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Original Research Article

Functional Outcome of Corrective Osteotomy with Volar Locked Plating without Bone Graft for Malunited Extra-Articular Distal Radius Fracture in Adults

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Abstract:
Background and aim: Distal Radius fracture is a very commonly encountered fracture in adults. Malunion is very common in such fractures in either neglected, poorly treated by conservative method or even in some surgically managed patients; with restricted functional ability and pain. Corrective osteotomy with fixation is a surgical treatment option in such cases. In our study we evaluated the functional outcome of corrective osteotomy and fixation with volar locked plate without application of bone graft.
Methods: An observational study was conducted at Agartala Govt. Medical College during February 2022 to July 2024 including 19 adult patients with malunited extraarticular distal radius fracture with restricted functional ability. All patients were managed surgically by corrective osteotomy and volar locked plating without application of bone graft via Modified Henry Approach. Functional outcome assessment was done using Patient-Rated Wrist Evaluation (PRWE) score and radiological assessment done on Xray of the effected wrist Antero-posterior and Lateral View.
Results: Among 19 patients who were included 7 were male & 12 female; mean age 51.8 years. Complete fracture union was seen in 18 patients without any further intervention, only one patient showing nonunion was reoperated and achieved union subsequently. Mean postoperative improvement in flexion was 24.9 degree, extension 22.2 degree, pronation 23.3 degree and supination 23.2 degree, ensuring functional range of motion. Only two patients showed early osteoarthritis. All patients achieved excellent functional outcome by the end of the study; the mean Pre-Operative PRWE score was 55.4 and the Mean Post-Operative PRWE score was 10.7 which is found to be statistically significant.
Conclusion: Corrective osteotomy and fixation by distal radius volar locked plate without application of bone graft is an effective, reliable and easily reproducible treatment option for malunited extraarticular distal radius fracture in adults which provides an excellent clinical, radiological and patient related functional outcome with improved grip strength and with minimal complications. This outcome reinforces the utility of this approach in its treatment.
Keywords: Distal radius fractures, distal radius malunion, corrective osteotomy, fixed angle volar locked plate.

Introduction

Distal Radius fracture is a very commonly occurring fracture in human adults with the incidence of around 8-17% of all fractures of the extremities [1]. Malunion is a very frequent complication of distal radius fracture in neglected, in conservative management if poorly treated (in 23% cases) & even in surgically treated patients (in 11% cases). They can be classified into intraarticular, extraarticular and combined patterns [2,3].

Majority of the patients regain satisfactory wrist function, but around 23-31% patients present with persisting pain, loss of range of motion and decreased grip strength leading to decreased functional ability of the effected wrist [4,5,6]. For these patients, surgical management by corrective osteotomy is the treatment of choice.

Regarding surgical management of malunited extraarticular distal radius fracture, previously dorsal corrective osteotomy with dorsal plating was preferred [7,8,9]. But later on the preference moved towards corrective osteotomy and volar plating [10,11]. About the bone graft, the advantage of applying bone graft was not established [12,13]. The aim of the study was to evaluate the functional and radiological outcome of corrective osteotomy and volar plating without bone graft for malunited extraarticular distal radial fractures in adults, to estimate the time of union and to estimate the proportion of complications in those patients.

Materials and Method

It was an Observational Study conducted at the Department of Orthopaedics, Agartala Government Medical College, Agartala, and West Tripura during the period between February 2022 to July 2024. All adult patients with malunited extraarticular distal radius fracture with decreased functional ability attending the Department of Orthopaedics, Agartala Government Medical college and G.B Pant Hospital, Agartala, West Tripura during the study period who met the inclusion and exclusion criteria were included in this study. In total 19(nineteen) patients were included in the study who met the inclusion and exclusion criteria.

Patients who met the following criteria were included in the study (i) All skeletally mature patients presenting with malunited extraarticular distal radius fracture with functional impairment, (ii) Patients presenting with Radiographic parameters of malunion: shortening of distal radius >5 mm, volar tilt >15degree or < 10degree; shift of distal fragment, (iii) Failure of conservative management, (iv) Patients having mechanical symptoms (v) Distal radioulnar joint disruption.

