

## DISTAL RADIUS GIANT CELL TUMOR EXCISION AND RECONSTRUCTION WITH AUTOGENOUS NON VASCULARIZED FIBULA GRAFT.

Ali Tauseef<sup>1</sup>, Arslan Ahmed Abro<sup>2</sup>, Asad Khan Gillzai<sup>3</sup>, Nouman Memon<sup>4</sup>, Hamidullah Khan<sup>5</sup>, Raza Mehmood<sup>6</sup>.

### ABSTRACT

**INTRODUCTION;** Distal radius is the third most common site of GCT (representing approximately 10% of all cases) typically affecting female gender, and mostly common in third and fourth decade of life. Distal radius site is the most locally aggressive one with higher possibility of recurrence (25 to 80%) and malignant transformation. **METHODOLOGY;** This is a prospective study, 11 patients were included in study out of which 7 were females and 4 were males, with mean age of 32 years. **RESULTS;** Patients who underwent en bloc excision of distal radius GCT excision and reconstruction with non-vascularized fibula graft have better early functional outcome. **CONCLUSION;** reconstruction of distal radius with non vascularized proximal fibula graft after en bloc resection of distal radius GCT is feasible, effective and reliable.

**KEY WORDS:** Distal Radius, GCT, Excision, Reconstruction

1. Resident Ortho, LNH and Medical College Karachi.
2. Senior Resident Ortho, LNH and Medical College Karachi.
3. Senior Registrar, Ortho, Civil Hospital Quetta.
4. Senior Registrar, Ortho, LNH and Medical College Karachi.
5. Prof Ortho, Bolan Medical College Quetta.
6. Senior Resident Ortho, LNH and Medical College Karachi.

**FOR CORRESPONDENCE:** Arslan Ahmed Abro<sup>2</sup> Senior Resident Ortho, LNH and Medical College Karachi. Email: arsalanabro@yahoo.com

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### INTRODUCTION

Giant cell tumor (GCT) is a locally aggressive benign bone tumor which has a tendency of local recurrence and pulmonary metastasis<sup>1</sup>. Distal radius is the third most common site of GCT (representing approximately 10% of all cases) after distal femur and proximal tibia, typically affecting female gender, and mostly common in third and fourth decade of life<sup>2</sup>. Distal radius site is the most locally aggressive one with higher possibility of recurrence (25 to 80%) and malignant transformation<sup>3-4</sup>. Different classification systems have classified GCT of bones on basis of clinical, radiological and histological features. Enneking's surgical stages include stage 1, 2 & 3, representing clinically latent, active and aggressive forms respectively<sup>3</sup>. Campannaci et al classify GCT into radiological Grade 1, quiescent form with minimal cortical involvement; Grade 2, active form with excessive cortical thinning and bulging, most common of all; Grade 3, aggressive form which breaks through the cortical bone and have a soft tissue portion covered by a pseudocapsule and periosteum<sup>4</sup>. Management of distal radius GCT is quite challenging however the goal of treatment of distal radius GCT is complete excision, aiming at prevention of recurrence and good acceptable cosmetic appearance and to attain good wrist function<sup>3</sup>. There have been a

number of treatment options described in literature for distal radius GCT including curettage, extended curettage with bone grafting or cementing, en bloc excision and reconstruction with non vascularized or vascularized fibula autograft, allograft or mega prosthesis, ulnar translocation and amputation<sup>4-9</sup>. The recurrence rate of GCT after curettage or extended curettage is relatively on higher side as compared to en bloc excision, particularly in tumors involving distal radius site, thus making latter more reliable option for treatment of aggressive forms of GCT<sup>10</sup>. Reconstruction after en bloc excision has always been technically demanding and challenging task, as most patients are young, active, cosmetically and functionally demanding<sup>4</sup>. Vascularized fibula graft definitely helps in early healing and helpful in larger defects, but reconstruction with non vascularized fibula graft is relatively quicker, less expensive and technically easier<sup>6, 9</sup>. This is a prospective study of 11 patients who underwent en bloc excision of distal radius GCT excision and reconstruction with non-vascularized fibula graft in our institution, presenting the experience with reconstruction and early functional

outcome using revised musculoskeletal tumor society score (MSTS)<sup>11</sup>.

