

Treatment of GCT of Distal Radius Bone with Pre-operative Denosumab Plus Replacement by Distal Ulna and Ulnocarpal Arthrodesis: A Case Report

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Abstract

Introduction: Giant cell tumor (GCT) of bone is a benign tumor, however locally aggressive with a tendency for local recurrence and potential for metastasis. The distal radius is the third most frequent location, after the distal femur and proximal tibia. In Campanacci grade Grade III tumors, multiple reconstruction techniques after resection of the distal radius have been described, such as bone graft plus wrist arthrodesis. The use of the drug Denosumab in the pre-operative period helps a surgery with less comorbidity, and limb preservation and reduces the chance of function loss. The objective is to report a case of a patient who underwent treatment of Campanacci grade Grade III distal radius bone GCT, with pre-operative Denosumab application and resection surgery, replacement by bone graft distal ulna), and ulnocarpal arthrodesis.

Methodology: Quantitative, descriptive, retrospective study by analyzing the medical record of a case report, plus literature study.

Conclusion: The use of pre-operative Denosumab favors surgery with less comorbidity; however, more studies are needed in order to define the ideal dosage. Ulnar translocation with ulnar carpal arthrodesis has also proved to be a successful technique and further studies are needed to evaluate its effectiveness.

Keywords: Giant cell tumors of bone (MeSH ID: D018212), denosumab (MeSH ID: D000069448), arthrodesis (MeSH ID: D001174), case report (MeSH ID: D002363). Giant Cell Tumors of Bone (MeSH ID: D018212); Denosumab (MeSH ID: D000069448); Arthrodesis (MeSH ID: D001174); Case Report (MeSH ID: D002363).

Introduction

Giant cell tumor (GCT) of bone is a benign tumor, however, locally aggressive, it tends to recur locally with a potential for metastasis [1, 2]. The distal radius is the third most frequent location, after the distal femur and proximal tibia [3]. Most common in the 30–40-year-old age group, predominantly female [4].

In the GCT, there is a proliferation in the stroma of mononuclear cells that express the Receptor Activator of the Nuclear Factor Kappa-B Ligand (RANKL) and an infiltrate of mononuclear cells which are similar to macrophages and multinucleated giant cells, both expressing Receptor Activator of the Nuclear Factor Kappa-B (RANK). RANK interaction with RANKL activates osteoclasts which are responsible for the extensive osteolysis accompanying tumor growth [5].

Campanacci Grade I and mostly Grade II lesions can be treated with intra-lesional curettage. In Grade III (where there is great bone destruction with soft-tissue invasion), the best treatment is the resection of the distal radius with an oncological margin, as the curettage has a 25% recurrence rate [6]. Denosumab is a human monoclonal antibody with high specificity to RANKL, inhibiting RANKL binding, reducing the formation and osteoclast activation in GCT, and resulting in reduced bone resorption. The pre-operative use of this medication helps in surgery with less comorbidity, in limb preservation and reduces the chance of function loss [5]. Multiple reconstruction techniques after resection of the distal radius have been described such as bone grafting along with wrist arthrodesis. This technique has shown good results. This study has the objective of

reporting the case of a 21-year-old male patient who was submitted to treatment for Campanacci Grade III distal radius GCT of bone with pre-operative denosumab and resection surgery plus replacement by bone grafting (ulna distal) and ulnocarpal arthrodesis.

Methodology

Quantitative, descriptive, and retrospective study by analyzing the medical record of a case report plus literature review. The articles were selected by the PUBMED research platform, only in the English language, over the past 5 years, with the following keywords: CGT and WRIST. The inclusion factors were articles that described the treatment with resection of the distal radius and replacement by autografting of the ulna (vascularized or not) or fibula (vascularized or not) or iliac; the use of pre-

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Figure 1: Anteroposterior and lateral radiography showing a large tumor on the distal, osteolytic, and soft-tissue invasion.

operative denosumab in the treatment of bone GCT of the distal radius; case report, case series, clinical trials, and reviews. The exclusion factors were articles that described treatment in other anatomical sites besides the distal radius; articles that reported other pathologies besides bone GCT; articles that did not have patients with Campanacci Grade III distal radius GCT.

Case Report

FPN, male, 21-year-old, came to the outpatient clinic complaining of pain and tumor formation after 6 months of symptoms. He was experiencing reduced range of motion and pain when moving wrist and fingers. Therist radiography showed a large-volume, osteolytic tumor with soft-tissue invasion in the distal radius (Fig. 1). The patient underwent a histopathological examination and resulted in GCT of bone and was classified as Campanacci III. After the biopsy result, the patient was submitted to drug treatment with a weekly 60



Figure 2: Anteroposterior and lateral radiographs after 3 months of using denosumab showing evidence of tumor delimitation and calcification.

mg application of denosumab for 3 months. He showed good clinical evolution with pain relief and improved range of motion in his fingers. Radiographically, the tumor was marked with a sign of enveloped sclerosis and more calcification (Fig. 2). He underwent resection surgery of about 5.7 cm of the distal radius with an oncological margin, in addition to scaphoid and semilunar bone resection plus replacement by distal ulnar grafting and ulnocarpal arthrodesis with a 3.5 mm DCP plate (Fig. 3). After surgery, the patient used immobilization with a cast for 6 weeks. Then, exercises were oriented to gain range of motion and pick up light objects, starting to pick up heavier objects at 3 months. Today, the patient has evolved for 6 months satisfied with the treatment without complaints of pain, reduction in supination and does not perform wrist flexion-extension. His fingers have good range of

motion. There is no tumor recurrence (Fig. 4).