The patients with the following criteria were excluded from the study (i) Patients with partial intraarticular and complete intraarticular fractures, (ii) Pathologic fractures from primary or metastatic tumours, (iii) Advanced radiocarpal and intercarpal degeneration, (iv) Fixed carpal malalignment, (v) Patients age less than 18 years, (vi) Patients with median and ulnar nerve injury, (vii) Patients with associated fractures in the same limb, (viii) Previous surgery of the same wrist, (ix) Patients with open fracture of distal radius, (x) Patients not fit for surgery, (xi) Patients not willing to participate in the study.

All surgeries were performed using the “Modified Henry approach” [14,15]. The patient was placed in the supine position with the upper limb keeping on arm board and general anaesthesia or regional blockade was administered, along with standard preoperative antibiotics. A pneumatic tourniquet was used. An 8-cm incision was made over the flexor carpi radialis tendon beginning at the wrist crease and carried proximally. The interval between the flexor carpi radialis and the radial artery was identified. The pronator quadratus was released along its distal and radial borders for later repair, followed by release of the brachioradialis from the radial styloid. Extraarticular malunion site is then explored and osteotomy done parallel to the joint line at the previous fracture site. Both fragments are aligned properly and provisionally fixed with K-wires and confirmed under IITV. Then final fixation done with distal radius volar plate and screws and K-wires removes. After thorough washing wound closed in layers & dressing done. After that a below elbow POP dorsal slab applies.

Postoperatively all patients were given antibiotic prophylaxis along with analgesics & anti-inflammatory medicines and immobilization in POP below elbow slabs applied for 2weeks. Wound check & dressing done on 5th day and stitch removal done after 2 weeks. Rehabilitation protocol included training for increasing grip strength starting in initial 2 weeks follower by wrist flexion and extension exercises 2 weeks after removal of the slab, forearm rotation exercises started after 3 weeks. 6 weeks postoperatively strength training exercises began and training for activities of daily living started gradually.

Clinical and radiological assessment was done using Patient-Rated Wrist Evaluation (PRWE) score and Xray of the effected wrist Antero-posterior and Lateral View. Data entry and analysis was performed in computer using SPSS-21 (Statistical package for the social sciences software version 25) for windows.

Results

In total 19 patients were included in the study. Among them 7 (36.8%) were male & 12 (63.2%) were female. The mean age was 51.8 years with a range of 27 years to 75 years. All patients were treated by corrective osteotomy and fixation by distal radius volar plate without bone grafts by Modified Henry Approach. No intraoperative complications were found.

Radiographic evaluation showed complete fracture union in 18 patients by 6 months. In 15 patients fracture united by 3 months and 3 patients union completed during the period between 3 months to 6 months.

Functional assessment revealed mean improvement in flexion ROM (Range of Motion) of 24.9 degree with the range from 22 degree to 28 degree and SD (Standard Deviation) of 2.04. Mean improvement in extension ROM is 22.2 degree with the range from 20 degree to 25 degree and SD of 1.5. Mean improvement in pronation is 23.3 degree with the range from 21 degree to 26 degree and SD of 1.7. Mean improvement in supination is 23.2 degree with the range from 20 degree to 26 degree and SD of 2.0. All patients achieved functional range of motion to perform regular activities without significant limitation.

Complications were very less. Only one patient showed non-union who was subsequently treated with revision surgery and achieved a good functional outcome at the end of the study. Two patients showed early osteoarthritis of radiocarpal joint at the end of the study.

The mean Pre-Operative PRWE score was 55.4 with the range from 32 to 80 and SD of 14.9 and the Mean Post-Operative PRWE score was 10.7 with the range from 2 to 20 and SD of 6.4. The improvement in functional outcome is found to be statistically significant ($p<0.05$).

All the patients also had a good grip strength at the end of the study.

