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Surgical outcomeof Distal radius fractures with volar locking compression plates.

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ABSTRACT: Background: Management of distal radius fractures has remained a controversial issue. They are treated by various methods, but the best treatment has not been defined yet.
Objectives: This study aimed to evaluate the surgical outcome of distal radius fractures with volar locking compression plates.
Patients and Methods: We reviewed 30 distal end radius fractures treated at our institution with volar locking compression plates. The patients' mean age was 41.93 ± 14.09 years (range 19 to 67), and the duration of follow-up was 6 months. The method used for fixation was open reduction and internal fixation with a volar locking plate. The functional evaluation was conducted by measuring the wrist joint range of motion and the grip strength. Gartland and Werley's demerit point system was used to assess the final outcome. Radiological parameters such as radial inclination, volar tilt, and ulnar variance were measured at the final follow-up.
Results: There was a case of superficial infection that responded to oral antibiotics. Two patients had developed a hypertrophic scar. Radiologically all patients had union within 2-3 months (8.6 weeks). According to Gartland and Werley, excellent results were reported in 66.6% of cases, while good results were present in 23.33% cases and fair in 10.06% cases.
Conclusion: Volar Locking compression Plates provides stable fixation for the patient's early mobilization, leading to early resumption to an individual's pre-trauma functional level while maintaining the radiological parameters with minimal complications.
Keywords: open reduction internal fixation, volar locking plate, Gartland and Werley's demerit point system

I. INTRODUCTION

Fractures of the distal radius are the most common fractures of the upper extremity encountered in practice and constitute 17% of all fractures and 75% of forearm fractures[1.]

The fracture occurs most frequently due to a fall on the hyperextended wrist with a combination of bending forces and axial load that produce the distal metaphyseal part of the radius fracture.

Lower end radius fractures have a bimodal age distribution, consisting of a younger age group due to high energy trauma and an elderly group due to low energy trauma[2].

A prospective multicentric, epidemiological study estimated these fractures' incidence to be 37 per 10,000 among women and 9 per 10,0000 among men aged 35 years and above[3]. There is an overall rise in the incidence of distal radius fractures in the last few decades.

To categorize distal radius fractures, AO (Arbeitsgemeinschaft fur Osteosynthesefragen) classification is simple, reproducible, and has value in research and documentation[4].

Restoration of volar angulation, radial length, and radial inclination is essential for good functional outcomes at the wrist. Maintainance of articular congruity and stable fixation reduce the incidence of osteoarthritis and also help with early rehabilitation.

Distal radius fractures are treated by a wide array of techniques such as closed reduction and casting, Kirschner wire fixation, pin and plaster, ligamentotaxis, external fixation, and internal fixation. Closed reduction and casting are optimal for undisplaced fractures and in the elderly. Complications of conservative treatment include residual pain, impaired joint mobility, malunion, and reflex sympathetic dystrophy[5,6]. Percutaneous Kirschner wire fixation and pins in plaster

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technique for both intraarticular and extra-articular fractures had minimal manipulation and negligible devascularisation of the bone as potential advantages. However, nerve injury and pin tract infections were associated with complications with this mode of treatment. Similar complications were also reported using a non-bridging external fixator for comminuted distal radius fractures[7,8].

The unstable distal radius fractures and those fractures with articular incongruity can not be anatomically reduced and maintained through closed manipulation, ligamentotaxis, and percutaneous pinning requiring open reduction and internal fixation.

Dynamic compression plates with rigid fixation disturb the vascular supply of the bone fragments leading to the nonunion. These insights lead to the development of biological osteosynthesis. Volar locking plates mechanically bridge the bone and bear the load through the locking construct resulting in a lower failure incidence. The subchondral placement of distal screws is essential to prevent loss of correction and achieve good functional results[9].

Variable screw angles provide a fixation option for a variety of fracture patterns. By directly restoring the anatomy, a variable angle locking plate allows secure internal fixation with resultant early return of wrist function. Furthermore, the increase in complex regional pain syndrome incidence with immobilization over long durations is circumvented by this fixation method.

This new fixation technique using a volar locking plate for distal end radius fracture shows promise in terms of stable intraoperative fixation, restoring acceptable anatomy, preservation of blood supply due to the limited plate to bone contact, and limiting vascular trauma, early mobilization, and good recovery of function. This holds good for osteopenic bones and unstable distal radius fractures.

The present study is aimed to analyse the surgical outcome of intraarticular distal radius fracture with a variable angle locking plate.

