

Distal Ulnar Translocation with Partial Wrist Arthrodesis for Grade III Campanacci Giant Cell Tumors of the Distal Radius – A Case Series

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Abstract

Introduction: Campanacci Grade III giant cell tumor of distal radius is an uncommon condition with limited treatments options and ulnar translocation is one.

Materials and Methods: We retrospectively analyzed five cases of Campanacci Grade III tumor in which three were recurrent cases, four female and one male all operated under regional anesthesia (supraclavicular brachial plexus block) with en bloc resection and reconstruction using ulnar translocation with fusion only with proximal carpal row from 2012 to 2018 at our institute. The mean length of tumor resected was 6.74 cm and average follow-up of 60 months. Average union time at radioulnar junction was 4–5 months and ulnocarpal joint was 3–4 months.

Results: Functional outcome was assessed using musculoskeletal tumor society scoring system, 80% had excellent and good outcome, and one patient had extensive recurrence and ended up in below-elbow amputation.

Conclusion: Ulnar translocation with partial wrist arthrodesis is a simple, valid, option with acceptable appearance of forearm, useful wrist function, no donor site morbidity nor need for a microvascular procedure, and no need to achieve complete wrist arthrodesis as compared to other options for reconstruction.

Keywords: Distal radius giant cell tumor, Campanacci Grade III tumor, modified ulnar translocation, partial wrist arthrodesis.

Introduction

Giant cell tumors (GCTs) of the distal radius account for around 10–12%, most of these are locally invasive tumor with 1% incidence of distal metastasis [1]. Campanacci Grade III lesions are less frequent, characterized by fuzzy borders, loss of cortical continuity, and extension into soft tissue so wide excision and reconstruction is preferred method of treatment than intralesional curettage alone [2, 3, 4].

GCTs of the distal radius have been frequently described as difficult to treat, chiefly because of their close proximity to multiple tendons, medial nerve, radial artery, and carpus [5].

The aim of the treatment is to achieve complete removal of the tumor and preserve the movements of forearm and wrist joint [6]. Curettage and bone grafting are a well-defined procedure, but recurrence is still common [7]. Several reconstructive options such as resection arthroplasty use of osteoarticular allograft to achieve arthrodesis

or arthroplasty [8] and ulnar translocation [9, 10, 11, 12] use of non-vascularized or vascularized fibular graft [13, 14] have been used prosthetic replacement [15, 16] and centralization of carpus over the remaining ulna [17, 18, 19]. Each procedure has its pros and cons and complications [20, 21]. Our aim was to study the functional outcome following modified ulnar translocation with partial wrist arthrodesis for Grade III Campanacci GCT of distal end radius.

Methods and Materials

We retrospectively analyzed five cases of Campanacci Grade III tumors, presented at our institute from 2012 to 2018. Proper informed consent and Institutional Ethical Committee approval were obtained for publication. Four were female, one was male, all were right-handed dominant with two having lesion in the right radius and three on the left, three were recurrent, and two were primary Campanacci Grade III tumors on presentation. Curettage and bone grafting

were done in three recurrent cases; pain and lytic lesion appeared on average within 18 months post-surgery.

The previous surgery histopathology reports confirmed GCTs, whereas biopsy was done in the primary cases before definitive procedure. All patients were evaluated by radiological imaging; computed tomography and magnetic resonance imaging assessment of wrist and also screening for metastasis were done; none of our cases had metastasis. The duration of symptoms was about 3 months in primary cases.

Operative procedure

All patients were operated under regional anaesthesia (supraclavicular brachial plexus block) by volar approach which was used under tourniquet for en bloc resection of the tumor with adequate normal soft tissue (part of pronator quadratus) and bony margins, taking care of complex anatomy protecting the surrounding normal tendons and neurovascular structures. The ulnar

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Figure 1: Case example of ulnar translocation with excellent outcome.

osteotomy is done at a slightly higher level and denuding of the articular surface is done and is translocated to the radial side into the defect and centralized over the proximal carpal bones mainly over the scapholunate region, which is also, denuded and aligned with the 2nd and 3rd metacarpal bone and fixed with multiple K-wires, this is where we differed from the previous studies and tried to achieve partial wrist arthrodesis. Utmost care is taken to maintain the periosteal soft issue and vascularity of the ulna during transfer. The fixation is achieved using dynamic compression plates (DCP)/locking compression plate (LCP) at radioulnar junction and K-wires were used to stabilize ulnocarpal junction (Fig. 1). Primary bone grafting was done harvested from the ipsilateral iliac crest in two patients. We have not done any flexor or extensor carpi ulnaris tendon tenodesis.

Our post-operative protocol was that the patient was immobilized in AE slab for 6–8

weeks and K-wires were removed between 8 and 12 weeks. Range of motion exercises and mobilization of wrist and forearm were advised after 12 weeks, and were allowed to do activities of daily living (ADL) and use limb as per pain tolerance. The patient's ability to carry on with his ADL was classified into excellent, good, fair, and poor as per their ability to perform the daily household chores and handgrip strength was assessed using a handgrip strengthening spring. The functional outcome was assessed using musculoskeletal tumor society scoring system.

Results

The average age was 23.2 years, maximum age 32 years and minimum 17 years. The union at radioulnar junction was achieved at average of 18 weeks and ulnocarpal junction at 16 weeks. The average length of tumor resection was 6.74 cm. Functional outcome was assessed using musculoskeletal tumor society

scoring system, one patient had extensive recurrence and ended up in below-elbow amputation (Fig. 1), 80% had excellent and good outcome (Fig. 2). We had no infections; only one case had mild radial drift of the wrist joint (Fig. 3). Table .1 Represents demographic data, primary or recurrent lesion, resection length, method of fixation, union time, complications and outcome at final follow up.

