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Original Research Article

Comparative Clinical and Functional Outcomes of Conservative Versus Operative Management in Acute Scaphoid Fractures

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Abstract:

Background: Scaphoid fractures are among the most frequently encountered carpal injuries in young adults and often result from low-energy falls on an outstretched hand. The debate between conservative management with cast immobilization and operative fixation for acute scaphoid fractures remains unresolved, especially in cases of undisplaced or minimally displaced fractures.

Objective: To compare the clinical and functional outcomes of conservative versus operative treatment in patients with acute scaphoid fractures.

Methods: A prospective comparative study was conducted at the Department of Orthopaedics, Tertiary Care Centre, India, for two years. A total of 100 patients with acute scaphoid fractures were enrolled and divided into two groups: Group A received conservative treatment (cast immobilization), and Group B underwent operative fixation using cannulated screws. Functional outcomes were assessed using the Modified Mayo Wrist Score (MMWS) and Visual Analog Scale (VAS) at baseline, 6 weeks, 3 months, and 6 months. Union was evaluated radiographically.

Results: Both treatment modalities resulted in fracture union in the majority of patients. However, the operative group demonstrated faster union times, earlier return to daily activities, and significantly better functional outcomes at 3 and 6 months, with no major complications reported in either group.

Conclusion: While both conservative and operative approaches are effective for acute scaphoid fractures, surgical fixation offers superior early functional recovery and union rates, particularly in active patients requiring early return to function.

Keywords: Scaphoid Fracture, Conservative Treatment, Operative Fixation, Wrist Injuries, Mayo Wrist Score, Functional Outcome, Comparative Study.

Introduction

Scaphoid fractures represent the most common carpal bone injury, accounting for approximately 60–70% of all carpal fractures and about 10% of all hand fractures. These injuries predominantly affect young, active individuals, particularly males aged between 15 and 40 years, and typically result from a fall on an outstretched hand (FOOSH) [1]. The scaphoid plays a vital role in the biomechanical integrity of the wrist due to its central position and function in carpal stability and load transmission. Therefore, timely diagnosis and appropriate management of scaphoid fractures are critical for preventing long-term functional impairment and arthritic sequelae [2].

Despite advancements in diagnostic imaging and surgical techniques, the optimal treatment strategy for acute scaphoid fractures particularly undisplaced or minimally displaced ones—remains a matter of debate in orthopaedic practice [3]. The traditional approach of immobilization using a below-elbow cast with or without thumb inclusion has been widely accepted due to its non-invasive nature and relatively favorable outcomes. However, conservative treatment requires prolonged immobilization typically 8–12 weeks or more leading to delayed return to work or activity, wrist stiffness, and reduced patient compliance [4].

On the other hand, operative fixation using cannulated compression screws or headless screws

has gained increasing popularity over the past two decades. Surgical fixation allows for direct anatomical reduction, rigid internal stabilization, early mobilization, and potentially faster union [5]. Numerous studies have reported improved early functional outcomes and shorter time to union with operative treatment, especially in patients with high functional demands. However, surgical risks such as hardware-related complications, infection, and iatrogenic damage to the scaphoid blood supply must be carefully considered [6].

Another critical factor influencing treatment choice is the vascular anatomy of the scaphoid. The proximal pole, supplied primarily by retrograde intraosseous branches of the radial artery, is vulnerable to avascular necrosis, especially in displaced or proximal third fractures [7]. Delay in diagnosis or inadequate management in such cases can result in nonunion or chronic wrist dysfunction. Hence, while conservative treatment is still widely practiced for stable fractures, there is growing advocacy for early surgical fixation even in undisplaced fractures in selected cases [8].

Functional outcome measures such as the Modified Mayo Wrist Score (MMWS), Disabilities of the Arm, Shoulder and Hand (DASH) score, and Visual Analog Scale (VAS) for pain provide objective insights into treatment efficacy. These measures are essential for comparing long-term results of different management strategies and understanding their impact on patients' daily living and occupational function [9,10].

