

## **Resection of Distal Radius Giant Cell Tumor and Reconstruction with Non-Vascularized Fibular Graft: A Case Report**

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**Abstract:** Giant cell tumor (GCT) is a benign and locally aggressive tumor. Cases of GCT found at the distal radius were rare and difficult to control locally. We reported a case of GCT with en bloc resection and reconstruction using non-vascularized fibular autograft. A 57-year-old female patient presented with a lump on the wrist joint of left arm, and was confirmed to have a giant cell tumor by histological study. The tumor was classified as a Campanacci Grade III tumor, therefore, an en bloc resection with non-vascularized fibular autograft was performed. Arthrodesis was added to increase stability. Resection with a clear margin, with no complications, was possible despite not previously receiving downsizing neoadjuvant chemotherapy. Acceptable functional results were achieved postoperatively; however, wrist motion was reduced due to the arthrodesis. Long-term follow-up should consider recurrence and graft-related complications, including fractures, dislocations, or subluxations. In conclusion, while there is no general consensus of how to treat GCT, the Campanacci classification is useful to make a surgical decision. Resection and reconstruction with non-vascularized fibular autograft were satisfactory, having achieved free margin resection. However, there is a decreased range of motion due to arthrodesis of wrist, in order to prevent subluxation and dislocation. Long term follow up is necessary to observe recurrences and complications related to bone autograft utilization.

**Keywords:** giant cell tumor; fibular graft; distal radius; reconstruction

## INTRODUCTION

Giant cell tumor (GCT) is a common benign tumor of bone with characteristics of being locally aggressive and having high recurrence rate. It is characterized by multinucleated giant cells belonging to an osteoclast-monocyte lineage, comprising about 5% of all bone tumors, both benign and malignant.<sup>2</sup> Common locations are metaphysis or epiphysis of the femur or tibia (knee joint), and with as few as 11 percent of cases involve distal radius.<sup>3</sup> This tumor is predominantly occurs in population of 20 to 40 years old, and rarely found over 50. Female is slightly more affected than male, with female-to-male ratio between 1.3 and 1.5 to 1.1. Metastasis is rare, but it can be found in 1% to 5% of patients.<sup>1,4</sup>

The grades of GCT are based on the Campanacci grading system, as follows:<sup>1,4</sup> Grade I, intraosseous tumor with well-margined border, the cortex is still intact; Grade II, extensive intraosseous tumor with cortical thinning; and Grade III, extraosseus tumor with soft tissue extension.<sup>3,4</sup>

Although there is no general consensus on how to treat CGT, various authors prefer to treat Grade I and II Campanacci tumors with intralesional curettage, while the one with Campanacci grade III is treated with en bloc resection. As for en bloc resection, the option for treatment is according to whether or not the resection will bring severe mechanical compromise. Expendable bones such as the lower end of ulna and upper end of fibula treated with en bloc resection without reconstruction maybe acceptable. However, other parts such as distal radius, tibia or femur, may require reconstruction. This may include prosthetic joint replacement or using bone autograft.<sup>2</sup>

We reported an uncommon case of distal radius GCT with extension to radiocarpal joint treated with en bloc resection and non-vascularized fibular autograft plus arthrodesis. This report discussed the operative technique and outcome of this type of treatment, as this may be reconducted for better result with minimal complication and acceptable joint function.

## CASE PRESENTATION

A 57-year-old female presented with a lump on her left wrist since six months ago. The lump initially felt small and gradually increased in size, accompanied with pain and tingling in her fingers. There were no history of significant weight loss, shortness of breath, and other musculoskeletal pain.

Previous medical histories were unremarkable, with no history of taking specific medication, previous tumor, or any significant comorbidities. The patient was a housewife, and not being in occupation of heavy lifting and frequently using left arm (right hand dominant). She denied any of her family members having a solid mass in limbs or other parts such as hers.

Her physical exam showed a lump on the left wrist, size 10x15 cm, and immobile. The lump was non-tender, non-erythematous, and hard in consistency. There were no abnormalities in sensory and motoric status (Figure 1). MRI of the patient's wrist joint revealed a 3.3 x 4.2x 4 cm lesion on the distal radius, with cortical and medullary involvement a month after the first consultation (Figure 2). Prior to surgery she had undergone biopsy and the result revealed that it was a giant cell tumor.

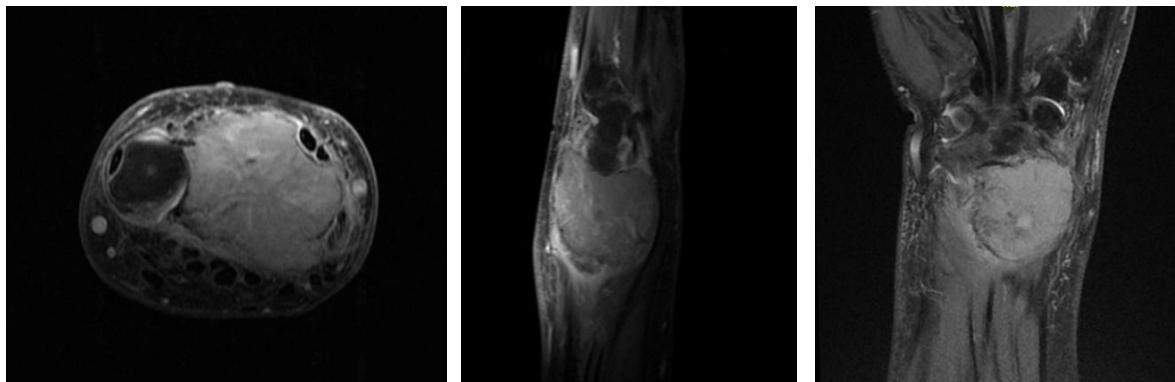
The patient underwent a bone reconstruction with non-vascularized fibular bone graft. The resection was performed through dorsal approach (Figure 3).



