

Case Report

A 22-year-old chronic scaphoid non-union treated with arthroscopic percutaneous scaphoid fixation – A case report and review of literature

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ABSTRACT

Scaphoid fractures are the most common fractures of the carpal bone. Most heal with adequate conservative treatment, but reports of non-union after conservative treatment have been up to 50%. Symptomatic non-union of a scaphoid fracture remains a common disabling problem. It is known that the scaphoid non-union will inevitably progress to the scaphoid non-union advance collapse over time. Surgical management of chronic non-union of scaphoid fracture includes vascularized bone grafting or non-vascularized bone grafting with or without internal fixation. A 36-year-old male presented with a hyperextension injury to the left little finger. An X-ray showed left little finger distal interphalangeal joint dislocation and an incidental 22-year-old chronic non-union scaphoid fracture. To date, incidental discovery of non-union is at the rate of 0.14%. The patient underwent arthroscopic non-vascularized bone grafting with internal fixation after the natural course of the condition was explained to him. He made a good recovery with a complete union of his scaphoid and resolution of his wrist pain. Our case describes the first case of arthroscopic repair of a chronic non-union scaphoid fracture of 22-year duration and demonstrates union of scaphoid fracture and resolution of symptoms can be achieved with good surgical fixation even extremely prolonged chronic non-union.

Keywords: Scaphoid fracture, Non-union, Arthroscopic bone grafting, Wrist arthroscopy

INTRODUCTION

Scaphoid fractures account for 60–70% of all carpal bone fractures with an incidence of 8–38/100,00.^[1] Failure of solid bony union 6 months after a scaphoid fracture is recognized as non-union. The risk factors for scaphoid non-union include its precarious blood supply, delayed diagnosis, inadequate immobilization, fracture pattern, fracture displacement, associated ligament injury, proximal pole fractures, and poor surgical technique.^[2]

Left untreated scaphoid non-union undergoes collapse or “humpback deformity,” leading to symptomatic radiocarpal arthritis, impaired hand function, and disability.^[3]

Non-union of scaphoid fractures with conservative treatment has been reported in the range of 5–50% with an annual incidence of 35,000.^[1,4]

The surgical management of non-union scaphoid fracture remains difficult and controversial. Various methods of scaphoid fracture stabilization have been described including vascular and

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non-vascular bone grafts with or without internal fixation with a success rate of 65–95%.^[4]

Recent advances in arthroscopic treatment of chronic scaphoid non-unions enable union with less morbidity, less stiffness, and better functional outcomes.^[5-7]

In this article, we describe the arthroscopic percutaneous fixation of a 22-year-old chronic non-union scaphoid fracture and review the available literature.

CASE PRESENTATION

A 36-year-old male presented to Accident and Emergency department (AED) with the left little finger hyperextension injury. An X-ray showed a left little finger distal interphalangeal joint dislocation. On follow-up in the fracture clinic, he was noted to have an undiagnosed chronic non-union scaphoid fracture. The patient reported a sporting injury to his left wrist approximately 22 years ago that may have been the cause of the fracture but did not seek treatment at that time. He was mainly asymptomatic with occasional wrist pain before the most recent injury. A six-shot X-ray series of the wrist demonstrated a non-union at the waist of the scaphoid, which was confirmed on magnetic resonance imaging [Figure 1]. In view of his age and the known sequelae of scaphoid fractures, the option of surgical intervention was discussed with the patient. The natural course of the condition was explained to him, that is, scaphoid non-union will probably progress to the Scaphoid Non-union Advanced Collapse (SNAC) over time. The patient opted for intervention and was listed for arthroscopic bone grafting with percutaneous fixation.

He underwent arthroscopy of his left wrist with arthroscopic bone grafting and percutaneous compression screw (Acumed Acutrak®) fixation of the non-union of the left scaphoid waist fracture under general anesthesia.

