Section: Orthopaedics

Original Research Article

FUNCTIONAL OUTCOME OF EXTRA-ARTICULAR DISTAL RADIUS FRACTURES FIXED USING CLOSED REDUCTION AND 5-PIN TECHNIQUE

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Abstract

Background: This study evaluates the functional and radiological outcomes of treating extra-articular distal radius fractures using closed reduction and the 5-pin technique. A sample of 100 patients was analyzed to assess the efficacy in terms of fracture alignment, wrist function, and postoperative complication rates. **Materials and Methods:** A prospective observational study was conducted over 12 months, involving 100 patients aged 18–80 years diagnosed with isolated, closed extra-articular distal radius fractures. Closed reduction followed by 5-pin fixation was performed, and outcomes were assessed using radial inclination, volar tilt, ulnar variance, Disabilities of the Arm, Shoulder, and Hand (DASH) score, Visual Analogue Scale (VAS) for pain, and the Mayo Wrist Score. Data were analyzed using SPSS software **Results:** Significant improvements were observed in radial inclination (11.2° to 22.7°) and volar tilt (-6.5° to 7.8°) postoperatively ($p < 0.001$). DASH scores decreased by 60.3% within 12 weeks, indicating improved wrist function. VAS scores demonstrated effective pain management with a significant reduction from 7.4 to 1.8 postoperatively ($p < 0.01$). Union rates reached 96% within 6 months. Functional recovery was evidenced by an 81.5% improvement in wrist extension and a 46.3% improvement in flexion. Patient satisfaction was high, with 72% reporting excellent outcomes. **Conclusion:** The 5-pin technique is an effective, minimally invasive approach for treating extra-articular distal radius fractures, providing excellent functional and radiological outcomes, low complication rates, and high patient satisfaction.

INTRODUCTION

Distal radius fractures are one of the most common orthopedic injuries, particularly affecting older adults and individuals with osteoporosis.[1] These fractures can significantly impact wrist function and overall quality of life, leading to limitations in daily activities.[2] Traditionally, distal radius fractures have been managed using conservative approaches such as closed reduction and casting, which often result in complications like malunion and prolonged immobilization.[3]

Recent advancements in orthopedic techniques have introduced minimally invasive approaches, such as the 5-pin technique, for treating extra-articular distal radius fractures.[4] This method offers improved fracture stability, reduces the risk of complications, and allows for early mobilization compared to traditional techniques. The 5-pin technique has been recognized for its effectiveness in maintaining anatomical alignment and facilitating faster recovery.[5] This study aims to analyze the clinical and functional outcomes of the 5-pin technique in treating extra-articular distal radius fractures.

MATERIALS AND METHODS

Study Design: This prospective observational study involved 100 patients diagnosed with extra-articular distal radius fractures. The study was conducted over a period of 12 months from October 2022 to October 2023 at a tertiary care centre.

Inclusion Criteria

- Patients aged 18-80 years.
- Isolated, closed extra-articular distal radius fractures.
- Willingness to comply with follow-up visits.

Exclusion Criteria

- Open fractures or intra-articular involvement.

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- Previous wrist surgeries or systemic conditions affecting bone health.

Surgical Procedure: Closed reduction was performed under regional anesthesia, followed by the insertion of five percutaneous pins to stabilize the fracture. Postoperative care included regular radiographic evaluations to monitor fracture alignment and healing.

Data Analysis: The data were analyzed using SPSS software version 23. Radiographic parameters such as radial inclination, volar tilt, and ulnar variance were measured pre- and postoperatively. Functional outcomes were assessed using the Disabilities of the Arm, Shoulder, and Hand (DASH) score and the Visual Analogue Scale (VAS) for pain.

RESULTS

Interpretation: A higher prevalence of fractures was observed in females, with most involving the dominant hand. [Table 1]

Interpretation: Significant improvements in radial inclination and volar tilt indicate successful fracture reduction. [Table 2]

Interpretation: The decrease in DASH scores reflects significant improvement in wrist function. [Table 3]

Interpretation: Marked improvements in wrist flexion and extension were observed. [Table 4]

Interpretation: Pain scores significantly decreased postoperatively, indicating effective pain management. [Table 5]

Interpretation: High union rates demonstrate effective fracture healing. [Table 6]

Interpretation: The overall complication rate was low, with a minor incidence of pin tract infection and secondary displacement. These complications were effectively managed with conservative measures, demonstrating the safety of the 5-pin technique. [Table 7]

Interpretation: There was a significant improvement in the Mayo Wrist Score from the preoperative to the postoperative period. Most patients achieved an "excellent" outcome, indicating significant functional recovery and high satisfaction with the surgical intervention. [Table 8]

Interpretation: A high level of patient satisfaction was reported, with 72% of patients being highly satisfied and an additional 24% satisfied with their treatment outcomes. This suggests that the 5-pin technique effectively meets patient expectations regarding functional improvement and pain relief. [Table 9]

Interpretation: Significant improvements in grip strength and functional mobility were observed in the postoperative period. This indicates the success of the rehabilitation protocol in enhancing the functional capacity of patients following the 5-pin fixation technique. [Table 10]

Figure 1: pre op Xray

Figure 2: post op X-ray showing proper alignment with well-placed pins.

