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Original Research Article

Comparative Study of Results of Intra-Articular Comminuted Distal End Radius Fracture Treated by Pinning with Ligamentotaxis Versus Plating

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Abstract:

Background: Intra-articular distal end radius fractures are common and challenging to treat. This study compares functional and radiological outcomes of pinning with ligamentotaxis versus volar plating.

Methods: 60 patients were studied prospectively at Jhalawar medical college, Jhalawar (from April 2023 to march 2025), divided into two equal groups. Group A underwent pinning with ligamentotaxis, while Group B was treated with volar plating. Functional and radiological evaluation was done at 3 months using Gartland & Werley score.

Results: Mean age was 44 years, with female predominance (55%). Fall on outstretched hand was the commonest mode of injury. Functional outcomes: Pinning with Ligamentotaxis Excellent 50%, Good 26.7%, Fair 16.7%, Poor 6.7%; Plating, Excellent 43.3%, Good 26.7%, Fair 20%, Poor 10%. Union was achieved in all patients (mean 8 weeks). Complications included stiffness, DRUJ pain, malunion, and infection, slightly higher in plating.

Conclusion: Both techniques provide satisfactory result, pinning with ligamentotaxis gave slightly better radiological and functional outcome.

Keywords: Distal Radius Fracture, Intra-Articular, Ligamentotaxis, Volar Plating, Functional Outcome.

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Introduction

Fractures of the distal end radius are among the most common orthopaedic injuries, accounting for nearly one-sixth of all fractures seen in emergency settings [1]. In younger individuals, these injuries are often caused by high-energy trauma such as road traffic accidents or falls from height, whereas in elderly patients with osteoporosis they typically result from a fall on an outstretched hand [2]. Since Sir Abraham Colles first described this fracture pattern in 1814 [3], the management of distal radius fractures has evolved considerably. While simple extra-articular fractures may be managed successfully with closed reduction and casting, high-velocity injuries often produce comminuted and intra-articular fractures that are unstable and difficult to maintain with conservative methods. Restoration of anatomic alignment and articular congruity is critical to prevent malunion, stiffness, and early osteoarthritis [4,5]. A variety of surgical techniques have been developed, including percutaneous pinning, external fixation using ligamentotaxis, arthroscopically assisted methods, and open reduction with internal fixation [6]. Ligamentotaxis, which relies on traction through surrounding soft tissues to achieve reduction, is particularly useful in comminuted intra-articular fractures but often fails to restore palmar tilt reliably. Conversely, volar plating with locking plates provides stable fixation, even in osteoporotic bone, and allows for early mobilization with superior anatomical restoration [7,8]. The present study compares two widely used modalities closed reduction with pinning and ligamentotaxis versus open reduction with volar plating to evaluate their functional and radiological outcomes in the management of intra-articular comminuted distal radius fractures.

Materials and Methods

The study was conducted in the Department of Orthopaedics, Jhalawar Medical College, Jhalawar, from April 2023 to March 2025, after obtaining institutional ethical committee approval. A total of 60 patients with distal radius fractures were included, with 30 treated using pinning with ligamentotaxis and 30 managed by open reduction and internal fixation with volar plating. All patients were followed for three months, and informed consent was obtained prior to enrollment.

Inclusion criteria comprised patients aged 18-60 years with closed distal radius fractures (AO type B1, B3, C1, C2), dorsal comminution, dorsal tilt

>10°, radial shortening >3 mm or presentation within two weeks of trauma. Gustilo Anderson grade I and II open fractures were also included. Exclusion criteria were AO type A and C3 fractures, Gustilo Anderson grade III open fractures, bilateral fractures, pathological fractures, previous wrist injuries, neurovascular injuries or medical contraindications to surgery.

Operative Procedures: All patients were operated under either regional (axillary/supraclavicular block) or general anesthesia in the supine position on a radiolucent table with the arm on a side arm-board. An image intensifier was positioned to obtain anteroposterior and lateral views of the distal radius and ulna.

Group A Pinning with Ligamentotaxis: After surgical site preparation and draping, closed reduction was performed and confirmed under fluoroscopy. Two 1.8 mm K-wires were inserted divergently from the radial styloid, followed by insertion of metacarpal Schanz pins through a small incision over the second metacarpal, avoiding injury to the radial nerve and interosseous muscle. Radial pins were inserted 10□15 cm proximal to the styloid through small incisions, with care to protect tendons and nerves. The metacarpal and radial pins were connected to an external distractor, adjusted for alignment, and confirmed by X-ray. Pin tract dressings were applied.

