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Credibility of locking plate in treatment of distal end radius fractures with intra articular extension

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Abstract
Background: The management of distal end radius has undergone an extraordinary evolution over the preceding twenty years. The technical advance of palmar locking plating has again changed the management of this fracture in a real and seemingly permanent way. Perhaps most importantly it is becoming increasingly apparent that operative intervention needs to be customized to the patient, fracture and expertise of the surgeon.
Materials and Methods: The study is hospital based prospective study centered in R.L. Jalappa Hospital from November 2013 to April 2015 between which thirty patient patients with intra articular distal radius fractures are treated with locking compression plate and screws.
Results: Patients were regularly followed-up post-operatively. Thirty cases were available for follow up. Excellent results were seen in 20 patients, good results in 5 patients, fair results in 3 patients and poor results in 2 patients.
Conclusion: Open reduction and internal fixation with locking compression plate and screws gives better functional and anatomical results in intra articular distal radius fractures. The successful use of locking compression plate for intra articular distal radius fractures requires careful assessment of fracture pattern, appropriate patient selection, meticulous surgical techniques, appropriate choice of fixation, screw size, judicious augmentation with internal fixation, careful post-operative monitoring and aggressive early institution of rehabilitation. The final functional result of treatment not only depends of on anatomical reduction but also depends on surrounding soft tissue injuries and early mobilization.

Keywords: Distal radius, intra articular fractures, locking compression plate, screws, mobilization

Introduction
Fractures of distal radius represent approximately 16% of all adult fractures treated by orthopaedic surgeons [1]. The incidence of this injury appears both to be gender and age specific [2]. There are three main peaks of this fracture distribution, one in children 5-14, second in males under age 50, third in females above 40 years [3]. The sharpest increase is seen in both elderly females and young adult males [4-6]. The difference in these two peak incidences indicates two different mode of injuries, one being an insufficiency fracture in elderly patients and other traumatic injury in younger individuals [1]. Risk factors for these fractures in elderly include female gender, etinicity, heredity and early menopause [7-10].
Although most of intra articular distal radius fractures are managed conservatively in the past the necessity of excellent functional results which requires maintenance of fracture alignment, length, rotations & early mobilization of the neighboring joints is achieved only by surgical intervention.
Open reduction &internal fixation with locking compression plate is advantageous as the reduction is done under direct vision, a method of achieving a stable fixation with almost perfect reduction, good reduction is achieved & maintained as the plate is placed, the muscle tone provides compression at the fracture site, rotatory instability is prevented, cost effectiveness, clean & sterile operation theatres with good antibiotics have decreased the chances of infections, there is no need for C- arm the medical staff has no radiation hazards, the limb can be mobilized early & joint stiffness as well as muscle contractures can be minimized.

The present study is an attempt to study the advantages & disadvantages of open reduction internal fixation using locking compression plate with screws for intra articular distal radius fractures, analyze the results & compare with the standard studies.

Materials and Methods

This present study includes 30 patients of intra articular distal radius fractures in adults treated with open reduction internal fixation with locking compression plate and screws at R.L JALAPPA HOSPITAL AND RESEARCH INSTITUTE, Kolar, from November 2013 to April 2015.

The study included patients diagnosed clinic radiologically as intra articular distal radius fracture, age above 18 years, both closed and open fractures (upto type 3A gustilo Anderson). Excluded patients are with pathological fractures and medically unfit for surgery.

Assessment of intra articular distal fractures was done with reference to skin condition (closed / open fracture), peripheral circulation, neurologic examination especially tendon injuries, compartment syndrome and associated injuries.

Diagnosis is confirmed through anterior-posterior and lateral radiographs of distal raidus. Computed Tomography is also used in some cases. Distal radius fracture were classified according to Frykman.

Basic investigations like Haemoglobin %, blood grouping and typing, random blood sugar, urine analysis, were performed. In the preoperative period splintage with below elbow dorsal slab and was carried out which facilitate fracture reduction and precision of locking compression plate and screws.

Surgical Technique

Under the effect of general anesthesia or interscalene block the patient was placed supine on the operation table. Tourniquet was used. Intravenous antibiotics in the form of 1 gm of ceftriaxone was given before the start of the procedure. The arm, Forearm, hand is scrubbed with Betadine scrub and was painted with betadine and spirit and then draped. The limb was placed on side board. Open reduction and internal fixation of the fracture was done by using Henrys volar approach [11]. Taking care not to injure vessels and nerves. The volar locking compression plate is fixed with screws. Reduction and fixation is verified under fluoroscopy. Intra venous antibiotics are administered for five days and then it is converted to oral antibiotics for next five days.

Post operative Protocol and Rehabilitation

Check X -rays were taken in both anterio-posterior and lateral views on postoperative day one. The reduction of the fracture was confirmed and any displacement of fracture was studied. Active exercises of fingers and thumb were commenced from the day of operation. Second postoperative day the dressing were removed and controlled mobilization of wrist was advised.

The patients were called for inspection and dressing change at the interval of one week for the next 4 weeks. The patient was assessed subjectively for pain at the fracture site, clinically for tenderness at fracture site. Suture removal was done after 10 days and complete range of motion of wrist exercises are advised. Wrist range of movements were recorded and documented on every visit after four weeks. All cases were followed after 4th week, 8th week, 12th week and 6 months.

Results

The age of the patients in the study ranged from eighteen years to sixty three years, average being 36.6 year. 11 patients are male (70%) and 19 patients are female (30%). Out of 30 patients 20 patients sustained fracture following trivial fall on out stretched hand and 10 patients sustained road traffic accident. Sixteen on right side and fourteen on left side. Among thirty patients claasified according to frykman[12] twenty one had intra articular fracture without an ulna fracture (type 3), two had intra articular with ulna fracture (type 4), three had intra articular fracture with DRUJ disruption without ulnar fracture (type 5), two had DRUJ intra articular with ulnar fracture (type 6), one had intra articular radio carpal and DRUJ without ulnar (type 7), one had intra articular radiocarpal with DRUJ and ulnar fracture (type 8).

