Incidence of Ligamentous and Other Injuries Associated With Scaphoid Fractures During Arthroscopically Assisted Reduction and Percutaneous Fixation

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Purpose: The purpose of this study was to describe chondral/osteochondral and ligamentous injuries associated with scaphoid fractures treated with arthroscopically assisted reduction and percutaneous fixation. **Methods:** The study consisted of 8 patients with stable scaphoid fractures and 16 with unstable scaphoid fractures. The mean age was 32 ± 14 years (range, 17 to 75 years). The arthroscopic findings were recorded, including intrinsic and extrinsic ligamentous injuries as well as osteochondral injuries. Percutaneous screw fixation through a dorsal approach was performed. In all patients with associated soft-tissue injuries, a short-arm thumb spica cast was used for a 3- to 6-week period. Follow-up included clinical evaluation with the Mayo Modified Wrist Score and plain radiographs. The mean follow-up time was 27 ± 16 months, with a minimum of 1 year. The mean healing time was 7 ± 4 weeks (range, 6 to 24 weeks). **Results:** Associated soft-tissue and/or chondral/osteochondral injuries were diagnosed arthroscopically in 15 of 24 cases in this series. The result was scored as good or excellent in 23 patients and poor in 1. Complications included 1 case with partial necrosis of the proximal scaphoid pole and 2 patients with loss of wrist flexion and grip strength that improved after hardware removal. **Conclusions:** In this series, 15 of 24 patients with acute scaphoid fractures presented with associated ligamentous and/or chondral/osteochondral injuries. **Level of Evidence:** Level IV, therapeutic case series. **Key Words:** Scaphoid fracture—Percutaneous fixation—Incidence of associated injuries—Carpal ligamentous injuries—Wrist arthroscopy.

Scaphoid fractures represent the most common carpal fracture in active adults.[1-3] Previously reported complication rates can be difficult to interpret because most studies have not differentiated those fractures most likely to be associated with healing problems, soft-tissue or osteochondral injuries.[4-9]

Some surgeons advocate percutaneous screw fixation of acute scaphoid fractures to decrease healing problems and achieve better functional results in active patients.[9,10] This technique minimizes the blood supply compromise and wrist ligament injury that may occur with open reduction–internal fixation.[11,12] In addition, percutaneous fixation involves faster radiographic union and earlier return to work or sport activities.[4,9,10,13-20] In most cases this approach allows early mobilization, but the potential ligamentous injuries associated with this fracture mandate a thorough investigation before mobilization is started.[5-7] Despite the consolidation of the fracture, untreated ligamentous injuries may lead to biomechanical dysfunction and wrist pain. The diagnosis of these injuries is a challenge, because in most cases they are not evident on plain radiographs or computed tomography (CT) scans.[2,21,22] Arthroscopy is a useful tool for the man-

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agement of articular fractures, not only to assess the quality of reduction but also to visualize osteochondral and ligamentous injuries associated with intra-articular fractures.[4,5,13,18,23,24]

The purpose of this study was to describe chondral/osteochondral and ligamentous injuries associated with acute stable and unstable scaphoid fractures. Our hypothesis was that there is a high rate of "hidden" ligamentous injuries associated with acute scaphoid fractures that might not be optimally managed with fracture fixation and early range of motion.

METHODS

Between April 2001 and January 2006, 24 patients with acute scaphoid fractures were treated with arthroscopically assisted reduction and percutaneous internal fixation. The inclusion criteria were skeletally mature patients with an acute injury (<21 days) who were medically fit for anesthesia and had no other injuries in the hand. For stable fractures, both nonoperative treatment and percutaneous fixation were offered as treatment options. For unstable fracture patterns[25] (>1 mm displacement or radiolunate angle >15°), operative treatment was recommended (Fig 1). Conversely, the exclusion criteria were medical contraindication for surgery, history of prior wrist infections, acute neurovascular injury requiring repair in the same limb, compartment syndrome, open fracture, and previous injury of the wrist.

Preoperative radiographic evaluation consisted of the following views: anteroposterior, lateral, posteroanterior with ulnar deviation, and oblique with 45° of pronation. CT with sagittal images in the plane of the scaphoid[26] was performed in all cases.

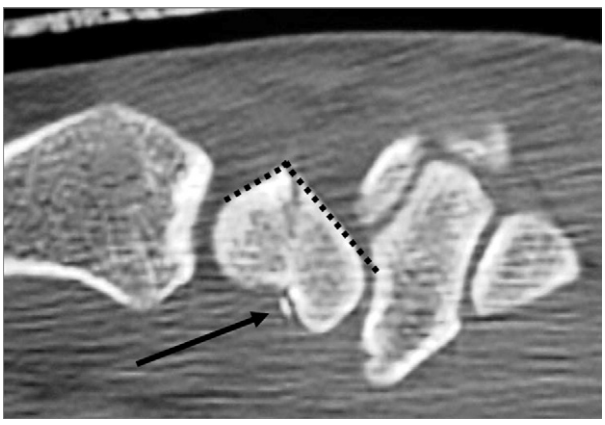

FIGURE 1. CT scan showing displaced scaphoid fracture with "humpback deformity."

The fractures were categorized using the classification of Herbert and Fisher.[27] Carpal ligament injuries, particularly scapholunate and lunotriquetral ligament injuries, were graded by use of the classification of Geissler et al.[28] The criteria of Palmer[29] were used for triangular fibrocartilage complex (TFCC) injuries.

Surgical Technique

During surgery, the wrist was suspended in a traction device with finger traps and 4.5 kg of countertraction on the arm to distract the joint and provide access to it. Evaluation of the radiocarpal joint was initially performed through the 3-4 and 4-5 arthroscopic portals. The midcarpal joint was evaluated through radial and ulnar midcarpal portals. To minimize the fluid extravasation through the capsular rents, a separate outflow was established in the 6U portal throughout the procedure and continuous saline solution irrigation was instilled by an irrigation pump system set at low pressure (35 to 45 mm Hg). A thorough arthroscopic assessment of all ligamentous and chondral injuries was performed, and the findings were recorded. Then, percutaneous fixation through a dorsal approach as previously described by Slade et al.[13,18] was performed. The cannulated screw (Acutrak Standard [Acumed, Beaverton, OR] in 18 cases, AO Synthes [Synthes, Paoli, PA] in 3 cases, and Herbert-Whipple [Zimmer, Warsaw, IN] in 3 cases) was placed under arthroscopic guidance to ascertain the quality of the fracture reduction, and fluoroscopic images were then taken to confirm screw length and position.

The arthroscopic findings were recorded, including intrinsic and extrinsic ligamentous injuries (e.g., radioscaphocapitate) as well as chondral injuries. All the associated injuries were treated. Intrinsic ligamentous injuries were treated following the criteria of Lindau[30]: debridement and postoperative immobilization for grade I and II injuries and debridement and percutaneous pinning for grade III and IV injuries. The treatment for type 1A TFCC injuries was debridement and immobilization for 6 weeks. Type IB TFCC injuries were treated with arthroscopic repair by use of a vertical bioabsorbable suture (polydioxanone No. 2) with an outside-inside technique and tension-band wire fixation when associated with an ulnar styloid fracture (Fig 2). These injuries were immobilized for 6 weeks. Small chondral/osteochondral fragments were excised and the base debrided. A