Percutaneous fixation of acute scaphoid fractures: a retrospective study

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Objective The aim of this study were to determine whether the functional outcome of the evaluation of the effectiveness of percutaneous retrograde (volar) approach of insertion of cannulated Herbert's screw to stabilize acute scaphoid fractures and to evaluate the functional outcome after this minimally invasive operative management of this problematic fracture.

Background Scaphoid fracture is the most common carpal fracture. It accounts for ~60–90% of carpal and 11% of hand fractures. Scaphoid fracture is a common fracture affecting mainly young active people during their work or while participating in sports activities.

Patients and methods This is a retrospective observational study of patients undergoing surgery for percutaneous fixation of acute scaphoid fracture. In our study, 12 patients with less than 14-day-old fractures were fixed percutaneously by Herbert's screw and reviewed for a minimum of 12 months (average of 24 months). The functional outcome of this method was assessed.

Results Fracture union was achieved in 11 (91.6%) cases at a mean of 8.29 weeks (6–12 weeks), whereas one case was ununited.

Conclusion This study proves that fixation of acute scaphoid fractures results in predictable satisfactory union rate and functional outcome. Moreover, it proves that percutaneous Herbert's screw insertion carries no risk of damage to soft tissues or vascular supply.

Sci J Al-Azhar Med Fac, Girls 2017 1:26–28

The Scientific Journal of Al-Azhar Medical Faculty, Girls 2017 1:26–28

Keywords: awadallah, Herbert screw, per cutaneous, scaphoid

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Received 21 August 2017 **Accepted** 6 September 2017

Introduction

Acute scaphoid fracture is a common condition whose management still remains controversial [1]. The general accepted treatment of acute, undisplaced fractures of the scaphoid is cast immobilization, which is reported to produce uncomplicated healing in most instances. However, in acute displaced scaphoid fractures, it can often be difficult to reduce anatomically and maintain reduction with cast only. In addition to that, 3 months of cast immobilization is often recommended to achieve union, which often leads to muscle wasting and joint stiffness [2].

Considering most scaphoid fractures are seen in young active men who do not want to be away from work or athletic activities for a prolonged time, operative stabilization of scaphoid fractures to reduce possible problems related to long immobilization can be justified. However, access to the scaphoid through an extensive open exposure can damage the blood supply or the anterior radiocarpal ligaments. Thus, to allow the patient's return to work and sports earlier and avoid possible complications of open procedure, minimal invasive percutaneous technique is performed to treat acute scaphoid fracture using cannulated headless screws, which is the most popular method of fixation [3].

Patients and methods

The purpose of this retrospective study is to document the percutaneous retrograde (volar) Herbert's screw fixation technique with free-hand method to stabilize acute scaphoid fractures and evaluate the clinical results. A total of 12 patients with less than 14-day-old fractures were fixed percutaneously by Herbert's screws and followed up for a minimum of 12 months (average of 24 months). Patients included had seven men and five women, with an average age of 29 years. According to Herbert's classification, 11 fractures were classified as acute unstable (B type) and one fracture as acute stable (A type). All 12 patients were evaluated for clinical and radiographic results.

The inclusion criteria for the study were as follows:

(1) Age over 16 years, including both sexes.
(2) Clinical signs and symptoms corresponding to acute scaphoid fractures.

 DOI: 10.4103/sjamf.sjamf_10_17

(3) Imaging techniques: findings of scaphoid fractures in hand radiography or hand computed tomography.
(4) Completion of questionnaires.
(5) Good understanding of spoken Arabic.

The exclusion criteria for the study were as follows:

(1) Age less than 16 years.
(2) Old scaphoid fractures.
(3) Crushed hand, or another fractures in hand bone.
(4) Major neurologic conditions.
(5) Psychiatric disorders.
(6) Inability to return to a participation site for the intensive exercise classes.

Results

A total of 12 cases of acute scaphoid fractures were treated by percutaneous retrograde (volar) Herbert's screw fixation in Al Azhar University hospitals.

The results were analyzed and revealed the following (Table 1): fracture union was achieved in 11 (91.6%) cases at a mean of 8.29 weeks (6–12 weeks); one case was ununited. In isolated scaphoid fracture, return to work or school ranged from 2 days to 8 weeks according to their occupation.

Patients were analyzed for the functional outcome using the following.

Herbert's grading system

One patient was classified as grade 3; despite radiographic nonunion and loosening around the screw, the patient was asymptomatic with normal function and unrestricted use.

One patient was classified as grade 2; in spite of the sound union of the scaphoid and normal carpal alignment, moderate symptoms and restriction of wrist flexion persisted owing to associated distal radius fracture that led to loss of volar tilt.

