

C A S E R E P O R T

Adaptive Proximal Scaphoid Implant stability despite a perilunate dislocation: a case report

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Summary. *Background:* We present the case of a 22 y.o. male patient suffering from scaphoid non-union with avascular necrosis of the proximal pole and initial degenerative arthritis. *Case report:* He referred to our institution with functional impairment and persistent pain (VAS 8\10). The patient underwent the positioning of the small size Adaptive Proximal Scaphoid Implant (APSI), without fixation, through an open dorsal approach and radial styloidectomy. The post-operative course was uneventful, and the patient could resume his daily routine without limitations. 5 years later the patient returned to our department referring a dorsal perilunate dislocation on the same hand. Unexpectedly no implant dislocation occurred and we were able to reduce the perilunate dislocation maintaining the same implant. At 30-month follow-up the patient was pain free (VAS 0\10) with almost completely recovered function of the hand and wrist. *Conclusion:* In order to minimize implant dislocation, both an adequate scaphoid resection and the choice of the right implant size (which should be lightly downsized compared to the scaphoid resection) are of paramount importance. At the same time, the capsuloplasty should be carefully performed at the right tension, providing adequate stability to the implant. This technique provided satisfactory functional results in a long-term follow-up, even in a young and active patient. Moreover, it does not preclude or complicate the possibility of resorting to different surgical procedures in case of necessity, whilst maintaining the same implant. (www.actabiomedica.it)

Keyword: APSI, scaphoid non-union, perilunate dislocation, implant dislocation

Introduction

Scaphoid fractures are among the most common occurring fractures to the carpal bones, accounting for almost 70% of all carpal fractures (1). Non-union is a well-known complication, particularly when the proximal pole of the scaphoid is involved, with an incidence rate ranging from 10% to 15% of scaphoid fractures. The high non-union rate is primarily due to the reduced retrograde bloody supply to the bone from the radial artery, but its incidence can rise depending on patient comorbidities, reduced immobilization time and delayed diagnosis\ treatment (2, 3). A surgical treatment is required especially in unstable non-union.

Key objectives should be preserving the length and alignment of the scaphoid, in order to restore carpal stability and prevent the onset of degenerative radio-carpal arthritis, according to the scaphoid non-union advanced collapse (SNAC) pattern (4).

Various surgical strategies have been proposed in order to stop the progression of the degenerative process and to regain the wrist function, ranging from bone autograft (eventually vascularized) with internal fixation, in milder cases, to partial or total wrist arthrodesis, in the most severe (5-7).

Despite being less commonly reported, the Adaptive Proximal Scaphoid Implant (APSI) represents a valuable surgical alternative in selected patients, par-

ticularly in case of small avascular proximal pole fragments (8). Its efficacy relies on the replacement of the proximal scaphoid pole, maintaining the carpal height and wrist kinematics. Implant instability and dislocation are among the most frightening complications, and the reported incidence of these has probably discouraged authors from using this technique (9, 10).

We describe a case of scaphoid non-union with avascular necrosis of the proximal pole treated using an APSI, which remained stable and well positioned, despite the patient experiencing a perilunate dislocation 5 years after the surgery. Surgical tips and indications are discussed together with general and functional outcomes.

Case Report

In February 2012, a 22 y.o. male patient came to our institution one year after a proximal pole scaphoid fracture of the non-dominant left hand, treated elsewhere with an internal screw fixation, referring functional impairment and persistent pain (VAS 8/10). The clinical examination showed a reduced range of motion (ROM, measured with a goniometer) of the wrist: 25° flexion (30% of contralateral), 20° extension (23% of contralateral), 5° radial deviation (50% of contralateral), 10° ulnar deviation (25% of contralateral) and 50° pronosupination (32% of contralateral). The grip strength tested using a hand-held dynamometer (Baseline1[®], White Plains, NY, 10602, USA) was reduced to 21 Kg (contralateral 28 kg), while the

key pinch strength test measured 8 Kg (contralateral 12 Kg). The DASH (Disability of the Arm, Shoulder and Hand) score and PRWE (Patient Rated Wrist Evaluation) score assessed a reduced functionality of the wrist (70 and 88 points, respectively) (11, 12) (Table 1). The X-Ray showed a scaphoid non-union together with a mild arthritis at the radial styloid (SNAC I). At the MRI, the proximal pole appeared avascular and necrotic (stage IV according to Herbert Classification) (Figure 1).

