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MANAGEMENT OF VOLAR BARTON FRACTURE WITH VOLAR PLATE OSTEOSYNTHESIS - PROSPECTIVE STUDY

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Abstract

Introduction- Distal radius reconstruction needs aggressive operative intervention is still a debate among researchers & orthopaedic surgeons. There is very little role of non operative management in geriatric unfit patients. Revolution of implants & techniques advocated the best clinical outcome.

Material & methods- Prospective research study is conducted at G.S. medical college Hapur, in department of orthopaedics. 20 patients of volar Barton fractures between the age group of 20 to 50 years were included in the study and treated with volar locking plate. out come of study was evaluated by using the Gartland & Werly score modified by Sarmiento & patient rated wrist Evaluation (PRWE) score.

Results- Mean palmar flexion was 74 degree, dorsi flexion was 84 degrees observed, average supination & pronation was 85 & 80 degrees respectively. Radial & ulnar deviations average 10 and 25 degrees observed. 85% of patient had loss of radial inclination less than 10 degrees. All the patient had less than 5 mm radial shortening. Loss of palmar tilt less than 6 degrees was observed. More than 90% of the patients had excellent to good outcome based on Gartland & Werley score.

Conclusion- Volar plating reproducible & proven method of choice in majority of Volar Barton fractures of radius irrespective of comminution &

fragments separation.

Keywords: Volar Barton fracture, volar plate, osteosynthesis.

Introduction

In modern age of development & industrialization, there is enormous increase in road traffic & industrial accidents and large number of patients of intra articular radius fractures are reported in emergency & orthopedic department trauma unit¹. Fifth to sixth decade persons with both genders are vulnerable to these injuries while females in their fourth decade which is peri-menopausal age reported high incidence².

Road accidents have significant role sustaining these trauma while senile age persons have house fall with trivial trauma^{3,4}. Patho-anatomy & biomechanics of radio carpal & radio ulnar joints have pivotal role in maintaining wrist functions & movements.⁵

Congruity of articular surfaces can only be achieved with ligament taxis & reconstruction of joint addressing each fragment along with early rehabilitation⁵. To date valid components of treatment strategy include ligamentotaxis with dynamic radial external fixater, ORIF with dorsal & volar plate osteosynthesis after meticulous anatomical reduction & restoration joint congruity⁶. Volar plating is mainstay of technique to achieve anatomic reduction and ligamentous reconstructions in majority of articular fractures of lower end of radius with less complications with meticulous surgery.^{7,8}

Material & Methods

In this study 20 patients who attended emergency & department of Orthopaedics, G.S. medical college Hapur during the period of 2017-2018 having Volar Barton fractures were managed by volar plate osteosynthesis. Among them 12 were male and 8 were female with age ranges from 20 to 50

years. Final outcome was evaluated using Gartland & Werley score modified by Sarmiento & patient rated wrist evaluation (PRWE) score.

Exclusion Criteria

- (1) Associated fractures of Carpal bones
- (2) Delayed presentation more than 2 weeks.
- (3) Pathological fractures.
- (4) Volar Barton fractures with fracture radial diaphysis.
- (5) Compound fractures.

Initial assessment of all the patients done to rule out any other associated injuries & splinting of affected limb was done. Clinical & radiographic evaluation of fractures was done by obtaining plain radiographs to evaluate loss of palmar tilt, dorsal angulations, radial shortening, loss of radial inclination and articular incongruity. Patients operated after proper counseling and informed written consent. Operations were done under regional or general anaesthesia using tourniquet and proper aseptic precautions.

Surgical Technique- 10 C.M. skin incision at volar aspect of wrist between radial artery & flexor carpi radialis tendon was given. Fracture site was exposed after dissecting subcutaneous tissue & achieving homeostasis, incising tendon sheath and retracting the flexor pollicis longus to the ulnar side, cutting the pronator quadratus in L shaped manner & retracting it.

Reduction was achieved by manual traction hold temporarily by K. wires under c-arm guidance. Appropriate size plate was applied over volar surface of radius below the watershed line and temporarily fixed with cortical screw in oval hole of locking plate. Fracture reduction was done with

ligamentotaxis & manual technique restoration of fractures fragments. Reduction was checked under and image intensifier and cortical screw in oval hole of locking plate was tightened and after application of screws in distal fragment. After confirming the desired reduction remaining screws were applied.

Pronator quadratus was repaired using absorbable sutures. Subcutaneous & skin closure was done. Post operative radiographs were taken. Limb was kept elevated in below elbow plaster slab, active finger movements, forearm rotation and shoulder exercises were started at the earliest possible, plaster slab was removed after 2 weeks & active exercises of wrist elbow & shoulder were started. Heavy weight lifting and strenuous work was not allowed until signs of fractures healing were radiographically confirmed.

Evaluation of outcome

Radiologically- The follow up protocol was 6 weeks, 3 months and 6 months. Clinical and radiographic assessments were performed at every visit. Radiological assessment included measurement of volar tilt, radial height and radial inclination & they were assessed according to the Sarmiento's modification of Lind Storm criteria.