Group B Volar Plating: A modified Henry's approach was used. Following a volar incision over the flexor carpi radialis, the flexor pollicis longus was retracted and the pronator quadratus elevated to expose the distal radius. Under fluoroscopy, fracture fragments were anatomically reduced and stabilized with a variable-angle volar locking plate using proximal cortical and distal locking screws. Final reduction and hardware position were confirmed in multiple views. The pronator quadratus was repaired, tendons restored, and the wound closed with a sterile dressing and below-elbow slab applied.

Post-operative Evaluation: All patients were encouraged to perform active and passive finger movements from the first postoperative day, along with elevation of the limb to minimize swelling. A single parenteral antibiotic dose was given, followed by oral coverage for 2□3 days. Pin sites and wounds were regularly inspected, with the first dressing on day two; sutures and slabs were removed at 10-14 days. Patients were discharged on day three and followed fortnightly for six weeks. Radiographs were obtained to monitor alignment and union. Wrist mobilization began after pin/distractor or slab removal, with physiotherapy advanced gradually, including strengthening by 6□8 weeks. Functional and radiological outcomes were assessed at three months.

Observations and Results

Table 1: Distribution of Gender of Patients

Gender	Pinning with ligamentotaxis	Percentage	Volar plating	Percentage
Female	17	56.7%	16	53.3%
Male	13	43.3%	14	46.7%
Total	30	100.0%	30	100.0%

Table 2: Distribution of Age of Patients

Age	Pinning with ligamentotaxis	percentage	Volar plating	Percentage
18-30 Years	4	13.3%	5	16.7%
31-40 Years	5	16.7%	6	20.0%
41-50 Years	6	20.0%	6	20.0%
51-60 Years	15	50.0%	13	43.3%
Total	30	100%	30	100%

Table 3: Distribution of side of patients

Side	Pinning ligamentotaxis	Percentage	Volar plating	Percentage
Right	19	63.3%	17	56.7%
Left	11	36.7%	13	43.3%
Total	30	100.0%	30	100.0%

Table 4: Distribution of mode of injury of patients

Mode	Pinning with ligamentotaxis	Percentage	volar plating	Percentage
Road traffic accident	13	43.3%	9	30%
Fall on outstretched hand	17	56.7%	21	70%
Total	30	100%	30	100%

Table 5: Distribution of AO Type of Patients

AO Types	Pinning with ligamentotaxis	Percentage	Volar plating	Percentage
23-B1	3	10.0%	4	13.3%
23-B2	2	6.7%	2	6.7%
23-B3	6	20.0%	5	16.7%
23-C1	11	36.7%	10	33.3%
23-C2	8	26.7%	9	30.0%
Total	30	100.0%	30	100.0%

Table 6: Distribution of Grip Strength of Patients

Grip Strength	Pinning with ligamentotaxis	Percentage	Volar plating	Percentage
Good	24	80.0%	22	73.3%
Fair	5	16.7%	5	16.7%
Poor	1	3.3%	3	10.0%
Total	30	100.0%	30	100.0%

Table 7: Distribution of Finger Movements of Patients

Finger Movements	Pinning with ligamentotaxis	Percentage	Volar plating	percentage
Good	24	80.0%	22	73.3%
Fair	5	16.7%	6	20.0%
Poor	1	3.3%	2	6.7%
Total	30	100.0%	30	100.0%

Table 8: Distribution of Range of Movement of Patients

	Pinning with ligamentotaxis			Volar plating		
	Minimum	Maximum	Mean	Minimum	Maximum	Mean
P F (in degree)	35.0	80.0	69.0	30.0	75.0	67.0
D F (in degree)	40.0	80.0	67.0	35.0	80.0	65.0
U D (in mm)	10.0	35.0	27.0	8.0	35.0	25.0
R D (in mm)	5.0	20.0	16.0	5.0	20.0	16.0
SUP (in degree)	40.0	80	68.0	35.0	75.0	66.0
PRO (in degree)	40.0	75.0	65.0	35.0	70.0	64.0

Table 9: Distribution of Radiological evaluation of patients

	Pinning with ligamentotaxis			Volar plating		
	Minimum	Maximum	Mean	Minimum	Maximum	Mean
VOLAR TILT (in degree)	**2**	**10.0**	**7.825**	1	10.0	7.012
RADIAL INCLINATION (in degree)	**4**	**22.0**	**17.725**	4	20.0	16.625
RADIAL LENGTH (in mm)	**3**	**12.0**	**8.225**	2	11.2	7.825
UNION (in weeks)	**6**	**10**	**8**	6	10	8

