acetabulum. Other affected areas, in decreasing frequency, are the proximal humerus, the scapula and the distal femur [3]. Chondrosarcoma is a chemo- and radiotherapy resistant tumor, which makes surgical treatment the only viable option. The purpose of orthopaedic surgery is that of resecting the tumor within oncological safety limits, achieving good limb functionality, as well as maintaining or increasing the quality of life, which are all more difficult to achieve in pelvic tumors due to the anatomical and biomechanical features of the area.

Materials and methods

We present the case of a 55-year-old male patient who presented to our department with 2 weeks-long right hip pain and partial loss of functionality in right limb. The symptoms occurred spontaneously, without any history of injury or trauma.

Clinical examination revealed antalgic loss of articular mobility in the right hip and tenderness at palpation, but without any discernable mass. The anteroposterior view X-rays showed a tumoral mass of the right hip involving the acetabulum and right iliac wing. Advanced investigations like magnetic resonance imaging (MRI), computed tomography (CT), bone scintigraphy, and angiography were performed afterwards.

The MRI revealed a bone tumor involving the acetabulum with right iliac wing extension and intimate contact with the adjacent muscular structures (Fig. 1).

The CT scan (Fig. 2) showed a polilobular bone tumor which penetrated the cortical bone and expanded to the internal obturator muscle.

The immediate phase of the scintigraphic exam revealed discrete hypercaptation in the soft tissue surrounding the right coxofemoral joint, while in the metabolic phase (Fig. 3), a moderate heterogeneous hypercaptation was

revealed at the acetabular site, denouncing a metabolic active process.

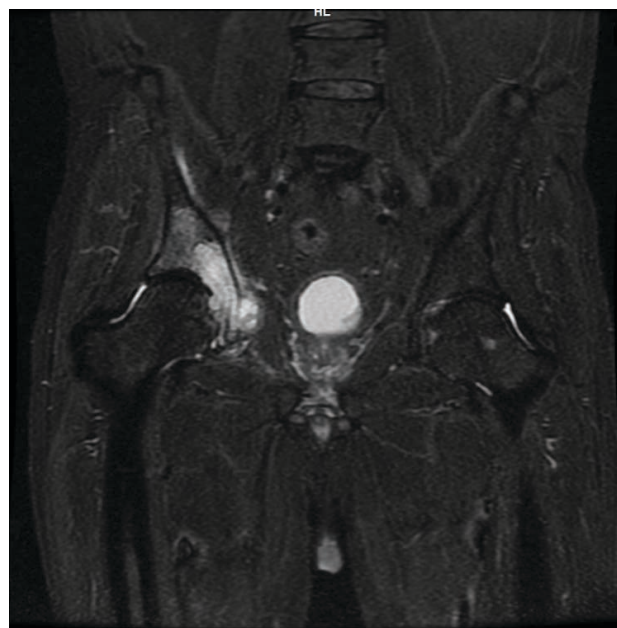


Fig. 1 MRI aspect showing bone tumor involving the acetabulum with right iliac wing extension



Fig. 2 The bone tumor penetrates the cortical bone and expands to the internal obturator muscle



Fig. 3 Moderate heterogeneous hypercaptation at the acetabular site

The angiography completed the imaging investigations, showing a slight loading with "tumoral blush" aspect in the projection area of the lesion, originating from the circumflex iliac artery. Notably, the internal margin of the common femoral artery had a slight irregular aspect, probably due to tumoral infiltration of the area.

Biopsy of the tumor was performed by iliofemoral approach and its result showed moderately differentiated chondrosarcoma (grade G2) (Fig. 4,5).

Orthopaedic surgery was performed, using both iliofemoral and Kocher-Langenbeck approaches, with tumoral removal within oncological limits, pelvic reconstruction using acrylic bone cement impregnated with Vancomycin, reinforced by two Schanz pins and one iliopubic plate with screws. The joint reconstruction ensued, using total hip cemented prosthesis (Fig. 6).

The histological examination of the resected tumor revealed a poorly differentiated chondrosarcoma (grade G3) without invasion of the resection margins (Fig. 7).

