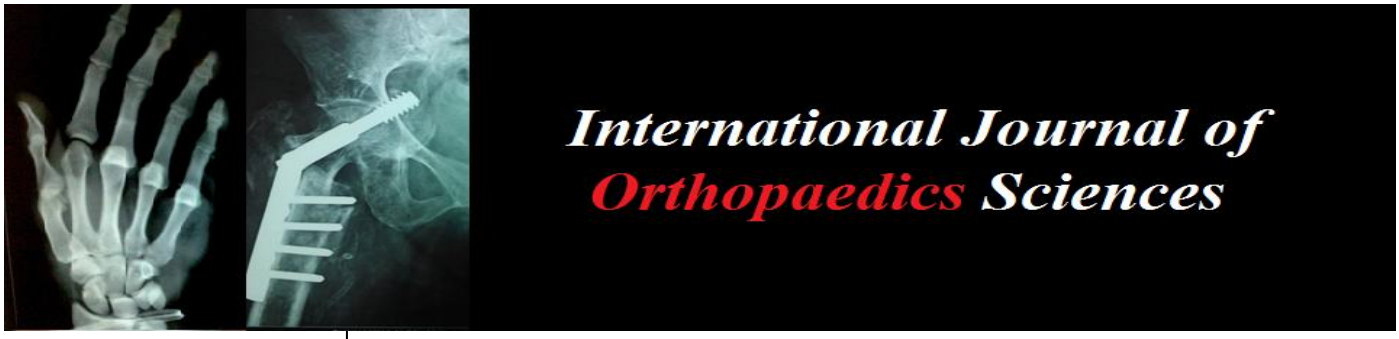

E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2021; 7(4): 710-714

www.orthopaper.com
Received: 29-06-2021
Accepted: 03-08-2021

Dr. Pawan Kumar
Associate Professor (Ortho), Hazaribag Medical College, Hazaribag, Jharkhand, India

Dr. Shashi Dinakar Minj
Associate Professor (Anaesthesia), Hazaribag Medical College, Hazaribag, Jharkhand, India

Dr. Mritunjay Kumar
Senior Resident (Ortho), Hazaribag Medical College, Hazaribag, Jharkhand, India

Corresponding Author:
Dr. Mritunjay Kumar
Senior Resident (Ortho), Hazaribag Medical College, Hazaribag, Jharkhand, India

Volar plating for distal radius fractures: A prospective clinical study

Dr. Pawan Kumar, Dr. Shashi Dinakar Minj and Dr. Mritunjay Kumar

DOI: https://doi.org/10.22271/ortho.2021.v7.i4j.2959

Abstract
Distal radius fractures are one of the most common type of fractures. They occur at the end of the radius bone near the wrist joint. An unstable distal radius fracture has been defined as a fracture that after an attempt at closed reduction demonstrates radiographic evidence of more than 15 of angulation in any plane, articular step off of more than 2 mm and/or radial shortening of more than 2 mm. Locked volar plating is the most common surgical procedure to treat distal radius fractures. The extended flexor carpi radial is (FCR) approach/Henry approach continues to be an excellent method for treating distal radius fracture surgically. Volar plating offers biomechanically stable fixation, allows early rehabilitation and enables treatment of the comminuted or osteopenia bone. Aim of the study is to investigate correlation between radiological and clinical outcome in patients of displaced distal radius fractures with volar intraarticular component stabilized by volar locking plate. Material and methods: Total 25 patients of distal radius fractures with ventral intraarticular component were studied in SB Medical College, Hazaribag from August 2019 to September 2021.12 male patients and 13 female patients were present. The age varied from 28-75 years (mean age 58 years). The cases were followed up clinically and radiologically with a mean follow up of 18 months. Outcome was assessed using pain, range of motion (ROM) and grip strength parameters. The immediate post-operative and final checkup radiography were scrutinized for alignment and intra-articular step off. No significant differences could be found between an unacceptable (>2mm) and acceptable (<2mm) ulnar variance in respect of pain, ROM, grip strength and patient reported outcome measurements. Conclusion: Stabilization of DRF by volar locking pate is a safe form of treatment and results in a good clinical and radiological outcome with low complication rate.

