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Outcome of fracture distal end of radius in adults treated by open reduction and internal fixation with buttress plate

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ABSTRACT

Fracture of the distal radius is one of the most common skeletal injuries treated by Orthopaedic surgeons. These fractures continue to pose a therapeutic challenge. Some of these fractures are caused by high energy trauma, resulting in intra-articular involvement and comminution. The purpose of this study was to evaluate the functional outcome of distal radial fractures in adults treated with open reduction and internal fixation with buttress plate and screws.

Materials and methods

This is a clinical study done on 32 patients with displaced, comminuted, intra-articular fractures of distal end of radius of whom 15(46.9%) were females and 17(53.1%) were males. Their average age was 39.37 yrs (range 20-69 years). All the patients were treated with open reduction and internal fixation by buttress plate and screws within 5-7 days of initial trauma using a dorsal or volar approach. The aim was to restore the radio-carpal and radio-ulnar joint congruity and to regain radial length. The fractures were approached according to the direction of the displaced fragment. Follow up and assessment were done at 6 weeks and 3 months, and the final evaluation was performed at 6 months using demerit-point system of Gartland and Werley.

Results

In our study the most common mode of injury causing distal end radius fractures was road traffic accident (RTA) 40.6%, followed by fall on outstretched hand 25%. In our series 6(18.7%) patients had excellent results, 15(46.8%) patients had good results, 6(18.7%) patients had fair results and 5(15.6%) patients had poor results. The complications encountered were: malunion in 3 patients, restricted wrist movements and stiffness in 8 patients and finger stiffness in 7 patients.

Conclusion

As per our results, excellent to good results were found in 65.6% of patients. So we conclude that this procedure is acceptable and it can be used as an alternative to other procedures in treating comminuted intra-articular fractures of distal radius.

Keywords: Fracture lower end of radius, internal fixation, buttress plate

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Fracture of the distal radius is one of the most common skeletal injuries treated by Orthopaedic surgeons. These injuries account for approximately one sixth of all fractures treated in emergency room.¹

Some of these fractures are caused by high energy trauma, resulting in intra-articular involvement and comminution. Treatment of such injuries are difficult.

Since these fractures often are unstable, difficult to reduce anatomically and are associated with complications of post traumatic osteoarthritis following intra-articular fracture of

the distal end of the radius.

Fractures of the distal radius was first described by Pouteau in 1783 and later by Abraham Colle's in 1814.² Restoration of radial length (distance from radial styloid process to the distal end of ulna), radial tilt angle and congruity of articular surface is important for good functional result.³

Failure to achieve and maintain near anatomic reduction can lead to degenerative arthritis, distal radio-ulnar and metacarpal instability and ulnar impaction syndrome with resultant pain, decrease in mobility, strength and

function.⁴

Recognition of fracture patterns, secure fixation of fractures and maintenance of reduction is the key for successful management of more complex fractures of distal radius.

A number of classification systems have evolved taking into consideration the fracture patterns, degree of comminution, radial shortening and displacement, dorso-palmar displacement, angulations and soft tissue involvement. Several classifications have evolved that recognise some of these variables. However no classification scheme successfully incorporates all the attributes of an individual injury. This places burden on the surgeon to evaluate each fracture individually.

Restoration of wrist function is the primary goal in the treatment of unstable distal radius fractures. It is well accepted that the restoration of disrupted radial anatomy, maintenance of accurate and stable reduction and early hand mobilisation are required for good functional results in unstable distal radius fractures. Open reduction and internal fixation is indicated to address unstable distal radius fractures and those with articular incongruity that cannot be anatomically reduced and maintained through external manipulation and ligamentotaxis, provided sufficient bone stock is present. A stable fixation permit early range of motion.⁵

The purpose of this study was to evaluate the functional outcome of surgical management of distal radial fractures in adults using open reduction and internal fixation with buttress plate and screws.

MATERIALS AND METHODS

This is a clinical study done on 32 patients with displaced, comminuted, intra-articular fractures of distal end of radius of whom 15(46.9%) were female and 17(53.1%) were males. The

average age was 39.37 years (range 20-69 years). 18 patients were below the age of 40 years. 6 patients were between 40-50 years, 4 patients were between 50-60 years and 4 patients were above 60 years. Right side (71.8%) was more than the left (28.1%). The right side was dominant for all the patients with right sided involvement.

