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A STUDY OF THE FUNCTIONAL OUTCOME OF LOW PROFILE DORSAL PLATING IN DISTAL END RADIUS FRACTURES

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Abstract:

Background: Distal end radius fractures comprise one of the commonest fractures seen today in all age groups. Recent improvements in dorsal plating designs are increased thinness, precontouring of plates with rounded edges and low-profile flush screw heads.

Objective: The purpose of this study was to evaluate the functional outcome along with patient satisfaction in low profile dorsal plating of distal end radius barton fractures.

Method: We noted and observed the results after studying a group of 40 patients. Fracture union, wrist dorsiflexion, wrist volar flexion, supination, pronation and grip strength were recorded individually for each patient.

Results: An excellent result was obtained with regards to wrist range of motion, union and grip strength.

Conclusion: We concluded that treatment of distal radius fractures with a low-profile dorsal plating system is a safe and effective method that provides stable internal fixation and allows for full extensor tendon glide, full metacarpophalangeal joint motion and near normal wrist range of motion.

Key words: *Distal end radius fracture, low profile plate, dorsal plating*

Introduction

Distal radius is the basis of wrist joint biomechanics and around 16% of all fractures treated by orthopaedic surgeons are fractures of the distal end radius. It is considered as an essential component of ligamentous support, reconstruction of articular congruity and stable fixation reduces the incidence of post-traumatic osteoarthritis. Distal end radius fractures are one of the commonest fractures in all age groups. In younger individual with good bone density distal radius fracture usually occur as a result of high energy trauma and are associated with substantial articular and periarticular tissue injury. Moreover, elderly patients showed a significant association with these fractures attributed to their osteoporosis.[1,2] The description of the most common fracture pattern affecting distal end radius is attributed to Abraham Colles in 1814, and is classically named after him. Colles' fracture specifically is a metaphyseal injury occurring at thecortico-cancellous junction (within 2−3 cm of articular surface) of the distal radius with characteristic dorsal tilt, dorsal shift, radial tilt, radial shift, supination and impaction. Smith's fracture, also referred to as reverse Colles' fracture, has a palmar tilt of the distal fragment. Barton's fracture is an intraarticular fracture with dorsal displacementwith radio carpal dislocation. Reverse Barton's is an intraarticular fracture of the volar lip with volar displacement and radio carpal dislocation.Chauffer's fracture is an intraarticular fracture of the radial styloid which originally occurred due to backfire of the car starter handles in older models.[3]Dorsal plating emerged as an effective management for dorsally displaced distal radius fractures in the late 1980s.[4] Dorsal plating provides a clear view of the articular surface and the ability to restore the anatomy in addition to the mechanical advantages of this approach. Restoration of parameters such as radial length, radial tilt angle and congruity of articular surfaces is important for good functional results.[5] Recent improvements in dorsal plating designs include increased thinness, precontouring of plates with rounded edges and low-profile flush screw heads. These new plates are associated with lower incidence of extensor tendon complications while retaining the advantages of the original dorsal approach. Recent studies have emphasized that, better method of identifying and classifying distal radial fracture may help the treating surgeon to choose a line of treatment and to adopt open reduction of these fractures when needed. Controversy exists regarding the efficacy and complications associated with dorsal plating for distal radius fractures.[5] This study evaluated the functional outcome of dorsal plating for dorsally angulated distal radius fractures at a single institution.

Materials And Methods

A prospective randomised study including 40 patients was conducted from September 2014 - September 2016.Only patients with fracture distal end radius, above 18 years of age were chosen. All patients had either AO type A or AO type B distal radius fracture. They were treated by open reduction and internal fixation by dorsal plating after obtaining an informed and written consent. Patients with pathological fractures, AO type C fractures or compound fractures were not included in this group. Patients not fit for surgery were excluded from this study. Postoperatively patients were immobilized in a below elbow slab and active finger and shoulder exercises started immediately. The plaster was removed at day 10, a crepe bandage given and active exercises of wrist were started. The patients were followed up for a minimum of 24 weeks at periodic intervals and clinical, radiological and functional reviews were performed. Follow up for range of movement and grip strength was recorded in detail. The Gartland and Werley Scoring (G&W) system was utilised to measure patient outcome. Functional assessment was done by quantifying range of motion (using goniometer) and grip strength (using dynamometer).

