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ORTHOPAEDICS

Evaluation of Volar Plating as A Treatment Modality for Distal End Radius Fractures

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ABSTRACT

Background and Aims:
Fractures of lower end radius are most common fractures of the upper extremity, encountered in practice and constitute 17 % of all fractures and 75% of all forearm fractures[1]. Open reduction and volar plating ensures more consistent correction of displacement and maintenance of reduction, this study evaluates the anatomical and functional outcome and complications of open reduction and plate fixation in the management of fracture distal end radius in thirty patients.

Material and Methods:
This is a retrospective and prospective study carried out on the patients with fractures of the distal end radius. Thirty patients with fractures of the distal radius were included in the study. Radiographic evaluation of the affected & the normal side was done at the time of injury. Fractures were classified as according to the AO Classification. The standard volar approach was undertaken to fix the fragments. The patients were followed up for minimum of 1 year. results were graded according to the Sarmiento's modification of Lind Strom Criteria[2] and demerit point system of Gartland and Werley with Sarmiento et al's modification

Results:
Anatomically 24 patients (80%) had excellent restoration of anatomy, 4 patients (13%) had good restoration and 2 had fair (7%) restoration of anatomy. Thus 93% patients had excellent to good alignment of fragments.
Functionally 22 patients (73%) had excellent, 5 good (17%) and 3 patients had fair (10%) restoration of functions. Poor function correlated with residual displacement and poor patient compliance.

Conclusion:
93% anatomical and 90% functional, excellent to good results, suggests that stabilizing the fracture fragments with volar plate and screws in the management of the fractures of distal radius, is an effective method to maintain the reduction till union and prevent collapse of the fracture fragments, even when the fracture is grossly comminuted/intra-articular/unstable and/or the bone is osteoporosed

KEYWORDS : fractures of lower end of radius, volar plating

INTRODUCTION:

Fractures of lower end radius are most common fractures of the upper extremity, encountered in practice and constitute 17 % of all fractures and 75% of all forearm fractures.

Close reduction and cast immobilization has been the mainstay of treatment of these fractures but malunion of fracture and subluxation /dislocation of distal radioulnar joint resulting in poor functional and cosmetic results is the usual outcome [3]. The residual deformity of wrist adversely affects wrist motion and hand function by interfering with the mechanical advantage of the extrinsic hand musculature [4].

Open reduction and volar plating ensures more consistent correction of displacement and maintenance of reduction. Campbell DA (2000) and Kamano M (2002)[5] reported a high rate of complications with dorsal plate placement such as tendon adherence, joint stiffness, and risk of extensor tendon irritation or even rupture. A volar plate placement through a flexor carpi radialis approach affords a soft tissue layer between the skin and the plate that may have greater depth than a dorsal approach. The rationale for volar exposure and volar plate fixation is that in most high- energy distal end radius fractures there is substantial comminution of the dorsal articular rim of the radius making it difficult to fully visualize the articular surface and reduce it anatomically and maintain it.

Volar plates fall into four functional categories: buttress plates (with or without distal screws), blade plates, fixed-angled locking plates, and poly-axial locking plates.

The rate of complications of volar locking plates varies from 8% to 32%.[6].

The most common complications are infection, extensor tendon irritation or rupture, placement of distal screws in the radiocarpal joints, irritation or rupture of flexor tendons, palpable prominent hardware volarly.

MATERIALAND METHODS:

Thirty patients with fractures of the distal radius were included.
The exclusion criteria were -

- Patients with comorbid conditions preventing surgical intervention
- Patients with more than 3 weeks duration of injury
- Patients with immature skeleton
- Patients with local tissue condition making the surgery inadvisable

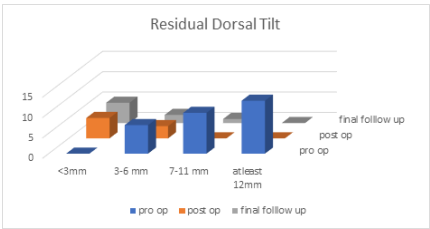
All the patients were subjected to clinical examination. Radiographic evaluation of the affected & the normal side was done at the time of injury with the antero-posterior and lateral views. The radiographs were assessed in terms of loss of palmar tilt or presence of dorsal tilt, radial shortening and loss of radial inclination. Fractures were classified as according to the AO Classification into type A (extra-articular), type B (partial articular) or type C (complete articular). After pre-anaesthetic evaluation patients were taken up for surgery.

