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ORIGINAL RESEARCH

Giant Cell Tumor of the Distal Radius: Wide Resection, Ulna Translocation with Wrist Arthrodesis

Dr. SiddalingamurthyG.[1], Dr. Ankit Gupta[2]

[1]Professor and Head, [2]Resident, Department of Orthopedics, JSS Medical College and Hospital, Mysuru, Karnataka, India

Corresponding Author
Dr. Ankit Gupta
Resident, Department of Orthopedics, JSS Medical College and Hospital, Mysuru, Karnataka, India

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Abstract
Giant cell tumor (GCT) represents one of the most prevalent benign bone tumors, primarily affecting young adults between the ages of 20 and 40. There are various methods described such as extended curettage and reconstruction using bone grafts or polymethyl methacrylate (PMMA) cementation, juxta-articular distal radius GCT which are associated with recurrence and are difficult to salvage the wrist joint anatomy and function. We have presented a case report of GCT of distal radius managed with wide resection, ulna translocation with wrist arthrodesis. The patient achieved a range of 70 degrees of supination and 80 degrees of pronation good functional finger grip.Ulnar translocation and wrist arthrodesis is a simple method of wrist reconstruction with local availability of vascularized graft and provides excellent forearm function and strength.

Key words: Giant cell tumor, Distal radius, Arthrodesis

INTRODUCTION

Giant cell tumor (GCT) represents one of the most prevalent benign bone tumors, primarily affecting young adults between the ages of 20 and 40. This tumor is characterized by a significant recurrence rate and the potential for aggressive clinical behavior. GCT is typically located in the metaphyseal or epiphyseal regions of the tibia or femur. Although it is generally classified as benign, the disease exhibits a highly variable and unpredictable course.[1-3] The local aggressiveness of GCT can manifest through focal symptoms resulting from bone or cortical destruction, as well as expansion into adjacent soft tissues, with rare instances of metastasis. When GCT occurs in the axial skeleton, it is associated with an increased risk of severe local complications and is frequently considered unresectable.[4, 5]

The occurrence of metastases in GCT patients ranges from 1% to 9%, with some earlier research indicating a correlation between the likelihood of metastasis and both aggressive tumor growth and local recurrence. There remains a lack of consensus on the optimal treatment approach for GCT, with proponents advocating for a variety of surgical interventions, from intra-lesional curettage to extensive resection. The primary objectives of treatment include the complete removal of the tumor, the maintenance of limb functionality, and the prevention of both local recurrence and distant metastasis. In the past decade, numerous adjuvant strategies beyond basic curettage have been documented in orthopedic literature, aimed at enhancing local control and reducing the risk of recurrence.[6-8]

There are various methods described such as extended curettage and reconstruction using bone grafts or polymethyl methacrylate (PMMA) cementation, juxta-articular distal radius GCT which are associated with recurrence and are difficult to salvage the wrist joint anatomy and function. However, methods such as wide resection and reconstruction using structural autografts fibula (vascularized/non-vascularized), allograft, or centralization of the ulna with wrist arthrodesis are reported with lower recurrence rates.[9] Hence, we present a case of distal radius GCT managed successfully with wide resection, translocation of the ulna, and wrist arthrodesis to preserve pronation and supination of the forearm and hand function with excellent functional outcome.

CASE REPORT

A 18-year-old female, presented to us with pain and swelling at the left wrist for six months. On

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examination, there was a non-tender, solitary, firm swelling at the distal radius measuring approximately 5 x 3 cm in size, with mobile overlying skin and dilated veins. The swelling was non-fluctuant, and the local temperature was mildly raised. There was no distal neurovascular deficit, and hand functions were normal.The patient was planned for wide resection, ulna translocation, and wrist arthrodesis Level of radius resection was planned according to MR findings, including 1 cm of normal healthy uninvolved bone.The patient was planned for wide resection, ulna translocation, and wrist arthrodesis Level of radius resection was planned according to MR findings, including 1 cm of normal healthy uninvolved bone. The tumor bed was treated with a 3% hydrogen peroxide solution to sanitize the wound for microscopic tumor cell spillage. Around 8 cm of the distal ulna was resected, keeping intact all soft tissue attachments, and centralized between the lunate column and the radius's cut end. Articular surfaces of distal ulna and lunate were removed with burr for arthrodesis, and it was stabilized with a 3.5 mm One DCP plate across the wrist over the 3rd metacarpal & Second DCP plate between resected radial end and translocated ulna. The wound was closed in a layered manner over the negative suction drain to prevent hematoma formation, which was removed after 48 hours.Post-operatively patient was followed up for two years with no clinical and radiological signs of recurrence. At the final follow-up, we assessed the functional outcome with the MSTS scoring system It is based on patient-specific factors (pain, functional activities, emotional acceptance) and upper limb-specific factors (hand position, lifting ability, manual dexterity). The patient achieved a range of 70 degrees of supination and 80 degrees of pronation good functional finger grip, and an MSTS score 28/30.

