



Treatment of acute scaphoid fractures: Non-randomized clinical study

Dr. Md Anwar¹, Dr. Chandan Kumar^{2*}

¹ Senior Resident, Department of Orthopaedics, Madhubani Medical College and Hospital, Madhubani, Bihar, India

² Assistant Professor, Department of Orthopaedics, Madhubani Medical College and Hospital, Madhubani, Bihar, India

* Corresponding Author: Dr. Chandan Kumar

Abstract

Aim: To compare the results of operative fixation of acute scaphoid fractures with those of non-operative treatment.

Materials & Method: This clinical study was carried out among 26 patients with an acute non displaced or minimally displaced scaphoid fracture reported to the OPD of Department of Orthopaedics Madhubani Medical College and Hospital, Madhubani, Bihar, India. From July 2019 to Nov 2019. Patients were non-randomly allocated to group A (non-operative treatment with a cast) and group B (internal fixation with a Herbert screw).

Results: mean age of the study population was 41.23 years. Majority of them were male 21 (80.7%) and rest 5 (19.3%) were female. Out of total 26 scaphoid fracture cases 16 (61.5%) were of right hand and rest 10 (38.5%) found on the left hand. Most common location of fracture was waist fracture (B2) 10 cases. 100% union was observed in group B.

Conclusions: study proves that Cast treatment has the disadvantages of longer immobilisation time, joint stiffness, reduced grip strength, and longer time to return to work whereas the operative fixation of acute scaphoid fractures results in predictable satisfactory union rate and good functional outcome.

Keywords: Cast treatment, scaphoid fracture

Introduction

Hand injuries are one of the commonest injuries seen in the accident and emergency department. Misdiagnosis of hand injuries may result in major morbidity from loss of hand function [1]. Hand and wrist injuries contribute a considerable workload for any individual accident and emergency department. There is little information concerning the prevalence of hand fractures and their distribution between the phalanges, metacarpals and carpal bones [2].

The carpal scaphoid bone is known to play a key role in the function of the wrist. Therefore, pathologic abnormalities of the scaphoid may have serious consequences. It is the most common carpal to get fractured. Over the years, identification and management of acute scaphoid fractures has generated substantial interest and research.

Scaphoid is very notorious to go into nonunion and ultimately avascular necrosis (AVN) which inevitably causes scaphoradial arthritis. Studies have shown that 95.6% of total scaphoid fractures are of waist and of these 63% are displaced fractures [3]. The incidence in Western countries is approximately five fractures in every 10,000 inhabitants [4, 5]. However, because of the diagnostic challenge that scaphoid fractures often present, the exact incidence is unknown.

Diagnosis is difficult; classification is controversial & there is never ending debate on appropriate treatment protocol. Once diagnosed, there is no clear-cut protocol for deciding appropriate treatment technique. There is controversy regarding whether to be managed conservatively or operatively. If managed conservatively, literature review revealed that there is

Insufficient evidence regarding position of immobilization (extension, ulnar deviation, neutral) or type of cast to be used in the non-operative treatment of non-displaced scaphoid fractures [6]. As a result of the complex three-dimensional anatomy of the scaphoid, there are also technical difficulties associated with the operative management [7].

The importance of a correct diagnosis and appropriate treatment of scaphoid fractures lies in its blood supply. The main blood supply to the scaphoid is from the radial artery. Over 80% of the scaphoid surface is covered with articular cartilage. The dorsal scaphoid branches from the radial artery enter the non-articular portion of the scaphoid at the dorsal ridge at the level of the waist and supply the proximal 70% to 80% of the scaphoid [8]. The volar scaphoid branches from either the radial artery or the superficial palmar branch enter at the distal tubercle and supply the distal 20% to 30% of the scaphoid. Thus, the vascularity of the proximal pole depends entirely on intraosseous blood flow. This tenuous blood supply to the proximal pole of the scaphoid helps to explain the increased frequency of delayed union, nonunion and avascular necrosis (AVN) of scaphoid fractures. AVN is reported to occur in 13% to 50% of scaphoid fractures, with an even higher incidence in those involving the proximal one-fifth of the scaphoid [9].

