Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v6i1.2048
*Biol. Clin. Sci. Res. J., Volume 6(1), **2025**: 2048*
Original Research Article

Functional Outcome of Herbert Screw Fixation with Bone Grafting in Scaphoid Nonunion

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(Received, 2nd December 2024, Accepted 22nd January 2025, Published 31st January 2025)

Abstract: *Scaphoid nonunion is a frequent complication of missed or inadequately treated fractures that may lead to wrist instability and degenerative arthritis. Surgical fixation with a Herbert screw, combined with bone grafting, has emerged as an effective technique for promoting union and restoring function.* ***Objective:*** *This study aimed to evaluate functional outcomes following surgical management of scaphoid nonunion with Herbert screw fixation and autologous bone grafting.* ***Methodology:*** *Sixty patients with a clinically and radiographically confirmed diagnosis of scaphoid nonunion were enrolled. All participants underwent Herbert screw fixation with bone grafting under general anesthesia. Postoperatively, the wrist was immobilized for two weeks, followed by mobilizing exercises. The functional outcome was assessed at 60 days post-procedure using the Modified Mayo Wrist Score.* ***Results:*** *In our study, union was achieved in 56 (93.3%) patients. Thirty-six patients (60%) were rated as having an excellent result, while 20 patients (33.3%) achieved a good outcome. A fair result was observed in 3 patients (5%), and a poor outcome in only one patient (1.7%).* ***Conclusion:*** *Herbert screw fixation with bone grafting in scaphoid non-unions exhibited a favorable functional outcome and a higher success rate for union.*

Keywords: Scaphoid Nonunion, Herbert Screw, Bone Grafting, Functional Outcome, Modified Mayo Wrist Score, Wrist Surgery

[***How to Cite:*** Saeed M, Khan MZ, Haq SU, Hussain M. Functional outcomes of Herbert screw fixation with bone grafting in scaphoid nonunion. *Biol. Clin. Sci. Res. J.*, **2025;** 6(1): 182-184. doi: https://doi.org/10.54112/bcsrj.v6i1.2048

Introduction

Scaphoid fractures represent a common type of wrist injury, especially to individuals engaged in sports. The scaphoid bone, situated beneath the proximal row of carpal bones, serves a crucial role in maintaining wrist stability and facilitating mobility. The unique anatomical position causes it to be susceptible to fractures, particularly in cases of hyperextension as well as trauma. The main hurdle in identifying scaphoid fractures lies in their often subtle presentation (1, 2). Approximately 25% of scaphoid fractures are located in the distal region of the scaphoid, while nearly 5% are found in the proximal region (3).

Patients often present with wrist pain after a recent traumatic occurrence. Patients may exhibit delayed symptoms, as injuries may be missed in standard radiographic assessments. Discomfort frequently originates on the radial side of the wrist and intensifies with movement (4). The scaphoid bone is among the most commonly fractured carpal bones due to its unique blood supply, which renders its proximal pole particularly vulnerable to avascular necrosis and nonunion. Surgical intervention, such as Herbert screws, combined with bone grafting, is a standard treatment. The Herbert screw is a specialized device used to stabilize scaphoid fractures. It facilitates secure internal fixation and has been shown to promote union (5, 6).

This method is widely used for its ability to provide strong mechanical stability while minimizing the risks associated with conventional plating techniques. X-ray evaluation of the scaphoid presents significant obstacles. Even when initial treatment is believed to have resulted in fracture healing, follow-up radiographic examinations frequently reveal the development of established nonunion (7-10).

Scaphoid nonunion is a common complication following scaphoid fractures that often results from delayed Diagnosis or inadequate initial treatment, leading to chronic wrist pain and reduced range of motion. Herbert screw fixation provides compression across the fracture site. It has been widely used to achieve stable fixation, while bone grafting facilitates biological healing by enhancing osteogenesis and bridging bone defects. Evaluating the functional outcomes of this combined approach helps determine its effectiveness in restoring wrist function and promoting union, thereby guiding optimal management strategies for patients with scaphoid nonunion.

