

# Transscaphoid Perilunate Fracture/Dislocations-Results of Surgical Treatment

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## Abstract

Sixteen cases of dorsal transscaphoid perilunate fracture/dislocations in 15 patients were treated by open reduction and internal fixation of the scaphoid with a Herbert screw and/or Kirschner wires. All patients were male, with a mean age of 31 years. The average follow-up period was 3 years. These perilunate dislocations were transscaphoid in 13 cases, and transstyloid and transscaphoid in 3 cases. There was one case of median nerve deficit preoperatively. Open reduction was performed through a volar approach in all cases. Herbert screw fixation of the scaphoid was performed on 13 cases, of which supplemental Kirschner wires were used in 2 cases. Three cases had fixation with Kirschner wires only. There were 2 cases of non-union which required bone grafting on follow-up. A clinical evaluation scoring system assessing pain, occupational ability, range of motion and grip strength was used. Based on this, there were 10 excellent to good (62.5%) and 6 fair results. For the majority of our patients, surgical outcome is characterised by acceptable relief of pain, functional motion and grip strength.

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**Key words:** Cooney's criteria, Herbert screw, Kirschner wires, Scaphoid fracture, Volar approach

## Introduction

Transscaphoid perilunate fracture/dislocations are relatively uncommon injuries of the wrist, constituting about 3% of all carpal injuries.<sup>1</sup> However, it accounts for more than half of perilunate dislocations,<sup>2,3</sup> the dorsal variant being by far the more prevalent.

Treatment concepts have changed greatly over the years. Treatment options included closed reduction and cast immobilisation (Russell<sup>2</sup>), primary arthrodesis (Wagner<sup>4</sup>), proximal row carpectomy (Campbell<sup>5</sup>), lunate excision (MacAusland<sup>6</sup>) and open reduction internal fixation with Herbert screw and/or k-wires.<sup>3,7-12</sup>

Although open reduction internal fixation is most commonly used in the treatment of such injuries, there is controversy pertaining to the surgical approach (volar<sup>12</sup> or dorsal<sup>7</sup> or combined<sup>9</sup>) and the choice of implant fixation (Herbert screw<sup>12</sup> or Kirschner wires<sup>7</sup> or both<sup>9</sup>). The objective of this study was to evaluate our experience with these injuries. The complications as well as final functional outcome using a standard scoring system were assessed. Our results would also be compared with other similar studies.

## Materials and Methods

Seventeen consecutive patients had open reduction

internal fixation of transscaphoid perilunate fracture/dislocations (Figs. 1a & 1b) between January 1992 and June 1997 at our institution. In July 1998, these patients were recalled for review.

Two patients were lost to follow-up, as they were foreign workers who had returned home. Fifteen patients (16 fracture/dislocations) were available for analysis. All had a minimum follow-up of one year. The average follow-up period was 3 years, with a range of 1 to 6.5 years. All were males and were between 23 and 47 years old (mean 31 years).

With regards to the mechanism of injury, 7 patients had injuries from falls on their outstretched hands and 8 patients had injuries sustained during road traffic accidents. Seven patients had their injuries on the left wrist, 7 on the right and 1 had bilateral fractures. All cases were dorsal dislocations. Among the 16 cases of perilunate dislocations, 13 were transscaphoid and 3 were both transscaphoid and transstyloid. Routine antero-posterior and lateral wrist radiographs were sufficient for diagnosis in all cases. Three cases were open fracture/dislocations and one case presented with median nerve deficit preoperatively. Four patients were found to have other injuries. One had deep facial lacerations; one had pneumothorax, burst fracture of the L5 vertebra and

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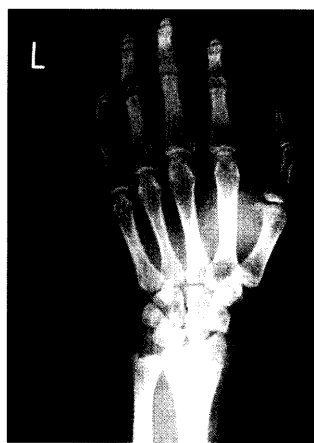


Fig. 1a.



Fig. 1b.

Fig. 1a. Antero-posterior radiograph depicting transscaphoid perilunate fracture/dislocation of the left wrist.

Fig. 1b. Lateral radiograph of the same patient.

open fracture of the contralateral distal radius; one had base of skull fracture, zygoma fracture and fracture of the left ilium; one had fractures of the contralateral olecranon, right acetabulum and 4th/5th ribs on the left.

