CASE REPORT

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Giant-cell tumor of the bone (GCTOB): clinical case

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Abstract

Giant-cell tumor of the bone is a benign tumor, but with high local aggressiveness, even with risk of distant metastasis. From an epidemiological standpoint, giant-cell tumor of the bone accounts for 4–5% of primary bone tumors and ~20% of benign bone tumors; commonly affects adults between 20–40 years, slightly more common in females. We present the case of a 57-year-old woman, without significant pathological history, which, after clinical, imagistic and anatomopathological investigations, is diagnosed with giant cell tumor of the right distal radius. The patient underwent surgery and segmental resection of the tumor in oncological limits was performed, replacing the remaining bone defect with fibular autograft. The results were good, according to Mayo functional assessment score. This way, the wrist joint mobility and the carpal cartilage were preserved, providing a barrier against distal migration of any remaining tumoral cells, as well. In conclusion, we can state that in aggressive giant cell tumors located at the distal radius, the best therapeutic option is en bloc resection of the formation (lesion) with fibular autograft replacement of the bone defect.

Keywords: giant cell tumor, distal radius, fibular graft.

Introduction

Giant-cell tumor of the bone (GCTOB) or osteoclastoma is a benign tumor, but with high local aggressiveness. It was first described by Cooper AS and Travers B in 1818 [1]. The first definition, however, was given by Jaffe HL *et al.* [2] in 1940, who considered it as a benign/malignant borderline tumor with three clinical-anatomical variants: inactive (benign form), active (intermediate form), aggressive (malignant form). They described it as a distinctive type of tumor that develops from non-osteoblastic connective tissue, composed of a vascularized network of fusiform or ovoid cells, interspersed with multinuclear giant cells (which are considered syncytial stromal cells by the authors). From an epidemiological standpoint [3] giant-cell tumor of the bone accounts for 4–5% of primary bone tumors and ~20% of benign bone tumors and most commonly affects adults between 20–40 years, slightly more common in females. It is rarely encountered before the growing plate closure. Although considered a benign tumor, GCTOB has been proved to metastasize to the lungs in up to 5% of the cases [4]. It has a predilection for the epiphyseal/metaphyseal region of long bones, and generally occurs in the third to fourth decade of life [5].

Patient, Methods and Results

A 57-year-old woman, without significant pathological history, is referred to our department with pain and limited range of motion in the right radiocarpal joint, swelling and no peripheral vasculonervous changes. At physical examination, an approximately 5/4 cm tumor located in the right distal radius is detected. The tumor has a firm consistency, is homogeneous, painful at palpation, fixed to the bone and mobile on the suprajacent tissues.

The antero-posterior and lateral view X-rays of the right wrist joint and forearm (Figure 1) show a lytic lesion in the distal epiphyseal/metaphyseal area of the right radius, with cortical thinning and extension to the subchondral area with a characteristic "soap bubble" appearance.

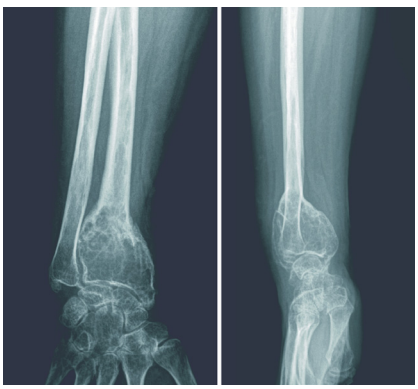

Figure 1 – ***Antero-posterior and lateral view X-rays of the right wrist joint and forearm: osteolytic tumor with cortical thinning and "bubble soap" appearance.***

Right forearm MRI (Figure 2) detects an expansive distal epiphyso-metaphyseal tumor in the radius, with minimal extension to the adjacent soft tissues on its lateral and posterior aspects and minimal fluid reaction in the wrist joint. Chest X-ray examination does not show any abnormalities of the lung tissue.

Incisional biopsy is performed and a piece of tumor is extracted and sent to histomorphological examination. Macroscopically, it looks like a brittle red-brown tissue of soft consistency. The diagnosis of giant cell tumor is

based on microscopic examination. The microscopic examination reveals tissular fragments with mononuclear monomorphic cell proliferation disposed in diffuse sheets (Figure 3). The cells have oval-shaped nuclei, with finely granulated chromatin, rarely visible nucleoli and moderate quantities of cytoplasm. Rare metaplastic bone spicules and small sheets of foam cells are interlaced between the mononuclear cells areas. Various quantities of giant multinucleated cells are present in the biopsy tissue (Figures 4 and 5). Other findings include vascular lacunae, but with no cellular necrosis or cells undergoing mitosis.

