

SURGICAL MANAGEMENT OF FRACTURES OF DISTAL END RADIUS WITH LOCKING COMPRESSION PLATEChinta Shyam Kumar¹, D. Venkateswara Rao², Anvesh Sangepu³**HOW TO CITE THIS ARTICLE:**

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ABSTRACT: Fractures of distal end of radius continue to pose a therapeutic challenge. Intra articular and extra articular malalignment can lead to various complications like post-traumatic osteoarthritis, decreased grip strength and endurance, as well as limited motion and carpal instability. Open reduction and internal fixation is indicated to address the unstable distal radius fractures and those with articular incongruity that cannot be anatomically reduced and maintained through external manipulation and ligamentotaxis, provided sufficient bone stock is present to permit early range of motion. **METHODS:** Sixty adult patients with distal radial fractures treated at Dept. of Orthopaedics, Government General Hospital and Royal Hospital, Vijayawada between May 2010 and April 2015 were included in this study. **RESULTS:** In this series 9(15%) patients were between 21-30 years, 15(25%) between 31-40 years, 24(40%) between 41-50 years, 9(15%) between 51-60 years and 3(5%) patients between 61-70 years. The age of the patients ranged from 26-62 years with an average of 43.3 years. Out of 60 patients, 48(80%) were males and 12(20%) were females, showing a male preponderance with the ratio being M: F 4: 1. Right side (Dominant wrist) was involved in 42(70%) patients and the left side was involved in 18(30%) patients. In our study there were 36 (60%) patients with road traffic accidents and 24(40%) patients fell on their outstretched hand. Of the 60 cases, 12(20%) of the fractures were of Type I Frykman's classification, 6(10%) of Type II, 21(35%) of Type III, 9(15%) of Type IV, 3(5%) of Type V and 9(15%) of Type VIII. There were no cases of Type VI and VII fractures. **SUMMARY:** Males were predominant with right wrist affection more than left. All fractures were either due to road traffic accidents or fall on the outstretched hand, with road traffic accidents being more common of the two. Most of the fractures were of Frykman Type I, III and IV. All (100%) the patients had their range of motion within the normal functional range. None of the patients had wrist stiffness. Complications were minimal. There was 3(5%) case of extensor pollicis longus tendon irritation which was because of long volar to dorsal screw and the pain subsided once the screw was removed. There was 3(5%) case with an intra-articular fracture developed grade I radiocarpal arthritis doing well with physiotherapy.

KEYWORDS: Distal radius, Locking compression plate.

INTRODUCTION: Fractures of distal end of radius continue to pose a therapeutic challenge. Intra articular and extra articular malalignment can lead to various complications like post-traumatic osteoarthritis, decreased grip strength and endurance, as well as limited motion and carpal instability.¹ Open reduction and internal fixation is indicated to address the unstable distal radius fractures and those with articular incongruity that cannot be anatomically reduced and maintained through external manipulation and ligamentotaxis, provided sufficient bone stock is present to permit early range of motion.² Internal fixation of metaphyseal bending fractures has become increasingly popular due primarily to (a) directly control and maintain physiologic palmar tilt, (b)

ORIGINAL ARTICLE

prevent collapse with external fixation, and (c) avoid bridging the radiocarpal joint. The distal fragment typically has sufficient size and integrity to provide adequate purchase and may be approached from either a dorsal or a volar approach. Palmar plating is preferred, as the screws directly buttress against collapse and loss of palmar tilt. With smaller and more distal fragments, a dorsal plate has to be positioned distally on the dorsum of the radius making extensor tendon injury more likely.³