Discussion

Wilson [22] initially suggested shifting the carpus centering over the ulna after the transaction of the tumor but this procedure resulted in the loss of forearm rotations, whereas when distal ulna was transposed into the defect by osteotomizing the ulna proximally it maintained the axis of forearm rotation (Fig. 4). Ulna translocation was performed in two patients reported on by Seradge [11], six patients reported on by Bhan and Biyani [12], one patient reported on by Lalla and Bhupathi [10], and 12 patients reported on by Puri et al. [23]. Hence, there is a paucity of cases treated with this method of treatment in the literature. The proximal stump of ulna remains stable and does not produce any cosmetic or functional disability, by preserving the soft-tissue attachment and its vascularity union is satisfactory.

The translocated ulna was hypertrophied due to its adaptation in the axial transmitted forces, but it was insufficient to withstand the stresses of strenuous activities [11, 12]. In our series, we noted similar hypertrophy of the distal end of ulna.

The most common complication described in the literature was delayed union or non-union of the proximal radio ulnar site



Figure 2: Case example of mild ulnar drift.



Figure 3: Case example of recurrence that ended in below-elbow amputation.

| Table 1: Represents demographic data, primary or recurrent lesion, resection length, method of fixation, union time, complications and outcome at final follow up. | | | | | | | | | | | | |
|--|------|--------|-------------------|---------------------|------------------|----------------------|-----------------------|------------|------------|--------------------|--------------|--|
| Age | Side | Gender | Primary recurrent | Symptoms (duration) | Resection length | Fixation | Complications | Union time | | Follow-up (months) | Outcome MTSS | Range of movement of wrist joint |
| | | | | | | | | Radioulnar | Ulnocarpal | | | |
| 25 | L | M | R | 21 | 7.2 | DCP and K-wire | None | 18 weeks | 16 weeks | 40 | 26 excellent | Supination 80° pronation 70° flexion 60° extension 50° |
| 17 | R | F | P | 2 | 6.5 | DCP and K-wire | None | 18 weeks | 16 weeks | 38 | 25 excellent | Supination 70° pronation 70° flexion 55° extension 50° |
| 32 | R | F | R | 13 | 6.8 | LCP and K-wire | Recurrence amputation | 20 weeks | 18 weeks | 30 | Poor | Not applicable |
| 25 | L | F | R | 22 | 6.5 | LCP and K-wire | Radial drift | 20 weeks | 18 weeks | 17 | 21 – Good | Supination 70° pronation 60° flexion 55° extension 45° |
| 17 | L | F | P | 4 | 6.7 | DCP and K-wire No BG | None | 16 weeks | 16 weeks | 28 | 26 excellent | Supination 80° pronation 60° flexion 60° extension 50° |



Figure 4: Clinical picture of ulnar translocation after tumor excision.

necessitating the revision fixation with autologous bone grafting. Bhan and Biyani [12] stated that despite the fact that ipsilateral translocated ulna preserves its periosteal blood supply due to the undisturbed soft-tissue attachment, its osteogenic potential is limited and primary bone grafting provided better biological and mechanical environment for bony union. In our series, early fusion was achieved and no additional procedure was needed. In our series, we had no non-union or delayed union. Most of the series have used long contoured DCP plates [17, 22] or Steinmann pins [16, 22] using dorsal approach to achieve wrist fusion. In our study, we used a very familiar and surgeon friendly volar approach, fixation was achieved with DCP plate at radioulnar junction, and K-wires at ulnocarpal region to achieve partial wrist arthrodesis helped in retaining wrist function and much better

hand grip. Study by Zou et al. has shown that there is no significant correlation between dominant and non-dominant hand affection [24]

Several reconstructive procedures such as vascularized and non-vascularized fibular graft; osteoarticular allograft and megaprosthesis [9, 13, 15] are in use for substitution of the defect in the distal radius following resection. Fibular head transfer being a long cortical bone placed in a relatively avascular bed, nearly always becomes osteoporotic is progressively absorbed and becomes incorporated slowly stress fracture, deformity, delayed, or non-union were common complications. To overcome this vascularized fibular head transplant was advised which is technically demanding procedure needs microvascular expertise and technical support, but provides no additional advantage and has similar rates of complications with donor site morbidity. The average healing between radius and non-vascularized fibula was 5.2 months and vascularized fibula between 2 ½ and 9 months [13].

Wrist subluxation and carpal subluxation with degenerative arthritis are common and occasionally producing disabling problems in cases where arthroplasty (fibular or

prosthetic) was done. However, these problems were not seen in ulnar translocation where vascularity is maintained and better fusion is achieved, we had mild radial drift in one case but the patient is comfortable. The role of radiological and histological grading of GCT is controversial. We agree with Enneking [18] that the use of either radiological or histological grading in isolation is of little help in prognosticating recurrence in GCTs. The recurrence rate after excision for distal end radius varies from 0 to 50% for Grade II and III tumors. Limitation of our study is it's a retrospective analysis of few cases a small number but still holds good because of the paucity of cases.

Conclusion

Modified ulnar translocation using familiar volar approach and achieving partial wrist arthrodesis is a very good, simple, valid, option with acceptable appearance of forearm, useful wrist function, no donor site morbidity, or need for a microvascular procedure and no need to achieve complete wrist arthrodesis is comparable to other options for reconstruction.

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