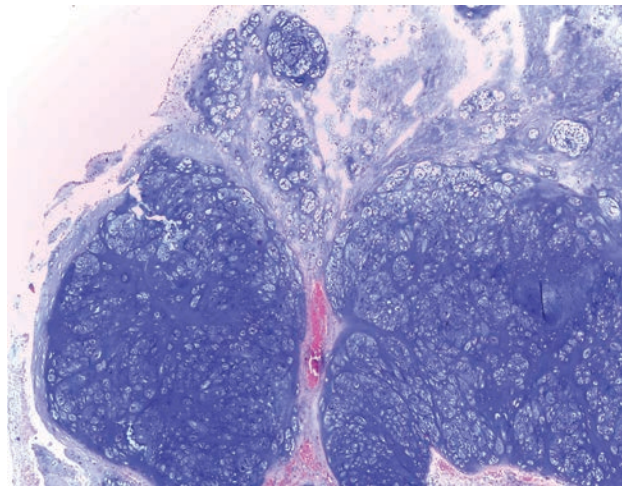


Fig. 4 Grade 2 chondrosarcoma with a multilobulated appearance. The lobules are separated by fibro-vascular bands. The chondrocytes, vary in size and shape, and contain enlarged hyperchromatic nuclei. Binucleation is frequently seen (H.E. ob. 100x)

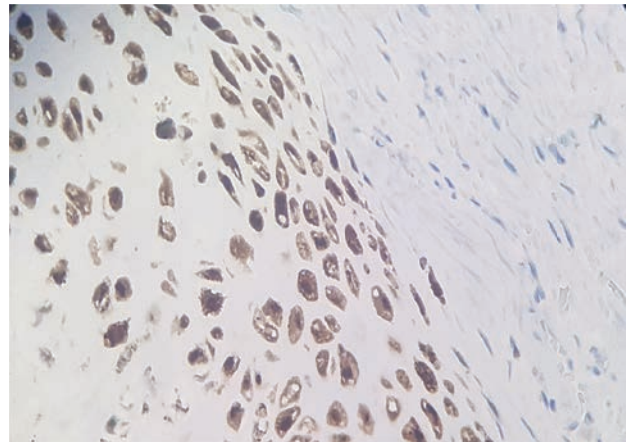


Fig. 5 Grade 2 chondrosarcoma showing specific, intense nuclear and cytoplasmic positive immunostaining for S100 of the atypical chondrocyte (IHC stain with DAB chromogen, ob. 200x)



Fig. 6 Postoperative anteroposterior view X-ray

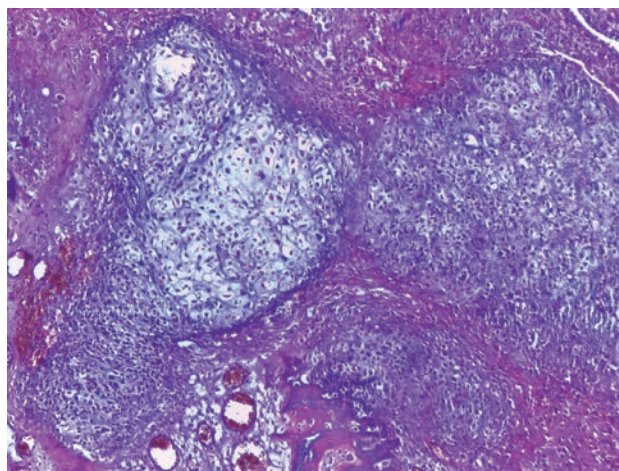


Fig. 7 Grade 3 chondrosarcoma with marked hypercellularity, extreme pleomorphism with markedly hyperchromatic nuclei; bizarre tumor giant cells and small cells, frequent mitotic figures. Focal hemorrhagic areas and exuberant neovascularization (H.E. ob. 200x)

Results

Results were assessed using the Musculoskeletal Tumor Rating Scale (MSTS) that evaluates the range of motion, pain, stability, deformity, strength (in abduction of hip), function activity, and emotional acceptance. A score of 23 out of 35 was obtained (higher is better).

Postoperative complications consisted in flap-skin necrosis that resolved within 2 months after surgery.