There are two types of plates for fractures of distal radius (a) Conventional plates and (b) Fixed angle locking compression plates. When using conventional plate's communitation must be less, they poorly hold the cancellous bone fragments, toggle of screws in the distal holes of the plate leads to settling and loss of reduction. With conventional plates and screws stability is achieved by compression of plate to bone by bicortical screws. With fixed angle locking plates the locking screws support subchondral bone and resist axial forces. Compression of locking compression plate to bone is unnecessary and preserves periosteal blood supply.⁴ Fixed angle construct provides additional strength to fixation by constructing a scaffold under the distal radial articular surface.⁵ Volar fixed angle locking plates are an effective treatment for unstable extra articular distal radius fractures allowing early post-operative rehabilitation.⁶ Because of angular stability of locking compression plates reduction can be maintained over times so that secondary displacement is no longer a problem.⁷ Primary stability achieved with locking screw in a plate prevents secondary displacement irrespective of the bone enabling good results in osteoporotic bones and young patients. Under 100N axial load, the palmar locking compression T-plate restores stability comparable to that of a intact radius, and is superior to conventional palmar or dorsal T plates.⁸ The development of fixed angular stable fixation techniques thoeratically improves stability to maintain the reduction of fractures in osteoporotic bones and fractures considered to be unstable.⁹ The purpose of this study was to evaluate functional outcome of patients with distal radius fractures treated with a volar locking compression plate.

OBJECTIVES:

1. To study the functional outcome of operative management of fractures of distal end of radius with locking compression plates.
2. To study the effectiveness and complications of distal end radius fractures treated with locking compression plate.

MATERIALS & METHODS: Hundred adult patients with distal radial fractures treated at Dept. of Orthopaedics, Government General Hospital and Royal Hospital, Vijayawada between May 2010 and April 2015 were included in this study.

Inclusion Criteria:

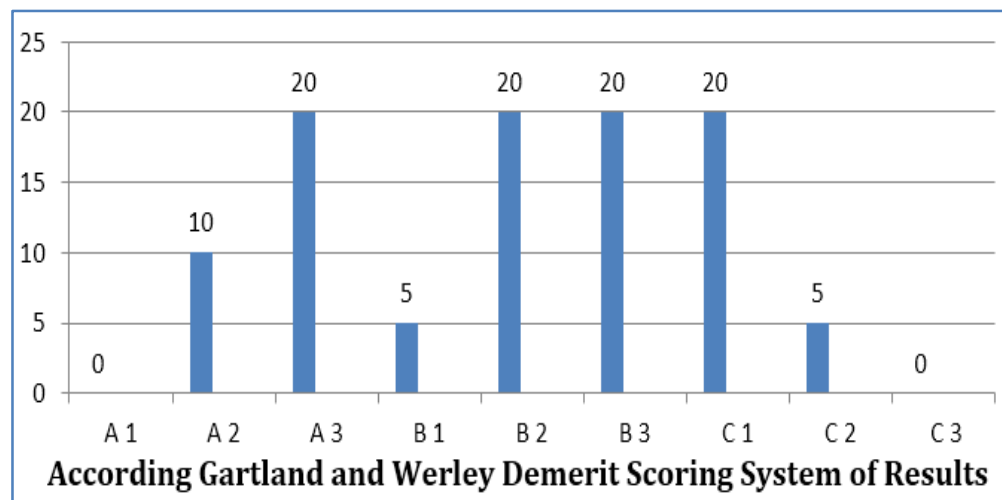
1. Adults (Aged over 18years), both male and female with unstable, comminuted or intra articular fractures of distal end radius.
2. Patients willing for treatment and given-informed written consent.

Exclusion Criteria:

1. Patients aged below 18 years.
2. Patients medically unfit for surgery.
3. Compound fractures associated with vascular injuries.
4. Patients not willing for surgery.

