Research Article

Neglected volar barton fracture treated by two-stage procedure

Saurabh Jain[1], Anil Kumar Jain[2], Ish Kumar Dhammi[2]

[1]Department of Orthopaedics, Mahatma Gandhi Memorial Medical College, Indore, Madhya Pradesh, India.
[2]Department of Orthopaedics, University College Medical Science and Guru Teg Bahdur Hospital, Delhi, India.
Correspondence to: Saurabh Jain, E-mail: jaindrsaurabh@yahoo.com

Received June 18, 2016. Accepted July 6, 2016

Abstract

Malunion following a neglected volar barton fracture can cause severe functional impairment owing to changes in normal anatomic and biomechanical relationships of the distal radius. These malunions, if mature can be treated by intra-articular osteotomies or the salvage procedures. But in nascent malunions, these procedures cannot be performed as the solid bony consolidation is absent and there is severe soft tissue contracture. In the present study, two-stage procedure was presented for the treatment of nascent neglected volar barton fracture presenting after 5 weeks, and treated primarily with gradual distraction and secondarily with open reduction and internal fixation with locked distal radius plate along with bone graft. Complete bony healing occurred in 6 months and Mayo wrist score improved from 31 to 85. At final follow-up after 2 years, visual and analog pain scores reduced from 68 to 11 and range of motion was 80° extension to 70° flexion along with near normal full grip strength along with mild wrist arthrosis. Surgical treatment of neglected fractures of distal radius can substantially improve wrist and hand functions, but rarely restores the limb to normal.

KEY WORDS: Neglected volar barton fracture, neglected distal radius fracture, intercarpal distraction, distal radius locking plate

Introduction

Fracture of the distal radius is one of the most common injuries, comprising 8–17% of fractures seen in the emergency department. Malunion is the most common complication following distal radius fracture, which can occur in approximately 23% non-surgical treated and in about 11% surgical treated patients.[1] The main cause of malunion is either improper treatment or delayed presentation. Owing to obvious revealing of fracture, gross pain and limitation of motion along with awareness and improvements in medical care, delayed presentation of volar barton fracture is extremely rare. Delayed presentation of these fractures particularly in developing countries are due to, primary treatment from bone setters/quacks/osteopaths, not seeking treatment at all, inability to identify re-displacement early, which is quiet frequent because of lack of regular follow-up. Other reason for neglect can also be acute life-saving medical condition, which took precedence over the treatment of distal radius fracture. Malunion following a neglected volar barton fracture can cause severe functional impairment.[2,3] In the present paper, a two-staged procedure for neglected volar barton fracture presenting after 5 weeks, primarily treated with gradual distraction and secondarily with locked distal radius plate along with bone graft was reported.

Access this article online	
Website: http://www.ijmsph.com	Quick Response Code:
DOI: 10.5455/ijmsph.2017.18062016558	

Case Report

A 28-year-old computer operator, with left hand dominance, presented with pain, deformity, and limitation of motion of left wrist joint after trauma, which occurred due to fall on out stretched hand around 5 weeks ago. It was primarily treated by bone-settler with massage.

Pain was severe to moderate, localized to volar aspect of wrist. There was rest pain which increased with activity leading to hamper the daily activity of the patient. Marked tenderness was present and wrist was volar subluxated, with typical dinner fork deformity at the wrist. Swelling or palpable mass around the wrist was absent. Grip strength was grossly decreased to 25% compared to normal side. Range of motion was painful and grossly restricted, with greatest loss in extension. Elbow and shoulder were normal. Allen test was

negative. There were no signs of complex regional pain syndrome or carpal tunnel syndrome.

Radiological examination of wrist showed old mal-uniting intra-articular fracture of distal end radius with gross volar subluxation of carpals with proximal migration and intra-articular incongruity (Figure 1a,b).

Primarily, a radio-metacarpal and ulno-metacarpal distractor was applied under brachial block with aim to distract the fracture site. Two schanz pins were passed proximally in the middle third radius between brachioradialis and ECRB and two distally in the 2nd metacarpal, for radiocarpal distraction. Distractors assembly was connected and similarly ulno-metacarpal distractor also applied and the gradual distraction was started at 1 mm/day. Regular X-rays at each week were done to note the distraction. Initial distraction was seen at fracture site and at wrist, but after 2 weeks the inter-carpal distraction was noted. Noting this inter-carpal distraction, the gradual distraction was stopped (Figure 2).