Methodology

This study was conducted as a descriptive study at Department of Orthopedic and Spine, Hayatabad Medical Complex, from May 2024 to November 2024 after obtaining ethical clearance from the hospital.

In our study, we enrolled 60 male and female patients aged 18 to 60 years who presented with a Diagnosis of scaphoid nonunion. This diagnosis was established clinically by the presence of persistent wrist pain (VAS > 4), specifically localized to the anatomical snuffbox, and confirmed radiologically. Radiographic confirmation involved plain X-rays of the wrist, including anteroposterior, lateral, and oblique views, which demonstrated a persistent fracture line, sclerosis at the fracture margins, or signs of avascular necrosis. Patients presenting with advanced comorbidities such as osteoporosis, rheumatoid arthritis, or those who were pregnant were excluded from the study.

The surgical management for scaphoid nonunion consisted of internal fixation with a Herbert screw combined with a bone graft, a procedure conducted under general anaesthesia. Intraoperatively, the nonunion site was prepared by excising all fibrous tissue and synovial adhesions while preserving the inherent stability of the bone. The resulting defect was then packed with cancellous graft material following the thorough removal of any avascular tissue and cystic formations. Reconstruction of the bony architecture was achieved using a corticocancellous bone graft. The Herbert screw was introduced via a manual technique guided into position with a drill guide wire. The bone graft was obtained primarily from the opposite hip or the lower end of the forearm, depending on the dimensions of the nonunion gap and the quantity of graft material needed. Postoperatively, the wrist was supported in a rigid, padded, and removable splint for the first fortnight. Upon removal of the sutures, patients were advised to commence a regimen of wrist joint mobilization exercises. They were specifically cautioned against excessive wrist loading and against engaging in contact sports. Functional recovery was evaluated after 60 days using the modified Mayo wrist score. A score

between 91 and 100 was classified as an excellent outcome, 80 to 90 as good, 65 to 79 as fair, and any score below 65 as a poor outcome. A consultant orthopedic surgeon supervised all assessments.

For data analysis, we used SPSS 25. Descriptive statistics were computed for all variables.

Results

Based on analysis of 60 patients in our cohort, the average age was 28.87 ± 8.40 years, with 43 patients (71.7%) in the 18-35-year age bracket. Male patients were in the majority (44, 73.3%), compared with 16 female patients (26.7%).

The patients' socioeconomic backgrounds varied, with 27 (45.0%) from low-income groups and 24 (40.0%) from middle-income groups. Regarding education, 37 patients (61.7%) were illiterate, while 23 (38.3%) were literate. The right wrist was more commonly affected in 41 cases (68.3%) (Table 1).

The average duration from the initial injury to the surgical intervention was 13.07 ± 1.19 months. The functional outcomes following the procedure were highly encouraging. A successful bony union was achieved in 56 patients, constituting 93.3% of the cohort (Figure 1). When evaluating the functional result, we observed that 36 patients (60.0%) achieved an excellent outcome, twenty (33.3%) had a good outcome, and 3 (5.0%) were rated as fair. A poor outcome was recorded in only one patient (1.7%) (Table 2).

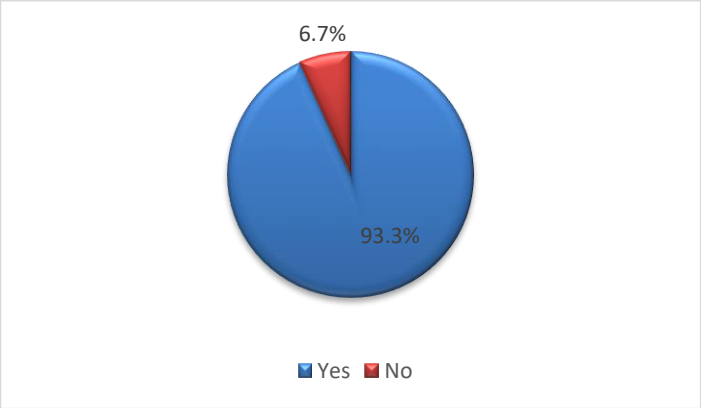

Figure 1: Union achieved.

