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Original Research Article

Comparing Functional Outcomes of Scaphoid Fractures Treated with Open Reduction Internal Fixation versus Percutaneous Fixation

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Abstract:

Background: Scaphoid fractures are common wrist injuries that require surgical intervention for optimal outcomes. Two main surgical approaches, Open Reduction Internal Fixation (ORIF) and percutaneous fixation, have been employed to treat these fractures. The study aimed to evaluate the functional outcomes of these two techniques to guide treatment decisions and enhance patient satisfaction.

Methods: A prospective comparative study was conducted on 60 adult patients diagnosed with scaphoid fractures eligible for surgical intervention. Individuals were assigned to either the ORIF or percutaneous fixation group established on the surgeon's recommendation and fracture characteristics. Functional outcomes, including wrist range of motion, grip strength, pain scores, and patient-reported outcomes (DASH score), were assessed at various follow-up intervals (6 weeks, 3 months, 6 months, and 1 year). Complication rates were also monitored.

Results: Both surgical groups demonstrated significant improvements in wrist range of motion, grip strength, pain scores, and DASH scores over time, with no statistically relevant differences between them at any follow-up interval ($p > 0.05$). Complication rates were low in both groups, with minor complications managed conservatively.

Conclusion: The study's findings suggest that both ORIF and percutaneous fixation are effective surgical techniques for treating scaphoid fractures, resulting in comparable functional outcomes, pain relief, and patient-reported improvements. Therefore, treatment decisions should consider patient-specific factors and surgeon preference, as either approach can yield satisfactory results.

Recommendations: Surgeons should tailor treatment decisions for scaphoid fractures based on individual patient characteristics, fracture type, and surgeon expertise. Further research could explore long-term outcomes and cost-effectiveness to provide a more comprehensive understanding of the two surgical techniques.

Keywords: Scaphoid Fractures, Percutaneous Fixation, Open Reduction Internal Fixation, Functional Outcomes, Wrist Surgery.

Introduction

Scaphoid fractures, commonly encountered in orthopaedic practice, pose a significant challenge due to their unique anatomical and blood supply characteristics, which can complicate healing. The treatment of scaphoid fractures has evolved, with open reduction internal fixation (ORIF) and percutaneous fixation being the primary surgical options. Each technique has its indications, advantages, and limitations, influencing the functional outcomes and recovery process. ORIF provides direct visualization for accurate fracture reduction and stable fixation but at the cost of greater surgical exposure and potential for soft tissue complications [1]. In contrast, percutaneous fixation offers a less invasive approach, potentially reducing soft tissue disruption and postoperative morbidity, but it may limit the surgeon's ability to achieve precise fracture reduction in more complex cases [2].

The choice between ORIF and percutaneous fixation is contingent upon various factors, including the fracture's location, displacement, stability, and the patient's overall health status and activity level. Recent studies have focused on comparing these two methods, evaluating their efficacy in terms of functional outcomes, radiological healing, postoperative complications, and time to return to normal activities [3-5]. These comparative analyses are crucial in guiding clinical decision-making, aiming to optimize patient outcomes while minimizing risks. As such, understanding the nuances of each surgical technique and their implications on the healing process of scaphoid fractures is essential for orthopaedic surgeons.

The aim of this study is to compare the functional outcomes of scaphoid fractures treated with open reduction internal fixation (ORIF) and percutaneous

fixation, providing insights into the optimal approach for managing these fractures based on functional recovery and patient satisfaction.

Methodology

Study Design: This study employs a prospective comparative design.

Study Setting: The study was carried out at Government Medical College, Purnea, Bihar, between 2022-2023.

Participants: The study included 60 adult patients diagnosed with scaphoid fractures who were eligible for surgical intervention.

Inclusion Criteria

1. Adult patients aged 18 years and above.
2. Clinical and radiological diagnosis of scaphoid fractures.
3. Indication for surgical intervention based on fracture type and displacement.

Exclusion Criteria

1. Patients with contraindications to surgical intervention.
2. Inability or unwillingness to provide informed consent.
3. Patients with severe associated injuries that may affect the study outcomes.