ORIGINAL ARTICLE

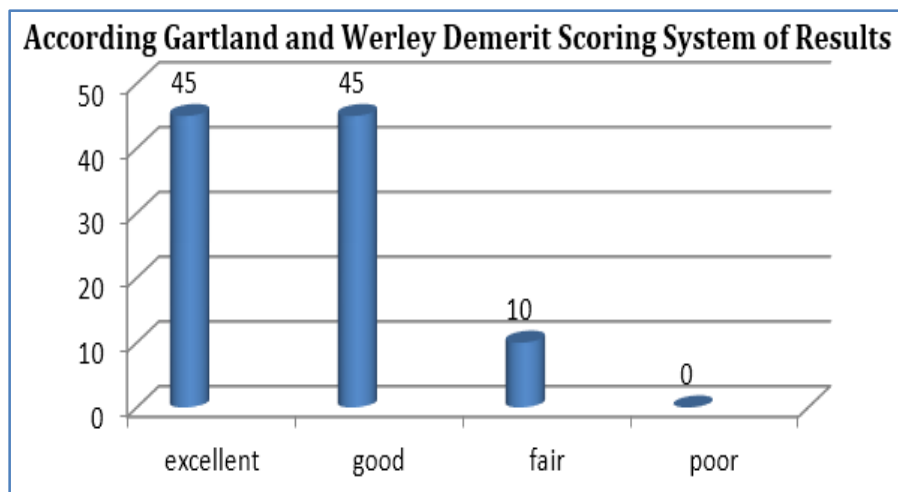
RESULTS: The present study consists of 100 cases of distal radius fractures Dept. of Orthopaedics, Government General Hospital and Royal Hospital, Vijayawada between May 2010 and April 2015. All cases were followed up periodically during the period 2010 to 2015. In this series 15(15%) patients were between 21-30 years, 25(25%) between 31-40 years, 40(40%) between 41-50 years, 15(15%) between 51-60 years and 5(5%) patients between 61-70 years. The age of the patients ranged from 26-62 years with an average of 43.3 years. Out of 100 patients, 80(80%) were males and 20(20%) were females, showing a male preponderance with the ratio being M: F - 4: 1. Right side (Dominant wrist) was involved in 70(70%) patients and the left side was involved in 30(30%) patients. In our study there were 60(60%) patients with road traffic accidents and 40(40%) patients fell on their outstretched hand. Of the 100 cases, 20(20%) of the fractures were of Type I Frykman's classification, 10(10%) of Type II, 35(35%) of Type III, 15(15%) of Type IV, 5(5%) of Type V and 15(15%) of Type VIII. There were no cases of Type VI and VII fractures. Of the 100 cases 10(10%) of the fractures were of AO Type A2, 20(20%) of type A3, 5(5%) of type B1, 20(20%) of type B2, 20(20%) of type B3, 20(20%) of type C1, 5(5%) of type C2. There were no cases of AO type A1 and C3 fractures.



Of the 100 cases, 95 (95%) of the fractures were of Closed Type and 5 (5%) were Open Type, which was of Type I of Gustilo and Anderson Classification, 5(5%). In the present study 80(80%) patients had union within 2-3 months and 15(15%) patients had union in 3-4 months. There was 5(5%) case of delayed union. In our study all patients had dorsiflexion within the normal functional range (Minimum 45°), all had palmar flexion within the normal functional range (Minimum 30°), all had pronation within the normal functional range (Minimum 50°), all had supination within the normal functional range (Minimum 50°), 85(85%) had radial deviation within the normal functional range (Minimum 15°) and 95 (95%) patients had ulnar deviation within the normal functional range (Minimum 15°).

95(95%) patients had grip strength more than 60% compared to the opposite side. 5(5%) had significant loss of grip strength (<60% compared to the opposite side). 10(10%) patients had pain in the distal radioulnar joint. None of the patients had stiffness of the wrist.