**Figure 1:** Clinical photograph taken preoperatively, showed a hard lump on the left wrist joint (10x15 cm)

The tumor was identified and separated carefully from nerves, major vessels of the wrist, and extensor and flexor tendons. Margins of 1 cm proximal from the tumor were taken and disarticulated on radiocarpal joint distally (Figure 4). This left a void which then reconstructed using a non-vascularized fibular autograft taken from the ipsilateral fibula (Figure 5). Approximately 9 cm fibular graft was harvested. The graft was trimmed to fit the defect and fixated proximally with plate and screw. Arthrodesis was conducted at wrist joint to the carpal bones to increase stability (Figure 6). A post operative plain radiography showed internally fixated fibular graft with arthrodesis (Figure 7).

Post operatively, the patient could readily move her fingers and had no sensory or neurological deficit. The wrist, though, was hard to flex or extend due to the arthrodesis. The patient was discharged three days later and was referred to medical rehabilitation for further management.



**Figure 2.** MRI of wrist (axial, coronal, and sagittal T2 views) showed 3.3 x 4.2x 4 cm lesion on distal radius, with medullary and cortical involvement a month after first consultation



**Figure 3.** Dorsal incision design for resection of GCT



**Figure 4.** A gross specimen of GCT tumor after resection



**Figure 5.** A void was left after tumor resection



**Figure 6.** Non-vascularized fibular graft was fixated proximally at radius bone and distally to carpal bones using arthrodesis



**Figure 7.** A post-operative plain radiography showed internally fixated fibular graft with arthrodesis

## DISCUSSION

There is no general consensus of how to treat GCT, let alone GCT of distal radius which only comprises of 11% of overall CGT incidence.<sup>3</sup> The decision was based on experience made by several case studies that the Campanacci grade I was treated by intralesional curettage and the Campanacci grade II and III by en bloc resection.<sup>5-11</sup> Intralesional curettage seems to preserve joint function, but carries higher risk of reoperation than resection due to recurrences. This case study presents a patient with the Campanacci grade III tumor who underwent resection with reconstruction using non-vascularised fibular graft, as this may be the means of reducing recurrence. No general consensus on how far the margin for CGT resection, but a study showed no recurrence for resection with 1 cm margin.<sup>8</sup> Thus, this prerequisite was used in this case to achieve similar result

Preserving the joint and surrounding structure such as nerves and vessels is important in conducting the resection. We were able to preserve the adjacent critical structures during the procedure, but not without difficulty, since the tumor had deviated the radial artery and nerve. The use of neoadjuvant therapy such as Danosumab may benefit for such cases. The drug may down-size the tumor prior to resection.<sup>1,10</sup> However, such drug was not given to patient prior to surgery due to unavailability. The en bloc resection was possible though with clear margin of 1 cm proximal from the tumor.

While resection with ulnar utilization such as centralization, translocation, and double barrel segmental reconstruction may be done,<sup>8,10</sup> fibular graft was opted for the case, because the former options tend to add more burden to functionality of wrist joint. Vascular grafting is useful because it improves the perfusion of the recipient site, thus improves the healing process.<sup>12</sup> However, the procedure is technically demanding and may prolong operating time. A study by Singh et al<sup>5</sup> showed acceptable functional results of 78.4% using Musculoskeletal Tumor Society Score (MSTS), 83.98% using Toronto Extremities Scoring System (TESS), and 25.2 using Disability of the Arm, Shoulder and Hand (DASH) scores, with non-vascularized fibular graft arthroplasty. There were 73% of the subjects having some degree of subluxation of the joint and 60% of the subjects had <2 mm joint, while there were no cases of dislocation. Another study used for osteomyelitis by Liu et al<sup>13</sup> showed that compared to vascularized fibular grafts, non-vascularized fibular grafts might need a longer time for union, and recommended that it should not be used when there was not a good soft tissue cover. This case used the same treatment with non-vascular graft. Though there were no short-term complications, the long term follow up should consider the previously mentioned complications.<sup>11,13</sup>

After resection with reconstruction using fibular autograft, arthrodesis was added at carpo-fibular graft joint, thus maintaining immobilization. While arthrodesis reduced wrist mobilization, this measure tends to minimize risk of reoperation due to subluxation and bone graft fracture. Arthrodesis also adds grip strength for people using the reconstructed part frequently.<sup>9</sup> Post operatively, this patient wrist mobilization was minimum as expected, and would be observed long term to evaluate whether there would be degenerative changes.

## CONCLUSION

While there is no general consensus of how to treat GCT, the Campanacci classification is useful to make a surgical decision. Resection and reconstruction with non-vascularized fibular autograft were satisfactory, having achieved free margin resection. However, there is a decreased range of motion due to arthrodesis of wrist, in order to prevent subluxation and dislocation. Long term follow up is necessary to observe recurrences and complications related to bone autograft utilization.

## Conflict of Interest

The authors confirm no conflict of interest in this study.

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