

SCAPHOID NON-UNION: THE ROLE OF VASCULARIZED GRAFTING IN RECALCITRANT NON-UNIONS OF THE SCAPHOID

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Achieving union using conventional grafts has a high chance of failure in patients with recalcitrant non-union (persistent pseudarthrosis) of the scaphoid bone, an avascular proximal fragment and previous failed surgeries because of poor host bed vascularity. Eleven patients with long-standing non-union were treated with vascularized pedicle bone grafting and supplementary corticocancellous grafting. Five had screw fixation and six were fixed with K-wires. The average age of the patients was 28 years, average duration of the non-union was 39 months and mean radiological follow-up was 32 months. There were no significant skeletal complications, although two patients developed neuromata. At review, only six of the 11 non-unions were united. Whilst this is a difficult clinical problem and achieving union is a formidable challenge, we believe that there is a role for such extensive surgery in order to achieve good postoperative function.

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INTRODUCTION

Recalcitrant non-union (persistent pseudarthrosis) of the scaphoid usually arises as a result of a combination of a long duration of non-union, previous failed surgery, avascularity of the proximal fragment or the location of the fracture, in particular fractures of the proximal third of the scaphoid. The results of conventional bone grafting in such patients are often poor (Carrozzella et al., 1989; Green, 1985; Shah and Jones, 1998).

In this study, the term “recalcitrant” refers to scaphoid fractures with a long duration of non-union, with an avascular proximal pole-type D4 in the modified Herbert’s classification (Filan and Herbert, 1996) and those who have had at least two previous failed operations. Our aim was to see if an acceptable incidence of union could be achieved in these cases by use of an extensive, vascularized grafting technique.

PATIENTS AND METHODS

Retrospectively, we examined a consecutive cohort of scaphoid fracture non-unions treated at Wrightington Hospital between 1993 and 2002. This included 15 patients who underwent vascularized grafting for established, symptomatic non-unions of the scaphoid which had failed to unite after a minimum of two previous surgical procedures of open reduction and internal fixation (ORIF) and conventional bone grafting.

One patient was lost to follow-up immediately post-operatively and it was not possible to assess the outcome in this case. Three others were excluded because of

incomplete documentation regarding the exact details of previous interventions, although two of the three went on to unite.

After exclusions, 11 patients were included in this study. The first operation in seven of the 11 patients had been carried out at other centres by surgeons with an interest in hand surgery and four had been done at our institute. Seven patients (four operated on previously at our institute and three who had had unsuccessful operations elsewhere) had the second operation at our hospital. The final treatment for all 11 patients was carried out in our hospital by two of the senior authors. Pre-operatively, the location of each fracture was recorded and the fracture morphology classified using the modified Herbert’s classification (Filan and Herbert, 1996).

A dorsal midline approach was used in the distal third of the forearm and extended dorsoradially distally at the wrist. The wrist joint was opened through the third dorsal compartment to expose the site of non-union, which was thoroughly curetted out before assessing the vascularity of the proximal pole. The vascularity of the proximal fragment was assessed by the presence, or not, of punctate bleeding at the time of surgery (Green, 1985; Straw et al., 2002). MRI scans were not obtained routinely. In five patients with a fracture of the middle third of the scaphoid, both ends of the bone were freshened and sclerosed bone excised creating a trapezoidal defect.

In a number of patients with a fracture of the middle third of the scaphoid, a “hump backed” deformity had to be corrected. This was undertaken by the additional use of a corticocancellous (tricortical) graft harvested from the iliac crest in three patients and the distal radius in two. In three patients, it was possible to insert the

graft entirely from the dorsoradial aspect, as described by Steinmann et al. (2002). However, dense fibrosis in the dorsoradial capsule prevented such an insertion in two patients. In these cases, an additional palmar approach to the scaphoid through the bed of the flexor carpi radialis tendon was undertaken to insert the graft.

In the six patients with a fracture in the proximal third of the scaphoid, curretting and freshening of the fracture ends left a bony shell with no humpback deformity to correct. This cavity was packed with cancellous graft chips harvested from the iliac crest in one case and from the lower end of the radius in others. The fracture was stabilized and a vascularized graft placed in a trough of equivalent size in the dorsum of the scaphoid.

