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A prospective study on the surgical management of distal end of radius fractures by various modalities

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Abstract

Aim: The purpose of this study was to evaluate the functional outcome of surgical management of distal radial fractures in adults using various methods such as Closed Reduction and External Fixation, External Fixation with Kirschner wire augmentation and Open Reduction and Internal Fixation with plate and screw.

Methodology: Prospective study was carried out in the Department of Orthopaedics, Great Eastern Medical School and Hospital (GEMS), Srikakulam. The assessment of results were made using the demerit score system of Gartland and Werley based on objective and subjective criteria, residual deformity and complications.

Results: Using the Demerit score system of Gartland and Werley, we had 5(10%) excellent results, 30(60%) good results, 13 (26%) fair results and 2 (4%) poor results. In our series, we had 10% excellent, 60% good, 26%, fair and 4% poor result. Patients, who obtained excellent results, had no residual deformities or pain. Range of motion was within the normal functional range. They had no arthritic changes or other complications. They were operated within 4 days after injury. Radial length, volar tilt and articular step-off were within acceptable limits. They were co-operative to physiotherapy. Patients with good results had minimal residual deformities, pain and slight limitation. Rest of their findings was within acceptable parameters. Patients with fair results, along with residual deformity, pain and limitation also had pain in the distal radio- ulnar joint and minimal complications. Few of their movements were less than that required for normal function.

Conclusion: Distal radial fractures are more common in the 3rd to 5th decades. Male preponderance is due to their involvement in heavy manual labour, outdoor activities and riding vehicles. Most of the fractures are treated with closed reduction and plaster application.

Keywords: distal radial fracture, Gartland and Werley scoring system, closed reduction, residual deformity

Introduction

Fractures of the distal aspect of the radius continue to pose a therapeutic challenge. Some of these fractures are caused by severe high energy trauma, resulting in intraarticular involvement and comminution. Treatment of such injuries is difficult. These fractures often are unstable, are difficult to reduce anatomically, and are associated with a high prevalence of complications of post-traumatic osteoarthritis after intra- articular fracture of the distal aspect of the radius. The restoration of disrupted radial anatomy, maintenance of accurate and stable reduction, and early hand mobilization are required for good functional results in unstable distal Radius fractures. 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 mobilization are required for good functional results in unstable distal Radius fractures. Open reduction and internal fixation are indicated to address the 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 to permit early range of motion. Since loss of reduction with subluxation of the carpus is so common, frequently used is a small buttress plate, as described by Ellis, as fixation for volar marginal fractures. Unstable bending fractures of the radial metaphysis are ideally suited for open reduction and internal fixation.

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Internal fixation of metaphyseal bending fractures has become increasingly popular due primarily to (a) directly control and maintain physiologic palmar tilt, (b) prevent collapse with external fixation, and (c) avoid bridging the radiocarpal joint. The distal fragment typically has sufficient size and integrity to provide adequate purchase and may be approached from either a dorsal or a volar 2 approach. Palmar plating is preferred, as the screws directly buttress against collapse and loss of palmar tilt. With smaller and more distal fragments, a dorsal plate has to be positioned distally on the dorsum of the Radius making extensor tendon injury more likely. Many things are subject to trend and fashion, and the treatment of distal radial fractures is no exception.

Pins and plasters gave way to external fixation, and now internal fixation has begun to supplant all other treatment modalities. Published clinical trials directly comparing treatment regimens of closed reduction, external fixation and percutaneous pinning with open reduction and internal fixation are lacking. The results of the currently published data are difficult to compare. Most studies are retrospective in nature and use various classifications and inconsistent outcome tools, especially in regard to comminuted fractures with joint incongruity. The purpose of this study was to evaluate the functional outcome of surgical management of distal radial fractures in adults using various methods such as Closed Reduction and External Fixation, External Fixation with Kirschner wire augmentation and Open Reduction and Internal Fixation with plate and screw.