Table 10: Distribution of Complication of Patients

Complication	Pinning with ligamentotaxis	Percentage	Volar plate	Percentage
DRUJ pain	2	6.7%	3	10.0%
Pin loosening	1	3.3%	0	0
Infection	1	3.3%	1	3.3%
Wrist stiffness	3	10.0%	4	13.3%
Malunion	2	6.7%	4	13.3%
NIL	21	70.0%	18	60.0%
Total	30	100.0%	30	100.0%

Table 12: The final results of our study

Result	Pinning with ligamentotaxis	Percentage	Volar plating group	Percentage
Excellent	15	50.0	13	43.3
Good	8	26.7	8	26.7
Fair	5	16.7	6	20.0
Poor	2	6.7	3	10.0
Total	30	100	30	100

The mean age of patients was 44 years, with the majority (47%) belonging to the 51□60-year age group, and there was a female predominance (55%). Right-sided fractures were more common (60%), with fall on an outstretched hand being the most frequent mode of injury (63%). According to AO classification, C1 type fractures were the most common (33%). Functional outcomes assessed using the Gartland and Werley score revealed excellent results in 50% of patients in the pinning group and 43.3% in the plating group, with good outcomes in 26.7% in both groups. Fair results were seen in 16.7% of pinning cases and 20% of plating cases, while poor outcomes occurred in 6.7% and 10% respectively. Range of motion and grip strength were found to be comparable between the two groups, though radiological assessment showed marginally better restoration of radial length, inclination, and volar tilt in the pinning group.

Complications:

The overall complication rate was low in both groups. Distal radioulnar joint (DRUJ) pain was observed in 6.7% of patients in the pinning group and 10% in the plating group. Wrist stiffness occurred in 13.3% of cases treated with pinning and 10% of those treated with plating. Malunion was more frequent in the plating group (13.3%) compared to 6.7% in the pinning group. Superficial infection was noted in 3.3% of patients in both groups. Pin loosening was seen in 3.3% of cases, exclusively in the pinning group.

Union: Achieved in all cases within 6□10 weeks (mean 8 weeks).

Discussion

This prospective comparative study evaluated functional and radiological outcomes of intraarticular distal end radius fractures treated with pinning with ligamentotaxis and volar plating. Both techniques provided satisfactory results; however, pinning with ligamentotaxis demonstrated slightly better functional and radiological outcomes, fewer complications, shorter operative time, and better cost-effectiveness. The mean age of patients was 44 years, comparable with previous studies by Kapoor, Leung, and Drobetz Female predominance (55%) in our study also aligns with earlier reports, likely related to postmenopausal osteoporosis. Most fractures occurred due to fall on outstretched hand (63.3%), with right-sided involvement being more common (60%). AO type C fractures (63.3%) predominated. Functionally, 76.7% of patients in the pinning group achieved excellent-to-good results, compared to 70% in the plating group. Radiologically, ligamentotaxis provided better maintenance of radial height and tilt. Complications were low in both groups, with superficial infections and wrist stiffness being the most common, but manageable. Our findings are consistent with earlier studies showing external fixation as a reliable alternative to plating, particularly in resource-limited settings. Thus, pinning with ligamentotaxis remains a safe, cost-effective, and minimally invasive option for selected intraarticular distal radius fractures.

Conclusion

This study compared pinning with ligamentotaxis and volar plating for intraarticular distal radius fractures. Both methods achieved satisfactory results; however, pinning with ligamentotaxis proved safer, less invasive, more economical, have better functional and radiological outcome. Patients in this group showed early pain relief, preserved soft tissue biology, satisfactory wrist motion, and fewer hardware-related complications compared to plating, which often required implant removal. Radiologically, ligamentotaxis maintained alignment effectively, while long-term outcomes remained comparable. Its shorter operative time, lower cost, and reduced complication rate make pinning with ligamentotaxis particularly suitable for resource-limited settings, osteoporotic patients, and complex comminuted fractures.