Figure 1:Pre-operative radiograph of right wrist showing locally aggressive giant cell tumor (GCT) of the left distal radius.

Figure 2:Immediate postoperative radiograph

DISCUSSION

GCT is classified as an intermediate-grade bone neoplasm noted for its significant local invasiveness, representing approximately 5% of all primary bone tumors. These tumors predominantly manifest around the age of 30 and are primarily situated at the epiphyseal region. Nonetheless, they can also originate in the metaphysis before the closure of the epiphyseal line. The most common sites for GCTB include the distal femur (30%), proximal tibia (28%), distal radius (9%), and distal tibia (6%). Additionally, occurrences have been reported in the pelvis (2%), sacrum (2%), and spine (3%).[10] The first-line approach for GCTB is surgical removal, where curettage is the most common surgical treatment aimed to remove the tumor and preserve as much bone as possible in order to guarantee good functional outcomes.[11]

Few case reports state that GCT of the distal radius is unpredictable, aggressive, and often metastasizes to distant organs, most commonly to lungs. The prospect of surgical excision and post-reconstruction functional deficiency should be kept in mind while planning wide local excision to prevent the local recurrenceFollowing distal radial resection, ulnar translocation to radius and wrist arthrodesis is a shorter duration procedure that utilizes a single incision and local availability of distal ulnar vascularized graftWith the minimal dissection of the ulna soft tissue attachments and preserved muscle attachment [Flexor carpi ulnaris (FCU) was retained], the vascularity of the ulna graft is maintained, which helps in the early bone union, decreases infection rates, and maintains good finger grip strength.Even though we have created a one-bone forearm, the preservation of pronator teres attachment in the ulna helps in pronation, and the biceps along with the supinator acts as a forearm supinator. Hence, this procedure conserves rotation.Our patient did not

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notice any complications and local recurrence till the last follow-up, and the patient has a considerably good functional outcome.

Various treatment options available include En-Block resection of the lesion and reconstruction with ipsilateral proximal fibula autograft (vascularized/non-vascularized), tri-cortical iliac graft, structural allografts, distal ulnar centralization, etc. Reconstruction with non-vascularized fibular autograft has been used by various authors with successful results. In these cases, problems such as non-union (12-38%), fracture of graft (13-29%) and risk of infection are not uncommon. The increased operative time and additional comorbidity to the donor area are other limitations. The need for advanced microsurgical techniques often limits the use of vascularized grafts in such scenarios. Allografts are readily available only in advanced orthopaedic setups.[12, 13]Johan MP et al examined the outcomes of patients with Campanacci grade 3 GCTBs of the distal radius who underwent wrist arthrodesis and reconstruction with ulnar translocation.Clinical assessments regarding the functional status and complications were follow-up. The functional results were evaluated using the Musculoskeletal Tumor Society (MSTS) and Disability of Arm, Shoulder, and Hand (DASH) Score. Seven patients were included with mean follow-up period was 14.43±8.08 months. The average length of tumour resection was 9.78±2.88 cm. The average range of motion of the involved forearm was 82.66° of supination and 81.54° of pronation. The average MSTS score was 11.71±2.21 before and 25.14±2.41 after the operation ($P<0.05$). The average DASH score on admission was 40.14±14.66, which decreased to 9.02±4.23 after the operation ($P<0.05$). Of the seven cases, one case had a recurrence, and one patient had radioulnarsynostosis.Wrist arthrodesis combined with ulnar translocation can be considered a simple and effective reconstruction method with preservation of function after en-bloc resection of Campanacci grade 3 GCTB of the distal radius. It provides good functional outcomes with low complication rates.[14]

CONCLUSION

Ulnar translocation and wrist arthrodesis is a simple method of wrist reconstruction with local availability of vascularized graft and provides excellent forearm function and strength.

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