Aim and Objectives

- To study the effectiveness of various surgical modalities in the fractures of the distal end radius in achieving anatomical reduction and stability of the fixation.
- To analyze the various surgical modalities and end result complications such as nerve injuries, post traumatic arthritis, stiffness and duration of the post-operative immobilization.

Materials and Methods

The present “A prospective study on the surgical management of distal end of radius fractures by various modalities” was carried out in the Department of Orthopaedics, Great Eastern Medical School and Hospital (GEMS), Srikakulam.

Inclusion criteria

- Adults (aged 20-60 Years),
- Both male and female
- Unstable, comminuted or intra articular fractures of distal end radius
- Open fractures
- Loss of volar buttress with displacement
- Secondary loss of reduction

Exclusion criteria

- Patients aged below 20 years.
- Fractures managed conservatively by pop slab.
- Compound fractures associated with neurovascular injuries.
- Pathological fractures

Results and Discussion

The assessment of results were made using the demerit score system of Gartland and Werley based on objective and subjective criteria, residual deformity and complications.

Table 1: Scoring system According to Gartland and Werley

Results	No. of cases	Percentage
Excellent	05	10
Good	30	60
Fair	13	26
Poor	02	04

Using the Demerit score system of Gartland and Werley, we had 5(10%) excellent results, 30(60%) good results, 13 (26%) fair results and 2 (4%) poor results.

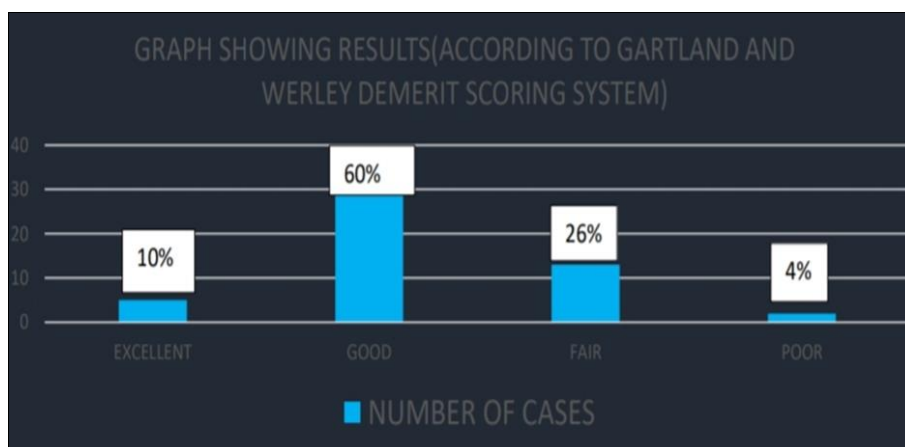


Fig 1: Showing results according to Gartland and Werley demerit Scoring system

In our series, we had 10% excellent, 60% good, 26%, fair and 4% poor result. Patients, who obtained excellent results, had no residual deformities or pain. Range of motion was within the normal functional range. They had no arthritic changes or other complications. They were operated within 4 days after injury. Radial length, volar tilt and articular step-off were within acceptable limits. They were co-operative to physiotherapy. Patients with good results had minimal residual deformities, pain and slight limitation. Rest of their findings was within acceptable parameters. Patients with fair

results, along with residual deformity, pain and limitation also had pain in the distal radio- ulnar joint and minimal complications. Few of their movements were less than that required for normal function.

Patient, who had poor result, was operated on the 2nd day after injury as he had type iii b (Gustilo & Anderson) compound fracture having radial metaphysiodiaphyseal extension and distal 1/3rd ulna fracture which was resected after initial wound debridement and treated with external fixator wound healed after skin grafting bony healing delayed

for 4 months. He had limitation, disability and weakness. Most of his movements were not within the range required for normal function. He also had pin tract infection. He was non-compliant with regard to post-operative physiotherapy. One more patient had fallen from electric pole from a height of 20 feet had Frykman type viii distal radius fracture treated with external fixation distal radioulnar dissociation persisted and he was non-compliant for physiotherapy and regular follow up resulted in deformity and painful restricted movements at wrist. Both patients are willing to undergo corrective surgery at a later date [5-7].

