Symptomatic extra-articular scaphoid tuberosity nonunion: surgical excision of the ununited fragment after failed nonoperative management

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Introduction

Scaphoid fractures are the commonest fractures of the carpus [2], accounting for 60–70 % of carpal fractures; they most commonly affect young men following a fall on the outstretched hand [8], with forced dorsiflexion of the wrist, particularly during sports [5]. The management of scaphoid fractures falls into two general categories: nonoperative or surgical management. Nonoperative management with immobilisation in a cast or splint is commonly used for stable, undisplaced waist or tubercle fractures (Herbert type A). Surgical treatment by means of percutaneous or open fixation, with or without bone grafting, is used for unstable, displaced or ununited fractures (Herbert types B, C and D) [5].

Fractures of the scaphoid tuberosity account for between 8 and 20 % of scaphoid fractures [9, 11]. In a series of 222 scaphoid fractures, 38 (17 %) were of the scaphoid tubercle, and all of these were confirmed as united on imaging at 39 days, following an average of 30 days of immobilisation in a cast [8]. Other authors reported a 4 % incidence of tuberosity fractures in a series of 81 scaphoid fractures and advocated conservative management for the extra-articular type [7].

Management of symptomatic nonunion of the scaphoid tuberosity is a rare clinical dilemma which does not appear to fall into the algorithm based on the Herbert classification.

Two male patients presented to our unit with long-standing symptoms from ununited extra-articular scaphoid tuberosity fractures following failed nonoperative management. Mean age at presentation was 23 (range 22–24 years). Surgical excision was offered as a management option to both of these patients. To our knowledge, only one case of surgical excision for failed nonoperative management has been previously reported in the international literature [10].

Materials and Methods

Both patients were assessed clinically and radiographically (Figs. 1 and 2). Pain scores were obtained according to the Numerical Rating Scale (NRS). The Quick version of the Disabilities of the Arm, Shoulder and Hand questionnaire (QuickDASH) was administered to both patients, and scores were obtained. Wrist range of movement and grip strength were assessed. Both patients initially underwent plain scaphoid radiographs. CT scans were also performed to assess the presence of nonunion and define more precisely size, shape and position of the tuberosity fragment to assess in particular whether the fragment was extra-articular or intra-articular.

Both patients underwent surgical excision of the ununited scaphoid tuberosity fragment. All procedures were performed by the senior author (LG), a consultant hand surgeon, using identical technique.

The surgical technique involved a general anaesthetic, with upper-arm tourniquet inflated to 250 mmHg. A volar V-shaped 2-cm incision over the scaphoid tuberosity was performed (Fig. 3). Neurovascular structures, flexor carpi radialis tendon and radioscapulocapitate ligament were identified and protected. Minimal dissection was carried out. The fragment was carefully detached from its flexor retinaculum,

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Fig. 1 **a** Case 1. Preoperative radiograph (posteroanterior view) showing scaphoid tuberosity nonunion. **b** Coronal and transverse CT scan images showing an ununited extra-articular scaphoid tuberosity fragment (size 9×5 mm), displaced from the main body of the scaphoid

scaphotrapezial ligament and scaphotrapezotrapezoid (STT) joint capsule attachments. The ununited scaphoid tuberosity was exposed, and fibrous adhesions were divided to excise the bony fragment. Image intensifier screening was performed to ensure complete excision (Fig. 4). The scaphotrapezial ligament, STT joint capsule and flexor retinaculum fibers were reinserted and closed with 4/0 monofilament polyglyconate synthetic absorbable sutures. The STT joint was tested for stability clinically and under image intensifier before skin closure. The skin was closed with interrupted 5/0 polybutester nonabsorbable monofilament sutures. The area was dressed with paraffin gauze, sterile dressing gauze and a volar plaster slab fitted for 48 h before the dressing was changed, and the patient was reviewed by the hand therapists. The patients were reviewed in our dressing clinic 5 days postoperatively.

Postoperatively, after 2 weeks of immobilisation in a custom-made thermoplastic wrist and thumb spica splint, until complete wound healing, progressive active range of motion wrist exercises were started, with removable splinting for comfort as needed.

Both patients were reassessed in the clinic at 6 weeks and followed up by telephone interview 4 and 6 months postoperatively. Postoperative QuickDASH questionnaires were administered at 6 months of follow-up.

Case Reports

Case 1

A 22-year-old right-hand-dominant male teacher, nonsmoker, without significant medical history, and a keen sportsman fell on his right hand while playing basketball. He was initially

treated nonoperatively elsewhere, with wrist immobilisation in a splint. He was referred to us after 8 months of ongoing pain. Eight months after the injury, he was still intermittently wearing a wrist support. The pain was aggravated by playing racquet sports. On clinical examination, pain was present on palpation over the scaphoid tuberosity and was exacerbated on radial deviation at the wrist. Pain scores at this time were 7/10. Preoperative QuickDASH score was 50, with specific work score of 6.5 and sports/hobbies score of 81.25. Radiographs showed evidence of a scaphoid tuberosity nonunion (Fig. 1a). CT confirmed the presence of an extra-articular scaphoid tuberosity ununited fragment (Fig. 1b). Surgical excision of the ununited bony fragment under image intensifier guidance was performed.