II. MATERIAL AND METHODS

This prospective study was undertaken between December 2018 and June 2020 in Narayana Medical College and Hospital, chinthareddypalem, Nellore district, Andhra Pradesh,with over 30 patients.An informed and written consent of the patient was obtained before inclusion in the study.The ethical clearance was obtained from the ethics committee before the start of the study.Patients aged between 18 to 70 years of either sex with distal radius fracture were included in the present study.Patients with compound distal radius fractures,pathological fractures,bilateral wrist fractures,and pregnant females were excluded from the study. AO/OTA classification was used to classify the fractures. The patients were given regional anesthesia, and all the operative procedures were performed under tourniquet control. Antibiotics were administered 30 minutes before the operation.

The patient was placed in a supine position on the orthopedic table with a radiolucent operating side table. Dissection was done using the standard FCR approach. Open reduction and fixation were made using appropriate sized plate depending on the fracture pattern. The reduction, plate, and screws position and length were confirmed per operatively under image intensifier. After confirmation of the position of the plate, fracture fragments were fixed using appropriately sized screws. Below the elbow, the pop slab was given for five days for pain relief.

FOLLOWUP AND EVALUATION

Immediate postoperative check x-ray of the forearm with wrist (AP and Lateral view) was done. Postoperatively all patients received broad-spectrum intravenous antibiotics for a minimum of 2 days, were discharged on the 3rd post-op day, and then shifted to oral antibiotics till suture removal. Fingers, elbow, and shoulder physiotherapy were started on the first post-operative day. The first post-operative day dressing was done on the second day of surgery, and the drain was removed. The second dressing was done on day five, and the patient was advised to do active wrist physiotherapy exercises, active finger movements, and handgrip exercises. Suture removal was done on a postoperative day 10. Regular follow-ups were done at 3 weeks, 8weeks,12 weeks, and 24 weeks for a clinical and radiological assessment, and the progress of the patient's recovery was documented. The outcome was evaluated clinically in terms of pain, range of motion, grip strength compared to the opposite hand, and complications. The value and practice of active physiotherapy were reinforced at each follow-up. After clinical and radiological union outcome was evaluated as per Gartland and Werley's Demerit point system at 6 months.Radiological assessment was also done at final follow-up (palmar tilt,radial inclination,ulnar variance).

The baseline parameters were assessed using descriptive statistics such as mean and standard deviation. SPSS (statistical package for social sciences) V26.0 software was used to perform these tests.

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III. OBSERVATION AND RESULTS

Most of the patients in the present study belonged to the younger age group with age ranging from 19 to 67 years. The mean age of patients in the study was 41.93±14.09 years. There were 16 male patients (53.33%) and 14 female patients (46.66%). Road traffic accidents (i.e., high-velocity trauma) were observed to be the most common mode of injury, accounting for 60% of the cases, whereas fall on outstretched hand accounting for 40% of the cases. Out of 30 patients,22 patients had involvement of the right side while 8 patients had involvement of the left side. All patients had right-handed dominance. Most common type of fracture was observed in the present study was AO type A3, B2 and B3, accounting for 60% of the cases. Associated fractures were observed in 2(6.6%) patients.In the present study, the average time to surgery after an episode of trauma was 3.8 days ranging from 1 to 7 days. Depending upon fracture pattern, fractures were fixed through a volar approach. Stainless steel variable angle locking compression plate (2.4 mm) was used to fix fractures in 20 patients, while ten patients were managed by using 3.5 mm stainless steel T-Plates. The average duration of the union in the present study was 8.6 weeks ranging from 2 to 3 months. There was no case of malunion or non-union requiring revision surgery.

In the present study,the final evaluation was done at 6 months follow-up based on Gartland and Werley's Demerit point system; 20 patients had excellent results accounting for 66.66%, 7 patients had good results accounting for 23.33%,3 patients had fair results accounting for 10%, and there were no patients with poor results.The mean radiological parameters attained in the present study at the final follow up were palmar Tilt of 8.3±1.350 degrees, radial inclination of 20.71± 1.121 degrees, and ulnar variance of -0.225±0.612 mm.