ORIGINAL ARTICLE



DISCUSSION: More than 190 years have passed since Colles described the fracture of the distal end of the radius. It is remarkable that this common fracture remains one of the most challenging of the fractures to treat. There is no consensus regarding the description of the condition and the appropriate outcome. Distal radius fractures are the most frequently seen upper extremity fractures. The main objective of its treatment is the re-establishment of anatomic integrity and functioning. In unstable intra-articular fractures, re-establishment of inter-articular integrity of the wrist and maintaining the radial length are often not possible with closed methods. In such cases, where an open positioning is required, various surgical methods and fixation materials can be used. A better understanding of wrist anatomy and functioning through the studies conducted in the recent years, as well as the increasing expectations of patients have expanded the borders of surgical treatment. Besides, improvements in fixation materials have provided new opportunities. Due to their intra-articular and unstable nature, B and C type were classified AO system distal radius fractures are treated surgically. Today, open positioning and plate fixation are the widely recognized surgical methods. Locked plates are in the progress of replacing conventional support plates. While facilitating the positioning, those anatomical plates with screw-plate interlocking feature have more biomechanical strength against forces applied on the fracture surfaces. Because of their biomechanical strength, locked plates are preferred in osteoporotic and/or multiple fractures. However, there is no consensus neither about how to approach to distal radius nor the positioning of the plate. During the recent years, volar approach has become more popular. The present study was undertaken to assess the functional outcome of operative management of distal radial fractures using a volar locked compression plate. We evaluated our results and compared them with those obtained by various other studies utilizing different modalities of treatment. Our analysis is as follows.

In our study, distal radial fracture was more common in the 3rd to 5th decade with an average of 43.3 years. Most of the intra articular, comminuted and unstable fractures requiring operative management occurred in young individuals are due to high energy trauma such as road traffic accident and fall from tree. Fractures occurring in old individuals are due to trivial fall and usually will be extra articular which in most cases can be treated with closed reduction and cast application. The average age in our study is comparable to the studies of Ayhan Kilic et al., (2009), Kevin C. Chung et al., (2006) and R.E. An akwe et al., (2010) who had an average age of 45 years, 48.9

ORIGINAL ARTICLE

years and 48 years respectively. Increased incidence in males is probably due to their involvement in outdoor activities, riding vehicles and heavy manual labour.

In our study 60% of the patients had road traffic accident and 40% had a fall on the out stretched hand. Kevin C. Chung et al., (2006) and Arora Rohit et al., (2007) reported fall on the outstretched hand as the most common mode of injury. We reported road traffic accident as the more common mode of injury. Ayhan Kilic et al (2009) and R.E. Anakwe et al (2010) also reported similar findings in their series.

Based on AO classification, we had 10 (10%) A2 type fractures, 20 (20%) A3, 5 (5%) B1, 20 (20%) B2, 20(20%) B3, 20 (20%) C1, and 5 (5%) C2 fractures. Ayhan Kilic et al., (2009) reported maximum number of cases of AO C2 type of fractures. Kevin C. Chung et al., (2006) reported maximum number of cases of AO C1 and A3 type of fractures. R.E. Anakwe et al., (2010) reported maximum number of cases of AO C3 and C2 type of fractures. Arora Rohit et al., (2007) reported maximum number of cases of AO A3 and C2 type of fractures. Our series is has maximum number of cases of AO type A3, B2, B3 and C1 type of fractures.

We encountered a complication rate of 10%, out of which 5 (5%) was due to extensor pollicis longus tendon irritation, caused by long volar to dorsal screw, 5 (5%) developed arthritis of wrist joint secondary to improper reduction and articular step. Ayhan Kilic et al., (2009) reported a complication rate of 11.1%, Kevin C. Chung et al., (2006) reported a complication rate of 9.1%, R.E. Anakwe et al., (2010) reported a complication rate of 4.8% and Arora Rohit et al., (2007) reported a complication rate of 57%.

In our series, we had 45% excellent, 45% good, 10%, fair and 0% poor result. Patients, who obtained excellent results, had no residual deformities or pain. Range of motion was within the normal functional range. They had no arthritic changes or other complications. They were operated within 4 days after injury. Radial length, volar tilt and articular step-off were within acceptable limits. They were co-operative to physiotherapy. Patients with good results had minimal residual deformities, pain and slight limitation. Rest of their findings was within acceptable parameters. Patients with fair results, along with residual deformity, pain and limitation also had pain in the distal radio ulnar joint and minimal complications. Few of their movements were less than that required for normal function. Our series is comparable to that of Ayhan Kilic et al., (2009) who had 44.4% excellent, 44.4% good, 11.2% fair.