Despite the abundance of literature, there is still no universal consensus on whether conservative or operative treatment provides better long-term outcomes for acute scaphoid fractures. Most existing studies either focus on displaced fractures or are retrospective in design. There is a pressing need for prospective, comparative data from real-world settings, particularly in developing countries where delayed presentation and limited access to surgical care may influence treatment decisions.

This study was thus designed to prospectively compare the clinical, radiological, and functional outcomes of conservative and operative management of acute scaphoid fractures over a six-month period in a tertiary care center in Central India. By evaluating union time, pain scores, and wrist functionality in both groups, this study aims to provide context-specific evidence to inform individualized treatment decisions and optimize patient outcomes.

Aim and Objectives

Aim: To compare the clinical, functional, and radiological outcomes of conservative versus operative treatment in adult patients with acute scaphoid fractures.

Objectives:

1. To evaluate the time to radiological union in patients treated conservatively and operatively.
2. To compare functional outcomes using the Modified Mayo Wrist Score (MMWS) and Visual Analog Scale (VAS) at 6 weeks, 3 months, and 6 months post-treatment.
3. To assess the complication rates (e.g., nonunion, infection, hardware issues) associated with each treatment modality.
4. To determine the duration required for return to daily activities and work in both treatment groups.
5. To identify demographic and fracture-related factors (e.g., fracture location, displacement) that influence treatment outcomes.

Materials and Methods

Study Design: This was a prospective, comparative observational study conducted to evaluate and compare the clinical and functional outcomes of conservative versus operative management in patients with acute scaphoid fractures.

Study Location: Department of Orthopaedics, Tertiary Care Centre, India, for two years.

Sample Size: A total of 100 adult patients diagnosed with acute scaphoid fractures were included in the study. They were assigned to two equal groups (n = 50 each) based on the treatment modality adopted:

- **Group A:** Conservative treatment with below-elbow thumb spica cast.
- **Group B:** Operative fixation using percutaneous or open insertion of a headless compression screw.

Inclusion Criteria:

- Adults aged 18 to 60 years.
- Radiologically confirmed acute scaphoid fracture (within 2 weeks of injury).
- Closed fractures classified as Herbert type A or B1/B2.
- Patients fit for anesthesia and surgery (for operative group).
- Informed consent obtained.

Exclusion Criteria:

- Open scaphoid fractures.
- Displaced fractures with >1 mm translation or comminution (Herbert types C and D).
- Associated carpal or distal radius fractures.
- Delayed presentation (>2 weeks post-injury).
- Patients with pre-existing wrist pathology, systemic illness affecting bone healing, or unwilling for follow-up.

Intervention Protocols:

- **Conservative Group (Group A):**

Patients were immobilized in a below-elbow thumb spica cast with the wrist in slight dorsiflexion and radial deviation. Serial radiographs were obtained every 3–4 weeks. Cast removal was performed upon clinical and radiographic signs of union. Passive and active physiotherapy was initiated thereafter.

- **Operative Group (Group B):**

Under regional or general anesthesia, patients underwent open or percutaneous internal fixation using a headless compression screw (Herbert or Acutrak). Postoperatively, a removable splint was applied for 2–3 weeks. Wrist mobilization and strengthening exercises were started thereafter under supervision.

Follow-up Schedule:

All patients were followed up at:

- 6 weeks
- 3 months
- 6 months

At each visit, clinical assessment (pain, tenderness, range of motion) and radiographs were performed to monitor healing. Functional evaluation was done using:

- **Modified Mayo Wrist Score (MMWS):** assessing pain, grip strength, range of motion, and return to work.
- **Visual Analog Scale (VAS):** to quantify pain intensity on a scale of 0–10.

Outcome Measures:

- Time to radiological union.
- Change in MMWS and VAS scores over follow-up.
- Complication rates in both groups.
- Time to return to routine activity and occupation.

Statistical Analysis: Data were analyzed and continuous variables were expressed as mean ± standard deviation. Repeated measures ANOVA was used to compare scores over time. Categorical data were analyzed using chi-square tests. A p-value of <0.05 was considered statistically significant.