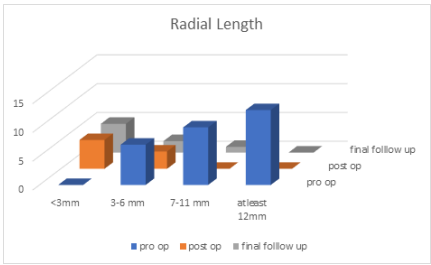
All procedures were performed under general or regional anaesthesia. Our standard practice was preoperative prophylactic intravenous cefoperazone & sulbactam combination and usage of tourniquet and bipolar diathermy for homeostasis. The standard volar approach was undertaken to fix the fragments. In cases initially approaching the radial styloid fragment, dissection between the flexor carpi radialis tendon and radial artery were used. For the die-punch volar fragment, dissection between the median nerve and flexor carpi radialis tendon was used. The distal and radial borders of pronator quadratus were lifted and retracted ulnarly. Open reduction was performed with the aid of intrafocal leverage, traction by an assistant, and provisional fixation by temporary Kirschner wires followed by definitive volar buttress or locking plate and screws. Image intensifier was used in theatre to assist the evaluation of fracture reduction and fixation. Postoperatively radiographs were taken, the limb was kept elevated in above elbow plaster slab, active finger and shoulder exercises were started at the earliest possible. Parenteral antibiotics were continued for two days postoperatively followed by oral antibiotics. The plaster slab was removed usually after 7 days, crepe bandage applied and active

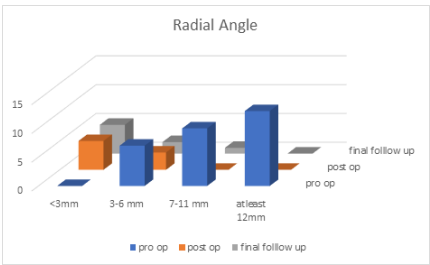
exercises of wrist, elbow and shoulder were started. The patients were followed up for minimum of 1 year. Clinical, radiological and functional reviews were performed at periodic intervals

RESULTS:

Radiological assessment was done in terms of residual dorsal angulation, radial shortening and loss of radial inclination and the results were graded according to the *Sarmiento's modification of Lind Strom Criteria*[2]. Functional evaluation of the patients was done at the last follow up according to the *demerit point system of Gartland and Werleywith Sarmiento et al's modification*







ANATOMICAL SCORE OF HEALED FRACTURE:

Anatomically 24 patients (80%) had excellent restoration of anatomy, 4 patients (13%) had good restoration and 2 had fair (7%) restoration of anatomy. Thus 93% patients had excellent to good alignment of fragments and good reduction could not be achieved in 7% patients resulting in fair or poor results.

FUNCTIONAL RESULT OF HEALED FRACTURE:

Functionally 22 patients (73%) had excellent, 5 good (17%) and 3 patients had fair (10%) restoration of functions. Poor function correlated with residual displacement and poor patient compliance.

DISCUSSION:

There are a number of methods to treat distal radius fractures such as closed reduction, cast application, percutaneous pin fixation, external fixation and open reduction and internal fixation.

Closed reduction relies on the principle of ligamentotaxis to reduce fracture fragments. No control can be expected for depressed articular fragments that lack ligament attachment. Jones (1915)[7] suggested a manipulative method of reduction, involving increasing the deformity, applying traction and placing the hand and wrist in reduced position. Bohler (1929)[8] described passive assisted gravity method of reduction. Connolly (1995)[9] reduced the fractures by reversing the original mechanism of injury.

Traditional casting technique was given by Charnley et al (1950)[10], that uses three pressure areas, giving three point moulding by placing a pressure dorsally over the dorsal fragment, volarlly and dorsally over the mid forearm and palmarly over the distal aspect of proximal fragment. Sarmiento and associates (1975)[11] recommended immobilization of forearm in supination, when there is associated involvement of the distal radioulnar joint, so as to hold the joint in the reduced position.

The ideal forearm position, duration of immobilization, and need for a long or a short arm cast remains controversial; no prospective study has demonstrated the superiority of one method over another. The final results are primarily determined by the original displacement and final reduction.

Percutaneous pinning techniques are an attempt to bridge the therapeutic gap between external fixators. Lambotte in 1908[12] suggested single pin placement through the radial styloid as a means of stabilizing the distal radius fracture. Kapandji in 1976 [13]first described two pin intrafocal pinning. John M. Rayhack in 1989 and again in 1991 [14] reported the technique of ulnar- radial pinning with fixation of the distal radio-ulnar joint following reduction by ligamentotaxis and manual manipulation of the distal fragment. This technique does not apply to Smith fracture with volar comminution.

External fixator usage was described by Anderson and O'Niel (1944)[15] using the principle of ligamentotaxis.

