Original Article

Evaluation of Ligamentotaxis in Management of Comminuted Intra-articular Fractures of Distal Radius Using Spanning Naseer–Awais (NA) External Fixator

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Abstract

Background: Comminuted intra-articular distal radius fractures are the most common amongst the fractures of the upper limb. There are various methods of management of comminuted intra-articular fractures of distal radius published in the orthopaedic literature, these are closed reduction and plaster cast application, closed reduction and percutaneous pin fixation, closed reduction percutaneous pin fixation with plaster cast application, ligamentotaxis with application of external fixation across the wrist joint and open reduction and internal fixation.

Objective: Objectives of this study were to evaluate the ligamentotaxis for the treatment of comminuted intra-articular fractures of distal radius and compare the prescribed data for comparison with similar series in the orthopaedic literature.

Methodology: During this study 30 skeletally mature patients with comminuted intra-articular fractures of distal radius attending outpatient department or orthopaedic emergency of Lahore General Hospital, Lahore, with less than one week duration were admitted in the hospital. They were examined clinically. Radiographs were taken and diagnosis was confirmed. Patients with open fractures or with multiple injuries were excluded from the study. Patients were administered general anesthesia. Skin distal to the elbow was prepared with antiseptic iodine solution and draping was done. Closed reduction of the fracture was done and N. A external fixator was applied across the wrist joint. Distraction force was applied across the fracture site by elongation of threaded rod of external fixator. This distraction force was maintained till union of the fracture according to the principle of ligamentotaxis. All the patients were examined in outpatient department at regular intervals. Data of this study was recorded for comparison of similar series in recent orthopaedic literature.

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Results: There were no serious complications in our study. Six patients (20%) developed mild pin tract infections these were treated by oral antibiotic therapy. One patient (3.3%) developed aseptic loosening of external fixator after three weeks. In this patient external fixator was replaced by plaster cast. One patient (3.3%) lost the reduction in which revision of external fixation was carried out. After removal of external fixator / plaster cast, a supervised programme of physiotherapy was started for restoration of the wrist and hand functions. Twenty two (73.3%) patients required physiotherapy for 1 week, 5 (16.7%) required for 2 weeks and 3 patient (10%) did not require it at all.

Conclusion: We conclude that ligamentotaxis is an excellent method for the management of comminuted intraarticular fractures of distal end of radius. It obviates the need of plaster cast application or open reduction and internal fixation of the fracture and result of this study are comparable with similar series published in the orthopaedic literature.

Keywords: Ligmaentotaxis distal radius fracture.

Introduction

Ligamentotaxis is the use of continuous longitudinal distraction force for reduction of fracture fragments. Longitudinal distraction force acts on the soft tissues surrounding the fracture and moulds the displaced fractures fragments in reduced position.[1] For this purpose external fixators are applied across the wrist joint for management of comminuted intraarticular fractures of distal radius.

Comminuted intraarticular fractures of distal radius are the most common amongst the fractures of the upper limb. These are caused by high energy trauma in young patients and by low energy trauma in elderly. These present as shear and impacted factures of the articular surface of distal radius with displacement of the fracture fragments.[2,3] These fractures must be reduced anatomically and stabilized till union for restoration of wrist and hand functions.

Failure to reduce fragments of comminuted intra-articular fractures of distal radial within 2 mm of articular congruity may lead to symptomatic degenerative arthritis of wrist joint. Therefore, management of these fractures is a great challenge for orthopaedic surgeons.[4]

There are various methods of management of comminuted intra-articular fractures of distal radius published in the orthopaedic literature. These include closed reduction and plaster cast application, closed reduction and percutaneous pin fixation, closed reduction percutaneous pin fixation with plaster cast application, ligamentotaxis with application of external fixation across the wrist joint and open reduction internal fixation.

In ligamentotaxis continuous longitudinal traction across the wrist joint produces tension in the intact ligaments of wrist joint and soft tissues surrounding the comminuted intra-articular fracture of distal radius, which reduces the displaced fracture fragments. Tissue tension produced by application of the external fixator is maintained till union of the fracture. After union of the fracture external fixator is removed and physiotherapy is started for restoration of wrist and hand functions.

In this study, 30 patients with comminuted intra-articular fracture of distal radius were treated by ligamentotaxis and data was recorded for evaluation in terms of age, gender, mode of injury, fracture side, hospital stay, duration of ligamentotaxis and complications for comparison with similar series in the orthopaedic literature.