Clinical & functional - Wrist range of motion was measured in flexion, extension, pronation supination, ulnar deviation & radial deviation and was compared with uninjured limb. The over all function of the upper limb was assessed using the Gartland & Werley score & patient rated wrist evaluation score (PRWE).

Results - Mean age of our series of patients was 37 years, most of the patients were younger age group.

Among 20 patients, there were 14 patients of less than 38 years of age, 12 patients were male and 8 were females.

There were 11 patients who had injury to right side, rest of 9 patients having injury to the left side. All the patients were having right hand predominant.

Incidence of road traffic accident was more as compared to domestic fall down. This may be due to physically active young patients are more in our study.

There were 95% of patients having excellent to good palmar flexion range at wrist at final follow up. Most of the patient had palmar flexion range from 65 to 85 degrees. The average palmar flexion was 74 degrees. All the patients have excellent to good results in terms of range of dorsi flexion of wrist at final follow up. All the patients had dorsi flexion range from 58 to 85 degrees. The average dorsi flexion was 84 degrees.

There were 95% of patients having excellent to good supination range at wrist joint at final follow up. All the patients, except one had supination range from 75 to 86 degrees. The average supination was 85 degrees.

All the patients have excellent to good pronation range at wrist joint at final follow up. 18 patients having pronation range from 76 to 85 degrees. The average pronation at final follow up was 80 degrees.

In our study 92% of the patients had excellent to good radial deviation range at wrist at final follow up. Most of the patients (17 Patients) having radial deviation range from 9 to 20 degrees. The average radial deviation was 10 degree. All the patients in our study had excellent to good ulnar deviation range at wrist at final follow up. All of patients having ulnar

deviation range of 20-30 degrees. The average ulnar deviation at final follow up was 55 degrees.

X-Rays of all the patients were evaluated for radiological assessment of radial inclination, radial shortening & palmar tilt accordingly. In our study more than 80% patients had loss of radial inclination less than 9 degrees and had excellent to good results.

The average radial inclination at final follow up was 19 degrees.

All the 20 patients in this study had less than 5 mm radial shortening and had excellent to good results.

Table – I - Sarminto's modification of lind storm criteria

Loss of Radial inclination (degree)	No of Patients (%)	Results
< 5	13 (65%)	Excellent
5-9	5 (25%)	Good
10-14	2 (10%)	Fair
>14	0	Poor

Table -2- Scoring System (Gartland & Werley (G &C) Score

G & W Score	Number of Patients	Percentage
Excellent 0-2	17	85%
Good 3-8	2	10%
Fair 9-20	1	5%
Poor >20	0	0
Total	20	100%

Table - 3 - Clinical outcome

	Palmar flexion	Dorsi flexion	Pronation	Supination	Radial deviation	Ulnar deviation
Average	73.6 (74)	83.7 (84)	80.1 (80)	85	9.6 (10)	25

Table -4 - Radiological outcome

	Palmar Tilt	Radial length	Radial inclination
Average	7.4 (7)	10.3(10)	19.5 (19)

More than 60% patients had excellent to good result with regard to loss of palmar tilt less than 6 degrees. There were 6 patients showing loss of palmar tilt up to 14 degrees & had fair outcome. It could be due to dorsal comminution & dorsal collapse on subsequent follow up.

Average palmar tilt at final follow up was around 7 degrees.

More than 90% of the patient had

excellent to good outcome based on Gartland and Werley score. Among them one patient had fair outcome. Patient was low demand patient.

We observed at ulnar styloid prominence in one patient (5%), residual dorsal tilt in one patient (5%), reflex sympathetic dystrophy in 1 patient (5%) & hard grip weakness in one patient (5%).



Preoperative X-ray



Postoperative X-ray

Discussion

Chung et al⁹ hypothesized demographical & population based incidence of internal fixation of distal end radius in on disposal. Patients consulted first to hand surgeons are more likely to be treated by internal fixation. We have included 20 patients among them 12 were male & 8 were females with an average of 37 years (20 to 50 years) having volar barton fractures of radius treated with volar locking plate from 2017 to 2018 in our institute.

We observed mean age in our study was 37 years. In a study by Keny Kwan et al¹⁰ mean age was 51 years. In a study conducted by Keny and Kwan et al¹⁰ mean supination & pronation were 86 and 80 degrees respectively, we observed clinically 85 degree supination 80 degrees pronation. We have small sample size compared to this study which has sample size of 75 patients. Radial and ulnar deviations are 10 and 25 degrees in our study while 23 and 37 degrees respectively in Denju Osada et al¹⁴ series.

In our study radiological outcome are within acceptable criteria. Clinical outcome in view of wrist range of motion and grip strength are also satisfactory.

The total functional result on basis of Gartland and Werley score was 85% of excellent and 10% of good out come on final follow up at approximately 6 month of follow up.