Discussions

The histopathological classification of chondrosarcomas is useful both from a therapeutical point of view and as a predictive factor. Considering cellularity, cellular atypia, and mitosis degree, chondrosarcomas can be classified into 3 types:

- 1st degree – moderate cellularity, hyperchromatic uniform nuclei;
- 2nd degree – the presence of cellular atypia and mitoses (mitotic activity);
- 3rd degree – nuclear pleomorphism and abundant mitotic activity.

The histopathological degree is regarded as inversely proportional with the patient's survival

rate in literature, i.e. the 10-year survival rate decreases from 100% [4] in chondrosarcoma of the 1st degree to 90% for 2nd degree and merely 55% for the 3rd degree [5,6].

Another important prediction factor is the location of the tumor and the adopted type of surgical procedure. At first Enneking and Dunham [7] and then Kollender [8] described 5 types of osteotomy in the pelvic region: the iliac, acetabular, ischiopubic, sacroiliac and type H if the femoral head is affected. Of all these, acetabular hemipelvectomy, alone or combined with any other type, achieved the worst results and the most frequent complications, probably because of the loss of an important support segment of the coxofemoral joint. Thus, Puri's study in 2013 highlights the high complexity of hemipelvectomy involving the acetabular area by increasing the duration of surgery from an average of 4.5 hours to 6.8 hours and also a significantly higher intraoperative bleeding in acetabular lesions with an average of 4500 ml versus 2500 ml. Postoperative results were quantified using the MSTS score, which was lower in patients requiring type 2 hemipelvectomy (with a median score of 22 versus 27) [9].

Tumor surgery in the pelvis is complicated both from a technical point of view, due to the vasculonervous and visceral structures, and due to the complications that may occur (20-60% of the cases) [10,11] - infections, pelvic limb inequality, skin necrosis, prosthesis dislocation, lesions involving the femoral vessels or the sciatic nerve [12,13]. Of all these, the most frequent appeared to be the occurrence of postoperative infection, possibly due to the increased duration of surgery, large bone defects after tumor excision, implantation of synthetic materials, proximity to the rectum and the genitourinary tract [14]. According to Buchholz's theory, as the local antibiotic levels are 200 times higher in the case of antibiotic-impregnated cement than by systemic administration, the infection rate can be diminished by using antibiotic-

impregnated cement [15,16]. Also, a Donati study concludes that the use of a cement spacer impregnated with Vancomycin diminishes the rate of infection in reconstruction resections techniques used for bone tumors of the pelvis [17].

The poor long-term prognosis of chondrosarcomas is also a result of increased incidence of recurrences and metastases. In literature, recurrences appeared in 15-35% of the cases and metastases in 20-40% [9,12,18]. The high rate of recurrence can be explained by the lack of adjuvant treatment, inappropriate surgical approach, and surgical reintervention [9].

The mortality rate is also high because of the difficulty of the surgical act, the aggressivity of chondrosarcoma, as well as the high recurrence rate. Deloin recorded a mortality rate of 39% in one of his studies [19].

The purpose of surgical treatment is to completely remove the tumor, within oncological limits and to achieve a good functionality of the affected limb.

From a historical point of view, hemipelvectomy represented the elective surgical approach in order to remove the tumor within oncological limits, but this technique is currently reserved for complex and extreme cases, as most studies report that there is no significant statistical difference between hemipelvectomy and tumor resection followed by local anatomical reconstruction [4,20,21]. Multiple reconstruction methods are currently under development and continuously adapted to the type of resection performed and the instability secondary to the tumor removal [22].

According to Johnson and Satcher, the use of cement in pelvic reconstruction techniques showed very good results, as they have filled the remaining bone defect with cement, and then implanted a total hip prosthesis [11,23].

Conclusions

Nowadays, the advancements in both

surgical approaches and techniques allow the reconstruction of the joints and bone structures, with improved functional outcome, as opposed to the historical resolve that mostly involved amputation.

Bone defects repair using antibiotic impregnated cement drastically reduced the rate of postoperative infections, thus decreasing both morbidity and mortality.

In spite of technological advancement, long-term prognosis remains reserved in chondrosarcoma, due to its specific aggressivity, resistance to chemo- and radiotherapy and high rate of recurrence.

In order to obtain a good outcome and an improved quality of life, the surgical treatment must be carefully planned and an increased attention must be paid to postoperative care and early detection of relapses.

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