The Unstable Nonunited Scaphoid Waist Fracture: Results of Treatment by Open Reduction, Anterior Wedge Grafting, and Internal Fixation by Volar Buttress Plate

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Purpose The purpose of this study is to evaluate the results of treatment of unstable nonunited scaphoid waist fracture by anterior wedge graft and internal fixation with the use of volar buttress plate and screws.

Methods Fourteen adult male patients with unstable nonunited scaphoid waist fracture with a humpback deformity were treated by reduction of the collapse deformity, insertion of anterior wedge graft, and internal fixation with the use of volar buttress plate and screws. The mean patient age was 26 years, and the mean duration of the nonunion before surgery was 16.5 months. The follow-up time ranged from 9 to 19 months (mean, 11 mo). Thirteen of the fourteen nonunions healed with sound radiographic union. Pre-existing avascular necrosis was a major adverse factor for achievement of union in one patient, even after a second bone-grafting procedure.

Results Union was achieved in a mean of 3.8 months. Most of the patients had satisfactory correction of scaphoid deformity and the associated dorsal intercalated segment instability. Postoperatively, improvements were seen in the range of wrist flexion and extension, grip strength, and degree of dorsal intercalated segment instability.

Conclusions The results of the series suggest that the method of anterior wedge graft and internal fixation with the use of volar buttress plate and screws is effective for the treatment of unstable nonunited scaphoid waist fractures. *(J Hand Surg 2011;36A:17–24. Copyright © 2011 by the American Society for Surgery of the Hand. All rights reserved.)*

Type of study/level of evidence Therapeutic IV.

Key words Scaphoid buttress plating, scaphoid waist nonunion, plate fixation.

UNSTABLE SCAPHOID WAIST fractures (volar type) are predisposed to fracture collapse and nonunion. The edges of the proximal and distal pole fragments abut each other and, after repeated cycles of loading, experience progressive erosion and bone loss. The scaphoid nonunion collapses into a humpback deformity and the rest of the carpals into a dorsal intercalated segment instability (DISI) pattern that must be corrected.[1–4]

At present, agreement has been reported about the 3-step principle of management of the nonunited scaphoid wrist collapse with DISI: open reduction, length restoration by interpositional anterior wedge grafting, and internal fixation by screw.[3–10] Although it was found that Herbert screw fixation gave a higher success rate in achieving bony union with better functional results, the technical difficulty and the need to release

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the scaphotrapezial ligament were addressed by some surgeons.[1,3,11]

From the mechanical standpoint, in comparison to compression screws, the buttress plate provides improved methods of internal fixation for a collapsed fracture. It is considered to be a perfect mechanical construct that meets the anatomic and biomechanical requirements of unstable fractures with the tendency of their fragments to collapse axially.[12]

The use of plates to treat the pseudarthrosis of the scaphoid has been described in the past. AO plates were described for the treatment of scaphoid pseudarthrosis by Braun et al.[13] The Ender compression hooked blade plate system was suggested by Huene and Huene[14] and Stanković and Burchhardt.[15] The function of the Ender hook plate was described as fixing the main bone fragments and exerting pressure on the in-between lying bone transplant.[14,15] Contrary to the concept of the Ender hook plate, the volar buttress plate was used in the present study to stabilize the reduced scaphoid fragments and to buttress the relevant compression or axial forces.

This study was undertaken to report the results of 14 nonunited scaphoid waist fractures treated by reduction of the collapse deformity by anterior wedge graft and internal fixation with the use of 1.5- or 2.0-mm miniplates and screws on the volar side of the scaphoid.

MATERIALS AND METHODS

A review of 14 patients who underwent open reduction, anterior wedge-shaped bone grafting, and internal fixation by volar buttress plate for the treatment of scaphoid fracture nonunions between March 2005 and October 2008 was carried out. The criterion for inclusion was symptomatic nonunited scaphoid wrist fracture that had been present for longer than 6 months. None of the patients had undergone previous scaphoid surgery.

All of the patients were men, with an average age of 26 years (range, 20–36 y). The right hand was involved in 9 patients (8 dominant; 1 nondominant) and the left hand in 5 patients (2 dominant; 3 nondominant). Ten patients were engaged in heavy manual work and 4 in office-type work. The average interval between injury and surgical treatment was 16.5 months (range, 7–96 mo). The mean period of follow-up was 11 months (range, 9–19 mo). All fractures were the result of a fall on the outstretched hand.

Preoperative planning on the basis of comparative radiographs of the opposite wrist was carried out.[16] On the basis of plain radiographs and intraoperative findings, all scaphoid nonunions were classified according to the system of Alnot[17] (Table 1). Six patients had nonunions classified as Alnot's type IIA, 6 as Alnot's IIB, and 1 as Alnot's IIIA.

TABLE 1. Alnot's Scaphoid Nonunion Classification

Stage I	Linear pseudarthrosis
Stage II	
IIA	Slight bone resorption, no displacement
IIB	Unstable pseudarthrosis, palmar flexion and adaptive DISI, palmar bone loss
Stage III	
IIIA	Unstable pseudarthrosis, palmar bone loss, radioscaphoid arthritis
IIIB	Radiocarpal arthritis

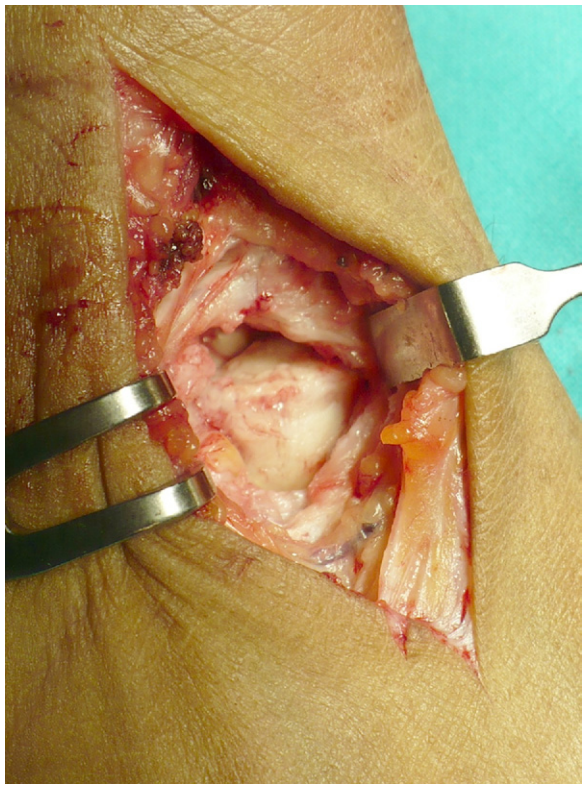

FIGURE 1: Exposure of the fracture site through the standard Russe anterior approach.

Surgical technique

General anesthesia was used in all patients; it was necessary when planning to harvest bone graft from the iliac crest. The patient was placed in the supine position. An inflated upper arm tourniquet was applied to the surgical extremity.

All patients underwent surgery through the standard Russe anterior approach (Fig. 1). The capsule