Keywords: Distal Radius fracture, ventral intra-articular component, osteosynthesis, volar locking plate

Introduction
Distal radius fractures with ventral intra-articular component are one of the most common fractures [1]. Distal radius fractures account for 8-17% of all extremity fractures, 44% of all types of hand and forearm fractures [2], 20% of all fractures and 1/6th of all the fractures treated in emergency around the world [3].

Materials and Methods
The study was conducted in SB Medical College, Hazaribag from the month of September 2019 to October 2021. Total 25 patients of unstable distal radius fractures with ventral intraarticular component were operated with volar locking plate and screws. The age varied from 28-75 years (mean age 58 years). The cases followed up clinically and radiologically with a mean follow up of 18 months. Ideal time for the surgery is within 1 week of injury, although this implant can be used in a patient even after malunion of the fracture after other forms of the managements. In our series, timing of surgery was 1-2 weeks. Mode of injury mainly fall on outstretched hand, followed by road traffic accident. (Preop photograph-Fig: 1).
Technique: Under Brachial anaesthesia, Tourniquet applied. The time of the tourniquet was 46 minutes in average (40-55 minutes). 8-10cm long incision made over distal wrist focusing FCR with a radially deviated incision at the wrist flexion crease. Incision continued distally to FCR tendon sheath protecting the superficial branch of radial artery. The incision made distally to the trapezoidal ridge protecting the palmar cutaneous branch of the median nerve. The incision continued distally cutting a leaflet of the transverse carpal ligament as well as

developing the space of Parona. Perforators to FPL coagulated and FPL retracted vulgarly. The watershed line is identified by palpating lunate fossa over the pronator quadrat us. The PQ is then elevated in an L-shaped vulgarly based flap from lateral side. Fracture segment exposed and reduced while supinating the proximal fragment and providing manual longitudinal traction. Plate placed 2mm proximal to the watershed line while maintaining the fracture reduction. Provisional fixation obtained with a bicortical no locking screw into the radial shaft while maintaining reduction. Use K wires through the proximal ulnar hole of the lunate head and proximal radial hole of the scaphoid head to the scaphoid and lunate fossa. Drill and fill the remaining proximal shaft and distal screws to complete the fixation. Reduction and screw length confirmed with AP, lateral, oblique and 10^{o} lateral view by fluoroscopy under Carm image intensifier (Peroperative C arm Figs. 2 and 3). Closure done in layers. B/E slab applied for 4 weeks. Limb elevated and finger movement started.

Fig 1: Preoperative x ray

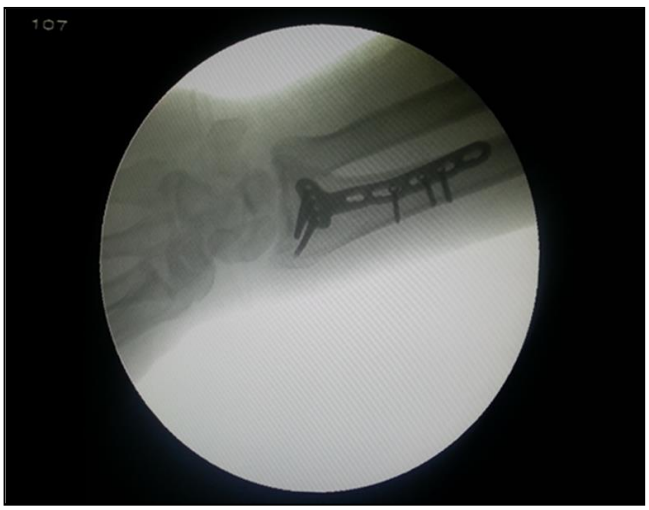

Fig 2: Peroperative C arm photograph

Fig 3: Peroperative C arm photograph

Follow-up

Immediate postop X ray taken (Fig 4). Follow up every 4 weeks, 8 weeks (Fig 5), 3 months, and 12 months (Fig 6) and after 18 months. (Follow up photographs 7 and 8). There was no case to be lost. Fracture united at an average of 12 weeks (Range 10-18 weeks) as determined by clinical examination and follow up radiographs.