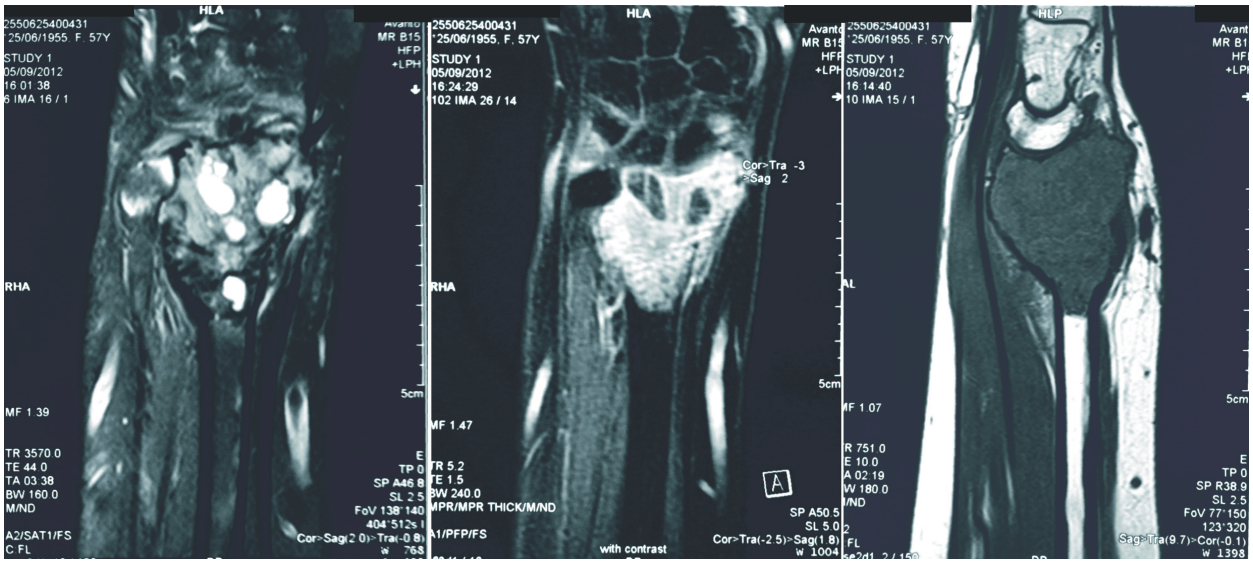

Figure 2 – ***Magnetic resonance imaging of the right wrist joint and forearm: expansive distal epiphyso-metaphyseal tumor in the radius with minimal extension to the adjacent soft tissues on its lateral and posterior aspects.***

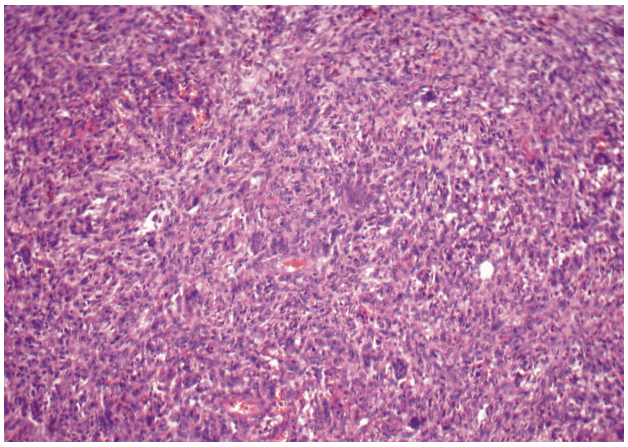

Figure 3 – ***Giant cell tumor, microscopic view: multi-nucleated giant cells and mononucleated stromal cells; nuclei are similar in both types cells (HE stain, ob. 10×).***

