Complications in Dorsal Percutaneous Cannulated Screw Fixation of Nondisplaced Scaphoid Waist Fractures

Brandon D. Bushnell, MD, Andrew D. McWilliams, MPH, Terry M. Messer, MD

From the Department of Orthopaedic Surgery, University of North Carolina School of Medicine, Chapel Hill, NC; and WakeMed Health & Hospitals, Raleigh, NC.

Purpose: With advances in tools and techniques, percutaneous screw fixation of nondisplaced fractures of the scaphoid waist has gained increasing popularity in recent years as an alternative to prolonged cast immobilization or open reduction and internal fixation. Many reports cite low complication rates, including no complications in some series. The purpose of this study was to evaluate the complications encountered with dorsal percutaneous cannulated screw fixation of nondisplaced scaphoid waist fractures.

Methods: A retrospective chart review was performed for 24 patients who had surgery performed by a single surgeon over a 5-year period. All cases involved dorsal percutaneous cannulated screw fixation of nondisplaced (<1 mm) fractures of the scaphoid waist. Complications were rated *a priori* as major or minor based on modifications of established criteria.

Results: The overall complication rate was 29%; there were 21% (5/24) major complications and 8% (2/24) minor complications. Major complications consisted of 1 case of nonunion, 3 cases involving hardware problems, and 1 case of postoperative fracture of the proximal pole of the scaphoid. Minor complications included intraoperative equipment breakage—1 case involving a screw and 1 case involving a guide wire.

Conclusions: Complications in dorsal percutaneous cannulated screw fixation of scaphoid fractures may be more common than previously reported. (J Hand Surg 2007;32A:827–833. Copyright © 2007 by the American Society for Surgery of the Hand.)

Type of study/level of evidence: Therapeutic IV.

Key words: Scaphoid, complications, scaphoid fractures, percutaneous screw fixation, percutaneous technique, dorsal percutaneous scaphoid technique.

Historically, nondisplaced fractures of the scaphoid waist were often managed with immobilization as the standard of treatment. Recently, there has been an increased trend toward surgical fixation of nondisplaced fractures of the scaphoid with percutaneous techniques. Several reports of successful results—most of them using a volar approach—have appeared in the literature. Many of these series have reported low complication rates (Table 1).[1–18] In particular, there have been 4 reports[6,7,15,18] involving the dorsal approach, with reported ranges of complications from 0% to 14%. Advances in tools and techniques, coupled with a desire to eliminate the long periods of immobilization associated with nonsurgical treatment, have contributed to the popularity of the percutaneous technique. Some surgeons have even suggested that percutaneous treatment should be considered the new standard of care for this injury.[19] The purpose of this study was to evaluate and report the complications encountered with dorsal percutaneous cannulated screw fixation of nondisplaced scaphoid waist fractures.

Materials and Methods

After obtaining appropriate institutional research review board approval, a retrospective review of medical records was performed for all patients who had surgical fixation of any scaphoid fracture by the senior hand surgeon at our institution (T.M.M.), an

Table 1. Selected Reports on Percutaneous Fixation of Scaphoid Fractures

Study	Year	N	Union Rate, % (n)	Approach	Complication Rate, % (n)	Complications
Woazasek and Moser[1]	1991	146	89 (130)	Volar	9 (13)	See below
Haddad and Goddard[2]	1998	15	100 (15)	Volar	7 (1)	Radial Nerve Dysesthesia
Adolfsson et al[3]	2001	23	96 (22)	Volar	8 (2)	Nonunion, reflex sympathetic dystrophy
Bond et al[4]	2001	11	100 (11)	Volar	9 (1)	Prominent Hardware
Saeden et al[5]	2001	32	100 (32)	Volar	6 (2)	See below
Slade et al[6]	2001	16	100 (16)	Dorsal	0 (0)	None
Slade et al[7]	2002	27	100 (27)	Dorsal	0 (0)	None
Yip et al[8]	2002	49	100 (49)	Volar	0 (0)*	None*
Jeon et al[9]	2003	13	100 (13)	Volar	8 (1)	RSD
Chen et al[10]	2005	11	100 (11)	Volar	9 (1)	Superficial skin infection
Dias et al[11]	2005	44	100 (44)	Volar	30 (13)	See below
Drac et al[12]	2005	26	96 (25)	Volar	4 (1)	Nonunion
Pirela-Cruz et al[13]	2005	51	98 (50)	Hybrid	2 (1)	Nonunion
Shih et al[14]	2005	15	100 (15)	Volar	0 (0)	None
Slade et al[15]	2005	7	100 (7)	Dorsal	14 (1)	EPL Rupture†
Wong et al[16]	2005	52	96 (50)	Volar	8 (4)	Nonunion (2), Delayed Union (2)
Arora et al[17]	2006	21	95 (20)	Volar	19 (4)	Nonunion, superficial wound infection, CRPS (2)
Bedi et al[18]	2007	18	94 (17)	Dorsal	6 (1)	Nonunion
Totals/average	—	577	96%	—	8%	Nonunion most common complication

The numbers included represent (when specified by the researchers) acute fractures with full follow-up evaluation:
Woazasek and Moser[1]: nonunion (5), superficial radial nerve irritation (3), superficial wound infection (2), Sudeck's atrophy (2), loose/painful screw (1).
Saeden et al[5]: loose screw (1), failure of the screw to enter the proximal fragment (1).
Dias et al[11]: hypertrophic scar (4), sensitive and hypertrophic scar (3), sensitive scar (3), superficial wound infection (1), hypoesthesia in region of palmar cutaneous branch of median nerve (1), mild early algodystrophy (1).
†The extensor pollicis longus rupture was due to a dorsal plate used to treat a concomitant ipsilateral distal radius fracture.
*These researchers did not consider hardware removal a postoperative complication.

academic-affiliated level I trauma center. Inclusion criteria included a nondisplaced (<1 mm) fracture of the scaphoid waist, a time from injury of less than 10 weeks, treatment involving dorsal percutaneous screw fixation as described by Slade et al,[6,7,15,20,21] and at least a follow-up period of at least 3 months. Exclusion criteria were initial fracture of the proximal or distal pole, fracture displacement of more than 1 mm, carpal instability, a delayed diagnosis of longer than 10 weeks, the presence of an established nonunion or malunion, use of open technique, and a follow-up period of less than 3 months. Concomitant injuries were not considered exclusion criteria.

Within the 5-year period between October 1, 2001 and September 30, 2006, 24 scaphoid fractures in 24 patients met our criteria and were included in this study. The average follow-up interval for these patients was 9 months (range, 3–24 mo). The average age of these 24 patients at the time of surgery was 28 years (range, 14–53 y). Fifteen surgeries were performed on the left hand and 9 on the right. The dominant hand was involved in 12 (50%) of the patients. Twenty-three cases involved the Accutrak screw system (Acumed, Inc., Beaverton, OR), and 1 case involved the TwinFix screw system (Stryker Leibinger Inc., Kalamazoo, MI).

The primary data points for this study were the incidence and type of complications. We classified both intraoperative and postoperative complications into major and minor groups, based on a modified version of the method of the assessment of complications in wrist arthroscopy described by Beredjiklian et al.[22] Major complications included any complication resulting in the need for additional surgical intervention, nonunion, malunion, fracture, compartment syndrome, permanent nerve injury, septic arthritis, vascular injury, complex regional pain syndrome, permanent stiffness, or tendon rupture. Minor complications included any complication that required additional nonsurgical intervention, resulted in deviation from the standard surgical technique, prolonged the surgical time, led to superficial