

Original Article

SPANNING PLATE IN FIXATION OF COMMINUTED DISTAL RADIUS FRACTURE

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Received 12/9/2021

Accepted 23/12/2021

Abstract

Distal radius fractures are commonly treated by orthopaedic surgeons. These fractures can be treated in a variety of methods, but the options for repairing can be limited in patients with high-energy fracture patterns. To evaluate the efficacy of dorsal spanning plate in distal radial fracture fixation, at Sohag University Hospital's Orthopedics & Traumatology Department, 15 patients were included in a cross-section study from April 2020 to April 2021. As regard the modified mayo score. The mean score was 56.1 ± 13.4 . There were 4 (26.7%) cases with excellent score, 9 (60%) cases with good score and 2 (13.3%) cases with fair score. As regard the range of motion. The mean flexion was 50.2 ± 5.8 , the mean extension was 46.5 ± 4.3 , the mean pronation was 70.3 ± 6.1 , the mean supination was 71.6 ± 5.7 , the mean ulnar deviation was 20.4 ± 2.1 . The mean radial deviation was 16.2 ± 2.5 . The mean radial height was 8.4 ± 1.9 and the mean radial tilt was 17.2 ± 2.4 .reduction.Dorsal spanning plate fixation is an excellent alternative surgical option for management of high energy distal radius fractures in the setting of multi-trauma. It can also provide the benefit of early mobilization of the patient by allowing the use of the injured hand and upper extremity for weight-bearing and activities of daily living in the case of concomitant injuries

Keyword: Distal radius fracture, Dorsal spanning plate.

1. Introduction

One of the most common injuries in orthopedics is the distal radius fracture. It's more common in physically active patients, low bone mineral density and osteoporosis which are considered as risk factors [1]. High-energy fractures of the distal radius involving both an articular component and a metaphyseal comminution remain a therapeutic challenge. Fracture dislocation with additional extrinsic (and/or intrinsic) ligamentous injuries poses an additional challenge [2]. The gold standard in operative treatment of distal radius fractures has been thought to be the External fixation, however, there is an increasing shift

towards the spanning plate in the last few decades [3]. The spanning plate was first described by Burke and Singer in 1998. The principle of a spanning plate as a temporary internal radiocarpal arthrodesis, bridging both the fracture site and the radiocarpal joint in complex, intra-articular fractures of the distal radius [4]. In the dorsal spanning plate, the fracture is reduced and then stabilized with Kirschner (K-) wires by a dorsal approach through the third extensor compartment [5]. In the first study by Burke and Singer, excellent results were reported 4 years after the index operation. Ever since, several studies pres-

ented their results of this technique including multiple variations such as retrograde placing of the spanning plate, using different extensor compartments and plate sizes [6]. The dorsal spanning plate is considered to have particular advantages in patients who benefit from early mobilization and weight bearing across the injured wrist in order to sit up, transfer and walk. This demand applies in particular to elderly frail patients with osteoporotic fractures but also to polytrauma patients [7].

2. Patients and Methods

This study was a cross section study. At Sohag University Hospital's Orthopedics & Traumatology Department, 15 patients were included in the study from April 2020 to April 2021.

2.1. Inclusion criteria

Skeletally mature patients aging 18 or more and comminuted distal radius fractures.

2.2. Exclusion criteria

Age less than 18 year or more, patients with previous fracture affecting wrist joint in the same side, patients with active infection in the affected joint, pathological fracture, neurological disorder (epilepsy ...etc) and rheumatoid arthritis

2.3. Ethical consideration

This study had been approved by the ethics committee of faculty of medicine. Informed consent was obtained from each patient.

2.4. Methods of the study

Following hemodynamic stabilization, appropriate emergency treatment is administered for associated head, chest, and/or abdominal injuries, radiological evaluation with x-rays in two views (anteroposterior and lateral), the limb is rested on a slab below the elbow, routine laboratory investigation, and fracture classification. AO classification: fractures were classified as type A (extra-articular), type B (partial articular), and type C (full articular), additional classification into 27 fracture pattern. Surgical procedure of dorsal spanning plate: The plate was placed directly on the dorsum of the wrist. Fluoroscopic

guidance was used to locate the incision sites. The first incision was then made over the dorsal part of the index metacarpal. A second longitudinal incision was then made on the dorsal side of the distal one-third of the radial shaft. After the plate was slipped beneath the extensor carpi radialis longus, screws were inserted. The skin and subcuticular layers are closed once the wound has been irrigated. The disabilities of the arm, shoulder, and hand (DASH) questionnaire will be used, this questionnaire include a scale of 30 symptoms. Score ranges from 0 to 100. The success of the surgical procedure was evaluated depending on the score as 0 score indicated no impairment.

4.5. Statistical analysis

The collected data will be coded, processed and analyzed using SPSS program (Version 25) for windows. Descriptive statistics will be calculating to include means, standard deviations, medians, ranges, and percentages. For continuous variables, independent t-tests will be performing to compare the means of normally distributed data, while Mann–Whitney U tests will be used to compare the median differences of the data that were not normally distributed, and chi-square test for categorical data. The t test and Wilcoxon test will be used in dependent groups. A p value below 0.05 considered statistically significant.

