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Original Research Paper

Orthopaedics

OPERATIVE TREATMENT OF DISTAL END OF RADIUS FRACTURES WITH LOCKING COMPRESSION PLATE

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ABSTRACT Background and objectives:The present study was undertaken to assess the functional outcome of operative management of distal radial fractures using a volar locked compressionplate. Methods: Patients were treated with open reduction and internal fixation with locking compression plate through a volar approach and followed up till functional recovery and assessed clinicoradiologically. The clinical and functional outcome was assessed using Gartland and Werley scoreand Mayo Wrist score respectively. **Results:** Using the demerit scoring system of Gartland and Werley,we had 48% excellentresults,40% goodresults, 12% fair resultsand nopoor results. **Conclusion:** In carefully selected patients even in the face of osteoporosis, fixation of fractures of distal end of radius with a locking compression plate has goodoutcome .

KEYWORDS : Intra articular, distal radius, Locking compression plate (LCP),Osteoporosis.

INTRODUCTION

Fracturesofdistal end of radius continue to pose a therapeutic challenge. Intraarticular and extraarticular malalignmentcan 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 sufficientbone stock is present to permit early range of motion [2]. Fixed angle construct provides additional strength to fixationby constructing a scaffold under the distal radial articularsurface[3]. Volar fixed angle locking plates are an effective treatment for unstable extra articular distal radius fracturesallowing early post operative rehabilitation[4].Because of angular stability of locking compression plates reduction can be maintained over times so that secondary displacement is no longer a problem[5].

Primary stability achievedwithlocking screw in a plateprevents secondary displacementirrespective of the bone,enablinggood results in osteoporotic bones and young patients[6].The development of fixed angular stable fixation technique theoretically improvesstability tomaintain the reduction of fractures in osteoporotic bones and infractures considered to be unstable[7]. The objectiveof this study was to evaluate functional outcome of patients with distal radius fracture treated with a volar locking compression plate and to study the effectivenessand complications of distalend radius fractures treated with locking compression plate.

METHODOLOGY

Aprospectivestudy of Twentyfive adult patients with distal radiusfractures treated at Department ofOrthopaedics, SriSiddhartha medical college andresearch centre,Tumkur, Karnatakastate betweenJanuary 2016 and February 2018was done.Inclusion Criteria:Adults (aged over 18years) both male and female with unstable, Comminutedo rintraarti cularfractures of distalendradius.

Patients willing for surgical treatment and givenwritten and informedconsent.

Exclusion Criteria:

Patients below18 years.
Medically unfit forsurgery.
Open fractures with vascularinjuries.
Patients not willingforsurgery.

There were 18 (72%) males and 7(28%) females between the age group of 25-65 years With mean age of 42.5 years.16 (64%)patients hadrightside involvement (dominant Hand)and 9(36%) hadleft side involvement.

Pre operative treatment:After admission to the hospital, a careful history was takenfrom the patients and / or attendants to reveal the mechanism and the severity of injury. Their general condition,presence of any systemic diseases and associated injuries were noted. Allthe details were recordedin the patient's proforma.Careful inspectionof thedeformity, swelling and ecchymosiswere done. Distal vascularity was checkedby radial artery pulsations, capillary refilling, pallor and par aesthesia over fingertips.The involved wrist wasimmobilized with a below elbow slab and elevation was advised. Oral analgesics and antiinflammatory medicines were given.

Pre-operative planning:Routine examination of bloodwasdone.Tetanus toxoid injection and intravenous antibioticwere given to all patients pre-operatively.Physicianfitness Was taken for all the patients. Consent for surgery wastakenand pre-anaesthetic

Evaluation was carried out.

X-ray:Standard radiographs in Anterioposterior and lateral viewsweretakenfor confirmation of thediagnosis and also to know the type of fracture. Thefracture fragmentswere analysed and involvement of radio carpaland distal radioulnar joints were assessed and classified according to Frykman's and AO classification.

Operative procedure:

The duration from the date of injury to date of operation ranged from 1-7 days (average 2.8 days).

Anaesthesia : surgeries were performed under general anaesthesia in 6cases and brachial block in 19cases.

Position and tourniquet:The patient was placed supine on the operating table.The affected limb waselevatedfor2-3 minutes

andexsanguinated. Then a mid-armpneumatictourniquet was applied and the limb was placed on a side arm board. Forearmandhandwerethoroughly scrubbed, painted anddraped.

PROCEDURE:
All cases are treated with a volar locking compressionplate using a volar Henry's approach.

