

Midterm results of volar plate fixation in intra-articular distal radius fractures

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Abstract

Intra-articular fractures of the distal radius represent a significant problem in terms of treatment and outcomes. We conducted a prospective study of patients with fractures of the distal radius managed by internal fixation using the volar locking plate between June 2014 and October 2016. Forty four patients including 32 males and 12 females with intra-articular distal radius fractures were included in this prospective study. Mean time for follow up was 30 months. Quick DASH score and the modified MAYO wrist score were used for functional outcome assessment. The median DASH score for all patients was 2.3 (IQR 0- 6.4) and the median MAYO score was 90 (IQR 75-100). Seven patients had complications including infection and CRPS. We concluded that ORIF with volar plating provide good functional outcome in midterm follow-up of intra-articular distal radius fractures.

Keywords: Distal radius, volar plating, intra-articular fractures.

1. Introduction

Intra-articular fractures of the distal radius represent a therapeutic challenge as compared with unstable extra-articular fractures. It is classified as type B3 volar Barton fracture and type C volar dislocation in the AO classification.[1] Since volar subluxation occurs due to a shear force in this fracture, open reduction through the volar side using a buttress plate is applied in many cases.[2]

Unstable distal radius fractures mostly occur in elderly patients with osteoporosis or young patients with high-energy injury.[3] The dorsal displacement fracture is the most common one among the unstable wrist fractures. In cases with a residual intra-articular volar displaced bonefragment, limitation of range of motion of the wrist joint, carpal bone subluxation, and early arthropathic changes of the wrist joint are frequently observed.[2] Despite the recent popularity of volar plating for dorsally displaced distal radius fractures there is a paucity of data documenting the results of this treatment method. In recent times, the volar locked plate osteosynthesis is considered as the “gold standard” in treatment of unstable distal radius fractures.[4]

2. Material and methods

We conducted a prospective study of patients with intra-articular fracture of the distal radius managed by internal fixation using the Volar Locking Plate between June 2014 and October 2016 treated in our institute. Objective of the study was to assess the functional outcome of volar plating in distal end radius fractures treated in our institute.

2.1 Inclusion criteria

- Displaced intra-articular fractures
- Articular step of > 2 mm
- Radial shortening of > 3 mm or > 15 degrees of sagittal plane angulation
- Metaphyseal comminution
- Unsatisfactory radio-carpal alignment.

2.2 Exclusion criteria

- Open fractures
- Fractures over 4 weeks old at the time of surgery
- Pathological fractures

Using the departmental trauma database and above criteria, 44 suitable patients were identified for inclusion in the study. Surgery was performed under general or regional anaesthesia with use of an arm tourniquet and administration of pre-operative antibiotics. A standard volar approach through the bed of Flexor Carpi Radialis was performed. The volar locking plate was used in all cases. Pre-operative radiographs were classified according to the AO-ASIF classification system [5] and post-operatively were assessed for fracture union. These findings were correlated with the clinical examination to determine whether there was pain on physiologic loading or on palpation before fracture union was declared.

These patients were followed up by means of case note and operative record analysis, radiographic assessment, complications and functional questionnaire. Patient data was recorded at pre-op, immediate post-op, 2 week, 4 week, 6 weeks and monthly thereafter. Case notes were used to establish all demographic details including; mechanism of injury, time to surgery, intraoperative details, post-operative immobilisation etc. The functional questionnaire utilised was the ‘quick’ Disabilities of Arm, Shoulder and Hand (Quick DASH) score [6] and the modified MAYO wrist score.[7]

The Quick DASH has been shown to be interchangeable with the traditional DASH score and is simpler to perform [6]. Both MAYO and DASH are scored from 0-100 but in the DASH score, a score of 100 constitutes the worst outcome whereas in the MAYO score this is equivalent to the best outcome. There are no defined parameters of what constitutes an excellent, good, satisfactory or poor score in the DASH system merely that a score of zero indicates no disability and a score of 100 indicates complete disability. We hence set these parameters ourselves for descriptive purposes (Table 1).

Table 1: Outcome grading for Quick DASH and MAYO wrist scores

Outcome	DASH score	MAYO score
Excellent	0-5	90-100
Good	6-15	80-90
Satisfactory	16-35	60-80
Poor	>35	<60

2.3 Statistical methods

Categorical variables and baseline demographic data are described using frequencies and percentages. Continuous variables with a symmetric distribution are presented using means and standard deviations (SD) and continuous variables with a skewed distribution are presented using the median and inter-quartile range (IQR). Spearman’s rank correlation coefficient was used to assess the association between continuous variables and non-parametric tests were used to test for differences in outcome between groups.