One patient was classified as grade 1, with sound union normal alignment, normal function, and unrestricted use but occasional pain and discomfort without radiographic abnormality.

Nine patients were classified as grade 0, with sound union, no deformity, normal function, and unrestricted use, and the patients were asymptomatic. One of them had an associated fracture of the distal radius, which had supplementary K-wire in addition to the screw, and the remaining eight cases had isolated fracture of the scaphoid that was fixed by only a Herbert's screw.

Modified Mayo score

Two patients were graded as good (85) owing to moderate pain and flexion extension range of 110° and 115°, but they returned to their regular job.

A total of 10 patients were graded as excellent (90 or above). One patient scored 95 owing to mild occasional pain, and nine patients scored 100%, including the patient classified as grade 3 in Herbert's grading system owing to nonunion.

Discussion

The scaphoid, like the talus or neck of femur, has an almost complete cartilaginous surface except for small portions on the dorsal and palmar aspect. Consequently, it depends on an intraosseous healing

Table 1 Characteristics of cases of the study

Case no.	Sex	Age	Occupation	Injury	Fracture site	Time to union (weeks)	Follow-up period (months)	Herbert's grading of results	Affected hand (dominance)	Associated injury and remarks
1	Male	24	Student	Fall	Waist B2	6	20	0	D	–
2	Male	28	Driver	Fall	Distal B1	9	24	0	D	–
3	Female	16	Student	Fall	Waist B2	6	24	0	ND	–
4	Male	25	Student	Fall	A	8	24	0	D	–
5	Male	42	Car technician	Fall	Waist B2	8	24	2	ND	DR+K-wire
6	Female	38	Housewife	Fall	Waist B2	8	20	0	D	–
7	Male	21	Car technician	Fall	Waist B2	12	24	0	D	–
8	Female	19	Student	Fall	Distal B1	10	20	0	D	–
9	Male	25	Student	Fall	Waist B2	6	18	0	D	–
10	Male	22	Student	RTA	Waist B2	6	24	0	ND	DR
11	Female	31	Housewife	Fall	Distal B1	12	24	1	ND	–
12	Female	52	Housewife	Direct	Proximal B3	No union	24	3	D	–

+K-wire, supplementary Kirschner wire for the scaphoid; D, dominant; DR, distal radius; ND, nondominant.

process especially in the proximal one-third that is supplied from intraosseous vessels. Therefore, there is greater possibility of a prolonged healing time and nonunion in the more proximal fracture [4].

Despite good results after conservative treatment of acute scaphoid fractures, the risk of nonunion is relatively high. Displaced scaphoid fractures occur because of high-energy impact resulting in intra-articular fragmentation and soft tissue lesions, hardly amenable to simple closed reduction and casting. If the result turns out to be nonunion or delayed union after weeks of conservative treatment, both the patient and surgeon should endure both complicated surgical treatment and long immobilization again. Considering that most scaphoid fractures occur in young men especially in manual workers or athletes, avoidance of cast immobilization is an advantage [5].

To avoid complications related to conservative treatment, early internal fixation of acute scaphoid fractures has been tested clinically and presented significant advantage over the conventional treatment [6,7].

Operative treatment has been shown to result in earlier bone union [2,3]. However, Adolfsson *et al*. [1] have found that rigid fixation does not actually accelerate healing of fractures, but it helps to reduce the factors that may delay healing.

The period of cast immobilization in conservative treatment is advised to be from 6 to 12 weeks [8]. Fixation of the scaphoid allows patients to return to full functional activity early as mobilization of the wrist could reduce wrist stiffness or cartilage degeneration [2–4,9,10].

The advantage of operative treatment of scaphoid fractures has been assessed in athletes [7], soldiers [2], and workers [3] who could return to their activities earlier.An important milestone in the surgical treatment of scaphoid fractures was the introduction of the Herbert's screw. In 1996, Filan and Herbert reported a union rate of 85.7% for 49 types B1, B2, and B3 fractures using open reduction and Herbert's screw fixation. Inoue and Shionoya [3] used a limited access method and achieved 100% union rate for 22 patients with B1 and B2 scaphoid fractures.

The introduction of cannulated screws has made it possible to fix the scaphoid fractures using a minimal invasive technique. The damage to the palmar carpal ligaments could be avoided, and the scar would be much better.

Haddad and Goddard [9] treated 15 acute scaphoid types B1 and B2 fractures using percutaneous cannulated screw and achieved 100% union rate at a mean of 57 days.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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