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Dr. Alagurswamy Ravi
M.S.[Ortho], Department of
Orthopaedics, Saveetha Medical
College and Hospital,
Thandalam, Chennai,
Tamil Nadu, India

Dr. Arun Kumar P
M.S.[Ortho], Department of
Orthopaedics, Saveetha Medical
College and Hospital,
Thandalam, Chennai,
Tamil Nadu, India

Dr. P Krishna Sandeep
M.S.[Ortho], Department of
Orthopaedics, Saveetha Medical
College and Hospital,
Thandalam, Chennai,
Tamil Nadu, India

Dr. Sai Dev Ramkumar M
M.S.[Ortho], Department of
Orthopaedics, Saveetha Medical
College and Hospital,
Thandalam, Chennai,
Tamil Nadu, India

Dr. Yeshwanth Subash
D.N.B[Ortho], M.N.A.M.S.,
Professor of Orthopaedics,
Saveetha Medical College and
Hospital, Thandalam, Chennai,
Tamil Nadu, India

Corresponding Author:
Dr. Yeshwanth Subash
D.N.B[Ortho], M.N.A.M.S.,
Professor of Orthopaedics,
Saveetha Medical College and
Hospital, Thandalam, Chennai,
Tamil Nadu, India

Functional outcome of distal radius fractures managed by MIPO: A prospective study of 25 patients

Dr. Alagurswamy Ravi, Dr. Arun Kumar P, Dr. P Krishna Sandeep, Dr. Sai Dev Ramkumar M and Dr. Yeshwanth Subash

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Abstract

Introduction: A distal radius fracture is a common injury that affects people of all ages. However, there are various therapy approaches that are controversial. The gold standard for treating distal radius fractures is yet unknown. Casting with or without closed reduction has long been considered a feasible option for treating distal radius fractures; alternative options include k-wire fixation and ligamentotaxis with external fixation. However, with limited function and impairments, the results are frequently poor. "Several studies have found that distal radius fractures treated with external fixation have good anatomical and functional outcomes, although there is a substantial risk of pin tract infection and nerve damage. Traditional open reduction and internal fixation frequently results in severe soft tissue dissection and periosteal damage, which can lead to infection, delayed union, and non-union. Fortunately, a new approach known as minimally invasive plate osteosynthesis [MIPO] has recently evolved, which can reduce soft tissue stripping and bone vascularity loss while improving fracture healing.

Materials and Methods: A prospective study of 25 patients with closed distal radius fractures were treated by MIPO technique with a T-Shaped palmar locking plate between July 2020 and December 2021 and were followed up for a period of 6 months.

Results: There were 11 males and 14 females with an average age of 55.6yrs. The average blood loss was around 55 ml approximately. 13 patients obtained excellent results, nine cases had good results and three patients had moderate effects. The average DASH score after 6 months was about 10.6.

Conclusion: In conclusion, two small incisions to implant a palmar locking plate by MIPO for distal radius fractures give good functional results as soft tissue handling is better compared to the conventional method of plating. But further research also should be carried out to explore more suitable treatment for specific individuals.

Keywords: Distal radius, ORIF, MIPO, DASH score

Introduction

Distal end radius fractures are one of the most common fractures seen by orthopaedic surgeons on a daily basis. Manipulation for quick reduction and the application of a cast or dorsal slab are two conservative treatment options. However, with limited function and impairments, the results are frequently undesirable ^[1]. Manipulation for close reduction and percutaneous K-wire fixation or external fixator application are among the minimally invasive treatments. Several studies have documented favourable anatomical and functional outcomes in distal radius fractures treated with close reduction, K-wire fixation, and external fixation, but have also reported a high incidence of pin tract infection and nerve damage ^[2]. Traditional open reduction with internal fixation can result in a lot of soft tissue dissection and periosteal stripping, which can lead to infection, delayed union, and non-union. According to the literature, the recently developed approach of minimally invasive plate osteosynthesis [MIPO] can reduce soft tissue stripping and bone fragment vascularity damage. It has the potential to reduce the complications that come with traditional open surgery. Although minimally invasive plate osteosynthesis is commonly utilised in the treatment of lower limb fractures, it is less commonly employed in the treatment of upper limb fractures ^[3]. The goal of this study is to evaluate the clinical findings, radiological characteristics, and functional outcome of distal end radius fractures treated with minimally invasive plate osteosynthesis ^[4].