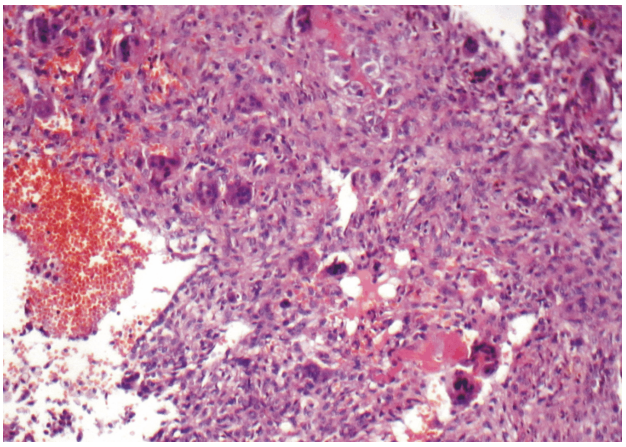

Figure 4 – ***Giant cell tumor, microscopic view: multi-nucleated giant cells, mononucleated stromal cells and blood vessels (HE stain, ob. 10×).***

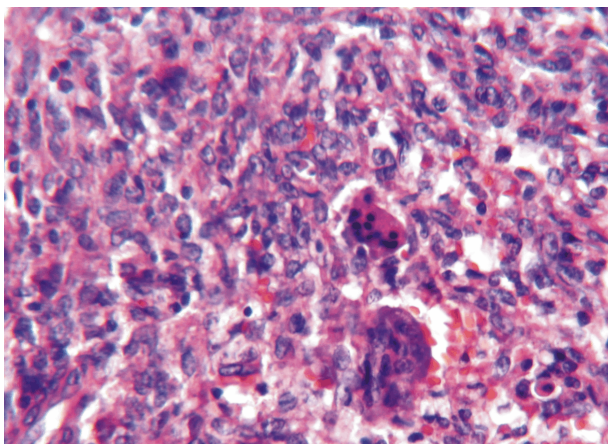

Figure 5 – ***Giant cell tumor, microscopic view: multi-nucleated giant cells and mononucleated stromal cells; nuclei are similar in both types cells (HE stain, ob. 60×).***

After getting the result of the biopsy, the patient returns to our department and undergoes surgical treatment.

An approximately 12 cm longitudinal approach on the posterior aspect of the right distal forearm is performed in order to expose the distal radius. Segmental resection of the distal radius is achieved, in oncological safe limits. The length of the resected tumoral piece is 9 cm (6 cm representing the tumoral tissue itself and another 3 cm proximal to the tumor representing healthy bone tissue).

An approximately 12 cm longitudinal approach on the lateral aspect of the left proximal leg is performed in order to expose the proximal fibula. Common fibular nerve is isolated and retracted from the fibular neck and an osteotomy of the fibular shaft is done at 10 cm distal to the upper extremity of the bone. (The harvested graft is 1 cm longer than the resected part of the radius in order

to compensate the compression process in the radio-fibular junction and eventual measurement errors).

Fibular structural autograft was introduced in the distal forearm, replacing the radial bone defect and was fixed with a plate and seven screws to the remaining radius and with two K-wires to the distal end of the ulna and first row of carpal bones (Figure 6).

Postoperative treatment is initiated with painkillers, anti-inflammatory drugs, antibiotics and antithrombotic prophylaxis, immobilization of the wrist in a short-arm plaster for 21 days. After eight weeks postoperatively the patient undergoes another surgery and the two K-wires are removed (Figure 7). Physical rehabilitation was started in order to restore wrist mobility and muscular strength of the right forearm.

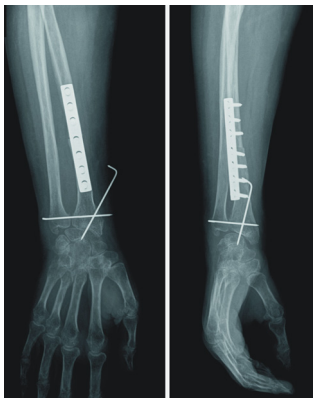

Figure 6 – ***Postoperative X-rays: fibular structural autograft introduced in the distal forearm and fixed with plate, screws and Kirschner wires.***

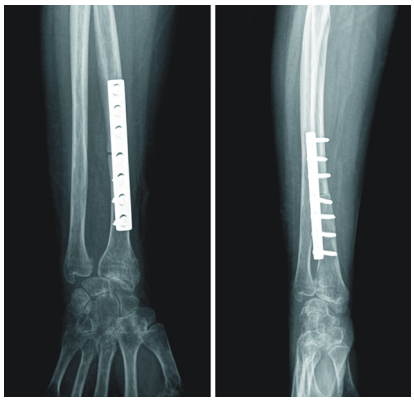

Figure 7 – ***Postoperative X-rays eight weeks after initial surgery: Kirschner wires were removed.***

Postoperative results were evaluated clinically and radiologically at eight weeks and three months after surgery, when AP and lateral view X-rays of the distal forearm were performed. Callus formation is observed in the radio-fibular (graft) junction and restoration of the anatomy of the wrist joint, very close to the normal radiological aspect. Also, clinical tests on the left knee show normal stability of the joint and a normal range of motion. After 12 weeks postoperatively, the patient was evaluated according to the Mayo functional score. This score ranges between 0 and 100, taking into account pain intensity, functional status, joint mobility and grip strength. The patient gained 85 points representing a good functional outcome of the surgery.