Figure 1: Pre-operative Xray

Figure 2: Pre-operative Xray

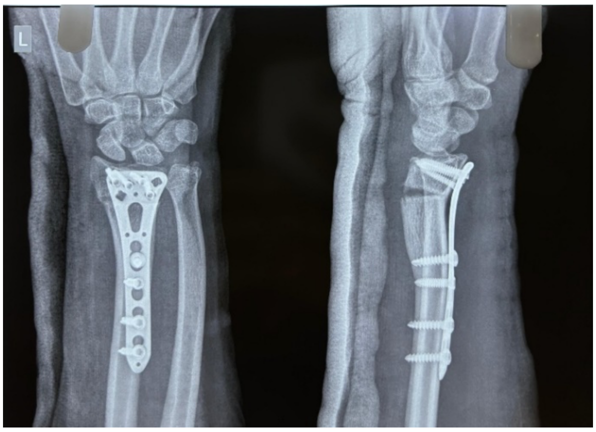

Figure 3: Immediate Post-operative Xray

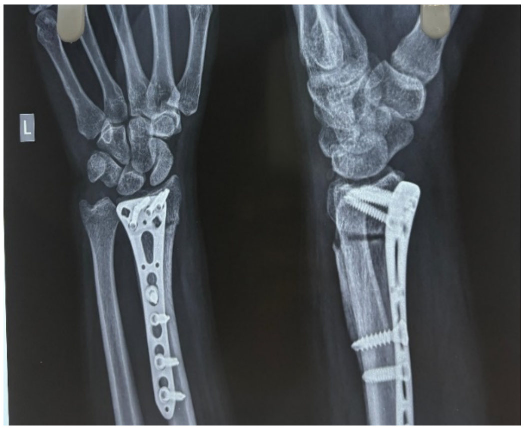

Figure 4: One Month Post-operative Xray

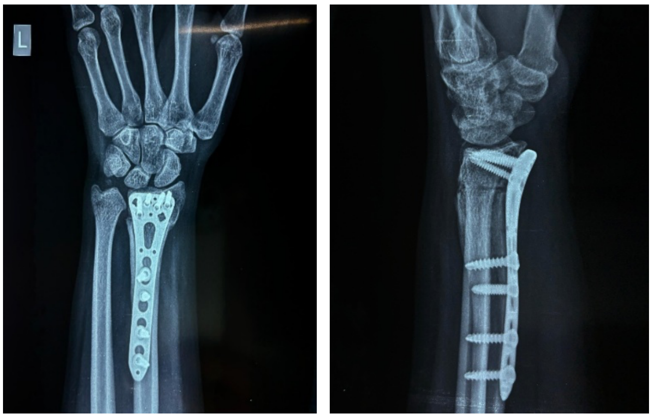

Figure 5: Three months Post-operative Xray

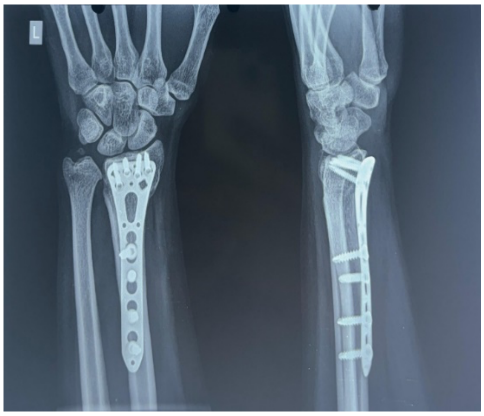

Figure 6: Six months Post-operative Xray

Discussion

Distal Radius fracture is a very commonly encountered fracture in human which is more common in elderly females. Malunion is a very common complication in distal radius fracture which were improperly treated or were managed conservatively. Unfortunately, some of the patients who were treated by surgical intervention also had malunion. Many of such patients have decreased functional ability of the effected wrist and becoming a relevant economic burden.

The treatment option in such cases is corrective osteotomy with fixation with plating; Corrective osteotomy by volar approach and fixation by volar locked plate being the most recent one. The aim of the operative intervention is the correction of angulation, displacement, and other functional and biomechanical alterations which might lead to chronic pain and degenerative changes in wrist joint. In our study we did corrective osteotomy by volar approach and fixed with distal radial volar plate without applying bone grafts.

In our study all patients achieved statistically significant improvement in functional outcome and good grip strength by the end of the study. Except one patient all patients achieved union by six months postoperatively. The only patient with non-union was reoperated and that patient also achieved union and a good functional outcome by the end of the study. The operated patients also achieved much improved range of motion of the wrist. Two patients had early osteoarthritis of wrist for which conservative management was started and are doing well functionally. The results of our study are comparable to other related studies being mentioned in other literatures.

The Limitations of our study includes limited number of samples, limited period of follow ups, operative interventions being conducted by different surgeons and the use of implants from different companies in different cases.

Conclusion

Corrective osteotomy and fixation by distal radius volar locked plate without application of bone graft is an effective, reliable and easily reproducible treatment option for malunited extraarticular distal radius fracture with decreased functional ability in adults which provides an excellent clinical, radiological and functional outcome with improved grip strength and with minimal complications. This outcome reinforces the utility of this approach in its treatment.

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