The time between injury and operation ranged from 0 to 21 days, with a mean of 3 days. Two patients had open reduction and internal fixation of the scaphoid later than 2 days after admission to hospital. Both had initial manipulation and reduction performed within 1 day of admission. One had Herbert screw fixation of the fractured scaphoid 2 weeks later because of multiple injuries that required initial stabilisation. The other had Herbert screw fixation 3 weeks later because of widening fracture gap of the scaphoid on follow-up. All transscaphoid perilunate fracture/dislocations in our series had open reduction and internal fixation performed via the volar Russe approach. Carpal tunnel release was performed on the case that presented with median nerve compression. The dislocations were successfully reduced in all cases. We did not need to perform a combined approach in any of our patients. The scaphoid fractures were internally fixed with Herbert screws (Figs. 2a & 2b) in 13 cases. Seven screws had to be inserted freehand due to the difficulties encountered in applying the jig. Two of these 13 cases had supplemental Kirschner wire fixation for lunotriquetral dissociation diagnosed intra-operatively with the aid of fluoroscopy. The remaining 3 cases had only Kirschner wire fixation performed. We repaired the palmar ligaments in all cases. No primary bone grafting was performed on any of our patients. Postoperative immobilisation in a short arm thumb spica cast was used in all cases. The length of cast immobilisation varied from 4 to 12 weeks, with an average of 8 weeks. The Kirschner wires were removed between 8 and 12 weeks (average 10 weeks) after surgery in our cases.



Fig. 2a.



Fig. 2b.

Fig. 2a. Antero-posterior radiograph depicting Herbert screw fixation of the fractured scaphoid.

Fig. 2b. Lateral radiograph of the same patient illustrating Herbert screw fixation of the fractured scaphoid.

## Results

The average hospitalisation stay was 6 days, with a range of 1 to 18 days. There were no immediate complications like wound infection and implant failure in our series. The only case that presented with median nerve compression recovered fully 4 months after surgery. Two cases had non-union detected on subsequent follow-up. One had bone grafting done 7 months after the index surgery and the other 9 months after the first operation. Both subsequently proceeded to unite completely with no further sequelae. The average and median time of union of the scaphoid fractures in our series were 5.5 and 3 months, respectively.

A clinical evaluation scoring system<sup>12</sup> on our operated cases based on Cooney's (Table I) was adopted. In this system, 4 categories were assessed: pain (25 points), occupational status (25 points), range of motion (25 points) and grip strength (25 points). An excellent result would have scores ranging from 90 to 100; good result 80 to 89; fair result 65 to 79 and poor result 0 to 64. Based on these criteria, we had 5 excellent, 5 good and 6 fair results. Excellent to good results were achieved in 62.5% of our patients. None of our patients had poor results.

## Discussion

The scaphoid plays an important role in wrist kinematics.<sup>3,13</sup> It spans both proximal and distal carpal rows and braces the midcarpal joint. Wagner<sup>4</sup> described the fracture/dislocations as a sequence pattern of injury that resulted from severe hyperextension wrist injuries. The presence of displaced scaphoid, capitate, or radial styloid would imply a high energy injury with significant soft tissue damage. The three- and five-stage concepts of perilunate fracture/dislocations were suggested by Mayfield et al<sup>14</sup> and Cooney et al,<sup>9</sup> respectively.

TABLE I: CLINICAL EVALUATION SCORING SYSTEM (COONEY)

|                                  |    |                                                |
|----------------------------------|----|------------------------------------------------|
| Pain<br>(25 points)              | 25 | No pain                                        |
|                                  | 20 | Mild, occasional                               |
|                                  | 15 | Moderate, tolerable                            |
|                                  | 0  | Severe to intolerable                          |
| Functional status<br>(25 points) | 25 | Returned to regular work                       |
|                                  | 20 | Restricted work                                |
|                                  | 15 | Able to work, unemployed                       |
|                                  | 0  | Unable to work due to pain                     |
| Range of motion<br>(25 points)   |    | % of normal                                    |
|                                  | 25 | 100%                                           |
|                                  | 15 | 75-100%                                        |
|                                  | 10 | 50-75%                                         |
|                                  | 5  | 25-50%                                         |
|                                  | 0  | 0-25%                                          |
|                                  |    | Dorsiflexion (DF) –<br>Palmarflexion (PF) Arcs |
|                                  | 25 | 120° or more                                   |
|                                  | 15 | 90-120°                                        |
|                                  | 10 | 60-90°                                         |
| Grip strength<br>(25 points)     |    | % of normal                                    |
|                                  | 25 | 100%                                           |
|                                  | 15 | 75-100%                                        |
|                                  | 10 | 50-75%                                         |
|                                  | 5  | 25-50%                                         |
|                                  | 0  | 0-25%                                          |

Results: Excellent = 90-100; Good = 80-89;  
Fair = 65-79; Poor = 0-64

According to Cooney, stage I is defined as a transradial styloid fracture/dislocation; stage II as transscaphoid fracture/dislocation; stage III as transscaphoid transcapitate fracture/dislocation; stage IV as transscaphoid (or radial styloid) transcapitate transtriquetral perilunate dislocation, and stage V as complete palmar lunate dislocation with carpal fractures.