Hence the aim of the current study was to investigate the outcomes of operative treatment for minimally-displaced and un displaced scaphoid fractures compared with non-operative treatment; furthermore, we also attempted to illuminate the limitations of current studies and to provide suggestions for further studies to evaluate these therapeutic options for the treatment of acute scaphoid fractures.

Material & Methods

Study Design

The present non-randomized clinical study was conducted for the period of six months among patients with a suspected or confirmed injury of the Scaphoid who had attended Out Patient Department of Orthopaedics Madhubani Medical College and Hospital, Madhubani, Bihar, India from July 2019 to Nov 2019

Inclusion criteria

- Patients ≥ 18 years of age
- Patients with isolated scaphoid fractures and acute i.e. no more than 2 weeks gap between injury and treatment

Exclusion criteria

- Patients with acute fractures of both hands or with one hand missing
- All injuries other than isolated scaphoid fractures
- Patients with radiological signs of carpal instability
- Patients with signs of any rheumatoid, osteoarthritis or polyarthritis
- Patients with previous skeletal or severe soft tissue trauma to the same wrist

Treatment allocation

The decision on whether to choose an operative or non-operative treatment procedure is taken by the patient together with his treating surgeon. The participation in the study is completely independent of this decision and does not influence the choice of treatment procedure. Patients are classified as operative or non-operative according to the initial treatment decision taken during the first two weeks following injury.

Interventions

Group A: non-operative treatment with a cast.

Group B: operative treatment with Herbert screw.

Patients in both groups received 10 sessions of physical therapy.

Outcome assessment

All patients were asked to attend for routine review at three months, 6 month and one-year, additional visits being scheduled as required.

Standard Scaphoid series radiographs were taken at each visit and a full clinical assessment was recorded. Modified MAYO Wrist score [10] was used to assess functional outcome of individual patient after treatment.

Union was considered to have occurred when there was no tenderness at the anatomical snuff box or at scaphoid tubercle and there was evidence of trabeculae crossing fracture on at least three views. Grip strength was measured asking the patient to squeeze the examiners index finger, and the strength was compared on contralateral side. To avoid subjective bias two surgeons assessed grip strength separately and the average of two findings was taken as a final outcome. Grip strength was graded according to MRC grading. Range of motion was measured using goniometer.

Statistical Analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2010) and then exported to data editor page of SPSS version 19 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics included

computation of percentages.

The statistical test applied for the analysis was Pearson’s chi-square test (χ^2). The confidence interval and p-value were set at 95% and ≤ 0.05 respectively.

Results

Table 1: Distribution of subjects as per Gender

Gender	Group		Total
	A	B	
Male	12	9	21
	80.0%	81.8%	80.7%
Female	3	2	5
	20.0%	18.2%	19.3%
Total	15	11	26
	100.0%	100.0%	100.0%
Mean±SD (Age Years)	29.21±2.18		

Test applied: chi-square test ($p \geq 0.05$)

Table 2: Distribution of subjects as per Laterality of the Fracture

Laterality	Group		Total
	A	B	
Right	9	7	16
	60.0%	63.6%	61.5%
Left	6	4	10
	40.0%	36.4%	38.5%
Total	15	11	26
	100.0%	100.0%	100.0%

Test applied: chi-square test ($p \geq 0.05$)

Table 3: Distribution of subjects as per Herbert Classification

Herbert Classification	Group		Total
	A	B	
A1	1	1	2
	6.6%	9.1%	
A2	1	1	2
	6.6%	9.1%	
B1	3	2	5
	20.0%	18.2%	
B2	6	4	10
	40.0%	36.3%	
B3	2	2	4
	13.4%	18.2%	
B4	2	1	3
	13.4%	9.1%	
Total	15	11	26
	100.0%	100.0%	100.0%

Test applied: chi-square test ($p \geq 0.05$)

Table 4: Distribution of subjects as per Modified MAYO Wrist score

Modified MAYO Wrist score	Group		Total
	A	B	
Poor	6	1	7
	40.0%	9.1%	26.9%
Fair	2	2	4
	13.3%	18.2%	15.4%
Good	4	6	10
	26.7%	54.5%	38.5%
Excellent	3	2	5
	20.0%	18.2%	19.2%
Total	15	11	26
	100.0%	100.0%	100.0%