After 1 week, distractor was removed and open reduction and internal fixation with distal radius locking plate and bone graft was done. In supine position with arm in the side table via volar approach under fluoroscopic guidance between palmaris longus and flexor carpi radialis the wrist was opened. The median nerve retracted medially and the pronator quadratus muscle cut in L fashion. Bony union was absent between the fractures and only fibrous union was present, which was curetted with removal of fibrous tissue to re-approximate the fracture line. A blunt probe was used to differentiate between hyaline cartilage and fibrous tissue. Joint was visualized through the fracture leaving the volar radiocarpal ligaments and wrist capsule intact. A 5-hole distal radius locking plate was applied after achieving the accurate reduction of the fragments and filling autogenous iliac cortico-cancelleous bone grafts between the fragments. Since the distal fragment was very small and all the distal screws when viewed under fluoroscopy directed inside the joint, hence the distal fragment was only buttressed with the plate without passing any screws in the distal fragment. After through wash, the wound was closed in layers.

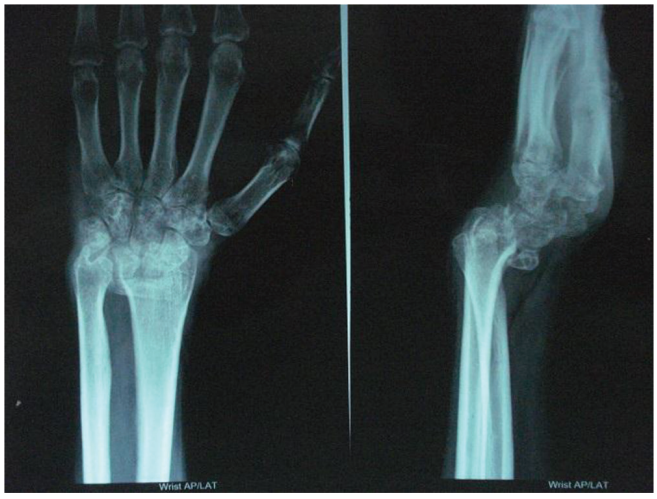

Figure 1: Pre-operative AP (a) and lateral (b) X-ray.

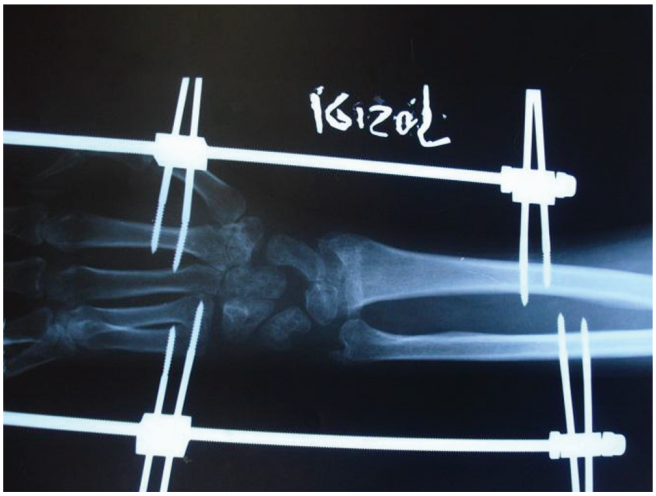

Figure 2: AP X ray after 2 weeks of distraction.

Wrist was immobilized in below elbow cast for 3 weeks after that gradual mobilization started and full ROM achieved at 6 weeks. Patient returned to employment at 6 weeks. Modified Mayo wrist score[4] improved from 31 to 85 points by 6 months. At final follow-up after 2 years, visual and analog pain scores reduced from 68 to 11 and range of motion was 80° extension to 70° flexion along with near normal full grip strength. Radiological examination showed complete bone healing with incorporation of the graft along with the maintenance of all radiological parameters like palmar tilt, radial inclination, ulnar variation and radial length to near normal of 15°, 24°, 2 mm, and 1.3 cm, respectively. Although the patient had arthrosis of the wrist joint with subluxation of DRUJ, the patient is doing fine with no impairment in functional daily activity and without change of occupation (Figure 3). Informed consent is obtained from patient.