A review of the literature on transscaphoid perilunate fracture/dislocations revealed changing concepts and methods of treatment of these injuries. The treatment methods ranged from closed reduction and cast immobilization,<sup>2</sup> primary arthrodesis,<sup>4</sup> proximal row carpectomy,<sup>5</sup> lunate excision in chronic dislocations presenting more than 6 weeks. However, the current treatment of choice would be open reduction and internal fixation,<sup>3,7-12</sup> regardless of the time of presentation. Bony union of the fractured scaphoid is dependent on the accuracy and stability of the reduction performed. Only open reduction and internal fixation will achieve the objective of anatomical reduction of the fractured scaphoid.

There is also controversy regarding as to the ideal choice of implant. Moneim et al<sup>7</sup> reviewed their experience with Kirschner wires in the treatment of such injuries and found good results in 10 out of 12 patients

using clinical and radiographic criteria. Of the 17 wrists, the scaphoid fracture healed in 15. Other authors reported good results after internal fixation of the scaphoid fracture using Herbert screw. Inoue et al<sup>12</sup> in their study of 13 patients with 14 fracture/dislocations found 2 excellent, 6 good, 5 fair and 1 poor results. Fifty-seven per cent of their patients had good to excellent outcome. They suggested that Herbert screw offered satisfactory results in the management of transscaphoid perilunate fracture/dislocations, despite the technical difficulties. Viegas et al<sup>10</sup> reviewed 6 cases of dorsal transscaphoid perilunate fracture/dislocations internally fixed with Herbert screws and found 3 excellent, 1 good and 1 fair results. In their study, they found the Herbert screw system<sup>15</sup> to be technically demanding. Mobilisation of the scaphotrapezial joint, axial distraction of the carpus to open the radiocarpal joint, and correction of any palmar-flexed deformity at the fracture site will facilitate positioning of the jig. They also stressed the importance of screw position, as malpositioning of Herbert screws was reported to be high in Pring's<sup>16</sup> series of 14 cases. In our experience, we found that the Herbert screws offer more rigid fixation, as compared to Kirschner wires. Hence, a shorter period of cast immobilisation is required. However, it is technically more demanding, especially with regards to the positioning of the jig for screw placement. In our series, 7 out of 13 cases had their screws inserted freehand due to difficulties in jig placement. We think that Kirschner wires still have a role to play in the management of such injuries. They are easier to apply and may be used as the primary or supplemental mode of fixation of the scaphoid. Lunotriquetral dissociation is another indication for Kirschner wire fixation, as in 2 of our cases. Kirschner wires can also be inserted to stabilise the capito-lunate joint in the correct anatomical position.

The choice of surgical approach is also another contentious issue. Various authors<sup>9,12</sup> have indicated the need for repair of the palmar ligaments to stabilise the distal carpus. The presence of median nerve deficit<sup>12</sup> is also another indication for using the palmar approach. On the other hand, others have found the dorsal approach<sup>7</sup> also to be effective in visualising the fracture fragments and ensuring reduction at the midcarpal joint level. They found that volar ligament repair is unnecessary as long as the dislocation is reduced and the midcarpal joint is stabilised by fixing the scaphoid. They also thought that median nerve compression in itself is not an indication for using the palmar approach because nerve recovery is always the rule. In our experience, we found that the volar or palmar approach offers good exposure for fracture reduction and scaphoid fixation. This approach also allows the repair of palmar ligaments which are important for the stability of the carpus. Median nerve decompression can also be performed via this

approach. We did not use the dorsal approach in any of our cases.

The timing of surgery is also a critical factor in obtaining good to excellent results. Moneim et al<sup>7</sup> believed that the high rate of successful bony union in their series (15 out of 17 wrists) is not only due to good anatomical reduction and stable fixation of the scaphoid, but also due to the fact that 12 of his patients were treated within 24 hours of injury and all of them, except 1, were treated within 2 weeks of injury. We also advised early surgery for these injuries. The 2 cases in our series that were operated on after 2 weeks were technically more difficult. Both eventually only attained a fair result based on Cooney's scoring system.

Our surgical results were based on clinical criteria and were comparable to that of other authors.<sup>3,9,10,12</sup> In conclusion, early open reduction and internal fixation offers the best results for transscaphoid perilunate fracture/dislocations. For the majority of our patients, surgical outcome is characterised by acceptable relief of pain, functional motion and grip strength. Volar approach should be used whenever possible, the implant of choice can be either Herbert screw, Kirschner wires or both. The accuracy and stability of reduction is the key to successful bony union.

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