Test applied: chi-square test ($p \leq 0.05$)

Table 5: Distribution of subjects as per Fracture Union

Fracture Union	Group		Total
	A	B	
Union	11	11	22
	73.3%	100.0%	84.6%
Non-union	4	0	4
	26.7%	0.0%	15.4%
Total	15	11	26
	100.0%	100.0%	100.0%

Test applied: chi-square test ($p \leq 0.05$)

Discussion

The incidence of scaphoid fractures quoted in different literatures ranges from 1.47 to 121 per 100,000 of the population per year and is one of the key areas of discrepancy in the scaphoid fracture literature. This is likely due to the, low capture rates, small population sample sizes, the lack of a defined captive population, and the limitation of many databases in their ability to distinguish between a true and suspected fracture.

In a prospective study conducted by Saeden B *et al.* [11] compared Herbert screw fixation versus short arm cast for acute scaphoid fracture in 61 patients with 62 fractures and found that the operative group returned to work in a shorter period of time. Hence there has been a trend towards surgical fixation of these fractures [12]. Even the primary treatment demands expertise and familiarity with different treatment options. If those requirements are met a good prognosis can be expected. Open reduction and internal fixation of acute fracture of the scaphoid using a compression lag screw was recommended by McLaughlin [13] and Maudsley [14] to allow early mobilization of wrist. Herbert and Fischer first described the technique in 1984, since then the Herbert screw has become widely accepted as a mode of treatment [15].

The average age of presentation in our study was 29.21 years. This was found in agreement with the study conducted by Parajuli NP *et al.* [16] found only two (13.3%) patients were above 30 years, rest 13 (86.7%) patients were below 30 years. This finding suggests that scaphoid fracture is common in young adults.

In the present investigation Most common location of fracture was waist fracture (B2) 10 cases followed by distal oblique fracture (B1) 5 cases, proximal pole fracture (B3) 4 cases, Trans scaphoid perilunate dislocations (B4) 3 cases. This was found in agreement with the results of the study conducted by Leslie & Dickson [17].

In a review study conducted by Duckworth *et al.* [18] Low-energy falls from a standing height were most common cause of scaphoid fracture. Contact sports comprised the next largest group, with football injuries being the most common. Major cause of injury in our study was Road traffic accident (51%) followed by sports injury (18%), work place injuries (16%), house hold injuries (8%), assault injury (7%).

In randomized clinical trials comparing the conservatively and surgically treated patients Bond and Saeden with co-workers found a significantly shorter period of sick leave in patients treated by percutaneous osteosynthesis. Differences in grip strength compared to the uninjured wrist between both groups were statistically insignificant with a better outcome in the surgically treated patients [9]. Adolfsen reported 13% mean loss of range of wrist motion in the conservatively treated group and 6% in the operated group

[19].

Our results confirm that internal fixation leads to better functional results & union of fracture than conservative treatment. We found more complain-free patients in the surgically treated group and fewer patients with resting pain and pain during sports and physical activities at the time of check-up which signifies a marked improvement in functional status with operative management. A high successful union rate of approximately 95% can be achieved after adequate screw fixation; however malpositioning can result in nonunion of scaphoid fractures [20, 21]. Nonunion may occur in 5% to 10% of all cases, with an even higher incidence in displaced fracture and proximal pole fracture. The reason behind such incidence is attributed to the tenuous blood supply of the scaphoid [22].

Limitation

We did not compare the time to union in the conservatively and surgically treated patients because, we did not perform CT examination routinely for all patients at the time of follow up evaluation. This was, along with a small sample, the main limitation of our study.

Conclusion

Open reduction and internal fixation is an option to reliably diminish the incidence of nonunion and malunion with residual carpal instability that occur with cast immobilization in scaphoid fracture. Our study proves that Cast treatment has the disadvantages of longer immobilisation time, joint stiffness, reduced grip strength, and longer time to return to work whereas the operative fixation with Herbert screw results in predictable satisfactory union rate and good functional outcome. Hence we recommend use of Herbert screw for fixation of scaphoid fracture whether displaced or undisplaced for better radiological and functional outcome.