The vascularized bone graft, typically measuring 1.2 × 1 × 0.7 cm, was raised from the dorsal aspect of the radius (Shin and Bishop, 2001). Different donor sites were used to achieve adequate length of the vascular pedicle. In eight patients, a pedicle based on the dorsal fourth extra compartmental artery was used (Fig 1). In two patients, a pedicle based on a 1, 2 ICSRA was used (Fig 2) and in one patient a pedicle based on a 4, 5 extra-compartmental artery was used (Fig 3). This was passed carefully under the dorsal capsule and placed in a trough of equivalent size created on the dorsal aspect of the scaphoid.

Six fractures were stabilized with Herbert type screws and five with K-wires.

Postoperatively, the forearms and hands were immobilized in a below elbow plaster of Paris scaphoid cast for 6 weeks. The cast was then removed and a removable splint applied for a variable period depending on the radiological appearance of the scaphoid.

The patients were followed-up with serial X-rays, union being assessed using the criteria described by Dias (2001). Functional outcome was not assessed in this study, although any complications were noted.

RESULTS

The 11 patients assessed included ten men and one woman. Eight were smokers, six had office-based jobs, three were heavy manual labourers and two were unemployed. The average age was 28 (range 20–53) years. The average duration of non-union was 39 (range 18–118) months. The average follow-up time after the vascularized bone graft surgery was 32 (range 9–51) months.

Six patients had fractures in the proximal third of the scaphoid and five in the middle third. All patients had a total absence of punctuate bleeding from the proximal fragments at surgery and, hence, were classified as type D4 using the modified Herbert's classification (Filan and Herbert, 1996).

At follow-up six, of the 11 fractures were united on X-ray. Due to the small number of patients, however, it is difficult to draw any conclusions about the

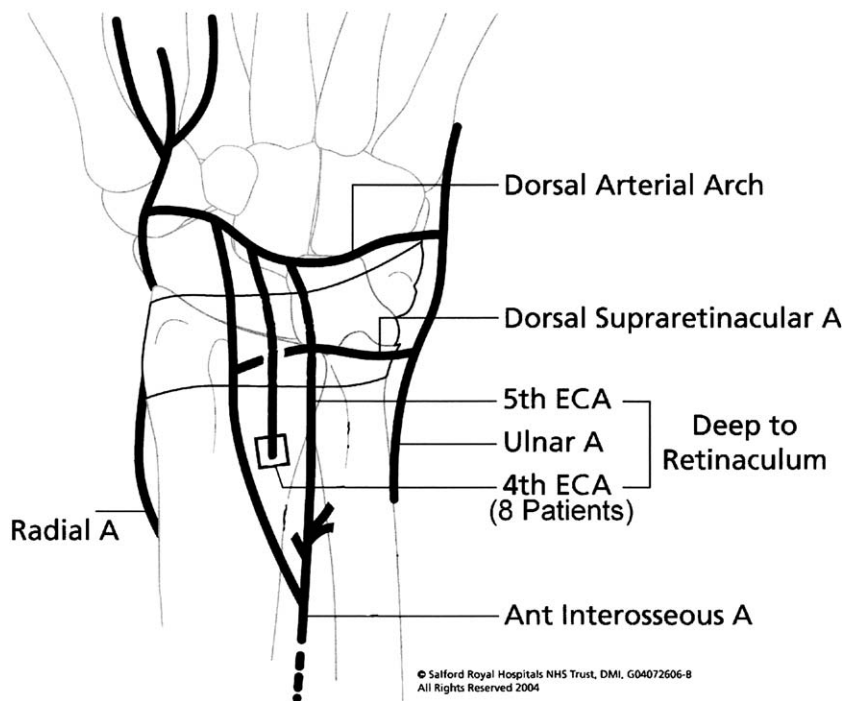


Fig 1 Vascular pedicle based on dorsal fourth extracompartmental artery (4, ECA).

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