Technique: An incision is made between the flexor Carpiradialis (FCR) tendon and the Radialartery. This interval is developed, revealing the flexor pollicis longus (FPL) muscle at the proximal extent of the wound and the pronator quadratus muscle more distally. The radial artery is carefully retracted radially, while the tendons of the FCR and FPL are retracted Ulnarly.After the pronatorquadratushas been divided and elevated, the fracture is readily visualized, and reductionmanoeuvrescan be accomplished under direct Vision.Thefracture is reduced and provisionally fixed under fluoroscopy with K-wires, Reduction clamps. The Finalpositionof theplatewas confirmedusing fluoroscopy.Oncestable fixationwasachieved and haemostasis secured, the wound was closed in layers and sterilecompression dressing wasapplied. The operated limb was supported with an anterior below elbow plaster of Paris Slabwiththewristin neutral position.

Postoperative regime:Routine intravenous antibiotics and analgesics were given for 2 to 3days and later oral antibiotics were continueduntilthe suture removal. Limb Elevation was given and the postoperative X-ray was done. Active finger, elbow and shoulder movements was encouraged from the3rd post operative day and sutures werereмoved after the 10th day. Patients were discharged from the hospitalaround 5 to 15th daydepending upontheir clinical and wound conditions.

Follow up:follow up was done at 6 weeks,3months, 6months, 12 months and 15 months.

Evaluation of results:
Theclinical assessment of results were made usingthe demerit pointsystem of Gartland and Werley [8]based on objective and subjective criteria, residual deformity and Complications.Mayo wristscore was usedforfunctional outcomeassessment.

Statistical methods
TheassumptionsofChi-squaretest areasfollows [9, 10]

Random sample: A random sampling of the data was done from a fixed distribution or population .

Sample size: A sample witha sufficientlylarge sizeis assumed. If chisquare test is conducted on a small sample size, then the test will yield an inaccurate inference. The researcher, by using chi square test on a small samples might end up committing a type 2 error.

Statistical Analysis: All the data was entered in Microsoft Excel sheet and then transferred To SPSS softwarever. 17 for statistical analysis. Appropriate tests wereapplied according to type and distribution ofdata and a p-value of less than 0.05 was taken as significant.

RESULTS
There were 23 closed fractures and 2 open fractures. All cases were followed up periodically during study and follow up period.Thefollowingare the observationsmade from our study.

Age distribution: In our series 4 (16%) patients were between 21 to 30 years, 6(24%) Between 31-40years,10(40%)between41-50years,4(16%)between51-60yearsand 1(4%)patientbetween 61-70 years[Table-1].

Table-1]: Age distribution

Age in Years	No.of Cases	Percentage
21 – 30	4	16
31- 40	6	24
41 - 50	10	40
51 - 60	4	16
61 - 70	1	4

Sex incidence: Out of 25 patients, 18(72%) were males and7 (28%) were females, showing amale predominancewith the ratio being approximately M:F = 3:1.

Side involved : Right side (dominant hand) was involved in 16 (64%) patients and the left Side was involved in 9 (36%) patients. Mode of injury: In our study there were 13 (52%) patients with road traffic accidents and 10 (40%) patientsfell on their outstretched handand remaining 2(8%) cases had a direct Blow.

Extra Articularand IntraArticular fracture:Of the 25 cases, 8(32%)of the fractures Were of Extraarticular Type and 17 (68%) were Intraarticularfractures.

Duration of fracture union: In ourstudy, 18 (72%) patients had union within 2-3 Months and 5(20%)patients hadunion in 3-4 months.There was 2(8%) casesofdelayed Union [Table-2].

[Table-2]: Fracture union duration

Time of Union	No.of Cases	Percentage
2-3 months	18	72
3-4 months	5	20
>4 months	2	8

Complications: 3 (12%) patients hadextensorpollicis longus tendon irritation because of longvolar to dorsal screw. 4 (16%) patients developed arthritis of the wrist joint due toimproper reduction and articular step. There were 1(4%)case of median nerve neuropraxia and 2(8%) cases had mild infection[Table-3].

[Table-3]:Post operative complications

Complications	No.of Cases	Percentage
Extensor pollicis longus tendon irritation	3	12
Arthritis	4	16
Median nerve neuropraxia	1	4
Infection	2	8
Total	10	40

Evaluation of results: a) Using the Demerit scoring system of Gartland and Werley [8], we had 12(48%) excellent result, 10(40%) good result, 3(12%) fair result and no poor results [Table-4].

[Table-4]: Evaluation of results using Gartland and Werley score

Results	No.of Cases	Percentage
Excellent	12	48
Good	10	40
Fair	3	12
Poor	0	0

b)By using Mayo wrist score, we had 14(56%) excellentresults, 6(24%) good result, 3(12%) had satisfactoryoutcome and 2(8%) poor outcome[Table-5].

[Table-5] Functional outcome of patients using Mayo

wrist score.