Case 2

A 24-year-old right-hand-dominant male information technology (IT) consultant, who was otherwise fit and well and a nonsmoker, fell on his right hand while playing football. He sustained a scaphoid tuberosity fracture that was managed nonoperatively elsewhere with initial immobilisation in a scaphoid cast for a few weeks. He was referred to us after almost 9 months of ongoing pain. On presentation to our clinic, he was still wearing a Futura wrist splint almost all the time. Right wrist flexion and extension were reduced to 2/3 of the contralateral wrist range of motion due to pain and prolonged splint immobilisation. Pain was present on palpation over the scaphoid tuberosity and on radial wrist deviation. The pain was exacerbated in certain positions and had severity of 6/10 on NRS. Preoperative QuickDASH score was 43.2; the work score was 0; however, sports/hobbies were a particular problem scoring 87.5. X-rays showed a scaphoid tuberosity nonunion (Fig. 2a), and CT confirmed

Fig. 2 **a** Case 2. Preoperative radiograph (posteroanterior view) showing scaphoid tuberosity nonunion. **b** Coronal and transverse CT scan images showing the ununited scaphoid tuberosity fracture, without intra-articular extension

Fig. 3 Skin incision

that the ununited fracture was extra-articular (Fig. 2b). Surgical excision of the ununited bony fragment under image intensifier guidance was performed 2 months later.

Results

Five days postoperatively, symptoms were almost completely resolved in one patient with a pain score of only 2/10 on NRS (case 1) and completely resolved with a pain score of 0/10 in the other patient (case 2).

On clinical examination 6 weeks postoperatively, both patients were pain-free with a full range of wrist movement and improved grip strength (patient 1 had 15 % improvement, and patient 2 had 10 % improvement), which both patients stated to have returned to normal. The STT joint was clinically stable. Patient 1 was already back to teaching and resuming his active lifestyle, and patient 2 was splint-free and back to regular sports and his work as IT consultant.

Fig. 4 Post-excision image intensifier screening to ensure that excision is complete

At 4 and 6 months of follow-up, there had been no changes; both patients were asymptomatic and using their hands normally for their daily activities and sports. QuickDASH scores for both patients in all categories were 0 at 6 months of follow-up. No further follow-up was required.

Both patients stated that they would choose to have surgery again rather than continued nonoperative management.

Discussion

The management of distal scaphoid tuberosity fracture nonunion is barely touched upon in the international literature, since only few cases have been reported [6, 10]. Outcomes of ununited scaphoid tuberosity fractures have also been rarely reported. Prosser et al. [12] and Kjell Jonsson [6] reported cases of scaphoid tuberosity nonunion, which were managed conservatively. Mody et al. [10] described four such cases and managed two nonoperatively and the other two surgically, one with excision of the fragment and the other with fixation. In their series of 81 scaphoid fractures, Kraus et al. [7] identified four Herbert type A1 isolated tuberculum avulsions. Three cases were extra-articular and treated conservatively; one was intra-articular and fixed surgically with a percutaneous screw.

Nonoperative management has been reported in the literature as largely successful for the management of scaphoid tuberosity fractures, with the majority uniting or becoming asymptomatic after several months [7, 8]. The only symptomatic patient managed nonoperatively by Mody et al. was asymptomatic after a year [10]. However, economic demand, surgical success and patient expectations have evolved significantly over the last 20 years. Patient demographics for scaphoid fractures suggest that young, active males are more commonly affected [8]. An early return to work, hobbies and sports is usually required in this patient group. A prolonged period of nonoperative treatment is not what these patients desire, and, in some cases, like the ones described in our series, it may result unsuccessful.

Surgical excision of an ununited scaphoid tubercle fracture fragment was performed by Mody et al. in one of his cases [10]. His patient was symptom-free after 8 weeks. Garcia-Elias and Lluch use multiple case examples of proximal and distal fractures to suggest that, in selected conditions, a partial scaphoidectomy or excision of an ununited bone fragment may be a preferred course of management over other alternatives, even if it must be always born in mind that any of these procedures on the scaphoid might result in carpal instability [3]. Treatment of symptomatic bone nonunion is generally recognised as a standard procedure internationally, especially in active young patients in the absence of contraindications or significant comorbidities. Surgical excision of fractured or ununited bony fragments is

already routinely performed in the wrist with good results, for instance, in the presence of a fracture of the hook of the hamate [1] or a symptomatic ununited ulnar styloid fragment [4].

We describe a subgroup of scaphoid tuberosity fractures that remain ununited and symptomatic. Even if these cases are rare and the international literature on this topic is scarce, we would suggest that these cases be added as a subgroup to the existing Herbert classification.

A limitation of this study is the small number of cases described, which is due to the rarity of symptomatic extra-articular scaphoid tuberosity nonunion following failed nonoperative management. Nevertheless, to our knowledge, this is the largest documented number of such cases treated with surgical excision of the ununited fragment and reported in the existing literature on this subject. Our encouraging results suggest that, in selected cases of long-standing symptomatic nonunion of extra-articular scaphoid tuberosity fractures, surgical excision of the ununited scaphoid fragment with minimal dissection and accurate reconstruction of the capsular and ligamentous components may be a viable option following failed nonoperative management, in active young patients. In case our results were confirmed in a larger series in future studies, we would suggest that this procedure be added to the current algorithm for treatment of scaphoid fractures.

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