Agee (1993)[16] found that palmar translation of the hand is necessary to restore palmar tilt Surgical treatment (plating in particular) ensures more consistent correction of displacement and maintenance of reduction due to direct visualization. The choice of surgical technique for reduction and fixation depends on fracture displacement, joint surface involvement, patient age, bone quality, handedness, occupation, and avocation.

Campbell DA (2000) and Kamano M (2002)[5] reported a high rate of complications with dorsal plate placement such as tendon adherence, joint stiffness, and risk of extensor tendon irritation or even rupture. With the advent of new fixed-angle screw-plate designs, volar fixation should be the standard approach for distal radius fractures with joint congruity. A volar plate placement through a flexor carpi radialis approach affords a soft tissue layer between the skin and the plate that may have greater depth than a dorsal approach. The rationale for volar exposure and volar plate fixation is that in most high- energy distal end radius fractures there is substantial comminution of the dorsal articular rim of the radius making it difficult to fully visualize the articular surface and reduce it anatomically and maintain it.

Rozental T (2006)[17] reported that volar plating is not immune to the extensor tendon complications that affect dorsal plates. The complications of volar plates such as irritation of the flexor carpi radialis and flexor pollicis longus tendon by the plate itself as well as dorsal tendon irritation from screw prominence have been reported. The rate of complications of volar locking plates varies from 8% to 32%.[6]

CONCLUSION:

93% anatomical and 90% functional, excellent to good results, in our study means that stabilizing the fracture fragments with volar plate and screws in the management of the fractures of distal radius, is an effective method to maintain the reduction till union and prevent collapse of the fracture fragments, even when the fracture is grossly comminuted/intra-articular/unstable and/or the bone is osteoporosed. The technique shows that open reduction and internal fixation with volar plating has excellent functional outcome with minimal complications thus proving that it can be the prime modality of treatment for distal radius fractures. The procedure is applicable for AO types A, B and C fractures of the distal radius, in young patients with a good bone stock as well as in elderly osteoporotic patients.

References:

1. Colles A. On the fracture of the carpal extremity of the radius. Edinburgh Med Surg 1814;10:182–6.
2. Sarmiento A, Pratt GAW, Berry NC, Sinclair WF: Colles" fractures: Functional Bracing in supination. J Bone Joint Surg 1975;57A:311-317
3. Bacorn RW, Kurtzke JF: Colles' Fracture: A study of two thousand cases from the New York states Compensation Board. J Bone Joint Surg 1953; 35A: 643- 658.
4. Fernandez DL: Correction of posttraumatic wrist deformity in adults by osteotomy, bone grafting and internal fixation. J Bone Joint Surg 1982;64A:1164 – 1178
5. Kamano M, Honda Y, Kazuki K, et al. Palmar plating for dorsally displaced fractures of the distal radius. Clin Orthop Relat Res 2002;397:403–8.
6. Chung KC, Watt AJ, Kotsis SV et al. Treatment of unstable distal radial fractures with the volar locking plating system. J Bone Joint Surg Am 2006; 88 2687-2694
7. Jones R (ed): Injuries of joints. London, England, Henry Frowde & Hodder & Stoughon, 1915, p 110
8. Bohler L (ed): The Treatment of Fractures. Vienna, Austria, W Maudrich,1929.
9. Connoly J. Fractures and Dislocations. Closed Management. Philadelphia: WB Saunders, 1995
10. Charnley J. The mechanics of conservative treatment. In: The closed treatment of common fractures. London: Greenwich Medical Media; 2003. p. 43–59.
11. Sarmiento A, Pratt GAW, Berry NC, Sinclair WF: Colles" fractures: Functional Bracing

in supination. J Bone Joint Surg 1975;57A:311-317
12. Castaing J: Recent fractures of the inferior extremity of the radius in the adult (French). Rev Chir Orthop 50:582-696, 1964
13. Kapandji A: Bone fixation by double percutaneous pinning. Functional treatment of non-articular fractures of the distal radius [French]. Ann Chir Main 30:903-908,1976
14. Rayhack J, Langworthy J, Belsole R: Transulnar percutaneous pinning of displaced distal radial articular fractures. Presented at the American Society for surgery of the Hand Annual meeting. Orlando, FL, October 3,1991
15. Anderson R, O'Niel G: Comminuted fractures of the distal end radius. Surg Gynecol Obstet 1944; 78: 434-440.
16. Agee JM: External Fixation: Technical advances based upon multiplanar ligamentotaxis. Orhop Clin North Am 1993;24:265-274
17. Rozental T, Blazar P. Functional outcome and complications after volar plating for dorsally displaced, unstable fractures of the distal radius. J Hand Surg [Am] 2006;31(3):359–65