During the procedure examination done through midcarpal and radial midcarpal portals showed normal architecture of the rest of the carpal bones. The non-union scaphoid waist and opposing site were debrided. The dorsal intercalated segment instability was temporarily corrected with Kirshner wiring of

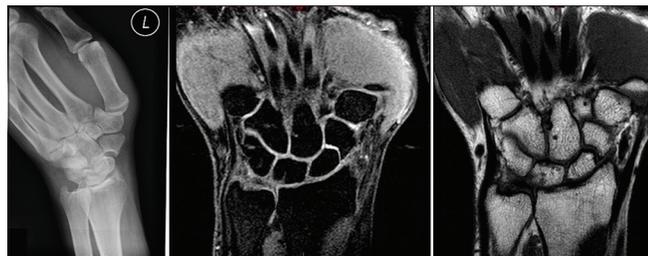


Figure 1: Posteroanterior view plain radiographs demonstrating chronic non-union of the waist of the left scaphoid with sclerotic edges and complementary T1- and T2-weighted magnetic resonance image.

radiolunate and then the lunate-triquetral joint. Autologous bone graft was harvested from the left iliac crest and delivered after preparation to the scaphoid non-union site. The bone-graft site of the non-union site was supported with the use of fibrin sealant Tisseel (Tisseel, Baxter, Westlake Village, CA, USA). A 24 mm Acumed Acutrak® compression screw was inserted across the scaphoid non-union site [Figure 2].

A volar scaphoid plaster of Paris cast was applied and the patient discharged the same day with advice on elevation and a supportive (Cory) sling. He was regularly seen in the clinic for clinical and radiological follow-up.

On follow-up in fracture clinic at week one postoperatively, the wound was healing well and a new scaphoid cast for 5 further weeks was applied. At week six post-operative evaluation, the patient was pain-free and was given a supportive splint. At week 14, a plain X-ray and computerized tomography scan (CT scan) showed signs of a healing fracture. [Figure 3].

At the 18-week follow-up visit, the patient was asymptomatic, and a repeat plain X-ray and CT scan showed complete union of the fracture and graft, and thus, the patient was discharged from clinic [Figures 4 and 5].

Patient functional outcome scores

The Michigan Hand Outcomes Questionnaire (MHQ) and the disabilities of the arm, Shoulder, and Hand Score



Figure 2: Intraoperative imaging of scaphoid fixation and arthroscopic bone grafting.

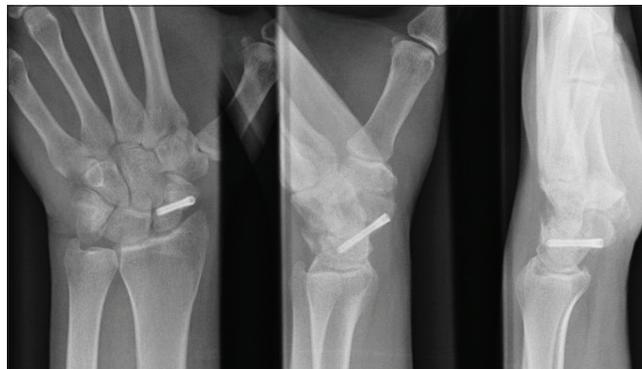


Figure 3: Plain radiographs showing healing across the scaphoid non-union with compression screw in situ at 14 weeks post-operative period.



Figure 4: Plain radiograph showing radiological union across the scaphoid non-union at 18 weeks post-operative period.

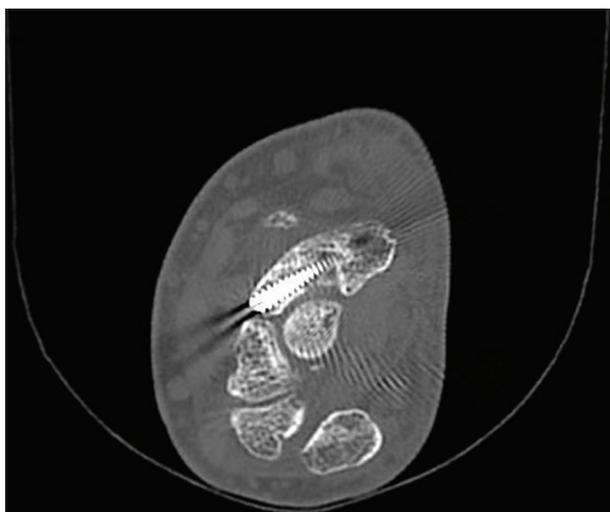


Figure 5: Computed tomography scan showing good healing at fracture with metal scatter at 18 weeks.

(QuickDASH) data were collected preoperatively. At final follow-up, we recorded any complications and carried out post-operative strength analysis, MHQ, and QuickDASH outcome measures. The MHQ is a multidimensional patient-reported outcome measure for hand function and includes six domains with overall hand function, activities of daily living, pain, work performance, esthetics, and satisfaction. The QuickDASH is a shortened version of the DASH Outcome Measure using 11 items to measure physical function and symptoms in people with any or multiple musculoskeletal disorders of the upper limb.