Using regional anesthesia and under fluoroscopic imaging control during the surgery, the patient underwent the positioning of the small size APSI spacer, without fixation, through an open dorsal approach and radial styloidectomy, according to previously described technique; beside the ablation of the internal

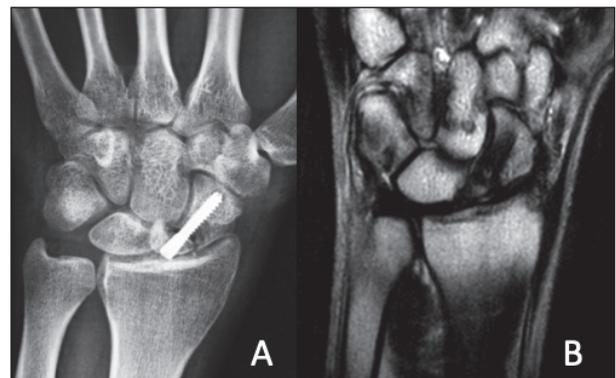


Figure 1. A) X-Ray antero-posterior view showing a scaphoid non-union together with a mild arthritis at the radial styloid (SNAC I); B) At the MRI, coronal view, the proximal pole of the scaphoid appears avascular and necrotic (stage IV according to Herbert Classification).

Table 1.

	Contralateral	Pre-OP	Post-OP 1	Post-OP 2
Flexion°	80	25	65	64
Extension°	85	20	70	73
Radial Dev.°	10	5	15	15
Ulnar Dev.°	40	10	25	20
Prono-sup.°	160	50	75	60
Grip strength, Kg	28	21	24	23
Pinch strength, Kg	12	8	10	9
DASH, points	0	70	7	8.3
PRWE, points	0	88	8.5	9

Abb.: pronosup, pronosupination; dev., deviation; DASH, Disability of Arm, Shoulder and Hand; PRWE

fixation screw (8). A double layered capsuloplasty was performed using 4-0 PDS sutures, re-tensioning carefully the capsular ligaments. A splint cast was kept for 3 weeks, afterwards the patient begun a specific physiotherapy rehabilitation protocol for 3 months. At his 6 month follow-up, no complications had occurred, the patient was very satisfied with the treatment and he had resumed his daily routine. No residual pain was described (VAS 0\10) and there was great improvement of all functional measured outcomes (refer to Table 1 for all details) (Figure 2). 5 years later, following a high energy motorbike accident, the patient returned to our department referring a dorsal perilunate dislocation (stage II according to Taleisnik classification) on the same hand, unexpectedly without dislocation of the implant (13). In the O.R., the implant was temporarily removed through the same dorsal access, the perilunate dislocation was reduced and fixed with 3 Kirshner wires (2 between triquetrum and lunate, and 1 between capitate and triquetrum), and finally the same implant reinserted. The wrist was then immobilized for 45 days before starting physiotherapy for 6 months. At the 30 months follow-up, the patient was pain free (VAS 0\10) with almost completely recovered function of the hand and wrist. The ROM values were as follow: 64° flexion, 73° extension, 15° radial deviation, 20° ulnar deviation and 60° pronosupination. Grip strength was improved to 19 Kg\N and the key pinch strength test to 9 Kg\N, while functional outcomes were greatly enhanced according to the DASH and PRWE scores (8.3 and 9 points, respectively) (Table 1). The antero-

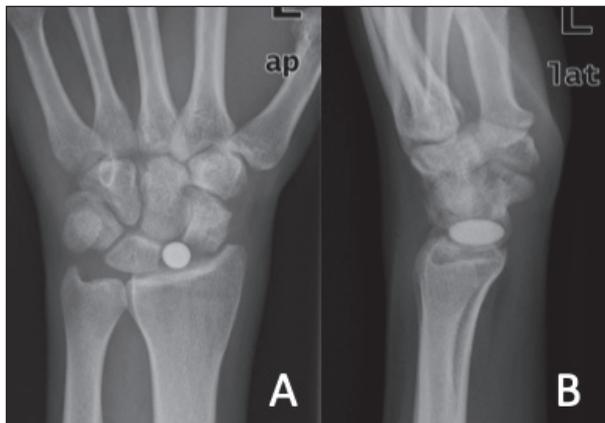


Figure 2. A-B) X-Ray antero-posterior and lateral view showing the good positioning of the APSI at 6 months post-op.

posterior and lateral X-ray projection performed at that time did not detect any sign of implant dislocation or osteoarthritis progression, while the carpal height was maintained (Figure 3). The patient was able to return to his daily activities and sports.

