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Original Research Article

A Prospective Single Centre Study to Examine the Differences Between the Outcomes of Operation Fixation of Acute Scaphoid Fractures and Those of Non-Operative Therapy

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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 nondisplaced or minimally displaced scaphoid fracture reported to the OPD of Department of Orthopaedics, Patna Medical College and Hospital, Patna, Bihar, India. 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:** It has been demonstrated in this study that cast treatment has the disadvantages of prolonged immobilisation time, joint stiffness, decreased grip strength, and a longer time to return to work, whereas operative fixation of acute scaphoid fractures results in a predictable satisfactory union rate and a good functional outcome.

Keywords: Cast Treatment, Scaphoid Fracture, Nondisplaced.

Introduction

Hand injuries are one of the most prevalent types of injuries encountered in the emergency room and the accident and emergency department clinic.

Misdiagnosis of hand injuries may result in severe morbidity due to the loss of hand function, which can be fatal[1].

Hand and wrist injuries add a significant amount of labour to the burden of any particular accident and emergency room.

In terms of the occurrence of hand fractures and the distribution of these fractures among the phalanges, metacarpals, and carpal bones, there is little information available[2].

As previously stated, the carpal scaphoid bone is recognised to play an important part in the proper function of the wrist. As a result, pathologic anomalies of the scaphoid may have life-threatening effects in certain cases. Fractures of the third carpal are the most prevalent kind of fracture.

The detection and treatment of acute scaphoid fractures has piqued a great deal of interest and study throughout the years, and it continues to do so. 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[4,3]. 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 reveled that there is insufficient evidence regarding position of immobilization (extension, ulnar deviation, neutral) or type of cast to be used in the nonoperative 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 interosseous 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 undisplaced 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 1 year among patients with a suspected or confirmed injury of the Scaphoid who had attended Out Patient Department of Orthopaedics, Patna Medical College and Hospital, Patna, Bihar, India From March 2019 to March 2020.The study protocol was reviewed by the Ethical Committee of the Hospital and granted ethical clearance.

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 nonoperative 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 out-come 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≥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≥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≥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≤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≤0.05)

Discussion

Various studies have reported scaphoid fracture rates ranging from 1.47 to 121 per 100,000 of the population each year, which is one of the most significant areas of difference in the scaphoid fracture literature.

This is most likely owing to poor capture rates, limited population sample sizes, a lack of a defined captive population, and the inability of many databases to discriminate between a genuine fracture and a suspected fracture, all of which are contributing factors.

Saeden B et al.[11] did a prospective trial in which they compared Herbert screw fixation with short arm cast for acute scaphoid fracture in 61 patients with 62 fractures and found that the surgical group returned to work in a shorter length of time.

As a result, there has been an increase in the use of surgical fixing for these fractures[12]. Even the most basic of treatments need knowledge and experience with a variety of therapy alternatives. If all of these prerequisites are accomplished, a favourable prognosis may be anticipated.

McLaughlin[13] and Maudsley[14] advocated open reduction and internal fixation of an acute fracture of the scaphoid utilising a

compression lag screw in order to allow for early mobility of the wrist after the fracture.

Herbert and Fischer published the original description of the procedure in 1984, and the Herbert screw has subsequently gained widespread acceptance as a modality of therapy[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%), workplace 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] Adolf son 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].

Conclusion

When treating a scaphoid fracture with cast immobilisation, open reduction and internal fixation is a viable approach for consistently reducing the rate of nonunion and malunion with persistent carpal instability that occurs with cast immobilisation.

Specifically, our study demonstrates that cast treatment has the disadvantages of prolonged immobilisation time, joint stiffness, reduced grip strength, and a longer period of time before returning to work, whereas operative fixation with the Herbert screw results in a predictable satisfactory union rate and a good functional outcome. To achieve a superior radiological and functional result in scaphoid fracture fixation, we propose the use of the Herbert screw, whether the fracture is displaced or undisplaced.

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