Results

A total of 100 patients with acute scaphoid fractures were enrolled and divided equally into two groups: Group A (conservative treatment) and Group B (operative fixation). The mean age was 29.3 years, with a male predominance (78%). Fracture union was achieved in most cases in both groups, though Group B showed significantly faster healing, better pain relief, and earlier return to activity. Functional scores were consistently higher in the operative group across all time points. No major complications were reported in either group, although delayed union and wrist stiffness were more frequent in the conservative cohort.

Table 1: Demographic Profile of Study Participants (n = 100)

Parameter	Group A (n=50)	Group B (n=50)	p-value
Mean Age (years)	28.9 ± 7.4	29.7 ± 6.9	0.53
Male:Female Ratio	40:10	38:12	0.62
Dominant Hand Involved	31 (62%)	33 (66%)	0.68

Table 2: Fracture Location and Classification

Parameter	Group A	Group B	p-value
Distal third	8 (16%)	6 (12%)	0.56
Waist (middle third)	38 (76%)	39 (78%)	0.81
Proximal third	4 (8%)	5 (10%)	0.72
Herbert Type A1/A2	19 / 31	22 / 28	0.46

Table 3: Mean Time to Radiological Union (in weeks)

Group	Mean Time to Union ± SD	p-value
Conservative	12.4 ± 2.6 weeks	—
Operative	8.6 ± 1.9 weeks	<0.001

Table 4: Pain Scores (VAS) Over Follow-up

Timepoint	Group A (VAS ± SD)	Group B (VAS ± SD)	p-value
6 weeks	4.8 ± 1.2	2.3 ± 0.9	<0.001
3 months	3.1 ± 1.0	1.2 ± 0.7	<0.001
6 months	1.2 ± 0.6	0.5 ± 0.4	<0.001

Table 5: Modified Mayo Wrist Score (MMWS) Across Time

Timepoint	Group A (MMWS ± SD)	Group B (MMWS ± SD)	p-value
6 weeks	42.5 ± 8.4	58.7 ± 9.1	<0.001
3 months	63.4 ± 7.6	78.1 ± 8.3	<0.001
6 months	81.2 ± 6.7	91.6 ± 5.2	<0.001

Table 6: Time to Return to Daily Activities

Group	Mean Time ± SD	p-value
Conservative	14.8 ± 2.2 weeks	—
Operative	9.3 ± 1.6 weeks	<0.001

Table 7: Range of Motion (Flexion-Extension Arc) at 6 Months

Group	Mean Arc (°) ± SD	p-value
Conservative	106.4 ± 12.3	—
Operative	118.7 ± 9.6	<0.001

Table 8: Complications Observed

Complication	Group A (n=50)	Group B (n=50)
Delayed Union	5 (10%)	1 (2%)
Wrist Stiffness	6 (12%)	2 (4%)
Infection	0	2 (4%)
Nonunion	2 (4%)	0

Table 9: DASH Score at Final Follow-up (6 Months)

Group	Mean DASH ± SD	p-value
Conservative	17.8 ± 5.3	—
Operative	9.2 ± 3.7	<0.001

Table 10: Grip Strength Recovery (% of Contralateral Hand at 6 Months)

Group	Mean Recovery (%) ± SD	p-value
Conservative	81.4 ± 7.6	—
Operative	92.1 ± 5.4	<0.001

Table 11: Patient Satisfaction (Self-reported) at 6 Months

Rating	Group A (n=50)	Group B (n=50)
Very Satisfied	30 (60%)	41 (82%)
Satisfied	14 (28%)	7 (14%)
Neutral/Dissatisfied	6 (12%)	2 (4%)

Table 12: Follow-up Compliance

Follow-up Interval	Group A	Group B
6 Weeks	50	50
3 Months	48	50
6 Months	47	49

Table 1 presents the baseline demographic profile, showing no significant difference in age, sex distribution, or dominance of the injured hand between the two groups, confirming comparability. Table 2 details the anatomical location and classification of scaphoid fractures. The majority involved the middle third of the scaphoid in both groups, with a similar distribution of Herbert types A1 and A2, indicating balanced fracture patterns. Table 3 shows that the mean time to radiological union was significantly shorter in the operative group (8.6 weeks) compared to the conservative group (12.4 weeks), favoring surgical intervention. Table 4 illustrates that pain scores measured via VAS were consistently lower in the operative group at all follow-up points, indicating faster and better pain relief. Table 5 reports on the Modified Mayo Wrist Scores, which were significantly higher in the operative group at 6 weeks, 3 months, and 6 months, reflecting superior functional outcomes. Table 6 reveals that patients undergoing operative treatment returned to daily activities approximately 5.5 weeks earlier than those treated conservatively. Table 7 compares range of motion, demonstrating a significantly greater flexion-extension arc in the operative group, suggesting better joint mobility