Patients and Methods

During this study 30 skeletally mature patients with comminuted intraarticular fractures of distal radius attending outpatient department or orthopaedic emergency of Lahore General Hospital, Lahore, with less than one week duration were admitted in the hospital. They were examined clinically. Radiographs were taken and diagnosis was confirmed. Patients with open fractures or with multiple injuries were excluded from the study. Patients were administered general aneasthesia. Skin distal to the elbow was prepared with antiseptic iodine solution and draping was done. Closed reduction of the fracture was done and N.A external fixator was applied across the wrist joint. Distraction force was applied across the fracture site by elongation of threaded rod of external fixator. This distraction force was maintained till union of the fracture according to the principle of ligamentotaxis. All the patients were examined in outpatient department at regular intervals. Data of this study was recorded for comparison of similar series in recent orthopaedic literature.

Results

In this study of 30 patients with comminuted intra-arti-

cular distal radius fractures, age ranged from 18 to 68 years with an average age of 30.80 ± 11.64 years. There were 22 (73.3%) males and 8 females (26.7%), male female ratio was 2.7: 1. Twenty one patients (70%) had right and 8 (26.7%) had left side and 1 (3.3%) had bilateral involvement.

In 26 (86.7%) patients comminuted intra-articular fracture of distal radius were caused by road traffic accident, 3 (10%) had fall from height and 1 (3.3%) fracture was caused by sports injury. The hospital stay ranged from 1 to 3 days with an average of 2.0 days. The duration for ligamentotaxis ranged from 5 to 8 weeks with an average of 5.9 weeks. There were no serious complications in our study. Six patients (20%) developed mild pin tract infections these were treated by oral antibiotic therapy. One patient (3.3%) developped aseptic loosening of external fixator after three weeks. In this patient external fixator was replaced by plaster cast. One patient (3.3%) lost the reduction in which revision of external fixation was carried out. After removal of external fixator / plaster cast a supervised programme of physiotherapy was started for restoration of the wrist and hand functions. Twenty two (73.3%) patients required physiotherapy for 1 week, 5 (16.7%) require for 2 weeks and 3 patient (10%) did not require it at all.

Discussion

Even in this era of navigational orthopaedic surgery, management of comminuted intra-articular fractures of distal radius is a challenging problem for orthopaedic surgeons in terms of reduction, maintenance of reduction and regaining wrist and hand functions. To solve these problems, different techniques have been tried by different orthopaedic surgeons in different ages. In 1929, Bohler advocated the use of fixed pin traction to

Table 1: Descriptive Statistics of Age (years), Duration of ligamentotaxis (weeks) and Duration of Physiotherapy (weeks).

	Age (years)	Duration of Ligamentotaxis (weeks)	Duration of Physiotherapy (weeks)
Mean	30.80	5.90	1.2833
Median	27.50	6.00	1.0000
Mode	23	6	1.00
Std. Deviation	11.645	.845	.65236
Range	50	3	3.00
Minimum	18	5	.00
Maximum	68	8	3.00

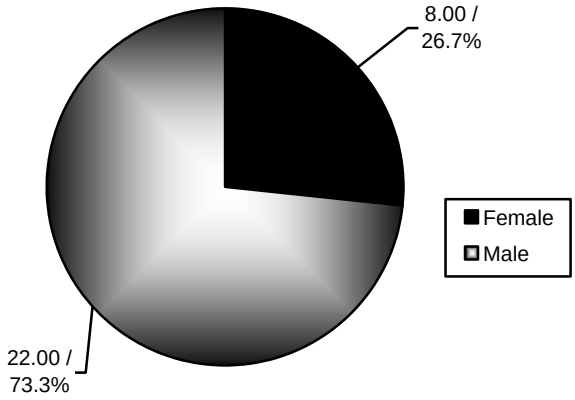

Fig. 1: Gender distribution.

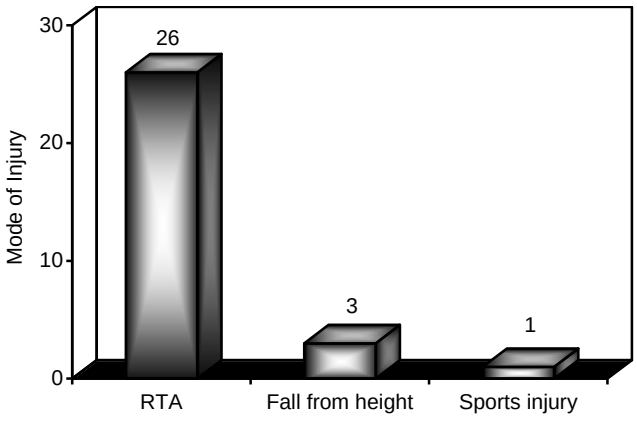

Fig. 2: Mode of Injury.