Discussion

Union with deformity or malunion is the most common complication of distal radius fracture.[2,3] It can leads to alterations in normal anatomic and biomechanical relations of distal radius, incongruency at DRUJ and DRCJ with changes in volar tilt and ulnar variance, loss of relative length and rotational deformity, which can finally lead to change in load concentration, shift of forces to volar position, decreased ROM, ulnocarpal impingement, changing the carpal tunnel direction, angulations in the flexor tendons, decreasing the grip strength and leading to post-traumatic arthrosis and diminished function.[3,5–11]

Malunuion following neglected distal radius fracture can be a “nascent malunion” as in our case in which deformity is

Figure 3: A 2-year-post-surgery follow-up AP (a) and lateral (b) X-rays and clinical photos (c and d).`

either a radiographic deformity that may or may not lead to functional limitation which is encountered during the time of fracture consolidation, prior to or shortly after cast removal, before sufficient period of exercise has passed to determine what functional limitations will be present due to bony deformity or a "mature malunion" in which there is functional limitation that may or may not be related to a radiographic deformity, which is encounter after a period of exercises has failed to resolve the functional limitation.[3]

Freshly presenting volar barton fractures, i.e., within 3 weeks, are primarily treated with open reduction and internal fixation, since closed reduction is difficult to maintain and redisplacements and subluxation of carpals are frequent in cast. But in mature malunion, i.e., presenting after 6 weeks, the fracture is consolidated, bony union is achieved and original fracture line is difficult to recreate, hence the treatment of these malunions is intra-articular osteotomies particularly in young, active individuals or the salvage procedures (limited carpal arthrodesis, total wrist arthrodesis, proximal row carpectomy, wrist denervation, and wrist arthroplasty) for individual with severe cartilage degeneration, low functionl demand and elderly.[2] But gray zone exists regarding treatment of the nascent malunion which presents between 3 and 6 weeks, as in our case, in which exact guideline not described.

In nascent malunions presenting between 3 and 6 weeks, the callus in nascent and immature and original fracture can be identified, recreated after callus removal, hence these can be treated with osteosynthesis. But due to soft tissue contracture and proximal migration of the fracture fragment, it is difficult to bring the fractured fragment distally and anatomically reduce the intra-articular fragement. Another option for treatment of nascent malunion, is to delay the intra-articular osteotomy till its conversion to mature malunion, which should not be done because performing the surgery earlier, prevents the maladaptive soft –tissue contracture and arthrosis.

In our case fracture was only 5 weeks old with nascent immature callus, without bony consolidation, we planned to perform osteosynthesis. But primary osteosynthesis alone was difficult to achieve in view of gross displacement, proximal migration and severe soft tissue contracture. Hence, the procedure was staged with primary gradual distraction with application of a radiocarpal and ulnocarpal distractor, followed by osteosynthesis by locked distal radius plate along with bone graft in second stage.

After initial successful distraction at fracture, inter-carpal distraction was noted following which, the distraction was stopped immediately. Hence we recommend regular serial follow ups with radiographs to anticipate this intercarpal over-distraction earlier and act accordingly because over-distraction has been implicated in producing stretching to tendons, worse digital motion, poor functional outcomes, and worse strength and pain scores.[12,13] Although there is no threshold limit for distraction, but there is a correlation between increasing carpal height index and worse functional outcomes with distraction of 5–8 mm across the radiocarpal and midcarpal joints have no negative outcome.[14]

Further fixed angle locking distal radius plates have distinct advantage over conventional plates providing stability by fixed angle locking and supporting the subchondral bone and resisting the axial forces across the wrist that lead to settling and loss of reduction. Although our patient had arthrosis of the wrist joint and dorsal subluxation of distal ulna, but there was substantial improvement in the functional outcome with no pain and without impairment in daily activities and change of occupation.

