ORIGINAL ARTICLE

TREATMENT OF UNSTABLE DISTAL RADIUS FRACTURES BY PERCUTANEOUS PINNING AND PLASTER CAST IMMOBILIZATION

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ABSTRACT

Background: Treatment of displaced fractures of the distal end of radius has changed over the course of time. This study was conducted to determine the functional and radiological outcome of percutaneous pinning followed by plaster cast for unstable fractures of distal aspect of radius.

Material & Methods: This descriptive study was conducted at DHQ Teaching Hospital D.I.Khan, from April 2009 to September 2012. A total of 32 patients with mean age of 58 years having unstable fractures of distal radius were included in the study. They were all operated within 48 hours by closed reduction and percutaneous K-wire fixation and POP cast. Mean follow-up was 28 weeks (range 22-32 weeks) during which patients were assessed both radiologically and functionally using criteria of Jakim et al.

Results: On radiological assessment, mean volar tilt was corrected to 3° (normal 11°). Mean radial height was 10 mm (normal 12 mm) and mean radial inclination was 22o (normal 23°). On functional assessment, 16 (50%) patients showed excellent, 12 (38%) showed good results while 4 (12%) gave fair outcome. Poor result was not encountered in any patient.

Conclusion: Percutaneous K-wire fixation and plaster cast immobilization can restore radiographic parameters to nearly normal values and provide good functional results without much complication.

KEY WORDS: Radius fractures; Radius; Colle's fracture; Plaster casts.

This article may be cited as: Shah MA, Shafiq M, Ali MA, Shah SA, Aziz I. Treatment of unstable distal radius fractures by percutaneous pinning and plaster cast immobilization. Gomal J Med Sci 2015; 13: 166-9.

INTRODUCTION

Treatment of displaced fractures of the distal end of radius has changed over the course of time. In past closed reduction and immobilization in the cast was considered the treatment of choice since no other treatment option was available.[1] However this concept is being challenged and reports addressing the operative treatment of complex intra-articular fractures are common. Still some physicians believe that no special treatment is needed as the resulting deformity rarely results in loss of function especially in the older patients with lower functional demands.[2,3]

While most of the stable fractures can be managed by closed manipulation and immobilization with plaster cast, there are still many controversies regarding management and assessment of outcome of unstable fractures.[4] Most of unstable fractures redisplace after close reduction and external splintage alone, resulting in poor outcome.[2] Retrospectively speaking, if reduction of a fracture cannot be maintained in a forearm cast, after good initial reduction, it is said to be unstable.[5] Over past few decades, many authors have attempted to identify risk factors associated with instability including intraarticular fractures, associated ulnar fracture, dorsal comminution, dorsal angulation >20°, radial shortning >5 mm, osteoporotic bone and severity of soft tissue injury.[6-8]

Different methods of preventing or minimizing the loss of reduction in unstable distal radius fractures have evolved over period of time. These include Functional bracing[9], immobilization with pin plaster[10], different external fixation assemblies[11,12], percutaneous pinning[4,13,14] and open reduction and internal fixation with various implants.[4,15] Each treatment plan has its merits and demerits, proponents and opponents. Whatever method is followed, it should include restoration of normal articular anatomy by restoring radial length, joint surface continuity and

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volar tilt of the distal radial articular surface.[16] Percutaneous pinning is a simple and minimally invasive procedure for maintenance of reduction in unstable fractures of distal radius in which anatomical reduction is possible.

The aim of this study was to determine the functional and radiological outcome of percutaneous K-wire fixation followed by plaster cast for unstable fractures of distal aspect of radius.

MATERIAL AND METHODS

This descriptive study was conducted at DHQ Teaching Hospital, D.I.Khan, from April 2009 to September 2012.

Patients older than 50 years of age having closed, comminuted and unstable fractures of distal radius were included in the study. All the patients were admitted through Accident and Emergency Department. X-rays of the involved wrist was performed both in Antero-posterior (AP) and Lateral planes. The fractures were classified according to Universal classification modified from Gartland et al[17] and Sarmento et al.[18]

Universal classification of distal radius.

Classification	Description
I	Non-articular, non-displaced
II	Non-articular, displaced
A	Reducible, stable
B	Reducible, unstable
C	Irreducible
III	Articular, non-displaced
IV	Articular, displaced
A	Reducible, stable
B	Reducible, unstable
C	Irreducible
D	Complex

Total number of patients was 32, out of which 11 (34%) were male and 21 (66%) female with mean age of 58 years (range 50-68 years). Dominant wrist was involved in 19 (59%) patients. Mode of injury in 26 (81%) patients was slip and fall, 3 (9%) patients reported of direct trauma, 2 (6%) road traffic accident and 1(3%) fall from height. Patients having open fractures, associated fractures of ipsilateral limb, previous fracture of wrist and stable fractures were excluded from the study.

After emergency management in the form of pain control and initial closed reduction, consent was taken for the procedure. The procedure was done within 48 hours on elective list under General anesthesia. Under fluoroscopic guidance, the fracture was reduced and Kirschner (K) wires were passed through the radial styloid with wrist in traction and ulnar deviation. The wires were drilled proximally until they penetrated the intact opposite cortex using Clancy technique.[13] Number of K-wires was selected according to fracture geometry. Minimum of two to three K-wires preferably in crossed configuration were used. The ends of wires were bent at right angle and were left protruding percutaneously. A well padded short arm cast was given. Post-operatively, 3 doses of first generation cephalosporin were given. Intramuscular analgesics were given on SOS basis. All the patients were discharged on first post operative day.