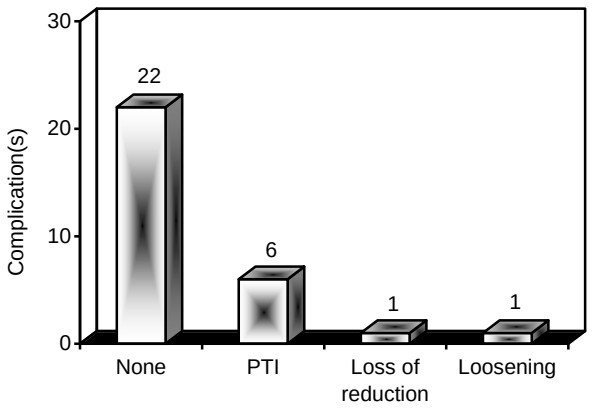

Fig. 3: Physiotherapy done (weeks).

maintain the reduction of comminuted fractures of the distal radius.[5] Since then this method has been recommended and modified by many surgeons. Fixed longitudinal distraction force applied by external fixator acts on surrounding soft tissues and moulds the displaced bony fragments into reduced position along with providing mechanical stability to prevent shortening of the distal radius till union of the fracture.

Current reports also reflect the growing popularity of this method for the treatment of comminuted, intra-articular fractures of distal radius, but the recommended duration for use of ligamentotaxis varies between 8 to 12 weeks in different similar series.[6-8]

Number of Patients

In this study 30 patients with comminuted intraarticular fracture of distal radius were studied whereas Leung et al 1989, Suhail A et al 2003, Bopha Rai RPS et al 2006 and Shyam et al 2010 published the series of 72, 30, 30 and 65 patients with similar type of fractures respectively.[9-12] In terms of biostatistics 30 is a sufficient number of patients for statistical analysis. Therefore this study yielded significant results.

Age

In this study age of patients ranged from 18 to 68 years with an average of 30.8 years. Leong et al 1989 published a study of 72 patients in which patients age ranged from 18 – 65 years with an average of 35.6 years.[9] Afzal et al 2003 published a study with age range between 20 – 62 years with an average of 42 years.[10] Shayam AK et al 2010 with age range between 23 – 79 years with an average of 42 years.[12] In our study patients are relatively younger as compared to other similar series because young population of the society is more active and are more prone to trauma.

Gender

There were 22 males and 8 females with male female ratio of 2.7: 1 in this study. Leong et al 1989 reported a series of 72 patients of intra-articular fracture of distal radius in which 53 were males and 19 were females.[9] Afzal S et al 2003 reported 14 males and 16 females in his series of intraarticular fracture of distal radius.[10] Shayam AK et al 2010 reported a series of 65 patients among them 40 were males and 25 were females.[12] Number of male is higher than the females because males are more active than the females in the outdoor activities. This fact makes them more prone to trauma. But it is strange that number of female patients is higher in the series of Afzal et al 2003[10] which reflects that females are more active than males in that society that makes them more prone to intraarticular fractures of distal radius.

Side

Our study of 30 patients with intraartiular fracture of distal radius right side was involved in 21 (70%) patients, left side was involved in 8 (26.7%) patients and in 1 patient involvement was bilateral (3.3%). Leung et al 1989 in a study of 72 patients reported right side involvement of 44 patients and left side involvement in 28 patients in his series of 72 patients.[9] Afzal S et al 2003 reported right sided involvement in 20 (67%) patients, left sided involvement in 9 (30%) patients and only 1 (3%) patient bilateral involvement in a series of 30 patients.[10] Shayam AK et al 2010 in a series of 65 patients reported left side involvement in 28 (43.07%) patients and right side involvement in 37 (56.93%) patients.[12] Side of involvement of intraarticular fracture of distal radius depends upon the position of the patient at the time of trauma and handedness of the patient. Right side involvement is more common in all the studies because as the patient falls he/she tries to protect him / herself by out stretching the dominant hand. In fact, the dominant hand is more active and reacts much more quickly than the non dominant hand. It plays important role in determining the side of involvement of intra-articular fracture of distal end of radius. In our study all the twenty one patients who had right side involvement were right handed eight patients who had left sided involvement were hit from the right side and landed on the ground on left outstretched hand the only 1 patient who had

bilateral involvement fell from height and landed on the ground with both outstretched hands.