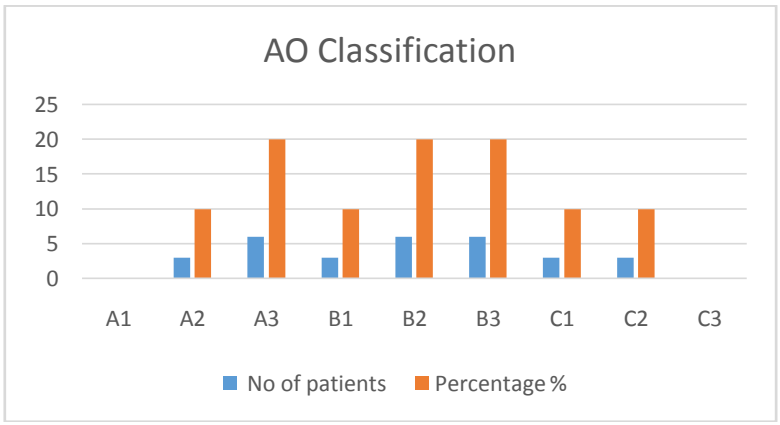

Figure 1 Graph showing fracture classification

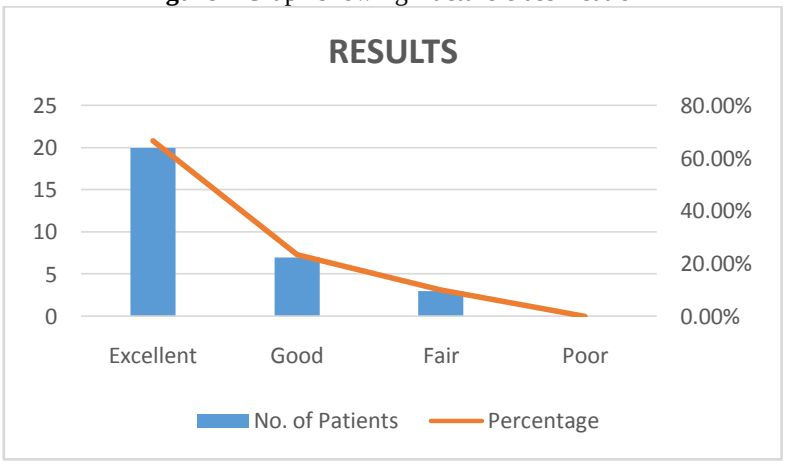

Figure 2 Graph showing results according to Gartland and Werley demerit point system.

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Preoperative x ray intra operative image

Immediate post-operative x ray six months follow up x ray

Figure 3 shows preoperative radiographs,intraoperativeimage,immediate postoperative radiographs and final follow up radiographs.

Palmar flexion

Dorsi flexion

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Figure 4 clinical images showing functional range of motion attained at wrist at final follow up

IV. DISCUSSION

The management of fractures of the distal radius has always been a debatable and challenging issue for orthopaedic surgeons. The goal is to achieve the proper reconstruction of disrupted anatomy and allow a quick return of function without complications. The results of conservative management of these fractures have historically been unsatisfactory, and many studies have reported better results with operative management. As a result, conservative treatment is generally reserved for patients with minimally displaced fractures or for those who could not bear the stress of surgery. Also, the conventional fixation techniques like K-wires and external fixators have their own share of problems. Locking plates offer a more effective and suitable alternative for the management of these fractures due to a more angular stable construct, choice of fragment fixation on a column basis, and better fixation for metaphyseal bone. Additional possible advantages of these plates include decreased soft tissue complications and the absence of secondary displacement of fracture fragments even in the absence of adequate contouring of plates. The present study was, therefore, conducted in a prospective manner to evaluate the role of Volar locking compression plates in distal end radius fractures. All patients had an average duration of union radiologically at 8.6 weeks ranging from 2 to 3 months, which is less compared to the study conducted by Kwan et al. all fractures united at the three months follow up and in the study conducted by Wong KK et al. the time to the union could not be determined because radiographs could not be taken frequently enough; some fractures healed long before the final radiographic assessment [10,11]. There were minor variations in the anatomical

parameters volar tilt, radial inclination, and ulnar variance in our study, which was comparable with the other studies [11, 12, 13, 14,15,16], has not affected functional results significantly. However, significant variation in anatomy (post-reduction) may result in cosmetic deformity, poor functional results, and early symptomatic osteoarthritis. Minor complications were reported in 3 of the patients (10%) enumerated and were resolved as detailed earlier. No major complications like deep infection, finger stiffness, tendon ruptures, nerve injury, vessel injury, non-union, malunion, or implant failure were observed in the present study. In the present study, excellent results obtained in 66.66% of patients,good results were obtained in 23.33%of patients, whereas 10% of patients had a fair outcome. Our study is comparable to that of Khavin Khatri et al[16]., who had 65%excellent, 35%good results, and A Manikandarajan et al[17]. (2018) 95% excellent and good results and 5% fair results in terms of union, anatomical parameters, and functions with a special feature of minimal complications.

Results obtained in the present study are similar & comparable to the results reported in the literature in terms of union, anatomical parameters, and functions with a special feature of minimal complications.

V. CONCLUSION

Locking compression plates in the management of distal end radius fractures provides stable fixation for the early mobilization of the patient, leading to early resumption to pre-trauma functional level of a young individual. Present study has shown excellent results with minor complications in various fractures of boththe younger and elder group of patients. However, longer follow-up is required to see the long term effects of these plates. Despite this, our results are encouraging and add to the growing body of evidence in favor of open reduction and internal fixation of distal radius fractures using a volar locking plate construct in younger patients.

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Declaration Of Conflicting Interests

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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