



## Original Article



## Evaluation of Functional Results and Local Recurrence in Enbloc Resection of Campanacci Grade 3 Giant Cell Tumor of Distal Radius and Wrist Arthrodesis Using Ulnar Translocation Technique

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## ABSTRACT

Reconstruction following en-bloc resection of a distal radius GCTB of Campanacci grade 3 can be difficult. **Objective:** To examine the outcomes of patients who had ulnar translocation correction and wrist arthrodesis for Campanacci grade 3 distal radius GCTBs. **Methods:** This retrospective study was comprised of 22 patients. After obtaining informed written consent detailed demographics were recorded. A follow-up clinical evaluation was conducted to determine the functional status and any problems. The MSTs and DASH scores, which measure impairments in the musculoskeletal system, were used to assess the functional outcomes. The MSTs and DASH scores were compared before and after the operation using paired t-tests. At a significance level of P less than 0.05, statistical differences were recorded. **Results:** The included cases had mean age 30.7±6.28 years. The majority 15 (68.2%) were females and 7 (31.8%) cases were males. Mean follow up was 33.25±9.38 months. Mean length of tumor resection was 8.97±5.79 cm. Before surgery, mean MSTs was 10.84±3.35 and after surgery mean MSTs was 26.01±3.19 p value <0.05. At admission, the mean DASH score was 40.14±14.66 and after surgery decreases to 8.91±12.51 with p value <0.05. Frequency of recurrence rate was 3 (13.6%) and radioulnar synostosis was found in 2 (9.1%) cases. **Conclusion:** It was found that ulnar translocation in conjunction with wrist arthrodesis is an easy reconstructive technique that preserves function, produces outstanding results, and has few problems.

## INTRODUCTION

High rates of local recurrence have been the primary reason for unsatisfactory clinical outcomes in patients of giant cell tumour of bone (GCTB), a clinically aggressive bone tumour that is histologically benign [1]. Past research suggests that the local recurrence (LR) rate in GCTB could be anything from 3% to 64% [2]. The most recommended surgical technique for treating Campanacci I and II GCTB has been curettage in conjunction with adjuvant local therapy. However, a major therapeutic dilemma is the

substantial local recurrence rate associated with Campanacci III tumours. The recurrence rate for en bloc resection is the lowest of all surgical procedures used to treat GCTB, ranging from 3% to 25% [3]. The high success rate of this surgical procedure is a direct result of this. An irregularity in the distal femur, proximal tibia, or distal radius is a hallmark of this disorder. These are the places where problems often arise. There is a correlation between the distal radius and an increased chance of local



recurrence, particularly in cases where Campanacci III tumours are encountered [4]. One initial treatment that has been supported by a number of trials is en bloc resection, which is then followed with reconstructions [5, 6]. The restoration of the wrist after en bloc resection of the distal radius bone cancer has proven to be a considerable challenge for orthopaedic oncologists. This is mostly due to the high functional demands that the wrist places on the body. A number of different ways have been investigated in order to find reconstructive methods for long bone defects [7, 8]. However, orthopaedic oncologists are not in agreement regarding the most effective form of treatment. The procedures might be categorised as either arthroplasty or arthrodesis, depending on the individual. The following procedures are included in this category: (i) complete or partial arthrodesis of the wrist; (ii) implantation of osteoarticular allografts; (IV) implantation of fibula autografts, depending on whether or not they are vascularised; and (v) replacement of the prosthesis. To the best of the knowledge, this study is the first evaluation that has been conducted to offer a comprehensive overview of the various reconstruction methods. Additionally, the indications, functional outcomes, and issues associated with each restoration process are discussed, as well as the technical refinement choices that can be utilised to improve the stability of the wrist joint. This review covers a variety of strategies, each of which has a unique mix of advantages and disadvantages. From the perspective of grip strength and long-term consequences, it seems that wrist arthrodesis is the superior alternative. On the other hand, wrist arthroplasty seems to be the superior option when it comes to the motion of the wrist. The neighbouring soft tissues become involved in Campanacci grade 3 GCTB after a cortical layer breach. Campanacci grade 3 lesions had a high recurrence incidence after intralesional excision and bone grafting. When a cortical break is present in a GCTB instance, the intralesional excision or curettage surgery is usually not an option. The recurrence rate is five times greater than with en-bloc resection, which is the reason why this [9]. The GCTB recurrence rate can be reduced to 16% with extensive resection, but functional impairment owing to patient-specific bone defects is still a possibility after surgery [10]. Therefore, it is vital to prescribe further reconstructive techniques in order to improve the quality of life following the operation and to maximise the functional outcome obtained from the procedure. Seradge originally detailed the resection of the radius GCTB's distal end [11-13]. To do this, the distal end was replaced using the ulnar translocation and the related soft tissues. When the distal end of the radius GCTB was removed, Seradge was the first to report using an ulnar translocation and its soft tissues to replace it. When treating GCTB including a cortical break, intralesional

excision or curettage is usually not an option because to the five-fold recurrence probability compared to en-bloc resection. Even though GCTB recurrence rates can be reduced to 16% with complete resection, patients may experience functional impairment after the operation as a result of bone abnormalities. Therefore, it is important to recommend additional reconstructive procedures to improve postoperative quality of life and optimize functional outcome [14].

