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CASE REPORT

Recalcitrant Scaphoid Nonunion Treated with a Palmar Angular-Stable Scaphoid Plate and Iliac Crest Cancellous Bone Grafting

The Surgeon

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His clinical expertise encompasses complex traumatic and reconstructive conditions of the hand and upper extremity. Research activities include clinical studies on surgical outcomes, innovations in hand and trauma surgery, and the optimization of rehabilitation strategies.

Introduction

Scaphoid fractures account for approximately 10% of all hand fractures [1]. Management of scaphoid fractures that fail to heal presents a significant challenge for hand surgeons. Particularly, recalcitrant scaphoid nonunions–defined by prior failed surgery, avascular necrosis, bone loss exceeding 7 mm or nonunion duration of more than two years–are very difficult to treat and are associated with a substantially reduced probability of union. In such cases, salvage procedures, including wrist denervation, radial styloidectomy, four-corner arthrodesis or proximal row carpectomy are frequently considered. However, palmar angular-stable scaphoid plating has emerged as a reliable surgical option, providing stable fixation and promoting bone consolidation even in these complex cases [1–7].

The Case

Patient History / Profile

A 22-year-old male sustained a wrist injury during a football game six years prior to the surgical intervention. Since the initial trauma the patient reported persistent wrist pain. He was subsequently referred to our outpatient hand clinic, where imaging studies confirmed a scaphoid nonunion. The patient had not undergone any prior surgical treatment for this injury.

Preoperative Clinical Findings

The patient exhibited an unrestricted range of motion in the wrist but reported pain during load-bearing activities. Radiographs (Figure 1a–1d) and computed tomography (CT) scans (Figure 1e, 1f) demonstrated a scaphoid nonunion with a severe humpback deformity and dorsal intercalated segment instability (DISI) of the lunate[8]. Advanced cystic changes and sclerosis were present at the nonunion site. Magnetic resonance imaging (MRI) revealed bone marrow edema in both fragments (Figure 1g) and absence of fat-suppression signal in the proximal scaphoid pole (Figure 1h), consistent with avascular necrosis. No significant osteoarthritic changes were observed in the wrist.

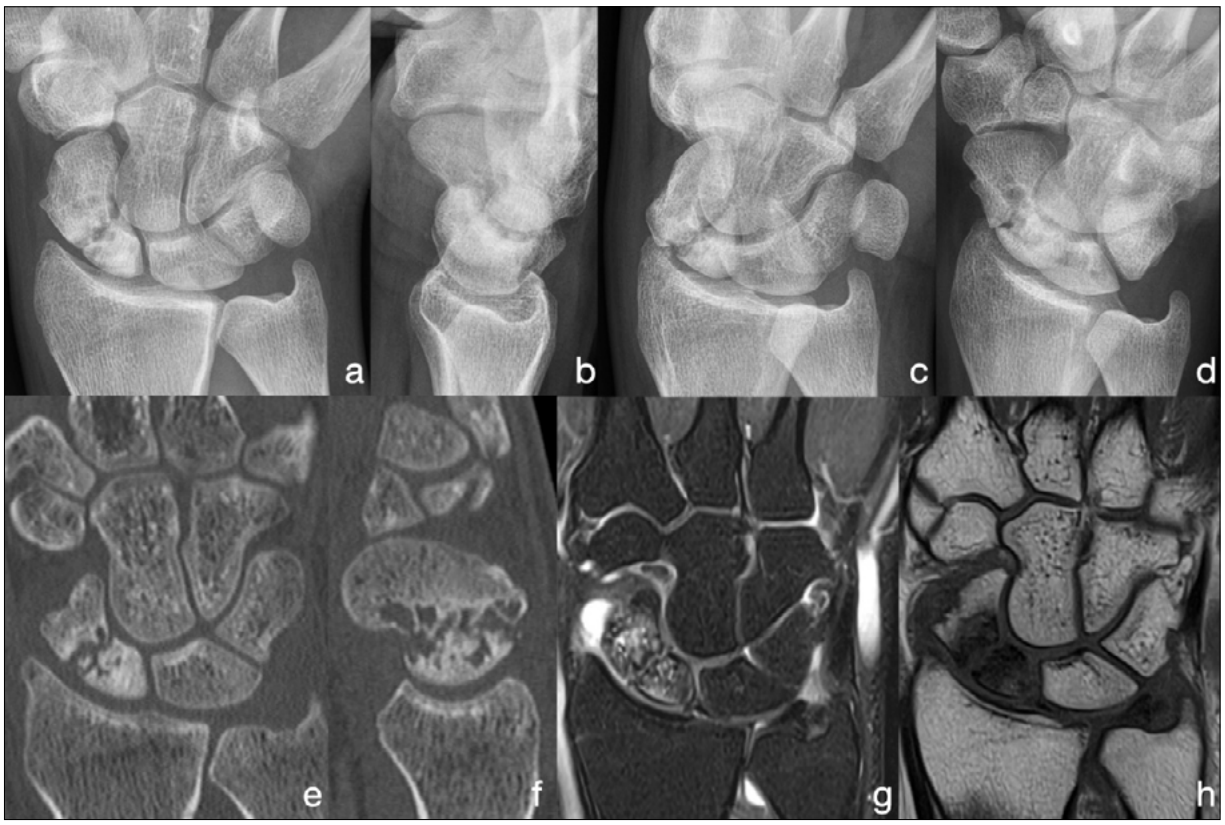

Figure 1: Pre-OP imaging of the scaphoid: a-d radiographs; e,f CT images; g,h MRI images

