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Incidence

- 5-10% of scaphoid fractures treated in a plaster cast, Gelberman et al.
- Herbert and Fisher reported an incidence in the order of 50%.
- Non union will also occur in an unknown number of unrecognized scaphoid fractures.

Causes of non union

Certain factors appear to predispose to non union:

- 1- Anatomical Factors
- The most important factor is the blood supply.
- Displaced fracture fragment.
- Soft tissue interposition can prevent union of acute fractures of the scaphoid by interrupting the blood supply.
- Synovial fluid dynamics predisposes to non union as it interferes with the formation of callus.

2- Factors in the management

- Failure of diagnosis of acute fracture.

- Inadequate immobilization.

Complications

- Weakness of hand grip.
- Limitation of wrist movement (flexion, extension, ulnar and radial deviation).
- DISI.
- Degenerative osteoarthritis of the wrist joint.

Treatment

The ideal treatment of non-union of the scaphoid remains unsolved and controversial.

 Bone graft with or without internal fixation is the standard treatment for symptomatic scaphoid nonunion without osteoarthritis. Cancellous bone grafting first described by Matti and Modified by Russe is the most common surgical treatment.



- Mc Laughlin (1954), is the first to recommend open reduction and screw fixation of the fracture scaphoid.
- Fernandez described a method of fixation using a volar wedge bone graft secured with Kirschner (K) wires in 1984 and in 1990 he reported his results using the 2-7 mm AO Lag screw injury.

- Herbert and Fisher described the Herbert screw fixation in 1984.



















Pronator quadratus pedicle bone graft



Functional Outcomes of Nonunion Scaphoid Fracture Treated by Pronator Quadratus Pedicled Bone Graft

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Abstract: Between 1998 and 2007, a pronator quadratus pedicled bone graft was performed for 45 patients of ununited scaphoid fracture. One of them had bilateral ununited scaphoid fracture. There were 29 men and 16 women with a median age at operation of 24 (16-32) years. The affected side was the right side (dominant hand) in 32 patients whereas 13 patients had fracture of the nondominant left side. There had been 32 proximal pseudoarthrosis (through or proximal to the junction of the proximal and middle thirds of the bone) and 14 of the middle third of the scaphoid. The original fractures were caused by motor cycle accidents in 23 patients, falling on outstretched hand in 15 patients, and sport injuries in the remaining 7 patients. Surgery was indicated from 5 months to 6 years after injury (average 43 months) because of complaints of pain on heavy work. The fracture has been missed at the initial examination in 23 patients whereas cast immobilization was done for 6 weeks and 3 months in 15 and 7 cases, respectively, that had failed to result in union. There were no preoperative osteoarthritic changes, but in 25 cases, there were avascular necrosis of the proximal fragment of the scaphoid. Forty-three patients showed radiographic union after an average of 14 weeks (12-16 weeks). One patient had dislodgement of the graft and refused to do it again. The average range of movement of wrist improved after operation. Taken as a percentage of the normal range, dorsiflexion increased from 69% to 80%, palmar flexion from 66% to 76%, radial deviation from 45% to 70%, and ulnar deviation from 67% to 84%. Grip strength improved from 82% to 92% of normal. All the patients have been able to return to their former activities with no pain.

Key Words: nonunion scaphoid fracture, vascularized pedicle bone graft, pronator quadratus muscle, avascular bone necrosis

with being the first to recommend open reduction and screw fixation of the fracture scaphoid. Herbert and Fisher⁵ described the Herbert screw fixation in 1984. Fernandez¹³ described a method of fixation using a volar wedge bone graft secured with Kirschner (K) wires in 1984 and in 1990¹⁴ reported the results using the 2.7-mm AO Lag screw injury. Bone graft with or without internal fixation is the standard treatment for symptomatic scaphoid nonunion without osteoarthritis. Cancellous bone grafting first described by Matti and modified by Russe¹⁵ is the most common surgical treatment. Pronator quadratus pedicled bone graft was described by Kawai and Yamamoto¹⁶ in 8 cases. One of these patients had scaphoid fracture in the proximal third. In this article, we present a retrospective study of the functional outcome for treatment of nonunion scaphoid fracture in 45 patients treated by pronator quadratus pedicled bone graft with or without internal fixation. One patient had bilateral nonunion fracture scaphoid. Thirty-two patients had scaphoid fracture in the proximal third. Avascular necrosis of the proximal scaphoid fragment occurred in 25 of them.

SURGICAL TECHNIQUE

A volar curvilinear incision is made over the scaphoid tuberosity and the distal radius. The incision is deepened between the flexor carpi radialis and the radial vessels (Fig. 1). On the distal radius, the pronator quadratus muscles should be identified clearly specially at the radial styloid process. It should be healthy, and a