Case Illustrations
Group Pinning with ligamentotaxis
56 year /Male, H/O RTA

Figure 1: Pre- op xray

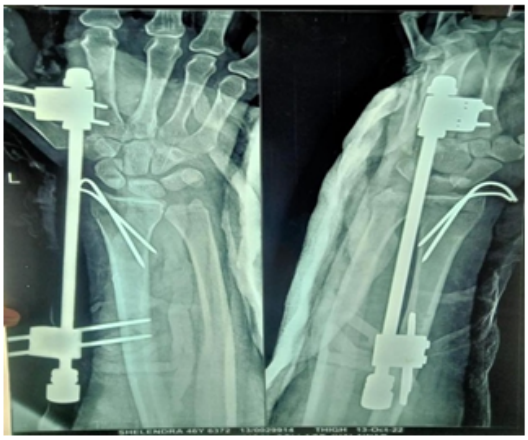


Figure 2: Post- op xray

Figure 3: 3 months follow -up xray

Clinical Photos

Dorsiflexion

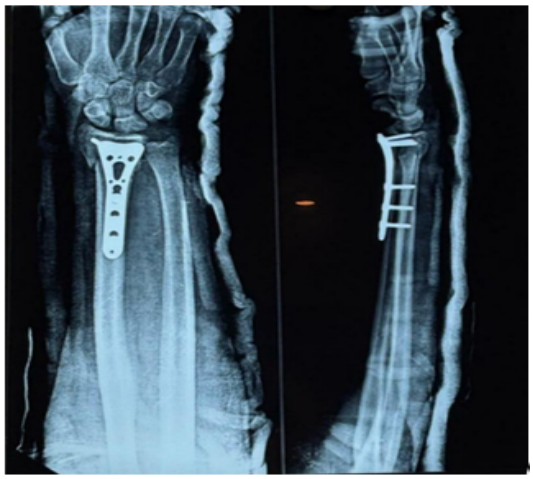
Palmarflexion

Pronation

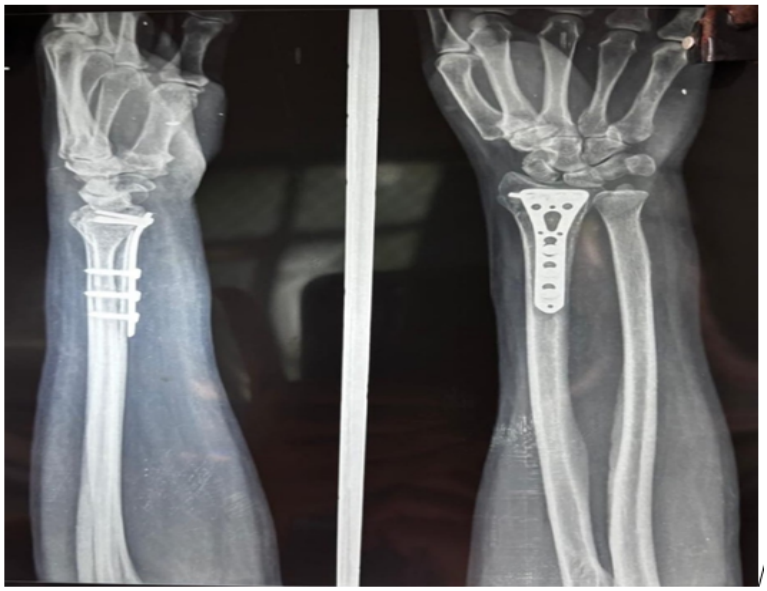
Supination

Group □ volar plating
52 year /Male, H/O FALL

Pre-op xray



Post-op xray



3 months follow-up xray

Clinical Photos

Dorsiflexion

Palmarflexion

Pronation

Supination

References

1. Fernandez DL, Jupiter JB. Fractures of the distal radius: a practical approach to management. Springer Science & Business Media; 2002.
2. Colles A. On the fracture of the carpal extremity of the radius. Edinburgh Med Surg J. 1814; 10:182-6.

3. Medoff RJ. Essential radiographic evaluation for distal radius fractures. Hand Clin. 2005;21(3):279-88.
4. Jupiter JB, Fernandez DL. Comparative classification for distal radius fractures. J Hand Surg Am. 1997;22(4):563-571.
5. Cooney WP. Fractures of the distal radius: a modern treatment-based classification. Orthop Clin North Am. 1993;24(2):211-216.
6. Jupiter JB, Ring D. Operative treatment of volar intra-articular fractures of the distal end of the radius. J Bone Joint Surg Am. 1996; 78(12): 1817-1828.
7. Orbay JL, Fernandez DL. Volar fixation for dorsally displaced fractures of the distal radius: a preliminary report. J Hand Surg Am. 2002; 27(2):205-215.
8. Rikli DA, Regazzoni P. Fractures of the distal end of the radius treated by internal fixation and early function. J Bone Joint Surg Br. 1996; 78(4):588-592.
9. Kapoor H, Agarwal A, Dhaon BK. Displaced intra-articular fractures of distal radius: a comparative evaluation of results following closed reduction, external fixation and open reduction with internal fixation. Injury. 2000;31(2):75-79.
10. Kreder HJ, Hanel DP, McKee M, et al. A randomized, controlled trial of percutaneous fixation versus volar plating for distal radius fractures. J Bone Joint Surg Am. 2005;87(1):1-1.