ORIGINAL ARTICLE

External Fixation Versus Internal Fixation for Closed Unstable Intra-articular Fracture of the Distal Radius. Early Results from a Prospective Study

Z Zamzuri, MSOrtho*, M Yusof, MSOrtho*, M Y Hyzan, MSOrtho**

*Department of Orthopaedics, Traumatology and Rehabilitation, Kulliyyah of Medicine, International Islamic University Malaysia, Kuantan, **Department of Orthopaedics and Traumatology, Hospital University Kebangsaan Malaysia , 56000 Cheras , Kuala Lumpur

Summary

This is a prospective study of a series of 26 patients with closed unstable comminuted intra-articular fracture distal end of the radius treated with two different methods of treatment to compare their anatomical and functional results. The external fixation group consisted of 12 patients and internal fixation group consisted of 14 patients. The anatomical and functional assessments were performed at six months and one year. The anatomical results at six months and one year showed that the internal fixation group was effective in maintaining the reduction compared to the external fixation group. The radial height, volar tilt and radial inclination were well maintained. However, the functional results at six months and one year showed no differences between these two types of fixation. The complication rate was higher in external fixation group.

Key Words: External fixation, Internal fixation, Unstable intra-articular fracture of the distal radius

Introduction

Fracture of the distal end of radius has been estimated to account upwards of one- sixth of all fractures seen and treated in emergency rooms[1]. Some of these fractures are caused by severe high-energy trauma, resulting in intra-articular involvement and comminution. Treatment of such injuries is difficult. These fractures often are unstable, difficult to reduce anatomically and associated with morbidity. Knirk and Jupiter[2] reported a 65 percent prevalence of post-traumatic osteoarthritis after intra-articular fracture distal end of radius in forty-three young adults and demonstrated a strong correlation between residual articular congruity and osteoarthritis. Restoration of normal alignment and articular congruity after a displaced fracture can be difficult, but it is essential for good functional result[2,3]. The results of closed reduction, percutaneous pin fixation, and internal and external fixation have been variable and largely determined by the pattern of the fracture[4]. This study was undertaken to evaluate anatomical and functional results of external fixation compared with internal fixation in the treatment of closed unstable comminuted intra-articular fracture distal end of radius.

Materials and Methods

A prospective study was undertaken in the National University of Malaysia Hospital, Cheras from January 2001 to December 2001. Twenty-six consequtive patients with closed unstable comminuted intra-articular fracture distal end of radius treated at the hospital were included in this study. Inclusion criteria was an unstable fracture, if they met one or more pre-reduction

This article was accepted: 16 June 2003

Corresponding Author: Zamzuri Zakaria, Department of Orthopaedics, Traumatology and Rehabilitation, Kulliyyah of Medicine, International Islamic University Malaysia (IIUM), Jalan Hospital, 25150 Kuantan, Pahang

radiograph (anteroposterior and lateral) features such as dorsal angulation of more than 11 degrees, volar tilt of more than 11 degrees, radial shortening of more than 2 millimeters compared with the measurements on the uninjured side (radial length is defined as the distance between two lines perpendicular to the long axis of radius: one through the distal tip of the radial styloid process and one through the most distal aspect of the articular surface of the ulna), radial inclination of more than 21 degrees ; and/or group C fracture by AO classification. Exclusion criteria were a Smith or Barton fracture, fracture associated with an ipsilateral fracture of the scaphoid or other carpal fracture dislocation, more proximal traumatic injury of the upper extremeties (multiple fracture of the same limb), pathological fracture; and/or patients with osteoporosis and over 60 years old to avoid the problem of pin [5].

The AO classification of the distal radius fracture was used based on the anteroposterior and lateral radiograph. On admission all patients included in the study had a true anteroposterior and lateral view of the injured and uninjured side. No closed manipulation reduction was performed to reduce the fracture; and a plaster backslab was applied to the injured limb before transferring the patient to the ward. Randomization for the operative procedure was based on the registration number of the patient .