Table 2: G & W system

Series	Excellent	Good	Fair	Poor
John K. Bradway <i>et al.</i> [13]	44	12	44	0
Jesse B. Jupiter <i>et al.</i> [18]	63	20	17	0
Harish Kapoor <i>et al.</i> [24]	15	15	8	4
Present study	10	60	26	4

Our series is comparable to Harish Kapoor *et al.* (2000) [7] who had similar percentage of results. Harish Kapoor *et al.* (2000) [7] also did plaster immobilization for 38% patients. Their results were not included for comparison. Jesse B. Jupiter *et al.* (1996) [4, 5] had similar percentage of excellent and good results.

Many of the literature denotes fracture of the distal radius are common in older individuals 4th to 6th decade, as our clinical trial was to study the effectiveness of the operative management of the distal radius fractures by various methods, we included the cases, requiring surgery which were comminuted and intra articular and occurred due to high energy trauma in young individuals. The mode of injury is either a road traffic accident or fall on the outstretched hand. Distal radial fractures which occur due to road traffic accidents (high energy trauma) are mostly intra-articular, displaced and unstable (Frykman Type III - VIII) and AO type B2, B3, C1 and C3. The choice of a particular operative method for each case should depend on the fracture pattern, reducibility and stability and quality of bone. Fractures with extreme comminution are best fixed with distraction and external fixation. Radial length, which is the most important radiological parameter, is best maintained by external fixation due to sustained counter traction utilising the principle of ligamentotaxis. However, joint congruity and volar tilt may not be fully restored with external fixation. Open fractures of the distal radius are also best treated with external fixation. Fractures which have intra articular incongruity of more than 2mm, which persists or recurs after closed reduction or percutaneous treatment, are at a higher risk of post-traumatic arthritis than those who have no incongruity. Patients who have such a fracture should be considered for open reduction and some form of internal or combined internal and external fixation. Open reduction and internal fixation provide the best chance for restoring joint congruity and therefore patients treated by this method have a lesser chance of developing secondary osteoarthritis. Kirschner wires are used for percutaneous pinning through direct imaging for extra articular fractures with adequate bone stock but anticipated late collapse, and application of below elbow cast for six weeks. Kirschner wires can be used to augment on external fixator to fix fragments too small for other means of fixation. [8, 9] They can also be used as 'joy sticks' to control fracture fragments prior to internal fixation. Operative treatment is a must for displaced, intra-articular fractures to prevent the sequelae of post-traumatic arthritis, pain and stiffness. Intra-

operative image intensification is a necessity for any operative method done to fix a distal radial fracture. Early fixation and early post-operative mobilization and range of motion exercises, greatly improve the long-term results. Among the radiological parameters, radial shortening is the most critical followed by joint congruity, radial angulation and dorsal tilt. Dorsal displacement produces minimal problems. Regardless of the type of fixation, complication rates can be minimized by proper selection of implant and procedure, good surgical technique, proper pin site and wound care and fixation removal at 6 weeks [10-12].

Union is not a problem as these fractures occur in the metaphyseal region. But malunion should be avoided by proper selection of implant and procedure. Operative management of distal radial fractures, regardless of the type of fixation, produces excellent to good results with proper pre-operative evaluation, selection of the method based on fracture pattern, reducibility, stability and quality of bone, early fixation, proper wound and pin site care, early post-operative rehabilitation and patient education.

Conclusion

The present study was undertaken to assess the functional outcome of operative management of distal radial fractures in adults by various methods and the following conclusions were drawn. Distal radial fractures are more common in the 3rd to 5th decades. Male preponderance is due to their involvement in heavy manual labour, outdoor activities and riding vehicles. Most of the fractures in the younger individuals is due to motor vehicle accidents or high energy trauma which are usually intra-articular, displaced and unstable requiring operative management. And the fractures occurring in the older individuals will be due to trivial fall on outstretched hand causing extra articular fracture in the osteoporotic bone, most of the fractures are treated with closed reduction and plaster application.

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