To evaluate the results of extensive excision, reconstruction with ulna translocation and wrist arthrodesis for Campanacci grade 3 GCTB of the distal radius.

## METHODS

This retrospective study was conducted at Sahiwal Medical College /Sahiwal Teaching Hospital during May 2024 to September 2024. The approved IRB reference number is 159/IRB/SLMC/SWL. People who had en-bloc tumor removal, gap reconstruction with translocation of the opposite ulna, or wrist arthrodesis after a diagnosis of Campanacci grade 3 GCTB (containing the distal radius) were evaluated. The procedures were carried out by a hand microsurgery specialist, two orthopaedic oncology surgeons, and an orthopaedic oncology surgeon. The data were collected using a non-probabilistic sequential sampling technique. With a margin of error of 7% and a 90% confidence interval, the Open Epi sample size calculator was used to compute the sample size. The proportion of Campanacci grade 3 GCTB patients treated with the ulna translocation procedure was estimated at 52%. Every case was verified by core needle biopsies. To be included, roentgenogram, MRI, or biopsy-confirmed histology had to show GCT characteristics. Wrist MRI were employed to determine the amount of bone to be removed, the lesion's size, extraosseous component, and neurovascular bundle connectivity. The MRI findings dictated the extent of radial bone resection, with a 2 cm margin of normal radius bone set aside as a precaution. All research participants received initial care at the clinic. Patients with metastasis, had history of treatment and those did not provide any written consent were excluded. Individuals underwent clinical evaluations every three to six months to ascertain their functional status and any possible consequences. Both hands' grip strength was measured using a dynamometer. The MSTS grading system and the DASH score (Disability of Arm, Shoulder, and Hand) were used to analyze the functional data. In 1993, the MSTS scoring system was developed to assess the quality of life and functional outcome after treatment for musculoskeletal tumors. This method focused on the function of one limb. Both general patient information and traits unique to the patient's upper limb are considered in the MSTS scoring method for the upper limb. This assessment consists of six parts: manual dexterity, lifting capability, hand positioning,

emotional tolerance, discomfort, and emotional tolerance. A point system is used to score each criterion. A self-administered questionnaire known as the DASH score contains 30 items that are associated with functional activities and symptoms in ADL. The patient is asked to rate each of the thirty items on a scale from one to five. A higher level of disability results in higher scores. Numerous studies have examined the DASH, looking at its validity, reliability, internal consistency, and level of clinical practice adoption [15-18]. It has been used to treat problems with the wrist, elbow, hand, and shoulder. When it comes to general upper limb surgery, the DASH is a well-respected tool for patient evaluations regardless of diagnosis. For the statistical analysis, the software used was SPSS Statistics 24.0, developed and maintained by IBM in the United States. Before and after the operation, the MSTs and DASH scores were compared using paired t-tests. When P was less than 0.05, statistical differences were deemed significant. Shapiro-Wilk or Kolmogorov-Smirnov was used for normality checking of statistical analysis.

## RESULTS

The included cases had mean age 30.7±6.28 years. The majority 15 (68.2%) were females and 7 (31.8%) cases were males. Left side was the most common found in 14 (63.6%) cases followed by right side in 8 (36.4%) cases. Mean follow up was 33.25±9.38 months. Mean length of tumor resection was 8.97±5.79 cm (table 1).

**Table 1:** Demographics of the Presented Cases

Variables	Mean ± SD / Frequency (%)
Mean Age (Years)	30.7 ± 6.28
<b>Gender</b>	
Male	7 (31.8%)
Female	15 (68.2%)
<b>Affected Side</b>	
Left	14 (63.6%)
Right	8 (36.4%)
Mean follow up (Months)	33.25 ± 9.38
Mean length of tumor resection (cm)	8.97 ± 5.79

Before surgery, mean MSTs was 10.84±3.35 and after surgery mean MSTs was 26.01±3.19 p value <0.05. At admission, the mean DASH score was 40.14±14.66 and after surgery decreases to 8.91±12.51 with p value <0.05. On average, the affected forearm could twist 81.9 degrees in a supination direction and 83.16 degrees in a pronation direction (table 2).