Table 1. Distribution according to Age groups

Age	Dorsal plating	Total
<30	10	10
30-39	14	14
40-49	10	10
50-59	6	6
Total	40	40

Table 2. Comparison based on union time

Treatment	UNION		Total
	≤ 8 weeks	> 8 weeks	
Dorsal Plating	24	16	40
	60.0%	40.0%	100.0%

Table 3. Comparison based on wrist dorsiflexion

Treatment	Wrist Dorsiflexion		Total
	>15	>20	
Dorsal Plating	5	35	40
	12.5%	87.5%	100.0%

Table 4: Comparison based on wrist volarflexion

Treatment	Wrist Volar flexion		Total
	>15	>20	
Dorsal Plating	7	33	40
	17.5%	82.5%	100.0%

Table 5. Comparison based on supination

Treatment	Supination			Total
	>40	>50	>60	
Dorsal Plating	4	1	35	40
	10.0%	2.5%	87.5%	100.0%

Table 6. Comparison based on pronation

Treatment	Pronation			Total
	>40	>50	>60	
Dorsal Plating	2	4	34	40
	5.0%	10.0%	85.0%	100.0%

Table 7. Comparison based on grip strength

Grip Strength	Plating	Total
Needs improvement	1	1
	2.5%	2.5%
Fair	4	4
	10%	10%
Good	8	8
	20.0%	20.0%
Very good	10	10
	25.0%	25.0%
Excellent	17	17
	42.5%	42.5%

Figure 1. Pre operative xray

Pre operative Xrays

Anteroposterior View Lateral View

Figure 2. Postoperative xray

Post operative Xrays at 8 weeks

Anteroposterior View Lateral View

Results

Union of the fracture occurred in less than 8 weeks in 60% and took more than 8 weeks in 40% patients.

Wrist dorsiflexion of more than 15 degrees was noted in 12.5% and more than 20 degrees in 87.5% patients.

Wrist volar flexion of more than 15 degrees was observed in 17.5% and more than 20 degrees in 82.5% patients

Supination of more than 40 degrees was seen in 10%, more than 50 degrees in 2.5% and more than 60 degrees in 87.5% patients

Pronation of more than 40 degrees was observed in 5% patients, more than 50 degrees in 10% and more than 60 degrees in 85.0% patients.

Grip strength was excellent in 42.5%, very good in 25%, good in 20%, fair in 10% and 2.5% needed improvement.

Gartland and werley score was excellent in 72.5%(29 patients) and good in 27.5%(11 patients).

Discussion

As per my findings, age and sex are non-significant confounding variables in the study. Atul F. Kamath et al found that compared to the contralateral side, the mean extension, flexion, pronation and supination were 88%, 81%, 89% and 87% respectively; and grip strength was 78%. Postoperatively 28 out of 30 patients had Gartland and Werley scores of good or excellent.[6] Paul M Simic et al found the mean active range of motion to be greater than 80% of that of the contralateral wrist in flexion, extension, pronation and supination. Grip strength averaged 90% of the contralateral side.[7] After open reduction and internal fixation, 90% of the patients had satisfactory results on the basis of the subjective criteria such as minimal deformity, absence of pain, and good strength. Objective assessment showed that the patients had 80% of normal motion and 73% of normal grip strength at a minimum of 2 years after the procedure.[8] Ring

et al. inferred that there was no loss of reduction, nonunion, or hardware failure after one year of follow-up in a study conducted on twenty-two patients who had been treated with a Synthes π plate,[9] while Campbell reported two cases of loss of reduction in a study of twenty-five dorsally displaced, unstable fractures that had been treated with a π plate.[10]. There were no cases of nonunion, malunion, or loss of reduction in patients who had been treated with either a Synthes π plate or a low-profile plate, confirming that these plates are a stable method of fixation for unstable, dorsally displaced fractures of the distal part of the radius.[11] Operative treatment of complex distal radius fractures with reconstruction of articular congruity with external fixation can lead to early return to function.[12,13,16] Currently, majority of studies are retrospective in nature and use various classifications and inconsistent outcome tools, especially in regard to comminuted fractures with joint incongruity.

Conclusion

The treatment of distal radius fractures with a low-profile dorsal plating system is a successful treatment modality that provides rigid internal fixation and allows for full irritation free extensor tendon glide, full metacarpophalangeal joint motion and near normal wrist range of motion.[6] Objective outcome testing by recording wrist range of motion and grip strength showed uniformly good to excellent recovery of wrist and hand function in all patients. Andrew A Willis et al in their study found that in dorsally comminuted extra-articular distal radial fractures, dorsal pi-plate fixation showed a better resistance to movement at the fracture gap than did the four types of volar plate fixation(AO T-plate, AO 3.5-mm small-fragment plate, AO 3.5-mm small-fragment locking plate and the Hand Innovations DVR locking plate).[14] The patient outcome was satisfactory and thus we can conclude that low profile dorsal plating is a novel and effective treatment modality for distal end radius fractures. Yangyang R. Yu et al concluded that more tendon irritation or rupture complications are not associated with dorsal low-profile plates and that volar plating is associated with a higher incidence of neuropathic complications.[15]M. Al-Rashid et al found an incidence of 8.6% of rupture of extensor tendon after fixation using a volar locking plate for both dorsally and volarly angulated fractures of the distal end of radius.[17] A study by Hove[18] LM observed that over a period of five years, 0.3% of cases had rupture of the extensor pollicis longus tendon after such a fracture. It is suggested that ruptures of the extensor pollicis longus can occur even after minimally-displaced fractures because the attachment of extensor retinaculum to Lister's tubercle remains intact and the third compartment is narrowed due to the formation of callus.[19] Thiscauses reduction in the blood supply to the tendonleading to degenerative necrosis and eventually rupture.[20]

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