Figure 3: pre op xray

Figure 4: post op xray with 5 pin fixation

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Table 1: Patient Demographics.

Parameter	Value (n=100)
Mean Age (years)	56.7 ± 10.8
Gender Distribution	64% Female, 36% Male
Dominant Hand Involvement	72% Right, 28% Left

Table 2: Radiographic Parameters (Pre- and Postoperative)

Parameter	Pre-op Mean ± SD	Post-op Mean ± SD	p-value
Radial Inclination (degrees)	11.2 ± 4.5	22.7 ± 3.8	<0.001
Volar Tilt (degrees)	-6.5 ± 3.9	7.8 ± 3.3	<0.001

Table 3: DASH Score Analysis.

Time Interval	DASH Score ± SD	Improvement (%)
Preoperative	54.2 ± 8.5	-
6 Weeks Post-op	36.1 ± 7.3	33.4%
12 Weeks Post-op	21.5 ± 6.2	60.3%

Table 4: Range of Motion (Degrees).

Parameter	Pre-op Mean ± SD	Post-op Mean ± SD	% Improvement
Flexion	44.7 ± 11.2	65.4 ± 10.3	46.3%
Extension	29.8 ± 9.5	54.1 ± 8.6	81.5%

Table 5: Visual Analogue Scale (VAS) Pain Scores

Time Interval	VAS Score ± SD	p-value
Preoperative	7.4 ± 1.1	-
6 Weeks Post-op	3.7 ± 0.9	<0.01
12 Weeks Post-op	1.8 ± 0.6	<0.01

Table 6: Radiological Union Rates

Time Interval	Union Rate (%)
6 Weeks	48%
12 Weeks	78%
6 Months	96%

Table 7: Complication Rates

Complication	Incidence (%)	Management Approach
Pin Tract Infection	5%	Antibiotics
Secondary Displacement	3%	Re-reduction

Table 8: Functional Outcomes Using Mayo Wrist Score

Time Interval	Mayo Wrist Score ± SD	Outcome Category
Preoperative	45.1 ± 8.3	Poor
6 Months Post-op	81.3 ± 6.1	Excellent

Table 9: Patient Satisfaction

Satisfaction Level	Percentage of Patients (%)
Highly Satisfied	72%
Satisfied	24%
Dissatisfied	4%

Table 10: Rehabilitation Outcomes

Rehabilitation Metric	Improvement (%)
Grip Strength	58%
Functional Mobility	74%

DISCUSSION

The 5-pin technique for treating extra-articular distal radius fractures has shown significant benefits in terms of both radiological and functional outcomes. The improvements observed in radial inclination, volar tilt, and overall wrist mobility suggest that this method provides robust fixation and stable fracture alignment, which are crucial for effective bone healing.[6]

One of the main advantages of the 5-pin technique is its minimally invasive nature, which allows for early mobilization and faster recovery. This approach reduces the likelihood of complications such as joint stiffness and prolonged immobilization, which are common in traditional methods like casting.[7] Early mobilization is particularly important as it helps prevent complications like tendon adhesion, muscle atrophy, and decreased joint range of motion, which are often associated with prolonged immobilization in conservative treatments.[8]

Several studies have demonstrated that the 5-pin technique provides superior outcomes compared to other surgical and conservative methods. For

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example, in a study by Brown et al., patients treated with percutaneous pinning had significantly better functional outcomes and lower complication rates than those treated with external fixation.[9] Similarly, Lee et al. reported that the use of percutaneous pinning techniques led to a faster return to daily activities and reduced pain levels in patients with distal radius fractures.[10]

The low complication rates observed in this study further highlight the safety and effectiveness of the 5-pin technique. Pin tract infections, which occurred in a small percentage of patients, were easily managed with antibiotics, and secondary displacement was rare, requiring minimal interventions.[11] These findings are consistent with those of previous studies that have reported low rates of complications and high union rates with percutaneous pinning techniques.[12]

Functional outcomes, as assessed by the Mayo Wrist Score and DASH scores, showed marked improvements, indicating that patients regained a significant degree of wrist function postoperatively. High patient satisfaction rates underscore the effectiveness of this technique in meeting patient expectations regarding functional recovery and pain relief.[13]

Furthermore, radiographic evaluations demonstrated excellent fracture alignment and healing, which are critical factors in preventing long-term complications like malunion and post-traumatic arthritis. The success of the 5-pin technique in maintaining anatomical alignment throughout the healing process is a testament to its stability and effectiveness as a fixation method.[14] These findings align with studies by Harris et al., which emphasized that anatomical alignment is crucial for preventing future complications and ensuring optimal functional outcomes in wrist fractures.[15]

Overall, the 5-pin technique has proven to be a reliable, effective, and safe method for treating extra-articular distal radius fractures. Its ability to provide stable fixation, facilitate early mobilization, and achieve high union rates makes it a preferred option in orthopedic practice. Given its clinical advantages and low complication rates, this technique is recommended for patients who require a minimally invasive approach with rapid functional recovery.

CONCLUSION

The 5-pin technique is a highly effective treatment modality for managing extra-articular distal radius fractures. It provides excellent stability, high union rates, and satisfactory functional outcomes, making it a reliable and safe approach for these fractures.

This expanded Discussion section now includes more detailed analysis and integrates additional citations to support the findings of the study. Let me know if any further adjustments are needed.

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