Materials and Methods

This was a prospective research that took place between July 2020 and December 2021 and involved 25 patients (11 men and 14 females). The Ethical Committee of our institute granted us ethical authorization to undertake this investigation. After explaining the study to each participant, they signed a written informed consent form. The study comprised skeletally mature patients with extraarticular and minimally comminuted intra-articular fractures. Patients with skeletal immaturity, open fractures, severe comminuted intra-articular fractures, fractures 5cm proximal to the articular surface, ipsilateral fractures of other upper limb bones, pathological fractures, previous history of radius fracture, pre-existing stiffness of ipsilateral joints, dorsal Barton, or severe dorsal comminution were all excluded from the study. The initial workup for the cases included particular X-rays of the afflicted wrist, including Antero-Posterior and Lateral views. Around 8 patients required a CT scan for pre-operative planning because to intra-articular extension and comminution.

After regional anaesthetic [Supra-clavicular block], the patient was placed supine on the OT table with the afflicted limb on an arm board. The first phase was to use traction and counter-traction to accomplish closed reduction. With the use of K wires, the required decrease was provisionally held once it was obtained and confirmed under C-Arm direction. A 2 cm long transverse incision was made at the proximal wrist crease, with a gap between the flexor carpi radialis and the radial artery. The belly of the pronator quadratus [PQ] was visualised after the flexor pollicis longus tendon was discovered and retracted medially. The distal edge of the PQ was broken transversely, exposing the anterior cortex of the distal radius. A precontoured distal radius T-Plate[5 holes] was put into a submuscular extra periosteal tunnel beneath the pronator quadratus and overlying periosteum." A 1.5 mm k wire was used to temporarily secure the T-plate to the bone through one of the distal holes. Another 2 cm long longitudinal incision was made along the medial border of the brachioradialis at the mid section of the forearm, corresponding to the proximal end of the plate. Another 1.5 mm K wire was used to hold the proximal part of the plate to the bone, keeping the plate centrally over the anterior side of the radius. C-Arm in AP and LAT views validated the final reduction at the fracture site and plate installation. If any malreduction remained, it was manually rectified. The fracture was repaired and the temporary K wires were withdrawn after locking screws were put distally. A cortical screw was first put proximally at the proximal end of the plate in order to recover the volar tilt. The wound was properly cleaned, and the pronator quadratus was mended before the wound was closed.

The forearm was kept elevated after surgery, and active/passive finger movements were started on the first post-operative day. In the majority of cases, physiotherapy was started right away. The limb was immobilised in a posterior slab until the sutures were removed in communicable fractures or in elderly individuals with osteoporosis. Range of motion exercises for the fingers, elbows, and shoulders began on the first post-operative day. The patient's tolerance for wrist dorsiflexion and palmar flexion was determined. In young patients with a stable fracture pattern and firm fixation, it was done right away. In individuals with osteoporosis or complex fracture patterns, however, wrist movements were delayed when sutures were removed.

Patients were closely evaluated in the hospital for compliance with physiotherapy and any acute post-operative problems. The patients were evaluated based on a variety of factors. The effects of surgical procedures and intraoperative factors were studied. At each follow-up, radiographs were used to assess bone union, and the DASH score was used to track functional outcomes. The time spent on surgery was measured from the first incision to the last suture, the time spent on fluoroscopy from the first shot to the last, and the blood loss was calculated using the number of sponges used and the amount of solution in the suction container at the end of operation.

Radial height, radial inclination, and volar tilt were used to make the radiographic assessment. These were compared and measured on pre-operative and post-operative radiography films. These characteristics were measured again at 12 and 24 weeks, and the results were compared to the previous films to see if the fracture site had collapsed. On X-rays, the fracture site union was also visible, and it was deemed adequate when bridging callus was visible at the fracture site in both the AP and LAT views. Delay in union was defined as three months without any or very little evidence of callus formation, while nonunion was defined as six months without any callus formation. The DASH score [Disabilities of the Arm, Shoulder, and Hand] was used to assess functional abilities.