Physiotherapy was started immediately after the surgery for both procedures. Active range of movements and gentle passive range of movements to fingers, elbow, shoulder and thumb were started. At 6 to 8 weeks, wrist flexion, extension, ulna and radial deviation was started. This was done within the comfort level of the patient. All the patients were followed up in the clinic at one week, six weeks, three months, six months and one year. All complications were recorded. Anatomical and functional evaluation was performed at 6 months and one year after the surgery.

Anatomical evaluation included radial height, radial inclination, dorsal angulation were measured on the anteroposterior and lateral radiographs of the wrist. The outcomes were graded as excellent, good, fair or poor based on the criteria by Stewart [6].

Functional evaluation was based on range of motion and grip strength. Active range of motion of the wrist was assessed by using standard goniometer and the grip strength was evaluated by using a Jamar dynamometer. The outcomes were graded as excellent, good, fair and poor based on the criteria by Stewart [6] and Gartland and Werley [7] (Table I). Subjective complaints such as pain was also recorded [7]. The statistical analysis was done by using Statistical Package for Social Studies (SPSS) version 10.05 for Windows 98. The chi-squared test was used to assess the level of statistical significance. The result was considered to be significant if $p < 0.05$.

Results

Twenty - six patients were studied. There were 21 (81%) males and 5 (19%) females with age ranging from 17 to 56 years . Ten cases (38%) involved the right radius and sixteen cases (62%) involved the left radius. Sixteen patients (61%) were involved in motor vehicle accidents; eight (31%) had falls, one (4%) due to sports injury and one (4%) involved in an industrial accident. Fourteen cases (54%) were classified as AO type C1, eight cases (31%) type C2 and 4 cases (15 %) as type C3. External fixation was used in 12 cases and the remaining 14 cases were treated with internal fixation. One patient refused treatment with external fixation and opted for internal fixation . Bone graft was done in 8 patients from external fixation group and 10 patients from internal fixation group.

Anatomical results

Six months after surgery, 11(78.6%) of 14 cases treated with internal fixation were graded excellent as compared to only one (8.3%) of 12 external -fixation treated cases ($p < 0.05$). At one year, 10 (71.4%) of the 14 cases treated with internal fixation were graded as excellent compared only one (8.3%) of the 12 external -fixation treated cases ($p < 0.05$) (Table II). On both occasions the internal fixation was shown to be effective in maintaining the reduction of intra-articular comminution as compared to the external fixator.

Functional results

At six months (Table III) and one year (Table IV) after surgery, the functional outcome in the two group of fixation was not significantly different ($p > 0.05$). The functional results at these two different periods were not influenced by the two methods of immobilization.

Complications

Six patients (50%) from the external fixation group developed pin tract infection and all patients recovered after oral administration of antibiotics and dressing. No

patient had loss of fixation or breakage of the pins. There was no reflex sympathetic dystrophy after continuous distraction for six weeks. Only two patients (14.3%) from the internal fixation group developed complications. One patient had superficial wound infection, which resolved with antibiotic. One patient developed median nerve compression which was diagnosed preoperatively and carpal tunnel release was done at the time of surgery.

Table I: Functional scoring method of closed unstable comminuted intraarticular fracture distal end of radius

Subjective evaluation	
Category	**Points**
Excellent: no pain, disability or limitation of motion	0
Good: occasional pain, slight limitation of motion and no disability	2
Fair: occasional pain, some limitation of motion, feeling of weakness in wrist, no particular disability if careful and activities slightly restricted	4
Poor: pain, limitation of motion, disability and activities more or less markedly restricted	6

Objective evaluation	
Movement/ function	**Score**
Dorsiflexion < 45 degrees	5
Palmar flexion < 30 degrees	1
Ulnar deviation < 25 degrees	3
Radial deviation < 15 degrees	1
Supination < 50 degrees	2
Pronation < 50 degrees	2
Loss of circumduction	1
Finger flexion not to distal crease	1 to 2
Loss of grip strength	1
Mild radial / median nerve neuritis	1 to 3