Functional outcome	No of patients	Percentage
Excellent	14	56%
Good	6	24%
Satisfactory	3	12%
Poor	2	8%

DISCUSSION

Distal radius fractures are the most frequently seen upper extremity fractures. In unstable intra-articular fractures, re-establishment of intra-articular integrity of the wrist and maintaining the radial length are often not possible with closed methods. A better understanding of wrist anatomy bythe studies conducted in the recent years, as well as the increasing expectations of patients have expanded the borders of surgical treatment.

While facilitating the positioning, these anatomical plates with screw-plate interlockingfeature have more biomechanical strength against forces applied on the fracture surfaces.Because of their biomechanical strength, locked plates are preferred in osteoporotic and inmultiple fractures.We evaluated our results and compared them with those available from various other similarstudies.Our analysis is asfollows.

Age distribution:The average age in our study is comparable to the studies of Ayhan Kilic et al [11] (2009), Kevin C. Chung et al[12] (2006) and R.E.Anakwe et al[13] (2010) who had an average age of 45 years, 48.9 years and 48 years respectively[Table-6].

[Table-6]: Age distribution in our study compared to other similar studies

Series	Minimum age in years	Maximum age in years	Average inyears
Ayhan Kilicet al, (2009)11	18	77	45
Kevin C. Chung et al, (2006)12	18	83	48.9
R.E. Anakwe et al,(2010)13	22	67	48
Arora Rohit et al, (2007)14	17	79	57
Our study	25	65	42.5

Mode of injury: Kevin C. Chung et al and Arora Rohit et al reported fall on the outstretched hand as the most common mode of injury.We reported road traffic accident as the mostcommon mode of injury.Ayhan KilicetalandR.E. Anakweetal also reportedsimilarfindings in their series [Table-7].

[Table-7]: Mode of injuryin our series compared to other similar study.

Series	Road traffic accident	Fall on the outstretched hand	Direct blow
Ayhan Kilic et al, (2009)11	13	14	-
Kevin C. Chung et al, (2006)12	42	45	-
R.E. Anakwe et al,(2010)13	14	7	-
Arora Rohit et al, (2007)14	40	60	14
Our study	13	10	2

Type offracture:Based on AO classification, we had 3 (12%) A2 type fractures, 5 (20%) A3,2(8%) B1, 5 (20%) B2, 5 (20%) B3, 4 (16%) C1, and 1 (4%) C2 fractures.Ayhan Kilic et al[11] reported maximum number of cases of AO C2 type of fractures.Kevin C. Chung et al[12] reported maximum number of cases of AO C1 and A3 type of fractures.

R.E. Anakwe et al[13]reported maximum number of cases of AO C3 and C2 type offractures.Arora Rohit et al[14] reported maximum number of cases of AO A2 and C2 type offractures.Our series hadamaximum number of cases of AO type A3, B2, B3 and C1 type of fractures[Table-8].

[Table-8]: Type of fracture in our series compared to other series.

Series	Type of fracture (%)								
	A1	A2	A3	B1	B2	B3	C1	C2	C3
Ayhan Kilic et al, (2009)11	0	0	0	0	3	2	2	14	6
Kevin C. Chung et al, (2006)12	0	16	19	4	0	4	23	5	16
R.E. Anakwe et al,(2010)13	0	0	0	0	0	0	4	8	9
Arora Rohit et al, (2007)14	0	39	16	0	0	0	24	30	5
Our study	0	3	5	2	5	5	4	1	0

Complications : Ayhn Kilic et al reported a complication rateof 11.1%, Kevin C. Chung et al reported a complication rate of 9.1%, R.E. Anakwe et alreported a complication rate of 4.8% and Arora Rohit et al reported a complication rate of 57%.

RESULTS:

In our series, we had 48% excellent, 40% good, 12% fair and no poor result according to Gartland and werley score.

Patients who obtained excellent results, had no residual deformities or pain.Rangeof motion was within thenormal functional range. Theyhadno arthriticchanges or othercomplications. They wereoperatedwithin4daysof injury. Radiallength, volar tilt and articularstep-off were within acceptable limits. They wereco-operativetophysiotherapy. Patients with good results had minimal residual deformities, pain and slight restriction ofwristmovements. Rest of their findings were withinacceptableparameters.

Patients with fair results hadresidual deformity, pain and marked limitations of wrist movements with minimal complications. Our results arecomparable to that of Ayhan Kilic et al who had 44.4% excellent, 44.4% good and 11.2% fair results. In R.E. Anakwe et alseries, outcome was assessed using clinical examination ofgrip strength, radiographs and PRWE (patient ratedwrist evaluation) scoring. In his series, 95%of patient had a very high level of satisfaction, good functional outcome and increased grip strength.Rohit Arora et al used modified Green and Obrein score, he had 31 excellent, 54 good , 23 fair and 6 poor results.

CONCLUSION

Locked plates that are widely used provide successful results especially for the treatment of intraarticularand 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 directionsare 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 conclude, use of lockingcompression 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 movements and daily

function is recovered in a shorter period of time.

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