Stabilization of Ulnar Stump with Extensor Carpi Ulnaris: A Case Report

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Abstract

Giant cell tumor (GCT) involving distal ulna being rare with reported rate of 0.45-3% of all GCT cases; the literature has only sporadic cases reported. Various treatment options have been proposed, and dilemma exist whether to do resection alone or resection combined with stabilization or reconstruction. Also, there is no conclusive evidence regarding the method of stabilization or reconstruction. A case of GCT of lower end ulna treated with excision of the distal end of ulna and stabilization of stump with extensor carpi ulnaris tendon slip in a 41-year-old female. The patient had an excellent functional outcome and no evidence of recurrence at 2 years of follow-up. Resection of ulna proximal to the insertion of pronator quadratus could lead to instability in the form of radio-ulnar convergence and winging of the ulnar stump and result in limitation of forearm rotation and weakness in grasping. Stabilization of the ulnar stump after resection for a GCT gave excellent results.

Keywords: Distal ulna, Giant cell tumor, Resection, Stabilization

INTRODUCTION

Giant cell tumor (GCT) of the distal end of the ulna is rare. Various treatment protocols have been developed for this benign tumor, which may turn locally aggressive or malignant. The goal of surgery is complete tumor eradication with preservation of forearm functions and motion. In underdeveloped countries like India patients present late and by the time of presentation the tumor has already reached a fairly large size rendering en-bloc resection as the only option left.1,2 Doing an en-bloc resection renders the risk of instability and reduction in functional usage of the limb. There is no consensus on the stabilization or reconstruction of the ulnar stump due to rarity of the condition.3-5 Case reports exist with proponents of excision alone6 soft tissue stabilization7,8 and excision with bone graft.9 We evaluated our case and presented our experience with stabilization of ulnar stump with extensor carpi ulnaris (ECU).10

CASE REPORT

A 41-year-old Muslim healthy appearing female, right-handed, working as house-wife presented with a 6-month history of increasing swelling along the ulnar aspect of his right distal forearm associated with dull aching pain. On examination, the swelling was diffusely tender, firm in consistency with no scar, sinus, fistula, or dilated veins over the swelling. Grasping power was reduced due to pain in right hand. There was no evidence of any lymphadenopathy and no known systemic disease. Hematological and biochemical investigations were normal.

On radiographic examination, an expanded multilocular and lytic lesion was detected at the lower end of the ulna with no periosteal reaction and partly destroying the thin cortex (Figure 1). On T1 magnetic resonance imaging (MRI) images lesion showed a high-intensity signal and T2 MRI showed low-intensity signal and a heterogeneous high-intensity signal on T2 MRI represents edema in surrounding soft tissue. A plain chest radiograph was normal. Fine-needle aspiration cytology confirmed a primary GCT (Figures 2 and 3).
Our patient was a housewife and considering functional demands of the patient, the technique first described by Goldner and Hayes in 1979 using ½ of ECU tendon for stabilization of ulnar stump was selected as flexor compartment muscles might have been involved by the tumour.

The extra-periosteal resection of around 9 cm of the ulna with triangular fibrocartilage complex (TFCC), the ulnar border of the pronator quadratus and distal radio-ulnar joint (DRUJ) capsule, in part. The sheath of the ECU was separated easily from the tumor by simple, blunt dissection. The sheath opened carefully and then resected with the rest of the specimen, salvaging the ECU tendon. The remaining capsule was reinforced with the radial half of the ECU tendon, longitudinally split to a point 1 cm proximal of the new distal end of the ulna. The dorsal branch of the ulnar nerve was preserved. The level of resection was determined by the extent of involvement on radiographs and computed tomography-scan and functional outcome (Figures 1-5). An additional 3.5 cm of radiographically normal-appearing bone was resected in order to achieve a wide safety margin. 9.0 cm long bone removed from the distal end of the ulna, with the forearm held in supination, 3 mm drill hole was made in ulnar stump 5 mm above the end of the ulnar stump in a dorsal to volar direction. The tendon was then directed to the ulnar side and sutured back off. This cuff of ECU tendon stabilized the remaining ECU and tethered it toward the radial side of the ulna. Wound closed in layers under the negative suction drain.

Histologically the lesion was a typical GCT composed of osteoclast-like giant cells, with intervening spindle-shaped stromal cells arranged in a storiform pattern. No mitotic figures present and surgical margins are free of tumor.

Post-operatively patient was immobilized in forearm splint for 45 days and later on daytime physiotherapy with night time removable splint was added. The follow-up was assigned every 6 months and 2 years, no evidence of recurrence or lung metastasis was found. The functional result was evaluated by Ferracini et al. scoring system based on a range of motion, pain level, muscle strength, and the presence or absence of ulnar impingement and ulnar or carpal instability. The patient achieved 18/18 score with a full range of motion compared to the normal side and no impingement, and ulnar or carpal instability grip strength was comparable to unaffected side as measured by a dynamometer. Radio-carpal stability assessed by determining radio-ulnar and volar-dorsal translation of hand and carpus relative to the stabilized distal end of radius.