#### **MATERIAL AND METHODS**

This is a prospective cohort study conducted at bolan medical college, quetta after taking IRB approval (BM-IR-249), Study duration was Jan 2008 – 2018 Jan, All patients who underwent biopsy proven distal radius GCT treatment with enbloc excision and reconstruction with non-vascularized fibula graft done at our institution from 2008 to 2018 were included. A total of 25 patients met our inclusion criteria out of which 8 lost to follow up and 6 refused to participate in study, after taking informed consent remaining 11 patients were enrolled in study out of which 7 were females and 4 were males, with mean age of 32 years. Inclusion criteria consisted of only those patients with campanacci grade 2 and 3 tumors, age between 20 and 40, confirmed GCT cases on biopsy, no previous surgery of tumor site except biopsy. Those with campanacci grade 1 tumor, age less than 20 and more than 40, preexisting pulmonary metastasis and recurrent GCT were excluded. Pre operative data regarding patients characteristics was collected includes age, gender, body mass index (BMI), preoperative MSTS, grip strength and campanacci grading. Routine pre operative workup was done in all patients, blood investigations includes CBC, UCE, Serum calcium, phosphorus, Alkaline Phosphatase and Parathyroid hormone (to rule out possibility of brown's tumor), pre operative radiographs, xray of wrist (Figure 2 and clinical appearance shown in "Figure 1") and full length radius and ulna anteroposterior and lateral views, MRI wrist with IV contrast, xray chest posteroanterior view and incisional biopsy was done. Campanacci system was used to grade the tumor<sup>12</sup>.

**Procedure:** The surgeries were performed by orthopaedic surgeon specialized in tumor surgery with at least five years of experience. All patients were operated in supine position, arm rests on side arm table under general anesthesia, single stage surgery consist of three steps: enbloc complete resection of tumor, proximal fibula graft harvesting and distal radius reconstruction with fibula graft by fixing with Dynamic compression plate (DCP) with k wires<sup>4</sup>. Forearm and leg was prepared and draped simultaneously. Pneumatic Tourniquet was applied (without exsanguination at forearm) to minimize blood loss while excising tumor and harvesting fibula graft respectively, Approached to distal radius GCT via Volar Henry approach in all cases, after careful dissection, identifying and protecting underlying neurovascular structures, tumor was separated from surrounding structures followed by enbloc excision of distal radius GCT (Figure 3) with safe margins of 3-4cm. Bone defect was measured using sterile ruler. During dissection some parts of radiocarpal ligaments were preserved for latter reconstruction, Biopsy tract was excised during approach in initial incision. After tumor excision meticulous hemostasis was achieved and soft tissue bed was treated with 3% hydrogen peroxide (for any tumor spillage), Ipsilateral Proximal fibula was harvested by

standard lateral approach, using fibular head as landmark, identified and mobilized common peroneal nerve (Figure 4) to prevent it from injury. Fibula was then resected (Figure 5) 1cm more than the measured defect of the distal radius after excision, length then was adjusted as per the defect of distal radius. Some part of ligamentous attachments were kept attached to proximal fibula for later reconstruction of fibulo carpal joint. Remaining lateral collateral ligament and biceps femoris tendon were attached to proximal tibia with cannulated screw and washer (Figure 5). Hemostasis achieved, wound was closed in layers in standard manner with a suction drain in place. Harvested non vascularized fibula was then placed in defect in ipsilateral forearm, radiocarpal and lateral collateral ligament were repaired, reduces newly formed in order to form fibulo - carpal joint. Proximal end of fibula was reduced to remaining radius diaphysis and fixed with a 6 or 7 whole 3.5 mm mini dynamic compression plate (DCP) as shown in (Figure 6). One k wire was passed from fibula to ulna to secure newly formed fibula-ulnar articulation, and two k wires passed to secure fibulo-carpal articulation as shown in post operative Xray-s (Figure 7). Hemostasis was secured and wound was closed on a suction drain, and patients were kept in above elbow back slab.