restoration. Table 8 lists observed complications, showing higher rates of delayed union and stiffness in the conservative group, while the operative group had minimal issues, including two superficial infections. Table 9 shows that DASH scores at 6 months were significantly better (lower) in the operative group, indicating reduced disability. Table 10 highlights that grip strength recovery, expressed as a percentage of the contralateral hand, was significantly better in the operative group. Table 11 presents patient satisfaction scores, where a higher proportion of surgical patients reported being "very satisfied" with their treatment outcomes compared to those treated conservatively. Table 12 confirms excellent compliance with follow-up in both groups, ensuring data completeness and reliability of outcome comparisons.

Discussion

Scaphoid fractures, particularly those affecting the middle third of the bone, are common in young adults and pose a clinical challenge due to their unique vascular anatomy, propensity for delayed union, and long-term impact on wrist function [11]. The primary goal of treatment is to ensure timely union and preserve full wrist motion and strength. This study was designed to compare the clinical, radiological, and functional outcomes of conservative management with cast immobilization versus operative fixation using headless compression screws in acute scaphoid fractures [12].

Radiological Union and Time to Healing

One of the most significant findings of this study was the markedly shorter time to radiological union in the operative group compared to the conservative group (8.6 vs. 12.4 weeks). This difference is statistically significant and clinically relevant [13]. Early stabilization with internal fixation likely promotes better vascular perfusion at the fracture site and facilitates primary bone healing. These findings are consistent with earlier literature, including a prospective study by Vinnars et al., which also reported faster healing in surgically treated patients [14].

Pain and Functional Outcome

Pain, measured using the Visual Analog Scale (VAS), was significantly lower in the operative group at all follow-up points, reflecting superior early symptom control. This supports the rationale that early mobilization and anatomical reduction reduce mechanical irritation and stiffness. The Modified Mayo Wrist Scores (MMWS) also consistently favored surgical treatment, with higher scores recorded at 6 weeks, 3 months, and 6 months post-treatment [15,16]. This functional advantage may be attributed to early mobilization and better anatomical alignment achieved through internal fixation.

Return to Activity and Range of Motion

Operatively treated patients resumed daily activities significantly earlier than those in the conservative group (9.3 vs. 14.8 weeks). This early return is crucial for individuals engaged in manual labor, sports, or occupations demanding full wrist function. The arc of wrist flexion-extension was also better in the operative group, reinforcing the importance of early joint mobilization in preserving function [17].

Complications and Healing Integrity

While both treatment modalities showed high union rates, the conservative group exhibited a higher incidence of delayed union (10%) and nonunion (4%). Additionally, wrist stiffness was more common among conservatively managed patients, likely due to prolonged immobilization. Although two superficial infections were observed in the operative group, no deep infections, hardware failures, or neurovascular complications were noted. This suggests that surgical fixation, when performed with proper technique, is relatively safe [18].

Patient-Reported Satisfaction

Subjective outcomes further affirmed the superiority of surgical treatment. A significantly higher proportion of patients in the operative group reported being "very satisfied" with their outcomes. These responses reflect both faster functional recovery and lower pain levels, confirming that early return to normal life plays a key role in perceived success of treatment [19].

Comparative Literature and Global Relevance

The findings of this study align with those reported in Western literature and strengthen the case for operative management in young, active patients with acute, undisplaced, or minimally displaced scaphoid fractures. While conservative treatment remains a viable and non-invasive option, particularly for low-demand patients or those unfit for surgery, its drawbacks include prolonged immobilization, potential joint stiffness, and delayed union [20].

In resource-limited settings, cost and surgical availability may influence treatment decisions. However, the demonstrated functional benefits of operative fixation may justify its upfront investment, especially in patients with occupational or lifestyle needs demanding early wrist function.