3. Observation and Results

The median DASH score for all patients was 2.3 (IQR 0- 6.4) and the median MAYO score was 90 (IQR 75-100). The MAYO and DASH scores were good or excellent in 33 patients (75%), satisfactory in 10 (23%) and poor in 1 patient (2%). There was a strong relationship between the two scoring systems with virtually no variation in outcomes. Out of 44 patients, 12 patients were female (27%) and 32 were male (73%). There was little variation in the MAYO score between men and women; however the DASH score for women was more variable than in men. Mean age was 62.4 years (range16-93; SD 17.9). No relationship was seen between age and either the MAYO or DASH score (Spearman’s correlation coefficient, MAYO 0.03; DASH 0.04). Mean time to surgery was 8 days (range 0-28 days; SD 6.4). No relationship was seen between time to surgery and either the MAYO or DASH score (Spearman’s correlation coefficient, MAYO -0.09; DASH 0.1).



Figure 1: Pre-Op X rays Fig2 - Post-Op X rays

Mean time for follow up was 30 months post operatively (13-53 months; SD 10.4). Post-operative immobilisation between four and six weeks was instituted in 8 patients (18%) as opposed to immediate graduated mobilisation in the remaining 36 patients (82%). This was surgeon dependent and there was no significant discrepancy between the two groups in terms of fracture type or patient age. There was no statistical difference between the groups in terms of functional outcome (DASH $p = 0.06$; MAYO $p = 0.11$) or in the incidence Chronic Regional Pain Syndrome (CRPS) ($p = 0.09$).

3.1 Complications

In total, 7 patients (15%) suffered a postoperative complication. 1 patient (3%) suffered deep infection and 4 patients had chronic regional pain syndrome in post-op period. Of the 2 tendon attrition and ruptures, 1 was of Extensor Pollicis Longus (EPL) and one was of Flexor Pollicis longus (FPL). The mean DASH and MAYO scores for patients suffering a postoperative complication were 9.0 and 80.3 respectively. Plate removal was performed in 4 patients (9%) in follow up period.

4. Discussion

While there are long term studies looking at the outcomes of patients treated non-operatively[3,7], with external fixation[8] and percutaneous fixation[9], there are few studies documenting the functional outcome after volar plate fixation beyond 2 years post operatively. Rozental *et al* showed mostly good and excellent functional outcomes in 45 patients at 17 months mean follow up [10]. Similar larger series [11] have reviewed the outcome of volar plate fixation in cohorts of 150 (24 months follow up) and 114 (12 months) patients respectively. Like our study these both showed good to excellent functional outcome using the DASH score.

Many authors have demonstrated that improvement in functional scoring is particularly applicable to the first year after surgery.[8,11] Goldfarb *et al* and Catalano *et al* followed up the same cohort of patients at a mean of 7 and 15 years after open reduction and stabilisation with wires and showed a long term progressive increase in functional score [12]. However, there is no current data to show whether a similar improvement is seen after volar locking plate fixation. The mean DASH scores in our study are better than in the corresponding papers mentioned and we feel this reflects the longer follow up time and infers that functional scores may continue to improve with time.

We used the MAYO wrist score alongside the DASH score to assess functional outcome. There was no discrepancy between the two scoring systems in terms of grading outcome. Although the two scoring systems are not directly comparable, the use of two systems reduces the likelihood of errors generated by the use of a single

system. We used the quick DASH score which is comprised of 11 questions and has been shown to have similar cross-sectional and test-retest reliability to the traditional 30 point full DASH score.[11]

Only one type volar locking plate was used for all patients in this series. Subsequent development has led to the design of many newer plates with a variety of features including different locking mechanisms, material properties and fragment specific designs. The use of newer plates may have changed outcomes in some way; however the basic principles of fracture reduction, stable fixation and respect for the soft tissues remain paramount regardless of implant. In a large radiographic study, Mackenney *et al* showed that age over 80 years; metaphyseal comminution and positive ulna variance were the main predictors of instability. This and poor radio-carpal alignment were shown to be associated with poor outcome.[7] However this study did not look at results after fixation with a volar locking plate which has specific design applications for use in osteoporotic unstable fracture patterns.

The only factor that was associated with a poorer functional outcome was the development of a postoperative complication. The 7 patients with a postoperative complication had both DASH and MAYO scores considerably worse than the other patients. The two patients who acutely developed tendon ruptures were both females under the age of 60 years. Neither had preoperative symptoms. One had a 23-C2 type fracture whilst the other had a 23-A2 fracture.

5. Conclusion

Open reduction and internal fixation of distal radius intra articular fractures with volar plating provide good functional results with comparable and predictable outcomes.

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