Statistical analysis

The statistical analysis was carried out using the SPSS statistical package software. The statistical review was carried out by a clinical epidemiologist. Due to the short sample size, the analysis was performed non-parametrically. The demographic and baseline information was presented, and then the results were compared. Statistical significance was defined as a P-value of less than 0.05.

Results

There were 11 males and 14 females in the study [fig 1]. The mean time from injury to surgery was 7 days. The average blood loss was found to be of 55.6ml. They were all closed fracture and were classified according to AO/ASIF system, including type A2 [n=5], type A3 [n=4], type B1 [n=5], type B3 [n=8], type C1 [n=2], and type C2 [n=1]. All 25 patients were followed up for 6 months. The Average DASH score was about 10.6. Thirteen patients obtained excellent results, nine cases had good results and three patients had moderate effects. The Average DASH score was about 10.6. None of the patients had poor results, thus, excellent and good results were seen in 88% of patients and fair results in 12% of the patients [fig 2].

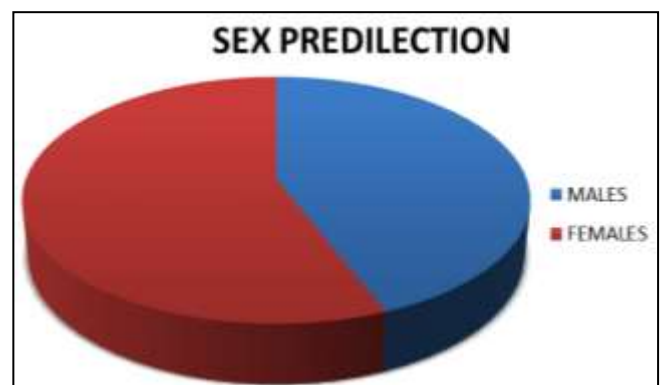


Fig 1: Sex predilection

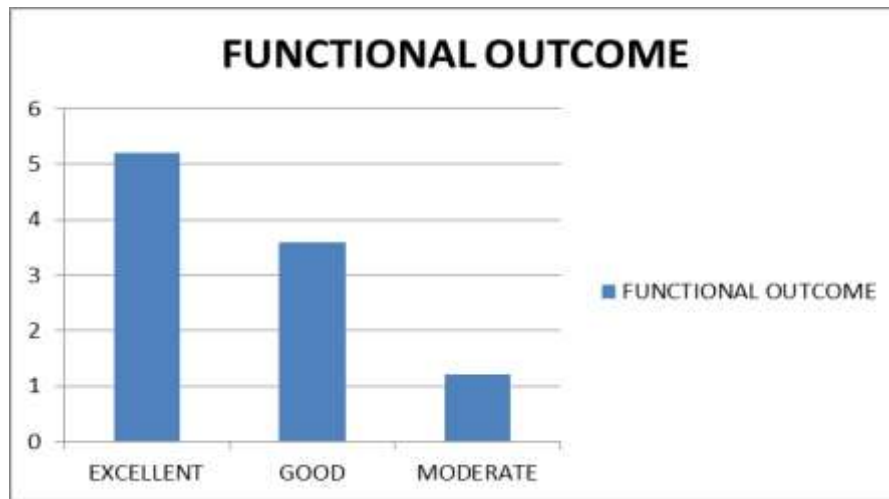


Fig 2: Functional outcome

The degree of dorsiflexion on an average was 66 degrees, palmer flexion was 82 degrees, radial deviation was 15 degrees and ulnar deviation was 35 degrees. (Table 1)

One patient had delayed healing in the proximal wrist crease. No damage to neurovascular structures such as the radial artery and median nerve occurred in all 25 patients

postoperatively, since our longitudinal incisions were usually along the radial side of the flexor carpi radialis and surgery was performed with caution on safe area to avoid accidental injury. Besides, neurovascular injury 4 patients had postoperative wrist pain for 3 months which was resolved on physiotherapy exercises.