Fig 4: Immediate Postop x ray

Fig 5: X Ray after 2 months

Fig 6: X Ray after 12 months

Observation and results: This study consisted of 25 cases of closed displaced fractures of distal radius with ventral intraarticular component. Cole's, smith and dorsal burtons fractures were excluded from the study. Each fracture was evaluated according to the AO Classification. Good functional result depends on the anatomical restoration of the articular surface and extra articular alignment. Our experience suggests that ulnar variance and volar tilt are the most important radiographic parameters to be restored to obtain good functional outcome in distal radius fractures. Small variations of other radiographic parameters seem not to affect the final outcome at minimum 18 months follow up. The standard lateral view of the wrist failed to detect all the screw penetrations. The dorsal tangential view increased the accuracy of detecting screw penetrations on the floor of the third dorsal compartment, whereas oblique view required detecting screw penetrations on the floor of the second and fourth dorsal compartments.

At the follow up of the sixth month, the radiographic parameters were as follows: volar tilt (9.45± 2.18)˚, radial inclination (24.61±3.86)˚, radial height (10.73±4.01) mm and ulnar variance (0.4±1.2)mm. At the follow up of the twelfth month, the degrees of wrist motion were as follows: Flexion 64.63±7.46; extension 61.91±7.44; radial deviation 17.30±3.52; ulnar deviation 21.79±4.01; pronation 74.36±8.91 and supination 77.43±8.04. The grip strength was 21.50±5.03kg. The scores assessed at the same time were DASH 13.09±7.43 and PRWE (pt. related wrist evaluation) 12.55±11.41. At the last follow up at 18 months, the average pain was 1.13(0-8). The quick DASH was 13.3 in average (0.86). The grip strength was at 80% in average (18-360%). The flexion of the wrist was 87% on average (0-133%). The extension of the wrist was 89% on average (25-133%). The ulnar deviation was at 92% on average (25-150%). The radial deviation was at 96% on average (0-167%). The pronation was at 96% on average (40-133%). The supination was at 93% on average (13-130%).

Discussion

During daily work, a phenomenon was observed that patients with distal radius fractures inherently had thick soft tissue but a thin radius in the wrist; the range of motion in flexion and extension after volar plating seemed better than others. After injury, the soft tissue surrounding the wrist gets swollen. We used STCTBC (Soft tissue circumference to bone circumference) to indicate the surrounding space between the skin surface and the bone surface at the watershed line in the distal radius[4].It is hypothesized that it has some relation with the range of motion of the wrist. So the ratio of STCTBC at the watershed line in the distal radius represents the patients inherent space between the bone surface and the skin in the distal radius without the impact of posttraumatic edema. A greater ratio means inherently larger space of the patients between the bone surface and the skin. This provides more effective buffer to avoid the damage to the wrist flexors and extensors. At the same time, larger space between the bone surface and the skin may further benefit the movement of the tendons and be more capable to avoid the impact between the tendon and the hardware.

Several factors predict the outcome of the volar plating system for the distal radius fractures. Age, AO Classification, distal radioulnar joint injury, ulnar styloid fracture and initial displacement are predictive of reduction loss. Acknowledging this fact that these factors are predictive, it can aid in early decision making as to the method of treatment [5]. Age, sex and size of dorsal cortex comminution can be used to predict the late dorsal tilt angulation of dorsal articular surface of radius at the end of immobilization [6]. Flexor pollicis longus tendon rupture is a common complication leading to the worst functional outcome after volar locked plating from distal radius fractures. Selvan DR, *et al.* [7] found that the risk of FPL tendon rupture decreased if the radial tilt was close to normal values after fracture reduction and the closer the distal end of the plate is to the joint, the risk of FPL tendon rupture increased. Lutz M, *et al.* [8] also reported that plate position is

associated with attritional flexor tendon rupture following DRF with Volar locking plate. The rupture risk increased when plate prominence was greater than 2.0 mm volar to the critical care or plate position was within 3 mm of the volar rim.

We failed to discover any relationship between the ratio and the other outcomes, pronation, supination, radial deviation, ulnar deviation, grip strength, DASH Scores. When we perform the volar plate surgery, we put nothing in the radial or ulnar side and even we didn't strip the soft tissue of both lateral sides. The hardware mainly occupies the palmar space and sometimes tip of the screws occupy the dorsal space. Grip strength mainly depends on the muscle strength and many items of the DASH evaluation have much to do with the function of the shoulder and elbow joint [9]. Volar plate shouldn't be too distal, as it would lead into the joint. It shouldn't be too proximal as it wouldn't support the subchondral bone. The plate placed too radial tilts on volar radial tuberosity and become palpable [10].