Cause of Injury

In our study of 30 patients, 26 (86.7%) comminuted intraarticular fractures were caused by road traffic accidents 3 (10%) were caused by fall from height and 1 (3.3%) was caused by sports injury. Afzal S et al 2003 reported fall from height in 28 (93%) and road traffic accident 2 (7%) as cause of intra-articular fractures of distal end of radius in his series of 30 patients.[10] Bopharai et al 2006 in a study of 30 patients observed that 17 intra-articular fractures of distal radius were caused by road traffic accidents, 6 were caused by fall of heavy objects, 4 were caused by direct blow during assaults and 3 were caused by machine injuries.[11] In our study majority of fractures were caused by road traffic accidents because of ill organized high speed vehicular traffic. During these accidents motorcycle riders were hit by the other high speed vehicles, the rider lost control on the motorcycle, fell down on the black top road by landing on out stretched hand sustaining intra-articular fracture of respective distal end of radius.

Hospital Stay

In our study hospital stay of the patient ranged from 1 to 3 days. Three patients stayed for I day, 24 patients stayed for 2 days and 3 patients stayed for 3 days with an average of 2 days. Afzal S et al 2003 reported average hospital stay of 2 days in a similar study.[10] Duration of hospital stay in our study is comparable with this study.

Duration of Ligamentotaxis

In our study duration of ligamentotaxis ranged from 5-8 weeks. Leong et al 1989 maintained ligamentotaxis for intraarticular fractures of distal radius for 3 weeks which was followed by a careful programme of rehabilitation.[9] Afzal S et al 2003 maintained the ligamentotaxis for 4 weeks and then he applied below elbow plaster cast for immobilization of the fracture.[10] Bopharai et al 2006 maintained ligamentotaxis for 5 – 20 weeks in his patients.[11] Shayam et al 2010 maintained ligamentotaxis in his patients for 7 weeks for the treatment of intraarticular fracture of distal radius.[12] Our this finding is also comparable with other similar studies as 5-8 weeks are required for union of the distal end of radius.

Acceptance of External Fixator

Afzal et al 2003 reported in his series of 30 patients that his 28 (93%) patients tolerated external fixator well.[10] In our study all the 30 (100%) patients tolerated the external fixator well because all the patients were adults and they were explained the procedure pre-operatively.

Duration of Physiotherapy

In our study duration of physiotherapy ranged from 0-3 weeks with an average of 2 weeks.

Complications

In our study there were no serious complications in our study. Six patients (20%) developed mild pin tract infections these were treated by oral antibiotic therapy. One patient (3.3%) developed aseptic loosening of external fixator after three weeks. In this patient external fixator was replaced by plaster cast. One patient (3.3%) lost the reduction in which revision of external fixation was carried out. Leong et al 1989 reported 1 fracture of second metacarpal 1 neuroma of superficial branch of radial nerve 2 transient carpal tunnel syndrome and 2 reflex sympathetic dystrophy in a series of 72 patients.[9] Afzal S et al 2003 in a study of 30 patients of intra-articular fractures of distal radius reported reflex sympathetic dystrophy in 2 patients.[10] Bhoparai et al 2006 in a series of 30 patients reported 13 pin tract infections, 3 delayed union and 1 malunion of intraarticular fracture of distal end of radius.[11] Shayam AK et al 2010 reported pin tract infections in 7 patients and reflex sympathetic dystrophy in 1 patient.[12] In our study there were 6 pin tract infections, because in hot and humid weather there is much sweating resulting in proliferation of bacteria already present on the body surface. These bacteria enter the body through pin tracts and result in pin tract infection. One patient developed aseptic loosening of the pin it might be due to over drilling of the pin tract. One patient lost the reduction because his fracture was extensively comminuted and was inherently unstable. In this patient revision of external fixation was done.

Conclusion

We conclude that ligamentotaxis is an excellent method for the management of comminuted intra-

articular fractures of distal end of radius. It obviates the need of plaster cast application or open reduction and internal fixation of the fracture and result of this study are comparable with similar series published in the orthopaedic literature.

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