References

1. Clark DP, Scott RN, Anderson IWR. Hand problems in an accident and emergency department. *Journal of Hand Surgery*. 1985; 10:297-99
2. Riggs L Jr. Medical-legal problems in the emergency department related to hand injuries. *Emergency Med Clin North Am*. 1985; 3:415-8.
3. Chari PR. Fresh fractures of the scaphoid: A rationale method of treatment. *Indian J Orthop*. 2006; 40:250-4.
4. Brauer RB, Dierking M, Werber KD: Use of the Herbert screw with the freehand method for osteosynthesis of acute scaphoid fractures. *Unfallchirurg*. 1997; 100(10):776-81.
5. Kozin SH. Incidence, mechanism, and natural history of scaphoid fractures. *Hand Clin*. 2001; 17(4):515-24.
6. Yin Z, Zhang J, Kan S, Wang P. Treatment of Acute Scaphoid Fractures: Systematic Review and Meta-analysis. *Clin Orthop Relat Res*, 2007.
7. Adams BD, Blair WF, Reagan DS, Grundberg AB. Technical factors related to Herbert screw fixation. *J Hand Surg [Am]*. 1988; 13:893-9
8. Gelberman RH, Menon J. The vascularity of the scaphoid bone. *J Hand Surg*. 1980; 5A:508-513.
9. Steinmann SP, Adams JE. Scaphoid fractures and nonunions: diagnosis and treatment. *J Orthop Sci*. 2006; 11:424-431
10. Cooney WP, Bussey R, Dobyns JH, Linscheid RL.

- Difficult wrist fractures. Perilunate fracture-dislocations of the wrist. *Clin Orthop Relat Res.* 1987; (214):136-147.
11. Saeden B, Tornkvist H, Ponzer S, Hoglund M. Fracture of the carpal scaphoid; a prospective randomized 12 year follow up comparing operative and conservative treatment. *J. Bone Joint Surg.* 2001; 83(2):230-4.
 12. Mcqueen MM, Gelbke MK, Walkfield A, *et al.* Percutaneous screw fixation versus conservative treatment for the fractures of the waist of Scaphoid, prospective randomized study. *J. Bone Joint Surg [Br].* 2008; 90(1):66-71.
 13. McLaughlin HL. Fracture of the carpal navicular (scaphoid) bone: some observation based on treatment by open reduction and internal fixation. *J. Bone Joint Surg [Am].* 1954; 36:765-74.
 14. Maudsley RH, Chen SC. Screw fixation in the management of the fractured carpal scaphoid. *J. Bone Joint Surg [Br].* 1972; 54:432-41.
 15. Herbert TJ. Use of Herbert Bone screw in surgery of the wrist. *Clin orthop.* 1986; (202):79-92.
 16. Parajuli NP, Shrestha D, Dhoju D, Shrestha R, Sharma V. Scaphoid Fracture: Functional Outcome Following Fixation with Herbert Screw. *Kathmandu Univ med J.* 2011; 36(4):267-73.
 17. Leslie IJ, Dickson RA. The fractured carpal scaphoid. Natural history and factors influencing outcome. *J Bone Joint Surg Br.* 1981; 63(2):225-230.
 18. Duckworth AD, Jenkins PJ, Aitken SA, Clement ND, Court-Brown CM, McQueen MM. Scaphoid fracture epidemiology. *J Trauma Acute Care Surg.* 2012; 72(2):E41-E45.
 19. Adolfsson L, Lindau T, Arner M. Acutrak screw fixation versus cast immobilisation for undisplaced scaphoid waist fractures. *J Hand Surg Br.* 2001; 26(3):192-5.
 20. Naranje S, Kotwal PP, Shamsheery P, Gupta V, Nag HL. Percutaneous fixation of selected scaphoid fractures by dorsal approach. *International orthopedics.* 2010; 34:997-1003.
 21. Bedi A, Jebson PJ, Hayden RJ, Jacobson JA, Martus JE. Internal fixation of acute nondisplaced scaphoid waist fractures via a limited dorsal approach; an assessment of Radiographic and functional outcomes. *J. Hand Surg.* 2007; 32A:326e1-e9.
 22. Kawamura K, Chung KC. Treatment of scaphoid fractures and nonunions. *J Hand Surg.* 2008; 33A:988-97.