**Table 2:** Functional results after ulnar translocation with ulnocarpal fusion and patient characteristics associated with GCTB distal radius

Variables	Before Surgery (Mean ± SD)	After Surgery (Mean ± SD)	CI 95%	P-Value
Mean MSTs	10.84 ± 3.35	26.01 ± 3.19	0.57	<0.05
Mean DASH Score	40.14 ± 14.66	8.91 ± 12.51	0.37	<0.05

Supination Direction	-	81.9	-	-
Pronation Direction	-	83.16	-	-

Frequency of recurrence rate was 3 (13.6%) and radioulnar synostosis was found in 2 (9.1%) cases (table 3).

**Table 3:** Frequency of Recurrence after Surgery

Variables	Frequency (%)
<b>Recurrence</b>	
Yes	3 (13.6%)
No	19 (86.4%)
<b>Radioulnar Synostosis</b>	
Yes	2 (9.1%)
No	19 (90.9%)

## DISCUSSION

Campanacci grade 3 GCTB of the proximal radius can be successfully treated by removing the tumor while preserving hand and wrist function, according to research. Those two passages a significant recurrence rate of 6 is linked to intralesional curettage excision, though. Therefore, treatment of Campanacci grade 3 GCTB requires extensive tumor removal [16]. Optimal limb function must be preserved for those with Campanacci grade 3 GCTB distal radius after cancer excision and bone defect rectification. Many options exist for the correction of bone defects following a substantial excision of GCTB at the distal end of the radius. Physicians can apply wrist arthrodesis, prostheses, allografts, or vascularized or non-vascularized autografts to keep the wounded wrist mobile [17]. How best to reconstruct depends on a number of factors, including the surgeon's level of experience, the availability of necessary medical resources, the patient's expectations, the length of treatment anticipated, the likelihood of complications, and the anticipated time required to complete the procedure. Concerns about the treatment's efficacy and the high recurrence rate made distal radius Campanacci III GCTB a challenging case to manage [18]. Separate risk factors for local recurrence (LR) of GCTB were found by Abraham AP et al., to be curettage and the position of the distal radius [19]. Allograft repair had a significant incidence of problems, such as infection, bone nonunion, and fractures, despite satisfactory postoperative function [20]. Although ulnar transposition decreased the occurrence of infection and nonunion in allograft bone, the most prevalent consequence was still nonunion of the proximal radio-ulnar junction. Internal fixation revision and autologous cancellous bone grafting may be necessary in this case [21]. Ulnar translocation streamlines the treatment process by avoiding the microvascular approach; it also preserves the ulna's blood supply unharmed and does not impact the attached muscles, much like vascularized grafts. Keeping blood flowing helps to create an ideal biologic environment for healing, which speeds up the process of fusing the two pieces together. Cautious were not to sever too much soft

tissue during the operation to ensure a normal healing of the ulna. Nothing has come up in the most current round of patient follow-ups that is associated with the union [22]. As part of this study, the participants were measured the grip strength using a portable dynamometer. In five of the cases, the results showed that the affected side had a residual grip strength that was 34.7–75.2 percent lower than the other side. Longer follow-up intervals were associated with an increase in postoperative grip strength, according to this study. Consistent with this result is a 2018 study by Vyas *et al.* [14] that followed 20 individuals for an average of 3.9 years and discovered that grip strength was 70% lower than the normal equivalent during that time. The respondents carried on as normal with their everyday lives despite the fact that their grip strength had decreased. Five regional issues sprung up as a direct consequence of the operation, according to these findings. Three patients experienced a return of GCT 18 months after treatment. The rebuilding process is not believed to be the cause of this local tumor recurrence [23]. Five months after the first operation, another patient developed radioulnar synostosis. The patient reported no pain and mild pronosupination movements at the follow-up appointment. The patient's functional status significantly improved following the excision of the radioulnar synostosis, as confirmed at the most recent follow-up appointment. The radioulnar synostosis can be prevented and the forearm's flexion or supination movements can be maintained by delicately separating the periosteal sleeve within the ulna at the point of the proximal osteotomy [23]. According to previous studies, 13.6% of patients who had distal radius GCTB of Campanacci grade 3 had local recurrence [24].

## CONCLUSIONS

It was found that ulnar translocation in conjunction with wrist arthrodesis is an easy reconstructive technique that preserves function, produces outstanding results, and has few problems.

## Authors Contribution

Conceptualization: BH

Methodology: AMS, TR

Formal analysis: MR

Writing, review and editing: MR, AMS, ARN, BH

All authors have read and agreed to the published version of the manuscript

## Conflicts of Interest

All the authors declare no conflict of interest.

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