#### **Post operative course and Follow up:**

Full weight bear mobilization was started on the first postoperative day. Suction drains were removed after 24 hours and stitches were removed after 15 days. Above elbow backslab was converted to below elbow backslab after 6 weeks and removed after 12 weeks, K wires were removed at 12 weeks. Started gentle active and assisted range of motion at wrist and elbow at 3 months, and gradually increased in intensity and range as per patient tolerance. No heavy weight lifting was allowed until 12 months postoperatively. Plain radiographs of wrist and full length radius and ulna anteroposterior and lateral views were repeated at 3 months to look for union, any recurrence and any complication. Patients were followed 3 monthly for one year, followed by 6 monthly until 3<sup>rd</sup> year, and annually thereafter till latest follow up.

**Complications:** Commonly occurring complications in these sort of cases are non union, delayed union, subluxation of wrist joint or newly formed fibuloulnar joint and local recurrence However two of our patients presents with non union, they were treated with bone grafting and achieved union later, the rate of non union at host graft site is decreasing probably due to increase use of primary bone grafting at radius and graft side

as reported in literature<sup>5,13</sup>. Other complications we faced were 3 cases of superficial infections

which were successfully managed with broad spectrum antibiotics.



Figure 1 : Picture Of Right wrist showing swelling at distal radius level and Extension on vollar and dorsal side

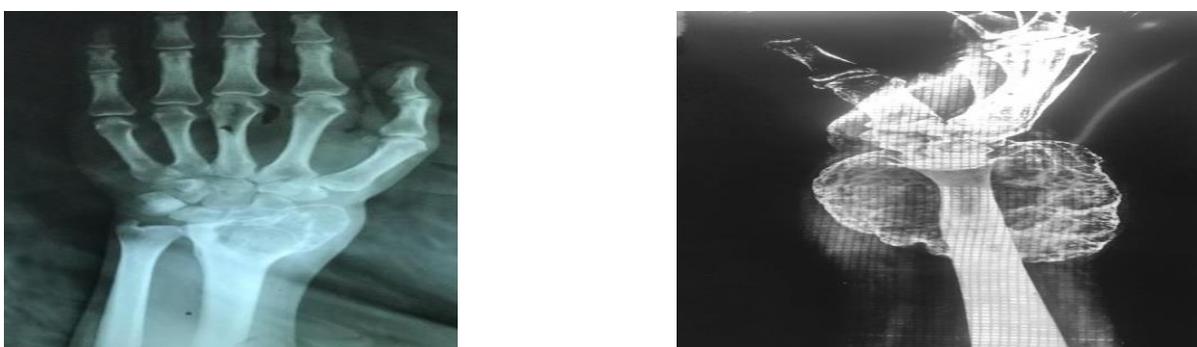


Figure 2: Xray Right Wrist Antero posterior and Lateral View: Showing Distal Radius Osteolytic Lesion with vollar and dorsal extension

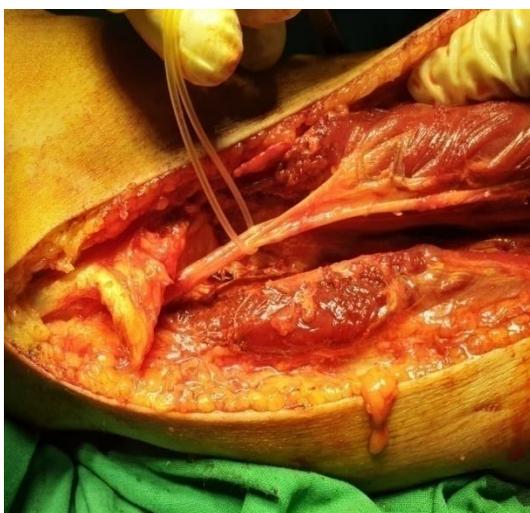


Figure 3: Intraoperative image showing Distal Radius Mass

Figure 4: Picture showing CPN was identified and secured in sling while proximal fibula resection