Final grade: excellent, 0 to 2; good, 3 to 8; fair, 9 to 14; poor > 15

Table II: Anatomical results of closed comminuted intraarticular fracture distal end of radius at one year

Operation / Outcome	Excellent	Good
External fixation	1(8.3%)	11(91.7%)
Internal fixation	10(71.4%)	4(28.6%)

Table III: Functional results of the wrist based on Stewart , Gartland and Werley at six months

Operation / Outcome	Excellent	Good
External fixation	8 (66.7%)	4(33.3%)
Internal fixation	11 (78.6%)	3(21.4%)

Table IV: Functional results of the wrist based on Stewart, Gartland and Werley at one year

Operation / Outcome	Excellent	Good
External fixation	9 (75%)	3 (25%)
Internal fixation	12(85.7%)	2(14.3%)

Discussion

Closed unstable comminuted intra-articular fracture of the distal end of the radius is one of the commonest injuries seen in the Orthopeadic Unit, National University of Malaysia Hospital. It is challenging, difficult to treat and the choice of fixation is always debatable.

There were 26 patients in this study with male predominance (81%). All patients were below 56 years of age. Motor vehicle accidents was the commonest cause of fractures followed by falls. These types of fracture is associated with high-energy injury and are common in younger patients. Many classifications can be used for these fractures. The AO classifications for distal end radius fracture was used in this study in view of its up-to-date and organised manner to document the severity of the articular lesions.

External fixation was used to treat 12 patients, 8 patients were augmented with a bone graft from the iliac crest. In the internal fixation group 10 out of 14 cases needed bone graft. The decision to perform bone graft depended on the intra-operatively findings where significantly large defect of the metaphyseal region were grafted. Bone grafting of the metaphyseal defect not only provides mechanical buttress of the joint fragments but also accelerates fracture healing [8].

The anatomical results at six months showed that internal fixation was effective in maintaining the reduction compared to the external fixation. The radial height, volar tilt, dorsal tilt and radial inclination were well preserved. Eleven (78.6%) of the 14 cases treated with internal fixation were graded as excellent compared to the only one (8.3%) of 12 cases in external fixation treated cases. However, there was no difference in the functional outcome at six months. Eight (65.7%) of 14 cases treated with internal fixation were graded as excellent compared to eleven (78.6%) of 12 cases in internal fixation treated cases. The anatomical and functional results at one year was similar. The anatomical and functional results of this study are similar to Mc Queen et al; [9] where four methods of treatment a) plaster cast, b) open reduction and bone grafting, c) closed external fixation with or d) without mobilization of the wrist at three weeks for unstable fracture of the distal radius were compared. They concluded that there was no difference in functional outcome of unstable fracture distal radius treated by the four different methods and the best anatomical results were obtained by open reduction and bone grafting. Early physiotherapy and regular wrist exercises also contributed to these results.

The complication rate seen in this study was higher with external fixation group compared to the internal fixation. Six (50%) of 12 cases treated with external fixation developed complications compared to only 2 (14.3%) of 14 cases treated with internal fixation. All six patients in external fixation group developed pin tract infection, which resolved with antibiotics and wound dressing. We believe the complications may be due to inadequate instruction and supervision given to patients with regard to pin tract care after discharge from the ward. In the internal fixation group, one patient developed superficial wound infection which resolved with antibiotics in one week and one patient developed compression of the median nerve as a result of a fracture which carpal tunnel release was done simultaneously with the fixation. Post-operatively, the numbness at the index and middle finger improved.

Conclusion

Internal fixation of closed unstable comminuted intra-articular fracture of the distal end radius provided a better anatomical reduction than external fixation. However, at one year follow-up there was no difference in the functional outcome.

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