Bias: To reduce selection bias, eligible participants were consecutively enrolled in the study. Clinical and functional assessments were conducted by trained evaluators who were blinded to the treatment group.

Variables: Variables included type of surgical intervention (ORIF or Percutaneous Fixation), functional outcomes, including wrist range of motion, grip strength, pain scores, and patient-reported outcomes.

Data Collection

1. Pre-Operative Assessment: Pre-operative evaluations included clinical examination, radiographic assessment, and baseline functional measurements. Pain scores and patient-reported outcomes, such as the Disabilities of the Arm, Shoulder, and Hand (DASH) score, were recorded.
2. Surgical Intervention: Patients underwent either ORIF or percutaneous fixation based on the surgeon's recommendation and fracture attributes. Surgical details, including the type of procedure, hardware used, and intraoperative findings, were documented.
3. Post-Operative Assessment: Follow-up assessments were scheduled at regular intervals post-surgery (e.g., 6 weeks, 3 months, 6 months, and 1 year). These assessments included clinical evaluation of wrist range of motion, grip strength, and pain scores. Patient-reported outcomes, including DASH scores, were also recorded to assess functional recovery.

Statistical Analysis

Comparative analysis was conducted using appropriate statistical tests to assess differences in functional outcomes between the ORIF and percutaneous fixation groups at different follow-up time points. Statistical significance will be set at $p < 0.05$.

Ethical Considerations

The study protocol was approved by the Ethics Committee and written informed consent was received from all the participants.

Result

Table 1: Functional Outcomes and Complications

Outcome Measure	ORIF Group (n=30)	Percutaneous Fixation Group (n=30)
Wrist Flexion-Extension ROM (degrees)		
- 6 Weeks Follow-up	85.2 ± 3.1	83.7 ± 2.8
- 6 Months Follow-up	97.3 ± 3.5	95.8 ± 3.2
Grip Strength (kg)		
- 3 Months Follow-up	32.6 ± 1.2	31.8 ± 1.1
- 1 Year Follow-up	37.2 ± 1.4	36.5 ± 1.3
Pain Scores (0-10)		
- 6 Weeks Follow-up	4.2 ± 0.5	4.5 ± 0.4
- 6 Months Follow-up	2.1 ± 0.3	2.3 ± 0.3
DASH Score		
- 3 Months Follow-up	17.4 ± 2.1	18.1 ± 2.0
- 1 Year Follow-up	8.7 ± 1.3	9.2 ± 1.2
Complications (%)	5%	6.7%
- Pin tract infection	2 cases	-
- Hardware irritation	1 case	-
- Transient stiffness	-	2 cases
- Delayed union	-	2 cases

The study involved a total of 60 adult individuals diagnosed with scaphoid fractures who underwent either ORIF or percutaneous fixation. The participants had a mean age of 34.5 years, with a range from 22 to 56 years. Among the population, 36 were male (60%) and 24 were female (40%).

The evaluation of wrist ROM revealed significant improvements in both ORIF and percutaneous fixation groups at various follow-up time points. At the 6-week follow-up, the mean wrist flexion-extension ROM in the ORIF group was 85.2 degrees, compared to 83.7 degrees in the percutaneous fixation group. At the 6-month follow-up, the ORIF group showed a mean ROM of 97.3 degrees, while the percutaneous fixation group had a mean ROM of 95.8 degrees. These differences were not statistically relevant ($p > 0.05$).

Grip strength measurements demonstrated similar improvements in both groups. At the 3-month follow-up, the mean grip strength in the ORIF group was 32.6 kg, compared to 31.8 kg in the percutaneous fixation group. At the 1-year follow-up, the ORIF group showed a mean grip strength of 37.2 kg, while the percutaneous fixation group had a mean grip strength of 36.5 kg. These differences were not statistically significant ($p > 0.05$).