Discussion

GCTOB represent approximately 4–5% of the primary bone tumors and 20% of the benign bone tumors. It is more frequent in females (sex ratio females/males 1.5:1) and in the third and fourth decades of life (70–80% of cases). Giant cell tumors are usually found in the epiphyseal/metaphyseal region of long bones, most often in the distal femur, proximal tibia and distal radius. Giant cell tumors of distal radius represent approximately 10% of GCTOB [6]. Even if it is a benign tumor, it has the potential to metastasize to the lungs (5% of cases). The metastases are usually histologically benign. In 1–3% of cases [7], the tumor undergoes a malignant transformation and becomes very aggressive and destructive. It is usually monostic (rate of polyostic form <1%).

Histologically, GCTOB are characterized by many large multinucleated giant cells with numerous inter-spersed mononuclear stromal cells (neoplastic cells). The nuclei of the multinucleated and mononuclear cells are similar. In fact, giant cells are circulating monocytes which were converted into osteoclasts [8].

Accurate diagnosis is possible only by histo-pathological examination. Lab tests especially help in making optimal therapeutic decision. Differential diagnosis is made with brown tumor of hyperparathyroidism, aneurysmal bone cyst, giant cell osteogenic sarcoma, chondroblastoma, fibrosarcoma of bone.

Campanacci M *et al.* [9] proposed the following radiological classification:

- Grade 1: Intramedullary lesion confined to bone;
- Grade 2: Thinned, expanded cortex;
- Grade 3: Cortical breakout.

Taking into consideration radiological and histological aspects of the tumor and relating them to the clinical findings, Enneking WF *et al.* brought up another classification [10]:

- Stage I (latent): Confined totally by bone, asymptomatic, inactive on bone scan, histologically benign;
- Stage II (active): Expanded cortex without break-through, symptomatic, pathological fracture possible, active on bone scan, histologically benign;
- Stage III (aggressive): Cortical perforation with soft tissue mass, may metastasize, symptomatic, intense activity on bone scan, histologically benign;
- Stage IV: Sarcomatous lesions.

The literature describes various approaches to this type of injury. In well-circumcised lesions, with no cortical erosion, is indicated curettage [11] and filling the restant bone defect with bone graft and/or acrylic cement or bone substitutes.

Tumor resection associated with wrist arthrodesis has certain disadvantages [12]: important reduction of wrist functionality and abolition of cartilage protective role against possible recurrences (known barrier function of cartilage against GCTOB).

En bloc excision of the tumor followed by reconstruction with allograft [13] to cover the remaining defect predisposes the host organism to infection, immune reactions and has a high rate of complications. The allograft is not revascularized and, in time, compactions and fractures can occur.

Ulnar translocation associated with tumor resection can provide good functional results [14], but it is not cosmetically acceptable as anatomical changes lead to poor aesthetics – forearm in “hourglass”.

Some authors have attempted tumor resection and arthroplasty reconstruction using prostheses after tumor excision, but the results were poor [15].

In the presented case, the tumor was classified in stage III according to Enneking classification, with a high-degree of local aggressiveness and cortical destruction, yet lacking histopathological features of malignancy and distant metastasis. Because of these characteristics, curettage and cement filling was not indicated, the method of choice being en bloc resection in oncological limits and replacing the remaining bone defect with fibular autograft.

In a retrospective study, Harness NG and Mankin HJ [16] have demonstrated an increased incidence of recurrence in patients with Enneking stage III treated by curettage than those treated by segmental resection and bone grafting (100% and respectively 17%).

Conclusions

In GCTOB with aggressive development (stage III), located at the distal radius, the best therapeutic option is the en bloc resection of the tumoral lesion and replacement of the bone defect with proximal fibula autograft. This method provides the best postoperative functional results with a lower risk of local recurrence and does not require microvascular surgery or access to a bone bank.

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