Surgical Treatment

The scaphoid nonunion was approached through a palmar incision over the flexor carpi radialis (FCR) tendon. After preparation of the FCR tendon, the tendon's sheath was incised, and the radioscaphocapitate ligament identified and longitudinally split to expose the scaphoid[11]. A palmar cortical window was created, and fibrous and necrotic tissue was debrided. To correct the humpback deformity and restore scaphoid length, the DISI position of the lunate was reduced using the Linscheid maneuver. In this maneuver, the wrist was flexed under image intensifier control, bringing the lunate into neutral position. Temporary transfixion of the lunate to the radius was achieved using a 1.4 mm K-wire (Figure 2a, 2b). An additional 1.2 mm K-wire was inserted perpendicularly into the distal scaphoid fragment and used as a joystick to facilitate final reduction.

Following restoration of scaphoid length and shape, residual sclerotic and fibrous tissue was removed using a low-speed spiral burr. The reduction was temporarily stabilized with a transfixing K-wire, and both fragments were additionally drilled until punctate bleedings were observed. The defect was filled with cancellous bone graft harvested from the iliac crest and impacted.

Due to the anatomy of the patient and size of the nonunion defect, the large version of the scaphoid plate was selected and positioned under image intensifier control. The plate was prefixed distally with a K-wire inserted through a screw hole. After verifying the correct plate position, locking screws were inserted after drilling and assigning the screw length (Figure 2c–2g).

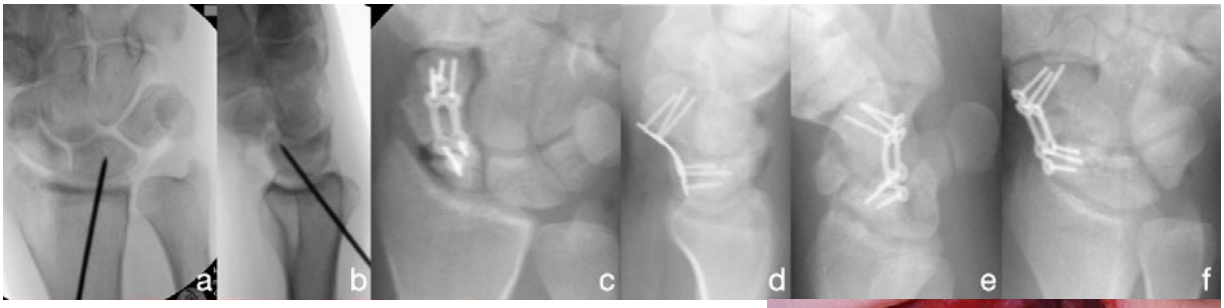

Figure 2: Intra-OP images: a,b Lindscheid maneuver to correct the DISI position of the lunate; c-f radiographs of plate position; g photograph of plate in situ

One session of high-energy extracorporeal shockwave therapy (ESWT) was applied immediately postoperatively, delivering 3,000 impulses at an energy flux density of 0.41 mJ/mm² and a frequency of 4 Hz[6,12].

Postoperative Treatment

Postoperatively, a below-elbow thermoplastic splint incorporating the thumb up to the interphalangeal joint was applied for eight weeks. After removal of the splint, active and passive wrist exercises were initiated in conjunction with hand therapy.

Follow-up assessments included radiographs at the time of splint removal and CT scans at three and six months postoperatively. Upon radiographic confirmation of bony healing, strengthening exercises were initiated.

The CT scan performed six months after surgery (Figure 3a, 3b) demonstrated bony healing of the scaphoid nonunion. Due to an impingement between the scaphoid plate and the palmar rim of the distal radius, removal of the plate was planned.

Figure 3: CT images at 6 months follow-up

Conclusion

Recalcitrant scaphoid nonunions remain a substantial challenge for hand surgeons due to their limited biological healing potential. Consequently, some authors advocate salvage procedures rather than reconstructive strategies in these cases. However, angular-stable plate fixation has emerged as a reliable treatment option, demonstrating high union rates and favorable clinical outcomes [1–7]. Compared with stabilization using only a single headless bone screw, plate fixation provides significantly greater rotational stability [6,9], and maintains space for cancellous bone graft insertion [9]. These aspects may contribute to the improved union rates reported in the literature [1–7] . The availability of scaphoid plates in different sizes allows accommodation of the considerable anatomical variability of the scaphoid as well as the diversity of nonunion defects.

However, it should be considered that plate fixation is frequently associated with the need for secondary plate removal after nonunion healing [1–7], particularly when the plate needs to be positioned proximal to the so-called „equatorial-line" to ensure sufficient stability[2]. In such cases, impingement with the palmar rim of the distal radius may occur[2]. Nevertheless, this should not be regarded as a complication but rather as an integral part of the treatment concept, and patients should be informed accordingly prior to surgery.[10]

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