The functional outcome scores at the final follow-up showed consistent improvement and the range of movement returned very quickly due to the minimally invasive surgery [Table 1].

Table 1: The disabilities of the arm, shoulder, and hand score (quick-DASH), MHQ and handgrip strength values in our patient.

Outcome score/strength	Pre-operative	Post-operative at final Follow-up
Q-DASH (0=no disability)	15.9	9.1
MHQ (100=normal)	68	80
Grip strength (kg force)	40 (50.7 contralateral right side)	44 (50.1 contralateral right side)

MHQ: Michigan hand outcome questionnaire

DISCUSSION

Scaphoid fractures are common carpal bone fractures, and healing with conservative treatment is reported in up to 90% of fractures.^[8] However, other papers have reported a non-union rate of 5–50%. The factors affecting non-union include patient and anatomical factors. With a delay in diagnosis, inadequate immobilization, site of the fracture, the tenuous blood supply, displacement, and ligamentous injuries are playing key roles in non-union.^[1]

Non-union of scaphoid fractures can be associated with wrist pain and may lead to progressive radiocarpal, midcarpal arthrosis, leading to SNAC over time.^[3] The pathophysiology is linked to the altered kinematics of the wrist at the site of non-union and due to the apex-dorsal malalignment of the scaphoid (the humpback deformity). With altered carpal height and associated dorsal angulation of the lunate, leading to dorsal intercalary segment instability (DISI), progressive radiocarpal arthrosis develops. The longer the non-union is left, the worse the arthrosis that develops, and risk of collapse increases.^[8]

Surgical management of non-union includes the debridement of the necrotic or sclerotic edges to the healthy bleeding bone and filling the defect with vascular or non-vascular bone graft with or without internal fixation.^[4] In vascularized bone grafts, either a dorsal or volar pedicled flap is taken from the distal radius and implanted in the fracture site. Due to the poor reach of the volar flap, the dorsal flap has gained favor over volar flaps.

In non-vascular bone graft, the graft is usually harvested from the iliac crest and implanted in the fracture site with or without a compression screw.^[4]

The management of non-union scaphoid fracture remains a topic of discussion. A review of the available literature provides differing opinions.

A systematic review by Munk and Larsen demonstrated that non-vascularized bone grafts with and without internal fixation had a union rate of 84% and 80%, respectively, and vascularized bone grafts had a union rate of 91%.^[9]

A systemic meta-analysis by Merrell of the available literature on management of non-union scaphoid fracture demonstrated a superior outcome in screw and grafting over Kirschner-wire and grafting in the management of unstable non-unions (94% vs. 77%, respectively) and a superior outcome of vascular versus non-vascular bone grafting if there was avascular necrosis (AVN) of the proximal fragment (88% vs 47%). The study concluded that unstable non-unions should be managed with screw and grafting and where there is AVN; then, a vascular graft should be used.^[10]

Thus, open surgical treatment of chronic scaphoid non-union with or without vascular bone grafting has been published with variable results.^[10] Recent advances in arthroscopic treatment of chronic scaphoid non-unions enable union with less morbidity and better functional outcomes.^[5]

The entire intra-articular location of the scaphoid non-union allows an arthroscopic scaphoid fixation with the advantage of preservation of blood supply and early functional union.^[6,7]

The arthroscopic approach of scaphoid non-union surgery appears to be an effective alternative to the conventional treatment of scaphoid non-union.^[5-7]

In our case, the use of non-vascular bone graft with percutaneous internal fixation provided excellent results with the complete union of the fracture even after a prolonged 22-year non-union.

We also highlight the assisted usage of human fibrin sealant in achieving successful union in a young patient using minimally invasive arthroscopic percutaneous compression screw fixation with bone grafting.

CONCLUSION

Scaphoid fractures are the most common fractures of the carpal bones with the propensity of developing non-union. Non-union of scaphoid fractures may lead to SNAC over time. Management of scaphoid non-union remains a difficult topic. Open reduction and internal fixation can be associated with significant soft-tissue stripping and have the potential to disrupt or damage the anterior radiocarpal ligaments that could further worsen the wrist arthrosis. With recent advances in arthroscopic wrist surgery, we suggest the use of minimally invasive arthroscopic assisted percutaneous

compression screw fixation with bone grafting for chronic scaphoid non-union.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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