All the patients selected for the study were admitted and examined according to the protocol. Associated injuries if any were noted, laboratory investigations were done and obtained fitness for surgery. Patients with open fractures and other bony injuries to the ipsilateral limb were excluded from the study.

All patients underwent open reduction and internal fixation by buttress plate and screws. The aim was to restore the radio-carpal, radio-ulnar joint congruity and to regain radial length. The fractures were approached according to the direction of the displaced fragment.

The surgery was carried out under general anesthesia or brachial block after thorough preparation of the part. A standard volar or dorsal approach was used. After the surgery, the operated limb was supported with an anterior or posterior splint and was kept elevated for 3 days till the edema subsided. All the patients received antibiotics, analgesics and anti-inflammatory drugs. Active movements of the fingers, elbow and shoulder were started on the first post operative day. On the 3rd postoperative day, the operated wound was inspected and active movements of fingers and wrist were encouraged. The range of movements depending upon the tolerance of pain by the patients. As the patient's tolerance to pain increased they were motivated for a more vigorous physiotherapy regime.

Sutures were removed on 10-12th post operative day. The splints were discarded and were replaced by a crepe bandage.

Mode of injury	Frykman Type								Total	%
	I	II	III	IV	V	VI	VII	VIII		
RTA	-	-	2	-	2	1	7	1	13	40.6
Fall on outstretched hand	-	-	5	-	1	-	2	-	8	25
Fall from height	1	-	3	-	2	1	-	-	7	21.8
Direct injury	1	-	2	-	1	-	-	-	4	12.5
Total	2		12		6	2	9	1	32	

Table 1. The mode of injury and its classification (Frykman)

Patients were advised to carry out normal activity within the crepe bandage and restrained from major activities. Non compliant patients were advised to wear the splints till the first follow-up. All the patients were reviewed at 6th week, 3rd and 6th month postoperatively and were evaluated clinically and radiologically.

Patients were enquired regarding pain, restriction of motion, disability and grip strength. Clinical examination regarding the movements at the wrist and fingers were done. Careful examination was done to rule out any infection. Radiological examination consisted of assessing the consolidation of the fracture site, collapse at the fracture site and any displacement of the implant. The final evaluation was done at the end of the 6th month. The patients were evaluated according to standard objective and subjective criteria using demerit-point system of Gartland and Werley.⁶

RESULTS

The final result in our series after an average follow up of 7 months (6-10 months) showed that 6 patients (18.7%) had excellent result. Of these 2 patients were above 40 years and 4



Figure 1. Per operative photograph showing the incision for the volar approach



Figure 2. Per operative photograph showing the implant in situ

were below 40 years. 4 patients had Frykman type⁷ III and 2 patients had type VII fractures.

3 patients sustained the fracture following an RTA, 2 patients sustained injury due to fall on outstretched hand and one patient had a fall from height.

On analysing the results, 18 patients (56.2%) were below 40 years of age. Of these, 4 had excellent result (22.2%), 8 had good results (44.4%), 3 had fair and 3 had poor results.

14 patients were above 40 years of age of which 2 had excellent results (14.2%), 7 had good results (50%), 3 patients had fair results and 2 had poor results. This reveals that the younger the patients were, the better is the result. This may be due to better quality of the bone, high motivation to get back pre-injury status and better patient compliance. In our series we did 5 dorsal buttress plating in which 3 had good results, 1 had fair result and 1 patient had a poor result.

In our series of 32 patients bone grafting was done in 6 patients. All were over 40 years of age. Of these none had an excellent result, 3 had good results, 2 had fair results and one had poor result. This shows that the use of bone grafting may not have a bearing on the end result.