However this study is just explanatory and does have many limitations. Lack of comparison to the opposite wrist caused that we didn't know the range of motion first and also the differences in strength between the dominant and non-dominant hands [11]. Methodological improvements are deeply required to make the value as true as possible. Further subtle studies with comparison to the opposite wrist are absolutely needed to provide guidelines for the surgeon regarding either the indication for the surgery or the technique of volar plating. Volar plating has its own drawbacks; such as large soft tissue dissection, tendons damage, median nerve injury, hardware complications and pain which compromise the clinical results directly or indirectly [12].

Complications

The literature reporting complications of volar plate fixation is limited primarily to case reports and small case series. There can be potential soft tissue, neurovascular and osseous complications, such as extensor tendon and flexor tendon injury, flexor pollicis rupture, carpal tunnel syndrome, complex regional pain syndrome, and loss of reduction, as well as hardware failure. Increased awareness of potential complications may lead to more prompt recognition and treatment when they do arise. In our series, one case of infection, three cases of complex regional pain syndrome and two cases of paraesthesia in median nerve territory. There was no case of tendon rupture. Hardware removal was done in one case using a similar minimally invasive procedure.

Fig 7: Follow up photograph

Fig 8: Follow up photograph

Conclusion

Stabilization of distal radius fractures by volar locking pate is a safe form of treatment and results in a good clinical and radiological outcome with low complication rate. Volar plate fixation for displaced distal radius fractures using a minimally invasive FCR/Henry approach seems reliable, reproducible with few complications. Preservation of ligamentotaxis facilitates fracture reduction and the small size of incision improves the cosmetic results of the procedure. It is always possible to convert the incision to a more extensive approach in case of a difficult reduction.

References

1. Chung KC, Spilson SV. The frequency and epidemiology of hand and forearm fractures in the United States. J Hand Surg. Am. 2001;26(5);908-15.
2. Grafmans WC, Ooms ME, Bezemer PD, Bouter LM, Lips P. Different risk profiles for hip fractures and distal forearm fractures: A prospective study. Osteoporosis Int. 1996;6(6):427-31
3. Cooper EO, Segalman KA, Parks BG, Sharma KM, Nguyen A. Biomechanical stability of a volar locking-screw plate versus fragment specific fixation in a distal radius fracture model. Am J Orthop (Belle Mead NJ). 2007;36(4):E46-9.
4. Matullo KS, Dennison DG. Outcone following distally locked volar plating for distal radius fractures with metadiaphyseal involvement. Hand (NY). 2015;10(2):202-6.
5. Myderrizi N. Factors predicting late collapse of distal radius fractures. Malays Orthop. J. 2011;15:2.
6. Hudak PL, Amadio PC, Bombardier C. Development of an upper extremity outcome measure: The DASH (Disabilities of the arm, shoulder and hand). The upper extremity collaborative group. (UEIG) Am J Int. Med. 1996;29(6):602-8.
7. Selvan DR, Perry D, Machin DG, Brown DJ. The role of postoperative radiographs in predicting risk of flexor pollicis longus rupture after volar plate fixation of distal radius fractures - A case control study Injury. 1885;45(12):8.
8. Lutz M, Arora R, Krappinger D, Wambacher M, Riagh M, Pechlaner S. Arthritis predicting factors in distal intraarticular radius fractures. Arch. Orthop Trauma Surg. 2011;131(8):1121-6.
9. Wilche MKT, Abbaszadegan H, Adolphson PY. Wrist function recovers more rapidly after volar locked plating than after external fixation but the outcomes are similar

after 1 year. Acta Orthop. 2011;82(1):76-81.
10. Williksen JH, Husby T, Hellund JC, Kvernmo HD, Rosales C, Frihagen F. External fixation and adjuvant pins versus locking plate fixation in unstable distal radius fractures: A randomized, controlled study with a 5 year follow up. J Hand Surg. Am. 2005;40(7):1333-40.
11. Kandemir U, Matityahu A, Desai R, Puttlitz C, Does a volar locking plate provide equivalent stability as a dorsal no locking plate in a dorsally communited distal radius fractures?. A biomechanical study. J Orthop. Trauma. 2008;22(9):605-10.
12. Jeudy J, Sleiger V, Boyer P, Cronier P, Bizot P, Massin P. Treatment of complex fractures of the distal radius: A prospective randomized comparison of external fixation 'versus' locked volar injury. 2012;43(2):174-79.