THE TREATMENT OF DELAYED UNION AND NON-UNION OF THE CARPAL SCAPHOID BY SCREW FIXATION

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A simple technique for screw fixation of the carpal scaphoid in cases of delayed union and non-union is described. The results obtained in 32 patients treated by this method are reported. The average follow-up was three years ranging from 10 months to 12 years. Union was obtained in 28 patients. The causes of failure to unite are discussed and the advantages of the reported method over other techniques such as bone grafting are stressed.

Early diagnosis followed by adequate conservative treatment will result in bony union of fractures of the carpal scaphoid in 90 to 97 per cent of cases (Bohler, Trojan and Jahna 1954; Russe 1960; London 1961; Fisk 1970). Failure to diagnose the fracture or inadequate conservative treatment may lead to delayed union or non-union.

Encouraged by reports of success in treating delayed union and non-union of this fracture by osteosynthesis, we have used a simple technique of screw fixation in these cases since 1967.

OPERATIVE TECHNIQUE

The method of exposure of the carpal scaphoid ensures that placement of the screw is under direct vision at all times. A bayonet-shaped skin incision is made with its distal limb along the line of the anatomical snuff-box and its proximal limb just to the ulnar side of the radial styloid process (Fig. 1). Subcutaneously the radial nerve and artery are seen and protected. The capsule of the wrist joint is incised in the line of the skin incision, allowing an excellent view of the whole of the scaphoid (Fig. 2). It is unnecessary to excise the radial styloid process for access.

The nature of the fracture is noted but at no time is the fracture site disturbed. A thick (2 mm) Kirschner wire is now inserted under direct vision from the scaphoid tubercle to the most proximal part of the proximal pole that can be seen (Fig. 3). A single radiograph is taken with the hand fully pronated and flat against the cassette (Fig. 4). The sole purpose of this radiograph is to determine the length of the screw, since the position of the K-wire is under direct vision throughout. The wire is withdrawn and the track tapped to a diameter of 2.7 mm. An AO scaphoid lag-screw is inserted ensuring that the whole of the threaded portion lies in the proximal fragment; in this way compression of the fracture is achieved. The wound is closed in layers and a crepe bandage applied. Active movements of the wrist and hand are encouraged after removal of the sutures at 10 days.

MATERIAL

Thirty-two patients were treated by this method between 1967 and 1977 and were reviewed at a mean time from operation of 3 years 1 month (range 10 months to 12 years). For review the patients were divided into two groups.

Delayed union (22 patients) was defined as a failure to unite within a year of injury, whilst non-union (10 patients) was defined as the presence of a clear gap at the fracture site after more than a year (Maudsley and Chen 1972).

Thirty-one of the patients were male. The mean age at presentation was significantly different in the two groups: 32.5 years in the delayed union group (range 18 to 57 years); and 24.9 years in the non-union group (range 17 to 34 years). The dominant hand was involved in 70 per cent of cases. Many of the patients (27) were in light manual or sedentary occupations; the lesser strains imposed on the wrist in these occupations may cause lesser symptoms and thus delay in seeking advice after injury.

The cause of the fracture was most commonly a fall on to the outstretched hand or an injury at sport (Table I). Association football injuries were often due to forced dorsiflexion of the wrist by direct contact with the ball. The fracture was most commonly situated at the waist of
the scaphoid (Table II). Of the delayed union group, seven had been immobilised for eight weeks or more in a plaster cast and 15 presented late after injury (average delay 14 weeks). Of the non-union group six patients presented at an average of 16 months from injury; the remaining four gave no definite history of injury.

Late diagnosis in the delayed union group was mainly due to a low index of suspicion in accident and emergency departments. Four patients presenting with painful wrists had no radiographs taken, five had normal radiographs and were discharged.

The main presenting symptom in both groups was pain and limitation of movement sufficient to interfere with work or sport (Table III). Physical signs were few though tenderness and swelling in the anatomical snuff-box together with decreased movements of the wrist were seen in some patients (Table IV).
operation showed a decrease in their range of movement to half the normal and this limitation persisted. Grip strength was normal in 26 of the patients. There was some slight tenderness over the surgical scar in seven patients and one had a complete radial nerve sensory deficit which was not a functional disability. There were no other immediate or late complications in the series.

Carpal instability as described by Fisk (1970) was carefully sought, clinically and radiologically, in all cases before operation. It was present in only four patients. Similar radiographic projections of the normal and fractured scaphoid bones were made in order to determine whether any scaphoid shortening had occurred as a result of the fracture. Significant shortening was not found except in three of the four cases which did not unite after operation. Late degenerative changes in the carpus were seen radiologically in only one case, seven years after operation; this wrist was completely asymptomatic.

**DISCUSSION**

We are convinced that adequate immobilisation is the key to the achievement of union of the fractured scaphoid. Unlike London (1961) it is our experience that the majority of non-unions do not become asymptomatic or respond well to conservative treatment. Adequate and, if necessary, prolonged immobilisation of the fresh fracture will usually result in union. Recent studies by King, Mackenney and Elnur (1982) have shown that union is even more likely to occur if the forearm is immobilised in a position of supination with some ulnar deviation and slight dorsiflexion of the wrist.

We have been unable to demonstrate the importance of carpal instability as described by Fisk (1970) or by Linscheid et al. (1972) in the aetiology of delayed and non-union of the carpal scaphoid.

Avascular necrosis as defined by increased density of the proximal fragment was rare (12.5 per cent) in this series. Refined techniques of radio-isotope bone imaging may allow a more precise definition of the term avascular necrosis and the importance of the blood supply to the bone in the healing of these fractures.

Our technique is simple, safe and produces consistently good results. We disagree with Cooney, Dobyns and Linscheid (1980) who state that compression screw osteosynthesis provides stability but not union. The union rate in this series was 87.5 per cent.

When fresh fractures are excluded from their series Maudsley and Chen (1972) achieved a union rate of only 32.3 per cent. However, in some of their cases they disturbed the fracture site, excised the fibrous pseudarthrosis and inserted a cancellous bone graft before inserting the screw. We believe that this interference with the fracture site gives bad results.

Our technique utilises simple and cheap equipment unlike the methods reported by Gasser (1965) and Maudsley and Chen (1972).

Bone grafting of the carpal scaphoid for delayed and
non-union has been advocated. A problem associated with this technique is the prolonged period of immobilisation required postoperatively. In Russe’s series (1960) the average period of immobilisation after operation was 4.6 months. The time to return to work is not recorded in those papers advocating bone grafting (Russe 1960; Mulder 1968; McDonald and Petrie 1975; Cooney et al. 1980). In our series the average time to return to work was approximately seven weeks.

The poor results in our series were in those patients in whom the radiograph demonstrated apparent cavitation at the fracture site, which was associated in three of the four cases with scaphoid shortening of more than 2 mm. The presence of these radiographic signs is, we believe, a contra-indication to any surgical attempt to achieve union.

REFERENCES