Figure 5 :Xray Left Knee (AP View) showing Cannulated Screw with washer used for fixation of Biceps Femoris and Lateral Collateral Ligament Figure 6 ; Reconstruction of distal Radius with proximal fibula and fixation with plate and Radio Carpal joint fixation with K wire



Figure 7 : Post Operative X-ray : Antero Posterior and Lateral View Showing Distal Radius Reconstruction with Ipsilateral Proximal Fibula and Fixation with Mini DCP and also showing restoration and fixation of Distal Radio-Ulnar joint and Radio-Carpal Joints

## DISCUSSION

The behavior of distal radius GCT is believed to be aggressive with malignant potential and management considered to be a quite challenging one due to its aggressive nature of course and extensive destruction of underlying bone<sup>1,14</sup>, Eckardt et al. recommended en-bloc wide resection of the distal radius when tumor breaks through the cortex on dorsal and volar sides, when tumor invades the wrist joint or more than 50% of the surrounding metaphysis has been destroyed.<sup>15,16</sup>

The main goal of treatment is to excise tumor completely with safe margins, reduce possibility of recurrence and increases chances of preserving joint function, Recurrence rate and loss of joint function are two main concerns after surgical treatment however Enbloc excision procedure has advantage in terms of very low recurrence rate and joint function can be preserve by newly formed fibula carpal joint with the help of ipsilateral proximal fibula graft but excision of distal radius GCT results in larger bony defect hence usually recommended for Campannaci grade 2 and 3 tumors while extended curettage is suggested as the procedure of choice in grade 1 tumors<sup>5,14,17,18</sup>

In this prospective study we managed all distal radius GCT patients by means of enbloc tumor excision and reconstruction with ipsilateral non-vascularised fibular graft. Non-vascularised proximal fibular graft is some what identical to distal radius and consolidate expeditiously, More over reconstruction of resected distal radius with ipsilateral proximal fibula has many other advantages as well such as graft site is approached conventionally, no any significant donor site morbidity, less time consuming, does not require microvascular anastomosis and incorporates more rapidly as autograft. Adequate fibula graft length must be obtained to prevent wrist joint subluxation by maintaining radial height, keeping this is mind we harvested fibula graft 1-2 mm more than the resected length, this 1-2 mm helped us in achieving compression at host-graft site while fixing with mini DCP however at this moment length of fibula graft was adjusted at the fibula carpal joint (as longer fibula is associated with wrist subluxation)<sup>19,20</sup> and

stabilized with 2 kirschner wire's to prevent wrist joint subluxation.

In this study, there was no cases of tumor recurrences or metastasis and we have achieved satisfactory results as of 20 patients 80% had excellent or good results, 90% returned to work and 80 % patient had no pain or occasional pain, the mean grip strength was around 75.6 % as compared to normal side while all patients had some sort of limitation in range of motion however mean range of motion was around 72.5 % as of normal side.

## CONCLUSION:

Although our study suggests that reconstruction of distal radius with non vascularized proximal fibula graft after enbloc resection of distal radius GCT is feasible, effective and reliable however it is hard to draw any conclusion from the study with such small sample size.

**PATIENT CONSENT:** Consent was taken from parents/every patient who participated in this study.

**ETHICS APPROVAL:** The ERC gave ethical review approval

**CONSENT TO PARTICIPATE:** written and verbal consent was taken from subjects and next of kin

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