Results and Discussion

With the keywords, 72 articles were found. Using the inclusion and exclusion factors, a total of seven articles were selected, all of which were case series.

GCT is an aggressive benign tumor with a high rate of local recurrence and risk of lung metastasis. The main objective of treatment is complete tumor removal to reduce the risk of recurrence and attempt to preserve limb functions. Many techniques have been reported in the defect reconstruction such as vascularized or non-vascularized fibula, osteoarticular allografts, partial or total wrist arthrodesis, and custom-made prostheses [1, 2].

In the study by McCarthy et al. (2017), the drug denosumab was used pre-operatively at a weekly 120 mg dosage for 3 months with additional 120 mg doses on days 8 and 15 in the 1st month. Patients were supplemented with calcium and Vitamin D due to the hypocalcemia risk. The use of this drug showed cortical and subchondral bone reconstitution in addition to sufficient marginal sclerosis to mark the tumor's margin, although not causing intra-lesional sclerosis. Patients underwent curettage with joint preservation, local functional anatomy, and wrist function. Thus, in 12 months of patient follow-up, they presented only one case of recurrence in a patient with Campanacci Grade III [5]. In the case reported here, the patient was subjected to denosumab at a weekly 60 mg dose for 3 months and the radiography also showed a response to cortical and subchondral bone reconstitution in addition to marginal sclerosis.

In the study by Qi et al. (2016), distal radius block resection was used, and the non-vascularized fibula was used to fill the defect. They report that patients had a relatively high satisfaction despite wrist instability and mild-to-moderate pain in some patients. In addition to 4 patients (out of 12 total) who evolved joint congruence loss [1]. In the study by Yang et al. (2016), in which a vascularized fibula was used, reports that it has the same characteristics as the non-vascularized fibula as the possibility of preserving the wrist function, but with the risk of bone non-union. The difference would



Figure 3: Anteroposterior radiographs and profile of the immediate post-operative period (a and b) and with 6 months (c and d). 5.7 cm resection surgery of the distal radius with oncological margin, in addition to scaphoid and semilunar bone resection, plus replacement by distal ulna graft, and ulnocarpal arthrodesis. The distal screw has already loosened up, but it did not lead to mechanical failure.



Figure 4: Clinical evolution 6 months after the operation, showing good clinical aspect, no tumor recurrence, active range of motion and full of fingers, reduction in supination and wrist flexion-extension.

be in osteointegration time, which is 3–5 months shorter when compared to the non-vascularized fibula [2].

Another way to preserve the wrist joint is with allografting, but in about 33% of patients, they will need revision or amputation, in addition to the risk of viral infection [4].

For Bianchi et al. (2020), wrist arthrodesis can have a favorable functional result because

forearm and hand joints can adequately compensate for the loss of wrist movement. To preserve some degree of mobility, partial arthrodesis can be performed, fixing the graft on the scaphoid and semi-lunar [7]. Gulia et al. (2019) report treatment with wrist arthrodesis with iliac bone grafting. As a limitation, the resection should be a 6 cm maximum. It shows complication risks at the donor site and bone non-union [6].

Wrist arthrodesis with ulnar centralization has the advantages of being a technically simple surgery and only one Kirshner wire is used for osteosynthesis, making it a low-cost surgery. However, complications include the need for an immobilization period of up to 12 weeks, reduced prone-supination movement and loss of flexion-extension, synthesis failure, ulnar pseudoarthrosis, and fracture [3, 4].

In the report, radius block resection plus translocation of the distal ulnar and ulnocarpal arthrodesis were used as surgical treatment. The patient evolved with reduced supination and loss of flexion-extension movement. Despite this, the patient is satisfied with the result, as the hand and forearm joints overcome those movement limitations. In addition, the patient has not complained of pain and signs of tumor recurrence.

Conclusion

Since bone GCT is a tumor with a high recurrence rate and a potential for lung metastases, the treatment recommended in cases of Campanacci Grade III is en bloc tumor resection. There are several ways to replace this defect that may or may not include wrist preservation of the wrist and each with its advantages and disadvantages. The use of pre-operative denosumab favors surgery with less comorbidity; however, more studies are needed to define the ideal dosage. Ulnar translocation with ulnocarpal arthrodesis has also proved to be a successful technique and further studies are needed to evaluate its effectiveness.

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