The primary goal in treatment of articular fractures of distal radius is to achieve proper reconstruction of the disrupted anatomy and expedite return of hand function without complications. Volar plating is considered superior in clinical, radiological and surgical outcome of patients compared to dorsal plating in majority of distal end articular

radius fractures. Palmar flexion in our study mean 74 degree achieved while in Denju Osada et al¹⁴, 66 degree achieved. Mean dorsal flexion was 75 degrees in study conducted by Denju Osada et al¹⁴ while we achieved mean 84 degrees of dorsal flexion of wrist.

Anatomical reduction of the palmar cortex may avoid the shortening of the radius which is important to its restoration. Plate requires bending according to AO principle of fractures reduction despite of relatively flat volar surface compared to dorsal distal radius^{11, 13, 14}.

Subky et al¹² biomechanical study indicates volar fixation of unstable distal radius fractures with a fixed angle devise is a reliable means of stabilization.

In order to achieve reproducibly good results, some aspects of surgical technique are very important. The distal locking screws have to be placed as close to the articular surface as possible. These screws act as a rake, maintaining reduction. Some oblique intra operative views are recommended to precisely assess screws tips penetration and trajectory.¹¹

We have come across some of the complications, one patient having prominent ulnar styloid & radial deviation of the wrist and one patient having residual dorsal tilt. One patient developed RSD and one patient had hand grip weakness.

We achieved Gartland & Werley score excellent result in 85% and good result in 10% of patients. Denju osada et al¹⁴ and keny kwan et al¹⁰ demonstrated 96% and 91% excellent results respectively.

Conclusion

- (1) Meticulous anatomical reduction of distal end intra articular radius fractures

managed with volar locking plate is promising and proven technique. Screws penetration inside joint and dorsal cortex can be avoided.

- (2) Volar plating has its own drawbacks but is less compared to other modality of treatments.
- (3) Flexor as well as extender tendons are safeguarded by meticulous volar approach and by learning plate fixation technique.

Reference

1. E. Skouras, Y. Hosseini, V. Berger, K. Wegmann, T. C. Koslowsky, Operative treatment and outcome of unstable distal radius fractures using palmar T plate at a non specialized institute, *Strat Trauma Recon.* 2013;8:155- 160.
2. Fractures of distal radius ulna, Rockwoods and Green's fractures in adults.
3. Joideep Phadnis, Alex Trompeter, Kirren Gallagher, Lucy Bradshaw, David S Elliott, Kevin Newman, Mid term functional outcome after the internal fixation of distal radius fractures. *Journal of Orthopedics Surgery and Research.* 2012;7:4
4. K Mader, D Pennig, The Treatment Of Severely Comminuted intra articular fractures of distal radius, *Strat Trauma Limb Recon.* 2006;1:2-17.
5. K K Wong, K W Chan, T K Kwok, K H Mak. Volar fixation of dorsally displaced distal radius fractures using locking compression plate, *Journal of Orthopedics Surgery.* 2005;13(2):153-157.
6. Michele Rampoldi, Dante Palombi, Dontella Tagliente, Distal Radius Fractures with Diaphyseal Involvement: Fixation With fixed

- Angle Volar Plate. J Orthopaed T Raumatol. 2011;12:137-143.
7. Jorge Orbay. Volar plate fixation of distal radius fractures. Hand clinics. 2005;21:347-354.
8. Jesse b. Jupiter, M. Marent Huber and LCP study group, Operation management of Distal Radial fractures with 2.4 mm locking plates. A multicenter prospective case series. J Bone Joint Surg Am. 2009;91:55-65.
9. Kevin C Chung, Melissa J Shauver, Huiying Yin, H Myra Kim, Onur Baser, John D Birkmeyer, Variation in the use of internal fixation of distal radius fracture in united states population. J Bone Joint Surg Am. 2011;93:2154- 2162.
10. Kenny Kwan, Tak Wing Lau, Frankie Leung. Operative treatment of distal radius fractures with locking plate system- A Prospective study. International Orthopedics (SICOT). 2011;35:389-394.
11. H. Drobetz. E. Kutscha-Lissberg, Osteosynthesis of distal radius fractures with a volar locking plate and screw fixation. International Orthopedics (SCIOT). 2003;27:1- 6.
12. Kareem Sobky, Todd Baldini, Kenneth Thomas, Joel Bach, Allison Williams. Jennifer Moriatis Wolf, BIO mechanical Comparison of different Volar Fracture Fixation plates for distal radius fracture. HAND. 2008;3:96-101.
13. Hanae Minegishi, Osamu Dohi, Soukan An, and Hidetsugu Sato, Treatment of unstable distal radius fractures with the volar locking plate. Ups J Med Sci. 2011;116(4):280–284.
14. Denju Osada, Shuzo Kamei, Koichiro Masuzaki, Morimitsu Takai, Masahiro Kameda, Kazuya Tamai, Prospective study of distal radius fracture treated with volar locking plate. Journal of Hand Surgery. 2008;v33A.