Table 1: Demographics

Demographics			
Mean			SD
Age (Years)		28.87	8.402
BMI (Kg/m2)		23.1695	2.65404
n			%
Age distribution (Years)	18 to 35	43	71.7%
	> 35	17	28.3%
Gender	Male	44	73.3%
	Female	16	26.7%
Socioeconomic status	Low (< 30K Rs/Month)	27	45.0%
	Middle (30 to 70K Rs/Month)	24	40.0%
	High (> 70K Rs/Month)	9	15.0%
Education status	Literate	23	38.3%
	Illiterate	37	61.7%
Residence	Rural	32	53.3%
	Urban	28	46.7%
Affected side	Right	41	68.3%
	Left	19	31.7%

Table 2: Functional outcome

Functional outcome		**n**	**%**
Functional outcome	Excellent	36	60.0%
	Good	20	33.3%
	Fair	3	5.0%
	Poor	1	1.7%

Discussion

The demographic profile of our patient cohort, with a mean age of 28.87 ± 8.40 years and a strong male predominance of 44 patients (73.3%), aligns very well with the patient populations described in previous studies. Huang et al. reported an average patient age of 30.6 years, whereas Dias et al. reported a mean age of 27.9 years (11,12). This consistent demographic trend across studies, including the research by Ahmed et al., which also had a predominantly male cohort (88.9%), underscores that scaphoid nonunion is a condition predominantly affecting young active males often in their prime working years (8).

The time interval from initial injury to surgical management in our study averaged 13.07 ± 1.19 months. Ahmed et al. documented a similar mean time of 11 months while Huang et al. reported a longer duration of 19.8 months (8, 11).

The primary objective of any intervention for scaphoid nonunion is to achieve solid bony union, and in this regard, our results are highly encouraging and consistent with established evidence. Our union rate of 56 patients (93.3%) is virtually identical to the 93.9% reported by Huang et al. in their long-term follow-up study (11). Hamid et al achieved a 100% union rate in their series.[14] Baby et al. reported a 94% union rate for screw fixation with grafting (15). This collective evidence strongly positions the combination of Herbert screw and bone grafting as a highly reliable method for achieving scaphoid healing. The success of this method, as discussed by Huang et al., can be attributed to the principles of thorough debridement of the nonunion site, the use of an intercalated corticocancellous graft to correct deformity and provide an

osteoconductive matrix, and the provision of rigid internal compression with the Herbert screw, which enables early mobilization (11).

Regarding functional outcomes, our results, which showed 36 patients (60.0%) with an excellent outcome and 20 (33.3%) with a good outcome, collectively representing 93.3% satisfactory results, compare very favorably with Huang et al., who reported 59.2% excellent and 34.7% good results using Cooney's scoring system. At the same time, Baby et al. documented 58.3% excellent and 33.3% good results on the modified Mayo wrist score (11,15). Ahmed et al. also reported a similar distribution with 66.7% excellent outcomes (8). The consistency in these functional results across different study populations and even different functional scoring systems strengthens the argument for the reproducible success of this surgical technique. The functional improvement is not merely radiographic success but also clinical benefits, including significant pain relief and restoration of grip strength and range of motion.

We suggest that Herbert screw fixation with bone grafting should be considered the Gold standard for the management of scaphoid nonunion in the absence of advanced avascular necrosis or carpal collapse. The procedure delivers notably high union rates and excellent functional recovery, allowing young patients to return to work and daily activities promptly.

Conclusion

From our study, we conclude that Herbert screw fixation with bone grafting for scaphoid nonunions is an effective technique, resulting in a favorable functional outcome and a higher union rate.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate
Approved by the department concerned. (IRB)

Consent for publication
Approved

Funding
Not applicable

Conflict of interest

The authors declared no conflicts of interest.

Author Contribution

MS (Associate Professor)
Conception of Study, Study Design, Data analysis, Manuscript drafting, and Final approval of draft
MZK (Associate Professor)
Review of Literature, Data entry, and Critical input
SUH (Specialist Registrar)
Conception of Study, Development of Research Methodology Design,
MH (Trainee Medical Officer)
Study Design, manuscript review, and critical input.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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