**DISCUSSION**

Enneking Stage 1 and Stage 2 distal Ulna GCTs can be managed by intra-lesional resection with or without adjuvants, but recurrence rates of 17% have been reported. En-bloc that is wide-intra-compartmental, resection with removal of entire tumor with its surrounding bone shell, periosteum, and reactive zone with a cuff of normal tissue is reserved for Enneking Stage 3 GCTs; this may damage the adjacent joint function due to proximity to carpal bones.
The distal end of the ulna contributes to the stability of the wrist and grip strength because of its relationship with the distal radius, carpus and TFCC. Ulnar collateral ligament plays an important role in the maintenance of this anatomical relationship. The level of resection in relation to the insertion of pronator quadratus is important. Problems arising due to prominence of ulnar stump are rupture of the digital extensor tendons, pain and limitation of activity due to a decreased dynamic interosseous space with ulnar stump impingement on the radius metaphysis and instability of the radio-carpal joint with ulnar translation of the carpus. Resection at a lower level could cause impingement symptoms due to a muscle pull while resection at a higher level causes prominence of the ulnar stump with instability. Even the Darrach procedure had excellent functional results by achieving painless supination and pronation in patients with DRUJ dysfunction, however it caused ulnar stump instability and radio-ulnar convergence leading to pain and clicking during rotatory movements of the wrist. Many stabilizing procedures such as tenodesis, pronator quadratus muscle transfer, combinations of the two, ulnar lengthening osteotomy and ulnar head prosthesis were recommended to avoid these complications. Cooney et al. performed simple en bloc excision without reconstruction in 9 cases of tumors of the distal ulna. They concluded that the reconstruction of the osseous defect added unnecessary risk and morbidity with no demonstrable functional gain. Wolfe et al. in his study of 12 patients underwent wide excision of the distal ulna without reconstruction for various conditions, including primary osseous neoplasms. They concluded wide excision of the distal ulna without reconstruction or stabilization is the procedure of choice for distal ulnar neoplasms. Harness and Mankin treated 3 patients with GCT of the distal ulna treated with primary resection. All patients had a few complaints except minor instability. Many authors believed that wide excision of the distal ulna could be predicted to fail due to dorsal translation and ulnar stump prominence during pronation.

Factors contributing to failure are (a) the length of resection of the distal ulna; complications increases with longer resections, (b) extra-periosteal resection prevents the role of periosteal sleeve (c) soft tissues around distal ulna play an important role, and their removal increases instability. They are wrist capsule, the TFCC, flexor carpi ulnaris (FCU), the ECU tendons, the pronator quadratus and the interosseous membrane, and (d) functional demands of the patients is more especially in young and active individuals. For reconstruction or stabilization tendons, allograft, autografts, plates and external fixator have been tried. Ferracini et al. used FCU, fascia lata, with an autograft, or with plate arthrodesis for stabilization of ulnar stump. Gainor recommends a lasso tenodesis of the ulnar stump where palmaris longus tendon is used to approximate FCU and ECU tendon. Harness and Mankin recommended an ulnar buttress. The authors reported resection of the distal ulna en bloc and grafted iliac bone to the ulnar side of the radius as a buttress using a screw and a K-wire. Excellent results were reported at 6 months follow-up. Wurapa and Whipple performed a 2-stage allograft reconstruction of the DRUJ with good results. Stoffelen et al. in a patient with parosteal osteosarcoma of the distal ulna performed wide resection and ulna was reconstructed by segmental transport of the remaining bone using an Ilizarov fixator. Patient had excellent results, but with the asymptomatic fibrous union of the distal ulna. Goldner and Hayes used the ECU tenoden for stabilizing the ulnar stump with excellent result. Additional procedures add to the morbidity and complications and require the skill of varying level and instrumentation.

We felt that a simple and technically easy procedure would have widespread acceptance. Moreover, our patient had Enneking Stage 3 at presentation hence oncological aspects like adequate margins take precedence over anatomical
and functional aspects to prevent the recurrences. At the end of 2 years, our patient had an excellent functional outcome with no limitation of functional movements and no complaint of ulnar snapping, radio-ulnar convergence or prominence of the ulnar stump. Grip strength of 5/5 power and no carpal translocation was present on radiographs on subsequent follow-up.

**CONCLUSION**

From the review of literature, it is evident that for a case of primary bone tumor of distal ulna it is inconclusive as to (a) resection should be supplemented with stabilization/reconstruction or not (b) and the preferred method of stabilization/reconstruction. We believe that the optimal method selected for stabilization or reconstruction after en bloc excision should be chosen taking into consideration the age, activity, functional demand, the level of resection and spread of the tumor. Although large multicentric or randomized control trials including various primary neoplasm of the distal ulna are necessary for reaching a conclusion. However in the meanwhile, the stabilization of the ulnar stump with half of ECU tendon without incurring additional morbidity and risk.

**REFERENCES**


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