Table 1: Patient Demographics and data

Sl. No	Side of injury	Mode Of Injury	Surgery Time (Mins)	Blood loss (ml)	C-Arm Shots	Dash Score		
						Pre-op	Post-op (3months)	Pre-op (6months)
1	R	RTA	70	35	22	53	35	10
2	L	RTA	65	42	18	51	33	12
3	L	SAF	80	56	27	53	27	10
4	R	SAF	81	48	29	54	25	9
5	R	SAF	54	25	16	54	36	10
6	R	RTA	64	30	20	52	29	11
7	L	SAF	69	62	23	51	24	9
8	L	SAF	57	39	21	52	23	10
9	R	SAF	59	47	23	54	36	12
10	L	RTA	66	59	26	53	34	11
11	L	SAF	70	55	29	53	31	10
12	R	SAF	62	58	30	53	30	10
13	R	SAF	68	66	33	54	37	11
14	R	SAF	75	29	35	52	36	10
15	L	RTA	77	31	36	51	29	9
16	R	RTA	82	68	39	54	28	9
17	L	SAF	86	54	41	53	31	10
18	L	RTA	71	45	33	54	33	10
19	R	SAF	66	43	27	51	36	11
20	R	SAF	77	38	35	53	30	10
21	R	SAF	74	36	31	54	33	11
22	L	RTA	58	49	25	51	31	10
23	L	SAF	61	57	29	53	28	9
24	L	RTA	79	6	38	54	29	10
25	R	SAF	77	74	40	54	30	12

F – Female, M – Male, L – Left, R – Right, RTA – Road Traffic Accident, SAF – Slip and Fall

Discussion

Plate osteosynthesis, a minimally invasive procedure, has been utilised to treat fractures of several long bones [5, 6, 7]. Compared to traditional ORIF, MIPO requires less soft tissue incision and periosteal stripping [8]. The benefits of MIPO may lead to better results in the management of distal radius fractures, and we have attempted to investigate this using this case series. Distal radius fractures, if not treated properly with articular surface reduction and a solid stiff fixation, can result in a slew of problems at the wrist [9].

We monitored the patients for complications and functional outcomes after they were treated using minimally invasive techniques. The most common cause of distal end radius fractures in our case series was trauma from a car collision, followed by a fall on an outstretched hand, indicating that this is the most common mechanism of distal end radius fractures [10]. External fixators are linked to higher infections and stiffness in distal radius fractures due to inadequate articular reduction. Open reduction and plating, on the other hand, can result in more extensive soft tissue dissection, which can lead

to soft tissue issues [11]. Both of these difficulties are not present in MIPO. Our study's functional outcome was excellent, even better than that of prior studies that looked at open reduction and fixator application for distal radius fractures. When we compared our DASH score values at 3 and 6 months to those from previous research, such as Lee *et al.*, we found that we were on the right track reported a DASH score of 10.1, but the DASH score in our study was consistently less than 10 from the start. The MIPO approach for distal radius fracture repair has a few drawbacks, one of which is the potential for unintentional injury to the median nerve, its palmar cutaneous branch, or even the radial artery due to the minimum exposure required [12].

However, in our research, we were aware of the danger zones and closely monitored the nerve and artery connections to the FCR tendon to ensure that they were not injured. The disadvantage was that Henry's approach did not handle an open plating control group. Other advantages of our study include a single investigator, which eliminates observer bias, and no follow-up loss. Another disadvantage is that our sample size was modest in comparison to other studies [13].

Conclusion

At the conclusion of this study, we highlight the advantages of this procedure in terms of safety and feasibility, without the need for specialised tools, difficult implants, or extensive radiographic monitoring [14]. When compared to conservative approaches, plate stability provides for a faster rehabilitation with better functional results. MIPO appears to be the best option for distal radius fractures and a potential method to minimise median nerve palsy in distal fractures.

Conflict of Interest

Not available

Financial Support

Not available

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