Kevin C. Chung et al., (2006) outcome measures included radiographic parameters grip strength, lateral pinch strength, the Jubsen Taylor test, wrist range of motion and Michigan hand questionnaire compared to normal side. In his series decrease in mean grip strength, mean pinch strength and mean flexion of the wrist was 86% of normal side. R.E. Anakwe et al., (2010) system outcome was assessed using clinical examination grip strength measures, radiographs and PRWE (patient related wrist evaluation) scoring. In his series 95% patient very high level of satisfaction, good functional outcome and increased grip strength. Rohit Arora et al., (2007) used modified Green and Obrein score he had 31 excellent, 54 good, 23 fair and 6 poor results.

CONCLUSION: The present study was undertaken to assess the functional outcome of operative management of distal radial fractures in adults by a volar locking compression plate and the following conclusions were drawn. Distal radial fractures are more common in the 3rd to 5th decades. Male preponderance is due to their involvement in heavy manual labour, outdoor activities and riding vehicles. Most of the fractures in the younger individuals is due to motor vehicle accidents

ORIGINAL ARTICLE

or high energy trauma which are usually intra-articular, displaced. The fractures occurring in the older individuals will be due to trivial fall on outstretched hand causing extra articular fracture in the osteoporotic bone. Many of the literature denotes fracture of the distal radius are common in older individuals 4th to 6th decade, as our clinical trial was to study the effectiveness of the operative management of the distal radius fractures by a locking compression plate, we included the cases, requiring surgery which were comminuted and intra articular and occurred due to high energy trauma in young individuals. The mode of injury is either a road traffic accident or fall on the outstretched hand. Distal radial fractures which occur due to road traffic accidents (High energy trauma) are mostly intra-articular, displaced and unstable (Frykman Type III - VIII) and AO type B2, B3, C1 and C3.

Locked plates that are widely used provide successful results especially for the treatment of intraarticular unstable fractures of distal radius. This method, which is effective in anatomic realignment, allows early joint motion, owing to its fixation strength. Close placement to joint interface and screwing capability in different orders are its biomechanical superiorities. Volar approach provides both access with minimal surgical trauma on distal radius and fixation with a better adaptation to surrounding tissues. In the subjects of our study, a successful anatomic alignment was acquired with volar approach, regardless of the direction of fracture angulation. The patients who were young adults in majority, went back to their daily activities with 90% recovery. We encountered 10 complications (10%) in our study. 5 being extensor tendon injury, which were because of long screws projecting dorsally. Other complication being arthritis in 5 patients, which were because of improper reduction and articular step. These complications can be prevented once the surgeon gets adapted to the procedure. Use of locked compression plates in distal radius fractures provide good to excellent results and are effective in the correction and maintenance of distal radius anatomy. By using these plates, joint motions and daily functioning is recovered in a shorter time.

SUMMARY: The study comprised of twenty cases of distal radial fractures in adults. All patients treated with open reduction and internal fixation with a volar locked compression plate. The follow-up ranged from 9-18 months. The average age was 43.3 years with the fracture being more common in the 3rd to 5th decades. Males were predominant with right wrist affection more than left. All fractures were either due to road traffic accidents or fall on the outstretched hand, with road traffic accidents being more common of the two. Most of the fractures were of Frykman Type I, III and IV. The average duration from the date of injury to the date of surgery was 2.35days. Surgery was delayed till the sixth day in 10(10%) cases, as both the patients were a known case of hypertensive and ischaemic heart disease, surgery delayed for till the patient was medically fit for surgery. All (100%) the patients had their range of motion within the normal functional range. None of the patients had wrist stiffness. Complications were minimal. There was 5(5%) case of extensor pollicis longus tendon irritation which was because of long volar to dorsal screw and the pain subsided once the screw was removed. There was 5 (5%) case with an intra articular fracture developed grade I radiocarpal arthritis doing well with physiotherapy. Though we had 70(70%) cases of intra articular fracture, the complication of post-traumatic arthritis was in only 5(5%) case. Long term follow up is needed to assess the arthritic changes. Using the Demerit score system of Gartland and Werley, we had 45(45%) excellent results, 45 (45%) good results, 10 (10%) fair results and 0 poor result.

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