Strengths and Limitations

This study's strengths include its prospective design, well-matched groups, and the use of validated scoring systems for functional assessment. Limitations include a relatively short follow-up of six months, which may not capture late complications such as post-traumatic arthritis. Additionally, longer-term assessments of grip

strength and radiographic union would further enrich the understanding of comparative outcomes.

Conclusion

This prospective comparative study demonstrates that operative fixation of acute scaphoid fractures offers clear advantages over conservative treatment in terms of faster radiological union, improved pain control, better functional outcomes, earlier return to activity, and higher patient satisfaction. While both modalities can achieve union, surgical management provides a distinct early functional edge, especially for young and active patients.

Given the low rate of complications and superior clinical recovery associated with operative intervention, internal fixation should be considered the preferred approach for eligible patients with acute, nondisplaced or minimally displaced scaphoid fractures. Nevertheless, treatment decisions should be individualized, taking into account patient preferences, comorbidities, occupational needs, and healthcare access.

References

1. Siotos C, Asif M, Lee J, Horen SR, Seal SM, Derman GH, Hasan JS, Grevious MA, Doscher ME. Cast selection and non-union rates for acute scaphoid fractures treated conservatively: a systematic review and meta-analysis. J Plast Surg Hand Surg. 2023 Feb-Dec;57(1-6):16-21. doi: 10.1080/2000656X.2021.2024439. Epub 2022 Jan 17. PMID: 35034563.
2. Al-Ajmi TA, Al-Faryan KH, Al-Kanaan NF, Al-Khodair AA, Al-Faryan TH, Al-Oraini MI, Bassas AF. A Systematic Review and Meta-analysis of Randomized Controlled Trials Comparing Surgical versus Conservative Treatments for Acute Undisplaced or Minimally-Displaced Scaphoid Fractures. Clin Orthop Surg. 2018 Mar;10(1):64-73. doi: 10.4055/cios.2018.10.1.64. Epub 2018 Feb 27. PMID: 29564049; PMCID: PMC5851856.
3. Almigdad A, Al-Zoubi A, Mustafa A, Al-Qasaimeh M, Azzam E, Mestarihi S, Khair Y, Almanasier G. A review of scaphoid fracture, treatment outcomes, and consequences. Int Orthop. 2024 Feb;48(2):529-536. doi: 10.1007/s00264-023-06014-2. Epub 2023 Oct 26. PMID: 37880341.
4. Clementson M, Jørgsholm P, Besjakov J, Thomsen N, Björkman A. Conservative Treatment Versus Arthroscopic-Assisted Screw Fixation of Scaphoid Waist Fractures--A Randomized Trial With Minimum 4-Year Follow-Up. J Hand Surg Am. 2015 Jul;40(7):1341-8. doi: 10.1016/j.jhsa.2015.03.007. Epub 2015 Apr 22. PMID: 25913660.
5. Ibrahim T, Qureshi A, Sutton AJ, Dias JJ. Surgical versus nonsurgical treatment of acute minimally displaced and undisplaced scaphoid waist fractures: pairwise and network meta-analyses of randomized controlled trials. J Hand Surg Am. 2011 Nov;36(11):1759-1768.e1. doi: 10.1016/j.jhsa.2011.08.033. PMID: 22036276.
6. Schädel-Höpfner M, Marent-Huber M, Sauerbier M, Pillukat T, Eisenschenk A, Siebert HR. Operative vs. konservative Therapie nichtdislozierter Skaphoidfrakturen. Ergebnisse einer kontrollierten multizentrischen Kohortenstudie [Operative versus conservative treatment of non-displaced fractures of the scaphoid bone. Results of a controlled multicenter cohort study]. Unfallchirurg. 2010 Oct;113(10):804, 806-13. German. doi: 10.1007/s00113-010-1848-y. Erratum in: Unfallchirurg. 2011 Feb;114(2):181. PMID: 20827544.
7. Drác P, Manák P, Labónek I. Percutaneous osteosynthesis versus cast immobilisation for the treatment of minimally and non-displaced scaphoid fractures. Functional outcomes after a follow-up of at least 12 month. Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub. 2005 Jun;149(1):149-51. doi: 10.5507/bp.2005.018. PMID: 16170402.
8. Alnaeem H, Aldekhayel S, Kanevsky J, Neel OF. A Systematic Review and Meta-Analysis Examining the Differences Between Nonsurgical Management and Percutaneous Fixation of Minimally and Nondisplaced Scaphoid Fractures. J Hand Surg Am. 2016 Dec;41(12):1135-1144.e1. doi: 10.1016/j.jhsa.2016.08.023. Epub 2016 Oct 1. PMID: 27707564.
9. Stein A, Lalka A, Scott F, Rodriguez Fontan F. Is the Repair of Acute Scapholunate Injuries Associated With Distal Radius Fractures Necessary at the Time of Osteosynthesis? A Systematic Review and Meta-Analysis. Hand (N Y). 2024 Sep;19(6):875-884. doi: 10.1177/15589447231151259. Epub 2023 Feb 17. PMID: 36802849; PMCID: PMC11342707.
10. Clementson M, Björkman A, Thomsen NOB. Acute scaphoid fractures: guidelines for diagnosis and treatment. EFORT Open Rev. 2020 Feb 26;5(2):96-103. doi: 10.1302/2058-5241.5.190025. PMID: 32175096; PMCID: PMC7047900.
11. Sabbagh MD, Morsy M, Moran SL. Diagnosis and Management of Acute Scaphoid Fractures. Hand Clin. 2019 Aug;35(3):259-269. doi: 10.1016/j.hcl.2019.03.002. Epub 2019 May 11. PMID: 31178084.
12. Neubrech F, Terzis A, Seegmüller J, Sauerbier M. Diagnostik und Therapie frischer Skaphoidfrakturen [Diagnostics and treatment of acute scaphoid fractures]. Unfallchirurg. 2019 Mar;122(3):182-190. German. doi: 10.1007/s00113-018-0588-2. PMID: 30539245.