All patients are followed up till six months. In the study, the Total time taken for fracture union ranged between 8weeks to 14weeks averaging 10 weeks. In fifteen patients fracture united between 10 to 12 Weeks, in eight patients fracture united between 13 to 14 weeks, in six patients fracture united between 8 to 10 weeks & In one patient there was infection which required plate removal and antibiotic administration.

The functional outcome was divided into grade I, garde II, Grade III & Grade IV as per demerit scoring system by gartland and Werley [13]. Of the thirty patients, twenty were of Grade I, five were of Grade II, Two were of Grade III &one were of Grade IV at the end of six months.

Only one patient had complication of infection, for which subsequently plate removal was done. None of the patients had iatrogenic median nerve palsy or any tendon injuries.

In the present study of thirty cases of intra articular fractures radius managed by locking compression plate & screws were assessed & evaluated as per the criteria formulated. There were twenty cases had excellent results, five cases had good results, three cases had fair results & two cases had poor results.

X-RAYS

Pre operative PA & Lateral radiographs

Post Operative PA & Lateral radiographs after six months.

Immediate Post operative AP & Lateral radiograph

Pre operative PA & Lateral radiograph

AP & Lateral radiographs after six months

Patient Photographs

1 2 3 4

Clinical photographs Showing
1. Pronation
2. Supination
3. Dorsiflexion
4. Palmar flexion

1 2 3 4 5

1. Pronation
2. Ulnar deviation
3. Palmar flexion
4. Dorsiflexion
5. Supination

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 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 reduction 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, most of the fractures from Frykman type III to type VIII are treated surgically. Locked plates are in the progress of replacing conventional support plates. There is no consensus either about how to approach to distal adius or the positioning of the plate. During the recent years, volar approach has become more popular. The present study was undertaken to assess the functional & anatomical outcome of operative management of intra articular distal radial fractures using a volar plate.

The age of the patients in the study ranged from eighteen years to sixty three years, average being 36.6year.Among thirty patients classified according to frykman twenty one had intra articular fracture without an ulna fracture (type 3),two had intra articular with ulna fracture(type 4),three had intra articular fracture with DRUJ disruption without ulnar fracture (type 5),two had DRUJ intra articular with ulnar fracture(type 6),one had intra articular radio carpal and DRUJ without ulnar (type 7),one had intra articular radiocarpal with DRUJ and ulnar fracture(type 8).

All patients are followed up till six months. In the study, the Total time taken for fracture union ranged between 8weeks to 14weeks averaging 10 weeks. In one patient there was infection which required plate removal and antibiotic administration.

The functional outcome was divided into grade I, garde II, Grade III & Grade IV as per demerit scoring system by gartland and werley. Of the thirty patients, twenty were of Grade I, five were of Grade II, Two were of Grade III &one were of Grade IV at the end of six months.

None of the patients had iatrogenic median nerve palsy or any tendon injuries.

Several studies have been done to assess the functional outcome of volar locking plate for intra articular distal radius fractures using gartland and werley scoring system. They are as follows John K. bradway *et al*. (1989) reported 56 % excellent, 25 % good and 19 % fair results according to Gartland and Werley by open reduction and fixation.

Fitoussi F *et al*. (1997) reported combined excellent and good result of 82 % according to Gartland and Werley by buttress plating [14].

H. Drobetz (2002) *et al*. reported excellent in 26(52%), good 20(40%), fair in 3 (6%) and poor in 1(2%) patients according to Gartland and Werley using LCP.

Andrew W Beharrie (2004) *et al* reported 83 % excellent and 17 % good in elderly patients according to Gartland and Werley using LCP.

KK Wong (2005) reported 24 (80%) excellent, 5(16.7%) good, 1 (3.3%) fair according to Gartland and Werley using LCP.

Ayhan Kilic *et al.* (2009) had 44.4% excellent, 44.4% good, 11.2% fair results using LCP according to Gartland and Werley [15].

Pattanashetty *et al.* (2013) reported 6 (18.7%) patient had excellent results, 15(46.8%) patients had good results, 6(18.7%) patients had fair results and 5(15.6%) patients had poor results [16].

Conclusion

The present study was undertaken to assess the functional and anatomical outcome of operative management of intra articular distal radial fractures in adults by locking compression plate and the following conclusions were drawn.

Fractures of distal radius represent approximately 16% of all fractures treated by orthopaedic surgeons [1]. There are three main peaks of this fracture distribution, one in children 5-14, second in males under age 50, third in females above 40 years [3]. The sharpest increase is seen in both elderly females and young adult males [4-6]. The difference in these two peak incidences indicates two different mode of injuries, one being an insufficiency fracture in elderly patients and other traumatic injury in younger individuals [1]. Risk factors for

these fractures in elderly include female gender, ethinicity, heredity and early menopause [7-10].

Distal radial fractures which occur due to road traffic accidents (high energy trauma) are mostly intra-articular, displaced and unstable (Frykman Type III – VIII).

Volar locking plates that are widely used provide successful results especially for the treatment of intra articular 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.

We encountered one complication in our study i.e infected implant for which implant removal and subsequent antibiotic administration was done.

Use of volar locking plates in intra articular distal radius fractures provides good to excellent results and is effective in the correction and maintenance of distal radius anatomy.

Thus locking compression plate can be considered as implant of choice for distal radius intra articular fracture.

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