Early Functional Results after Volar Fixed-Angle Plating of Distal Radius Fractures

A. Todor, A. Pojar, C. Arghius, and D. Lucaciu

"Iuliu Hatieganu" University of Medicine and Pharmacy, Orthopedic and Traumatology Clinic, Cluj-Napoca, Romania

Abstract— **Aim of the study was to evaluate the short term results and rehabilitation period after distal radius fractures treated with a volar locking plate and screws. 10 patients with unstable fractures of the distal radius were included in the study. Radiological and functional results were evaluated at 2 and 6 weeks postoperatively which showed no redisplacement of the fracture and faster rehabilitation than with other methods of treatment.**

Keywords— **distal radius fracture, volar plating, functional results.**

I. Introduction

Distal radius fractures are very common injuries and represent about one sixth of all fractures seen in the emergency department [1]. While many of these fractures can be successfully managed nonoperatively, some require surgical stabilization. Debate continues as to the optimal treatment modality of unstable fractures, both intra and extraarticular [2]. Some of the most popular stabilization techniques used to be external fixation [3, 4], pinning [2, 3], dorsal plating or a combination of these [2]. External fixation devices are uncomfortable, need to be kept in place for 6 to 8 weeks and some fracture redisplacement often occurs after the fixation device has been removed [4, 5]. Percutaneous pinning is unsuitable for displaced intraarticular fractures and has less stability in osteoporotic bone [6]. Dorsal plates have the risk of extensor tendons irritation and need to be removed on a regular basis. Volar locking plates are a relatively new concept and are being widely used in the surgical treatment of distal radius fractures [3]. The volar approach is more physiological than dorsal approach and is less disruptive to the tendons because there is more space available on the volar aspect of the radius [7]. Volar approach also maintains dorsal vascularity of the fragments thus allowing early motion of the wrist joint. The plates are well covered by soft tissues in the pronator fossa and implants are not removed routinely. We started using this technique for treatment of distal radius fractures that require surgery and present our early results.

II. Materials and methods

From August 2010 to January 2011 we included in the study 10 patients with unstable unilateral distal radius fractures. We define an unstable fracture when redisplacement occurs after initial reduction and cast immobilization or if, after closed reduction, displacement still exists and is greater than 15° angulation in any plane, 2 mm of articular step-off, or greater than 2 mm of shortening [9]. . Written informed consent was obtained from each patient prior to enrollment in the study There were 7 women and 3 men with a mean age of 58 years (33 - 71). 7 fractures were extraarticular, Colles type, and 3 had intraarticular involvement. All patients were operated in regional anesthesia (plexus block). We used the extended flexor carpi radialis (FCR) approach as described by Orbay et al. [10]. The skin incision is made directly over the course of the FCR tendon and is about 8 cm long. Over the wrist flexion creases, the incision is made in a zigzag fashion (Fig. 1).

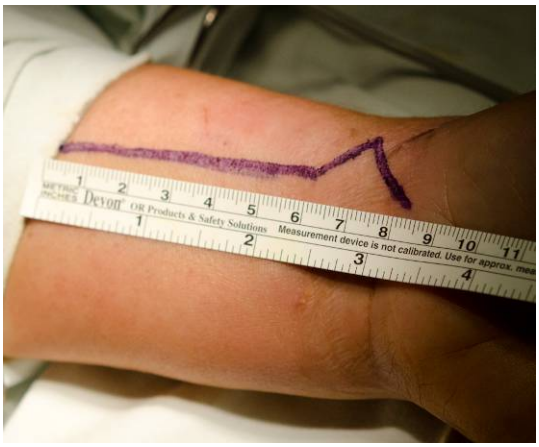

Fig. 1 Skin incision over the FCR tendon and zigzag over the wrist flexion creases

The FCR tendon is retracted medially, protecting the median nerve and the radial artery is retracted laterally. The floor of the tendon sheath is then incised to gain deep access. Distally, the dissection is taken to the level of the scaphoid tuberosity. The virtual space between the flexor

S. Vlad and R.V. Ciupa (Eds.): MEDITECH 2011, IFMBE Proceedings 36, pp. 392–395, 2011.
www.springerlink.com

tendons and the volar surface of the pronator quadratus, the space of Parona, is developed by blunt digital dissection. The pronator quadratus is mobilized with an L-shaped incision along the radial and distal sides and is lifted from its bed by subperiosteal dissection and retracted ulnarly, exposing the fracture site. The extended FCR approach has three steps more than the standard FCR approach. These are represented by the release of the radial septum with opening of the extensor compartment and releasing the insertion of the brachioradialis, pronating the proximal radial fragment out of the way and reduction of the articular fragments by intrafocal manipulation. The release of the brachioradialis is important as this is the primary deforming force of the distal fragment. After fracture site debridement and reduction of the articular fragments to restore normal anatomy the radius is supinated back in place and the plate can be applied. Adequate reduction of the fracture and positioning of the plate and screws is confirmed with fluoroscopy. The screws in the distal fragment must be applied in the subchondral bone. The brachioradialis and the pronator quadratus are sutured back in place covering the plate and separating it from the flexor tendons.

We used two types of fixed angle locking plates specially designed for volar fixation of distal radius fractures (3.5 LCP locking T-plate , Synthes and ChLP System® 4,5 ChM Ltd.).

All patients were immobilized in a below elbow splint for two weeks. Immediate postoperative finger and elbow motion was encouraged. After 14 days patients were called for splint and sutures removal. At that time they were instructed to start progressive wrist motion exercises. Next visit was scheduled at 6 weeks postoperatively when range of motion was assessed and X-rays were taken.