3. Results

Follow up for clinical evaluation by the Mayo modified wrist score. Plain wrist radiographs were performed for detection of any difficulties or instability following surgery, fig. (1). As regard the demographic data, the mean age was 50 ± 8.2 years. There was 10 (66.7%) male and 5 (33.3%) female, tab. (1). As regard fracture characteristics, there were 2 (13.3%) cases with open fracture and 13 (86.7%) cases with closed fracture. There were 3 (21.4%) cases with dislocation and 12 (78.6%) cases without dislocation, tab. (2). As regard the modified mayo score. The mean score was 56.1 ± 13.4 . There were

4 (26.7%) cases with excellent score, 9 (60%) cases with good score and 2 (13.3%) cases with fair score, tab. (3). As regard the range of motion. The mean flexion was 50.2 ± 5.8 , the mean extension was 46.5 ± 4.3 , the mean pronation was 70.3 ± 6.1 , the mean supination was 71.6 ± 5.7 , the mean ulnar deviation was 20.4 ± 2.1 . The mean radial deviation was 16.2 ± 2.5 . The mean radial height was 8.4 ± 1.9 and the mean radial tilt was 17.2 ± 2.4 , tab. (4). As regard complication. There were 3 (20%) cases with pseudo atrophy, there was 1 (6.67%) case with pin track infection, there was 1 (6.67%) case with metacarpal fracture, there were 2 (13.3%) cases with tendon injury and there were 3 (20%) cases with loss reduction, tab. (5).



Figure (10) **a.** Preoperative AP & Lat view, **b.** postoperative Lat view, **c.** postoperative AP view, **d.** After removal

Table (1) Demographic data among the participants

Variables	
Age Mean \pm SD	50 \pm 8.2
Gender	
Male n (%)	10 (66.7)
Female n (%)	5 (33.3)

Table (2) Fracture characteristics

Variables	
Fracture	
▪ Open n (%)	2 (13.3)
▪ Closed n (%)	13 (86.7)
Dislocation	
▪ Yes n (%)	3 (21.4)
▪ No n (%)	12 (78.6)

Table (3) Mayo Modified wrist score

Variables	
Mayo score	
Mean \pm SD	56.1 \pm 13.4
Excellent n (%)	4(26.7)
Good n (%)	9(60)
Fair n (%)	2(13.3)
Bad n (%)	0

Table (4) Range of motions

Variables	
Flexion; Mean\pm SD	50.2 \pm 5.8
Extension; Mean\pm SD	46.5 \pm 4.3
Pronation; Mean\pm SD	70.3 \pm 6.1
Supination; Mean\pm SD	71.6 \pm 5.7
Ulnar deviation; Mean\pm SD	20.4 \pm 2.1
Radial deviation; Mean\pm SD	16.2 \pm 2.5
Radial height; Mean\pm SD	8.4 \pm 1.9
Radial Tilt; Mean\pm SD	17.2 \pm 2.4

Table (5) Complications distribution among the participants

Complications	n (%)
Pseudo atrophy	3 (20%)
Pin track infection	1 (6.67%)
Metacarpal fracture	1 (6.67%)
Radial nerve injury	2 (13.3%)
Tendon injury	2 (13.3%)
Loss Reduction	3 (20%)

4. Discussion

Comminuted fractures of the distal radius have shown to be particularly difficult to treat and stable. The concept of a spanning plate as a temporary internal radiocarpal arthrodesis, bridging both the fracture site and the radiocarpal joint, is used in complicated fractures [8]. Distal radius fractures are common, accounting for one-sixth of all fractures treated in the emergency dep. In postmenopausal women, only compression fractures of the spine and hip fractures had a greater lifetime chance of developing a distal radius fracture. Many articular fragments in severely comminuted distal radius fractures are not amenable to direct fixation, offering a considerable treatment challenge, especially in an older patient with osteopenia [9]. The mean age was 50 ± 8.2 years. There was 10 (66.7%) male and 5 (33.3%) female, tab. (1). In the study by Dodds et al. [10] there were a total of 25 patients were identified. There were 11 female patients

and 14 male patients, with a mean age of 54.6 years. In another study by Shahid & Robati [11] there were 132 patients comprised of 34 males and 98 females, with an average age of 51 years (range 17-77 years). As regard fracture characteristics, there were 2 (13.3%) cases with open fracture and 13 (86.7%) cases with closed fracture. There were 3 (21.4%) cases with dislocation and 12 (78.6%) cases without dislocation. Our results were supported by study of Wang & Ilyas [12] as they reported that there were 22 closed and 2 open fractures. As regard the range of motion. The mean flexion was 50.2 ± 5.8 , the mean extension was 46.5 ± 4.3 , the mean pronation was 70.3 ± 6.1 , the mean supination was 71.6 ± 5.7 , the mean ulnar deviation was 20.4 ± 2.1 . The mean radial deviation was 16.2 ± 2.5 . The mean radial height was 8.4 ± 1.9 and the mean radial tilt was 17.2 ± 2.4 , tab. (4). Our results were supported by Dodds et al. [10] in which the mean range of flexion was 45.8, the mean range of extension was 42.4, the mean range of pronation was 76.4, the mean range of supination was 68.6, the mean range of ulnar deviation was 18.3, the mean range of radial deviation was 14.2, the mean radial height was 10.3 and the mean radial tilt was 18.9. In a systematic review by Fares et al. [13] the range of flexion was 36-37 with a mean of 45, the range of extension was 40-65 with a mean of 50, the range of pronation was 65-80 with a mean of 75, the range of supination was 68-77 with a range of 73 and the radial deviation ranges 18-20 with a mean of 19. Another research Jain & Mavani [14] on 20 patients with comminuted distal radius fractures who were treated with DSP fixation. The radiographic results showed a mean volar tilt of 7° , ulnar variation of 0.5 mm, radial inclination of 18° , and radial height loss of 2 mm. The average wrist range of motion in that research was 46° flexion, 50° extension, 79° pronation, and 77° supination.

5. Conclusion

Dorsal spanning plate fixation is an excellent alternative surgical option for management of high energy distal radius fractures in the setting of multi-trauma. It can also provide the benefit of early mobilization of the patient by allowing the use of the injured hand and upper extremity for weight-bearing and activities of daily living in the case of concomitant injuries

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