Very few articles are available on neglected intra-articular fractures or malunions.[8,15–17] But all these cases had mature malunions, which presented after 6 weeks when there was solid bony consolidation, which were amenable to intra-articular osteotomy.

Conclusion

In conclusion, surgical treatment of neglected fractures of distal radius can substantially improve wrist and hand functions, but rarely restores the limb to normal. Mature malunions are treated by intra-articular osteotomies or the salvage procedures. But in nascent malunion were the solid bony consolidation is absent, osteosynthesis can be attempted. It reduces the donor site morbidity, as the callus resected

during exposure and mobilization of the fracture can be used as bone graft, thereby avoiding need to operate on a second site and avoids complications related to osteotomy like non-union, osteonecrosis of distal fragment or instablility in construct. The problem of difficulty in reduction, soft tissue contracture, tendon shortening can be overcome by initial gradual distraction avoiding need of con-commitant tenotomy or Z lengthening of the flexor tendons.

References

1. Fernandez DL, Jupiter JB. Fractures of the distal end of the radius. In: *Malunion of the Distal Radius*. New York: Springer; 1996. pp. 263–316.
2. Bushnell BD, Bynum DK. Malunion of the distal radius. J Am Acad Orthop Surg 2007;15:27–40.
3. Ring D, Mishra P. Neglected distal radius fractures. In: *Neglected Musculoskeletal Injuries*, 1st edn. Jaypee; 2010. pp. 376–97.
4. Bradway JK, Amadio PC, Cooney WP. Open reduction and internal fixation of displaced, comminuted intra-articular fractures of the distal end of the radius. J Bone Joint Surg [Am] 1989;71A:839–47.
5. Pogue DJ, Viegas SF, Patterson RM, Peterson PD, Jenkins DK, Sweo TD, et al. Effects of distal radius fracture malunion on wrist joint mechanics. J Hand Surg Am 1990;15:721–7.
6. Short WH, Palmer AK, Werner FW, Murphy DJ. A biomechanical study of the distal radial fractures. J Hand Surg Am 1987;12:529–34.
7. Ring D. Treatment of the neglected distal radius fracture. Clin Orthop Relat Res 2005;431:85–92.
8. Thivaios GC, McKee MD. Sliding osteotomy for deformity correction following malunion of volarly displaced distal radius fractures. J Orthop Trauma 2003;17:326–33.
9. Jupiter JB, Ring D. A comparison of early and late reconstruction of malunited fractures of the distal end of the radius. J Bone Joint Surg Am 1996;78:739–48.
10. Adams BD. Effects of radial deformity on distal radioulnar joint mechanics. J Hand Surg Am 1993;18:492–8.
11. Smith DW, Heney MH. Volar fixed angle plating of the distal radius. J Am Acad Orthop Surg 2005;13:28–36.
12. Kaempffe FA, Wheeler DR, Peimer CA, Hvisdak KS, Ceravolo J, Senall J. Severe fractures of the distal radius: Effect of amount and duration of external fixator distraction on outcome. J Hand Surg Am 1993;18:33–41.
13. Kaempffe FA, Walker KM. External fixation for distal radius fractures: Effect of distraction on outcome. Clin Orthop Relat Res 2000;380:220–5.
14. Kaempffe FA. External fixation for distal radius fractures: Adverse effects of excess distraction. Am J Orthop 1996;25;3:205–9.
15. Capo JT, Rossy W, Henry P, Maurer RJ, Naidu S, Chen L. External fixation of distal radius fractures: Effect of distraction and duration. J Hand Surg Am 2009;34;9:1605–11.
16. Ring D, Prommersberger KJ, Del Pino JD Capomassi M, Slullitel M, Jupiter JB. Corrective osteotomy for intra-articular malunion of the distal part of the radius. J Bone Joint Surg Am 2005;87:1503–9.
17. Marx RG, Axelrod TS. Intraarticular osteotomy of distal radial malunions. Clin Orthop Relar Res 1996;327:152–7.

How to cite this article: Jain S, Jain AK, Dhammi IK. Neglected volar barton fracture treated by two-stage procedure. Int J Med Sci Public Health 2017;6:214-217

Source of Support: Nil, **Conflict of Interest:** None declared.