III. Results

No complications were recorded during surgical procedures and early postoperative period. All patients were discharged 2 days after surgery. By 2 weeks finger motion was comparable to preoperative status. At the 6 weeks follow-up wrist range of motion was very good, ranging from 70% to 100% with a mean value of 84% compared to the contralateral side (Fig. 2-4). Comparing the postoperative X-rays with those taken at 6 weeks, there was no loss of reduction in any of the cases (Fig. 5-8).

With regard to pain, 3 patients had none during normal activities, 5 patients reported mild pain at peak motion of flexion and extension and 2 patients complained about moderate pain when also at peak motion of the wrist.

There were no cases of tendon irritation, or other complications like infection, reflex sympathetic dystrophy or hardware failure.

Fig. 2 Range of motion – flexion - 6 weeks after surgery

Fig. 3 Range of motion – extension – 6 weeks after surgery

Fig. 4 Range of motion – pronation – 6 weeks after surgery

Fig. 5 Postoperative AP view

Fig. 6 Postoperative lateral view

Fig. 7 6 weeks AP view

Fig. 8 6 weeks lateral view

IV. Discussions

Treatment of distal radius fractures evolved significantly over the years. Not only the final outcome is important but the time to functional recovery also matters and influences patient satisfaction.

Knox J et al. [11] showed, in a cadaveric model study, that volar plate fixation results in less displacement of intra-articular distal radius fractures with dorsal comminution compared with Kwire fixation. Also, McFadyen I et al. [2] compared volar locked plating and percutaneous pinning for distal radius fractures and found both superior functional and radiological outcomes, 3 and 6 months after surgery in the locked plate group and a significantly less complications than in the pinning group.

Other authors [4] compared functional results after volar plating and after external fixation of distal radius fractures and found that volar locked plating was advantageous in the early rehabilitation period, compared to bridging external fixation.

Other advantages are seen with volar plating in relationship with dorsal plating. Volar plating preserves vascular supply to dorsal metaphyseal fragments and does not cause extensor tendon problems [12]. On the other hand, dorsal approach is particularly beneficial for intrarticular reduction as classical volar approach doesn't permit good intraarticular visualization. This problem was resolved by Orbay JL. et al. [10] who described and popularized the extended volar approach which uses intrafocal reduction and restoration of articular congruency indirectly. Also, locked plates have the advantages of creating a rigid construct that allows the transfer of axial load across the fracture site, as implants possess a mechanical strength similar to normal bone [2]. This is particularly important in osteoporotic bone, many of these fractures involving elderly patients with osteoporosis. Orbay JL et al. [8] showed that open reduction and internal fixation with a volar fixed angle device is effective for the treatment of unstable distal radius fractures in the elderly population.

For all these reasons we started using this technique and we were pleased with the outcome and found the procedure effective. Patients demonstrated early functional use of the hand and were satisfied with the results.

References

1. Browner B, Levine A, Jupiter J, Trafton P. (2003) Skeletal Trauma. Basic Science, Management, and Reconstruction. 3rd. ed. Saunders, USA
2. McFadyen I, Field J, McCann P et al. (2011) Should unstable extra-articular distal radial fractures be treated with fixed-angle volar-locked plates or percutaneous Kirschner wires? A prospective randomised controlled trial. Injury, Int. J. Care Injured 42:162–166
3. Bentley G. (2009) European Instructional Lectures, vol. 9, 10th EFFORT Congress, Springer, Vienna, Austria
4. Wilcke MKT, Abbaszadegan H, Adolphson PY. (2011) Wrist function recovers more rapidly after volar locked plating than after external fixation but the outcomes are similar after 1 year. A randomized study of 63 patients with a dorsally displaced fracture of the distal radius. Acta Orthopaedica 82: 76–81
5. Dicpinigaitis P, Wolinsky P, Hiebert R et al. (2004) Can external fixation maintain reduction after distal radius fractures? J Trauma, 57 4: 845-850
6. Blakeney WG. (2010) Stabilization and treatment of Colles' fractures in elderly patients. Clin Interv Aging. 18:5:337-344
7. Orbay JL, Touhami A. (2006) Current Concepts in Volar Fixed-angle Fixation of Unstable Distal Radius Fractures. Clin Orthop Relat Res 445:58-67
8. Orbay JL, Fernandez DL. (2004) Volar Fixed-Angle Plate Fixation for Unstable Distal Radius Fractures in the Elderly Patient. J Hand Surg 1:96-101
9. Orbay JL, Badia A, Khoury RK, Gonzalez E, Indriago I. (2004) Volar Fixed-Angle Fixation of Distal Radius Fractures: The DVR Plate. Tech Hand Upper Extrem Surg 8(3):142–148
10. Orbay JL, Badia A, Indriago IR et al. (2001) The extended flexor carpi radialis approach: a new perspective for the distal radius fracture. Tech Hand Up Extrem Surg
11. Knox J, Ambrose H, McCallister W, Trumble T. (2007) Percutaneous Pins Versus Volar Plates for Unstable Distal Radius Fractures: A Biomechanic Study Using a Cadaver Model. J Hand Surg 6:813-817
12. Osada D, Kamei S, Masuzaki K, Takai M, Kameda M, Tamai K. (2008) Prospective Study of Distal Radius Fractures Treated With a Volar Locking Plate System. J Hand Surg 33A:691-700Smith J, Jones M Jr, Houghton L et al. (1999) Future of health insurance. N Engl J Med 965:325–329

Author: Adrian Todor
Institute: "Iuliu Haţieganu" University of Medicine and Pharmacy, Orthopedics Clinic
Street: 47 Traian Mosoiu
City: Cluj-Napoca
Country: Romania
Email: adi.todor@yahoo.com