First visit in OPD was after 3 days for swelling examination and pain assessment. Next visits were after every 2 weeks for 12 weeks. Average follow-up was 28 weeks (22-32 weeks). Clinical and radiological reviews were performed and ROM at proximal and distal joints was assessed. Removal of plaster and wires was done in OPD after 5 weeks. The ROM was recorded for forearm supination/ pronation, wrist flexion/ extension and radial/ ulnar deviation of the wrist by goniometer and was compared with contralateral side. All the patients were evaluated according to scoring system of Jakim et al[19]. Final functional and radiological evaluation was done 8 weeks after the removal of wires.

RESULTS

Detail of fracture types are given in Table 1. The average time of fracture healing was 8.5 weeks (7-11 weeks). There was no perioperative complication. Superficial infection was seen in 2 (6%) patients which were successfully treated with wound care and oral antibiotics. There was no case of deep infection. Nine (28%) cases showed wrist and elbow stiffness while shoulder stiffness was seen in 2 (6%) cases, all managed successfully with physiotherapy. No case was encountered with problems of distal radio-ulnar joint, ulno-carpal joint, reflex sympathetic dystrophy and stiffness of fingers.

Overall 28 (88%) patients showed good to excellent results on functional evaluation 4 weeks after the removal of wires, 4 (13%) showed fair results and there was no poor result. (Table 2)

Table 1: Detail of fracture type according to Universal classification.

Type of fracture	Number	Percentage
Type II	13	40.5%
Type III	5	15.5%
Type IV A	6	19%
Type IV B	8	25%
Total	32	100%

Table 2: Functional outcome using scoring system of Jakim et al.

Grade	Points	Number	Percentage
Excellent	100-90	16	50
Good	89-80	12	37.5
Fair	79-70	4	12.5
Poor	<70		
Total		32	100

Table 3: Mean radiological measurements at different intervals before and after the procedure.

Measurements	Normal	Pre-Operative	Post-Operative	At 12 weeks
Volar Tilt	-11°	32°	-2°	-1°
Radial Height (mm)	12	5	10	9
Radial Inclination	23°	14°	22°	22°

Radiological assessment was done immediately postoperatively and 12 weeks after the procedure. (Table 3) On an average, loss in radial height was corrected 2 mm short of normal on postoperative x-rays. 1 mm further loss was noted at 12 weeks. Radial inclination was corrected to 22° which remained same after 12 weeks. Volar tilt was corrected on an average 9 mm short of normal with further loss of 1 mm after 12 weeks.

DISCUSSION

Fracture of the distal radius is considered to be the most common fracture in adults younger than 75 years of age.[20] While non-operative treatment by reduction and immobilization remains the most common option for stable fractures, there is still no agreement regarding maintaining reduction in unstable fractures. If stability is attained in cast with excessive wrist flexion, it can compromise the carpal tunnel and normal tendon function. Median nerve compression has been reported in 13% to 23% cases as a result of initial trauma, displacement of fragments and inadequate reduction.[11]

The treatment of unstable distal radial fractures is complex and demanding. Precise restoration of radial height and volar tilt is of fundamental importance. Even fractures with small amount of displacement can result in degenerative changes in the joint causing pain and stiffness in the wrist. Many studies show direct relationship between anatomical results and functional outcome.[4,11,21] A step in articular surface of more than 2 mm may lead to development of degenerative arthritis of wrist[22] and residual angular deformity of more than 20° leads to poor outcome.[23]

Percutaneous pinning has been recommended as a simple way of providing additional stability to immobilization in a cast in unstable fractures of the distal radius in which anatomical reduction is possible.[15] It offers the advantage of a minimal invasive procedure with good results regarding fracture reduction and early motion.[13,14] However, controversies remain for their application in old patients and in comminuted fractures. McQueen MM[21] considered its use inappropriate in osteoporotic bones and severely comminuted fractures since this procedure provide little stability in such circumstances. External fixator is advocated by many for comminuted fractures.[11,12,16] Azzopardi et al[24] while comparing close reduction and casting and close reduction and pinning concluded that supplementary fixation by K-wire was only marginally superior to cast immobilization alone in reducing displacement of the fracture after closed manipulation.

Many different variations have evolved in pinning technique. Kapandji A[25] uses intrafocal pin technique in which K-wires are introduced into the fracture site itself instead of the distal fragment and are used to lever or buttress the fracture. A total of 4 wires (2 volar, 2 dorsal) are used in the technique. DePalma AF[26] drilled first through the ulna until the pin reached inner cortex of radial styloid while Rayhak JM[14] advocates drilling through the radial styloid until it is completely through the ulna.

Some authors doubt if K-wire fixation is firm enough to obtain and maintain good anatomical alignment and recommend use of external fixator for unstable distal radial fractures.[27] Haas et al.[28] also observed significant loss of reduction after K-wire stabilization of complex distal radial fractures. In our patients restoration of volar tilt of type III and IV fractures was difficult to achieve. Some loss of radial height was also seen; however, radial inclination was brought to near normal and was maintained. On functional assessment, 88% of our patients had good or excellent results.

CONCLUSION

Percutaneous K-wire fixation and plaster cast immobilization can restore radiographic parameters to nearly normal values and provide good functional results without much complication.

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CONFLICT OF INTEREST
Authors declare no conflict of interest.
GRANT SUPPORT AND FINANCIAL DISCLOSURE
None declared.