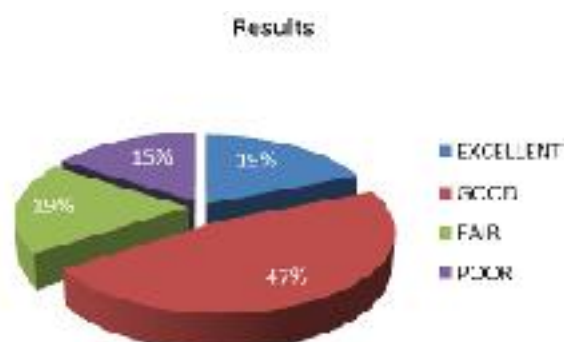


Figure 3. Chart showing the distribution of end results

The complications encountered in our study were as follows: 3 patients had deformity due to malunion, which put them into poor and fair category due to restriction of wrist movement and finger stiffness. One of them had bone grafting. All were of 60 years and above. 7 patients had finger stiffness and 8 patients had restricted wrist movements and stiffness at wrist and fingers.

DISCUSSION

This study was undertaken to assess the functional outcome of operative management of distal radial fractures in adults by



Figure 4. Radiographs of the wrist AP and Lateral views showing the fracture



Figure 5. Post operative radiographs AP and lateral view showing buttress plate used for stabilising the fracture



Figure 6. Radiographs of the wrist AP and lateral view showing the comminuted fracture



Figure 7. Post operative radiograph AP and lateral view showing the buttress plate in situ

open reduction and internal fixation by buttress plates and screws. Increased awareness of the complexity of Colle's fracture has stimulated a growing interest and prompted new ideas regarding their optimal management.

Although closed reduction with cast immobilisation remains a reliable standard method of treatment for stable extra articular fractures and minimally displaced articular injuries, similar management for unstable articular disruption is prone for failure. The best method of obtaining and maintaining an accurate anatomy remains a topic of considerable controversy. However recent critical evaluation of fracture pattern and results of treatment have demonstrated the need for surgical intervention.

In our study, thirty two patients were treated with buttress plates for comminuted intra-articular and unstable extra-articular fractures of distal end of radius and followed up for a minimum of 6 months. They were analysed according to the criteria of demerit point system of Gartland and Werley.⁶ Six patients

(18.7%) had excellent results, 15 patients (46.8%) had good results, 6 patients (18.7%) had fair results and 5 patients (15.6%) had poor results.

A study was conducted by John K. Bradway and William P Cooney on 16 patients with comminuted intraarticular fractures of distal radius, with a mean follow up of 5.7 years. The evaluation was based on the criteria of Garland and Werley⁶ and also by Green and O'Brien scoring system. 56% of their patients were rated excellent, 25% good and 19% fair. They had no poor results.⁸

This high percentage of excellent and good results compared to our study may be due to fact that the follow up was of longer duration and their patient compliance was better. Bone grafting was done in larger number of patients in their study.

Fitoussi F et al. (1997) in their study of 34 patients with intra-articular fractures of the distal radius treated with open

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Results	Frykman Type								Total
	I	II	III	IV	V	VI	VII	VIII	
Excellent	-	-	4	-	-	-	2	-	6
Good	2	-	6	-	4	2	1	-	15
Fair	-	-	2	-	1	-	2	1	6
Poor	-	-	-	-	1	-	4	-	5

Table 2. Classification of final results



Figure 8a & b. Clinical photograph of a patient after completion of treatment showing the range of dorsiflexion and palmar flexion



Figure 9a & b. Clinical photograph of the patient showing the range of pronation and supination

reduction and internal fixation with buttress plate and screws, concluded that the potential for restoration of normal alignment and stability of fixation are the main advantages of internal fixation with plates.⁹

Ruch and Papadonikolakis in 2006 studied results of 34

patients of distal radius fractures treated with open reduction and internal fixation of a multifragmentary intra articular distal radius fractures with a non locking volar or dorsal plate. 20 patients were treated with dorsal plating and 14 patients with a volar plating. They concluded that volar plating resulted in a significantly better Gartland and Werley score compared with

dorsal plate.¹⁰ The results in our study show that excellent and good results were achieved in 65.6% i.e., in 21 patients and fair and poor results were seen in 34.3% i.e., in 11 patients. This means that the use of buttress plates gives relatively better results in comminuted intraarticular fractures of distal radius.

This does not mean that buttress plating is the gold standard in the treatment of comminuted intra-articular fractures of distal radius. This is only an alternative method in treating these injuries.

CONCLUSION

Among the different modalities of treatment of fracture of the distal end of radius, open reduction and internal fixation using a buttress plating is a good modality and provides acceptable results and a good functional outcome of the limb.

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