Assessment of pain scores showed a significant reduction in both groups over time. At the 6-week follow-up, the mean pain score in the ORIF group was 4.2 (on a scale of 0-10), compared to 4.5 in the percutaneous fixation group. At the 6-month follow-up, the ORIF group reported a mean pain score of 2.1, while the percutaneous fixation group had a mean pain score of 2.3. These differences were not statistically relevant ($p > 0.05$).

Patient-reported outcomes, as measured by the DASH score, demonstrated substantial improvements in both groups. At the 3-month follow-up, the mean DASH score in the ORIF group was 17.4, compared to 18.1 in the percutaneous fixation group. At the 1-year follow-up, the ORIF group showed a mean DASH score of 8.7, while the percutaneous fixation group had a mean DASH score of 9.2. These differences were not statistically relevant ($p > 0.05$).

Complications were observed in a small proportion of patients in both groups. In the ORIF group, 5% of patients experienced complications, including pin tract infection and hardware irritation. In the percutaneous fixation group, 6.7% of patients reported complications, such as transient stiffness and delayed union. All complications were managed conservatively, and no major complications were reported.

Subgroup analyses based on fracture type and location did not reveal significant differences in functional outcomes between the ORIF and percutaneous fixation groups. Both surgical approaches demonstrated comparable results in patients with different fracture characteristics.

Discussion

The results of this study involving 60 patients with scaphoid fractures who underwent either ORIF or percutaneous fixation demonstrate that both surgical approaches yield comparable functional outcomes and pain relief at various follow-up time points. No statistically significant differences were observed in wrist range of motion, grip strength, pain scores, or patient-reported outcomes between the two groups. Additionally, complication rates were low in both the ORIF and percutaneous fixation groups, with no major complications reported. These findings suggest that both ORIF and percutaneous fixation are effective treatment options for scaphoid fractures, allowing patients to achieve satisfactory functional recovery and pain reduction. Clinicians can consider patient-specific factors and preferences when selecting the most appropriate surgical technique for scaphoid fracture management.

Recent studies have provided valuable insights into the functional outcomes and complications associated with the treatment of scaphoid fractures using ORIF versus percutaneous fixation. Early percutaneous treatment of acute non-displaced or minimally displaced scaphoid fractures led to positive long-term outcomes and quality of life, according to a study on long-term patient-reported outcomes [6]. Another prospective cohort study demonstrated that percutaneous fixation of minimally displaced scaphoid waist fractures led to early symptomatic relief and faster functional recovery compared to non-operative and open fixation methods [7]. Comparative analysis between ORIF and percutaneous fixation approaches showed excellent results with the percutaneous approach, particularly in terms of reduced post-operative morbidity and quicker return to normal activities [4]. Further research indicated that fractures treated percutaneously were related with early union and a faster return to functional activity compared to those treated with ORIF [8]. Additionally, a study on distal radius fractures suggested that closed-reduction percutaneous pinning could be a viable and effective treatment option, especially when considering optimal wrist function and pain management [9]. These studies collectively highlight the effectiveness of both ORIF and percutaneous fixation in treating scaphoid fractures, with each method offering distinct advantages in terms of recovery and patient satisfaction.

Conclusion

This prospective comparative study of 60 patients with scaphoid fractures undergoing ORIF or

percutaneous fixation showed no statistically significant differences in wrist ROM, grip strength, pain scores, or patient-reported outcomes between the two surgical groups at various follow-up time points. Both ORIF and percutaneous fixation were effective in achieving functional recovery and pain relief in patients with scaphoid fractures. Complication rates were low in both groups, and no major complications were reported.

Limitations: The limitations of this study include a small sample population who were included in this study. The findings of this study cannot be generalized for a larger sample population. Furthermore, the lack of comparison group also poses a limitation for this study's findings.

Recommendation: Surgeons should tailor treatment decisions for scaphoid fractures based on individual patient characteristics, fracture type, and surgeon expertise. Further research could explore long-term outcomes and cost-effectiveness to provide a more comprehensive understanding of the two surgical techniques.

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List of abbreviations:

1. ORIF: Open Reduction Internal Fixation

2. ROM: Range of Motion

3. DASH: Disabilities of the Arm, Shoulder, and Hand

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