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# Treatment of Scaphoid Nonunion with Iliac Crest Bone Graft and Kirschner Wire Fixation - A Case Report

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**Abstract:** ***Scaphoid nonunion can occur in both non-operative and operatively treated scaphoid fractures. Nonunion is influenced by gross displacement, impaired blood supply. Without treatment, this can lead to carpal collapse and degenerative arthritic change and patients may experience both pain and functional loss in the early and late phases of progression. An operative technique with a high success rate for union is important. This paper describes a technique for treatment of scaphoid nonunion with K-wire fixation and iliac crest cancellous bone graft. After taking informed consent from patient for this study, we report a case of 11 month old scaphoid non-union in a 22 year old male treated with iliac crest cancellous bone graft (ICBG) and k wire fixation.***

**Keywords:** Scaphoid, Non Union, Kirschner wire. Iliac crest, Cancellous,Bone graft, Carpal collapse, Scaphoid Non union Advance Collapse, SNAC

## 1. Introduction

Scaphoid nonunion is a difficult complication from scaphoid fractures that can result from missed diagnoses at the time of injury, delayed diagnoses, or unsuccessful initial non-operative or operative management. The rate of nonunion can be as high as 5-15% of all acute scaphoid fractures. In addition, the rate of nonunion is reported to be as high as 10% in surgically fixed scaphoid fractures. There are few factors that have been shown to be predictors of a higher risk of nonunion including proximal pole fractures, avascular necrosis, fracture displacement, fracture comminution, professional heavy work, associated radial styloidectomy, smoking, delay to presentation and treatment, and carpal instability. This can result in significant problems for patients subacutely, such as pain and loss of function due to alterations in wrist biomechanics. In the long term, scaphoid nonunion can lead to a predictable pattern of degenerative arthritis in the wrist and progressive carpal collapse, known as scaphoid nonunion advanced collapse (SNAC).

Union rates for operative treatment of scaphoid nonunion vary considerably in the literature. Nonunion associated with proximal pole fractures and avascular necrosis can have union rates as low as 50%. With operative intervention, successful union for middle third and distal third nonunions varies from 70 to 100%.

Successful treatment of scaphoid nonunions can be technically challenging. Several bone-grafting techniques have been described utilizing cancellous or cortico-cancellous graft, where the type and technique of graft used are based on surgeon preference. Although many studies strongly suggest that cancellous bone grafting is the superior treatment, there is no definitive evidence for the most reliable method for achieving union.

The goal of this paper is to describe the author's specific surgical technique for treatment of scaphoid nonunion with iliac crest cancellous bone graft (ICBG) and K-wire fixation.

## 2. Materials and Methods

A 22 year old male sustained injury to left hand 11 months ago and now presented to our hospital with complaints of pain in left wrist since 11 months. He took treatment at bonesetter 11 months ago. Student by profession. On examination patient moderately built, afebrile, vitals stable. Conventional radigraphs showed scaphoid fracture.


**Figure 1:** Shows non united left scaphoid fracture, arrow showing non union

A surgical intervention as done.The affected arm is exsanguinated, and a tourniquet is used to facilitate a bloodless exposure. A longitudinal incision, starting at the dorsal rim of the distal radius, extending to the dorsal intercarpal ligament given. The wrist capsule is incised longitudinally, and the scaphoid is identified. The capsule is elevated both radially and ulnarly to improve the exposure as needed. It is important to look for synovial tissue around the scaphoid and remove this when present. The nonunion site can then be evaluated. The fibrous nonunion is debrided using spine curettes. This gives access into the proximal and distal scaphoid fragments for inspection of the bone quality. The segments are carefully debrided until the bone quality is felt to be good, and the tourniquet is then released. Punctatebleeding is ideally visualized. This can create a significant cavity across the site of the nonunion. Once the debridement is complete, scaphoid length is restored under direct visualization using X-rays of the contralateral wrist as comparison. Fluoroscopy is used to confirm correct scaphoid alignment. Wrist extension with ulnar deviation and an elevator on the radial border of the two scaphoid fragments can help facilitate reduction. In addition, it is critical to reduce any intercarpal malalignment prior to wire fixation and grafting. This is accomplished by placing a 0.045 K-wire from the radius into the lunate and capitate to help reduce any DISI deformity. This also helps to facilitate bringing the proximal scaphoid fragment into appropriate position. Once the scaphoid is reduced, 0.045 K-wires are placed from distal to proximal and from radial to ulnar through the skin and across the scaphoid. These are visualized through the incision to pass from the distal fragment into the proximal pole of the scaphoid. The position is checked under intraoperative fluoroscopy. Either two or three K-wires are placed percutaneously in a convergent orientation through the length of the scaphoid and their position confirmed with fluoroscopy. The scaphoid is tested with wrist flexion, extension, and radial and ulnar deviation to confirm that the two fragments move in unison. The K-wires are then bent and cut outside of the skin, ensuring that no tension is being placed on the surrounding skin.Pin sites are dressed with a non-adherent sterile dressing. The wrist wound is irrigated with copious normal saline, packed with gauze, and the tourniquet is released.

Cancellous bone is then harvested from the iliac crest in a standard fashion. Once adequate graft has been obtained attention is then returned to the wrist. The arm is then reelevated, and the tourniquet is re-inflated. The harvested cancellousiliac crest cancellous bone graft (ICBG) is carefully cut into less than 1 mm3 fragments using a bone cutter. Meticulous attention is placed to manual packing of the nonunion site. An X-ray is taken intraoperatively to confirm that the cavity is completely filled and no longer appreciable on X-ray. The wrist capsule is closed using three, non-absorbable sutures, and all sutures are placed prior to tying. The skin is then closed in standard fashion. Sterile dressing is applied and the arm is placed in a sugar-tong thumb spica splint with the interphalangeal joint included, to ensure the elbow is at 90 degrees with no pronation or supination allowed. The patient is immobilized in an above-elbow thumb spica cast for 6 weeks, followed by a below-elbow thumb spica cast for an additional 6 weeks, and seen every 2-3 weeks for cast changes and pin site examination.


**Figure 2:** Immediate post op x ray


**Figure 3:** Follow up x rays after 2 months,arrow showing callous formation and bridging of fracture site

**Figure 4:** Healed Scar

## 3. Discussion

Scaphoid nonunion treated with K-wire fixation and (iliac crest cancellous bone graft) ICBG is shown to have excellent union rates compared to other techniques in the literature. There are other studies that have not demonstrated as high union rates with this technique. scaphoid nonunions treated with ICBG and K-wire fixation and had a union rate of 97% with a mean time to union of 17 weeks. Our preference is to use only cancellous graft, as this is believed to re-vascularize more readily. The importance of thorough and careful debridement of synovial tissue and the nonunion site is perhaps as important as the use of cancellous bone grafting.

We also believe the orientation of the K-wires is important, with the use of convergent K-wire placement being the most favorable. This allows the K-wires to pass through the most surface area of the scaphoid as well as allows for a more targeted placement into the proximal pole. It is recognized that parallel K-wires were less strong and less stable versus compression crews; however, the trade-off to using a screw is there is more scaphoid volume occupied by the screw which decreases the amount of bone graft that can be placed.

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