Discussion

Scaphoid nonunion represents a disabling disease, causing wrist pain and functional impairment of the hand and reducing the patient's quality of life. The surgical management of this pathology, especially when is associated to the necrosis of the proximal pole of the scaphoid, pose unique challenges to the hand surgeons, and there is a lack of consensus in literature (1).

The use of autologous non-vascularized bone graft with internal fixation is widely accepted as the standard treatment for scaphoid non-union, eventually combined with the radial styloidectomy in presence of mild osteoarthritis degeneration (SNAC I) (14). However, when the proximal fragment is avascular, a high incidence of failure is expected (15). In such cases, the use of vascularized bone graft either pedicled



Figure 3. A-B) X-Ray antero-posterior and lateral view showing a dorsal perilunate dislocation (stage II according to Taleisnik classification) without dislocation of the implant; C-D) The perilunate dislocation is reduced and fixed with 3 Kirshner wires (2 between triquetrum and lunate, and 1 between capitate and triquetrum), the APSI is reinserted; E-F) X-Ray antero-posterior and lateral view at 30 months follow-up, showing good implant positioning without arthritis progression.

(from the distal radius) or free (i.e. free medial condyle flap or iliac crest free flap) is advisable (16). Nevertheless, the bone graft from the distal radius is limited in size and has a thin cortex which may be insufficient for severe deformities, while performing a free flap from the medial condyle is time consuming, requires microsurgical expertise and is related to increased donor site morbidity (7, 17). More invasive procedure, such as the proximal row carpectomy (PRC), the 4-corner fusion (4CF) or the total wrist arthrodesis, are considered as salvage procedures and are reserved for symptomatic SNAC III-IV (5).

The use of the APSI has been documented with promising results in SNAC earlier stages (I-II), even in young and demanding patients (8). The ovoid-shape implant replaces the degenerated proximal pole of the scaphoid, and thanks to the preservation of the bone length, the distribution forces at the proximal carpal row are restored (9). The APSI is made of pyrocarbon, an inert and resistant material, characterized by an elasticity and density modulus very similar to that of the cortical bone, thus reducing the risk of stress shielding (18). Pequignot et al., first described in 2000 the use of this implant in 25 patients with a satisfactory functional outcome and no progression towards the osteoarthritis degeneration on a 6 years follow-up (19). In 2007, Grandis and Berzero reported their experience in 98 patients (age range 22-68), who described pain relief and resumption of previous jobs and daily activities. Similarly, thanks to a 10 years follow-up on 39 SNAC I-II wrist patients, Aribert et al. suggested that the APSI outcomes were similar to those reported with more traditional procedures (PRC and 4CF), being less invasive (9). Poumellac et al. state that an evolution towards a carpal collapse with reduced carpal height is seen in longer follow-ups but it is generally well-tolerated (8).

Implant infection, dislocation (dorsal or volar), peri-implant osteolysis and progression of arthritis degeneration are among the most commonly reported complications in implant surgery (20).

In our patient, the proximal pole of the scaphoid was avascular and fractured in several small pieces. According to the first author preference and to literature, an interposition hemiarthroplasty of the scaphoid using the APSI was performed (9, 18, 19). In our opin-

ion, in order to minimize implant dislocation, both an adequate scaphoid resection and the choice of the right implant size (which should be lightly downsized compared to the scaphoid resection) are of paramount importance. At the same time, the capsuloplasty should be carefully performed at the right tension, providing adequate stability to the implant.

In the presented case, thanks to this surgical shrewdness and despite a high energy trauma (resulting in perilunate dislocation), the implant remained in position, maintaining the carpal height and avoiding the need for more complex procedure (e.g. PRC). Consistent with the previous literature, the APSI guaranteed satisfactory results in a long-term follow-up, allowing the maintenance of the wrist function with good ROM and strength recuperation. Moreover, the technique does not preclude or complicate the possibility of resorting to different surgical procedures in case of necessity, whilst maintaining the same implant.

Conflict of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

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