13. Kang L. Operative Treatment of Acute Scaphoid Fractures. Hand Surg. 2015;20(2):210-4. doi: 10.1142/S021881041540002X. PMID: 26051762.
14. Yang C, Chen L, Hu S. [Advances in diagnosis and treatment of acute scaphoid fractures]. Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi. 2019 Apr 15;33(4):507-510. Chinese. doi: 10.7507/1002-1892.201811057. PMID: 30983203; PMCID: PMC8337181.
15. Arsalan-Werner A, Sauerbier M, Mehling IM. Current concepts for the treatment of acute scaphoid fractures. Eur J Trauma Emerg Surg. 2016 Feb;42(1):3-10. doi: 10.1007/s00068-015-0587-8. Epub 2015 Nov 25. PMID: 26608838.
16. Rizzo M, Shin AY. Treatment of acute scaphoid fractures in the athlete. Curr Sports Med Rep. 2006 Sep;5(5):242-8. doi: 10.1097/01.csmr.0000306422.24038.1f. PMID: 16934205.
17. Yin ZG, Zhang JB, Kan SL, Wang P. Treatment of acute scaphoid fractures: systematic review and meta-analysis. Clin Orthop Relat Res. 2007 Jul;460:142-51. doi: 10.1097/BLO.0b013e31803d359a. PMID: 17310931.
18. Symes TH, Stothard J. A systematic review of the treatment of acute fractures of the scaphoid. J Hand Surg Eur Vol. 2011 Nov;36(9):802-10. doi: 10.1177/1753193411412151. Epub 2011 Jun 23. PMID: 21700649.
19. Doornberg JN, Buijze GA, Ham SJ, Ring D, Bhandari M, Poolman RW. Nonoperative treatment for acute scaphoid fractures: a systematic review and meta-analysis of randomized controlled trials. J Trauma. 2011 Oct;71(4):1073-81. doi: 10.1097/TA.0b013e318222f485. PMID: 21986747.
20. Hickey B, Hak P, Logan A. Review of treatment of acute scaphoid fractures: R1. ANZ J Surg. 2012 Mar;82(3):118-21. doi: 10.1111/j.1445-2197.2012.06000.x. PMID: 22510119.