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Original Article

The Headless Compression Screw – Technical challenges in scaphoid fracture fixation

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ABSTRACT

Background: The Headless Compression Screw® (HCS) is a cannulated screw that is used for scaphoid fracture fixation. The screw generates compression across the fracture site prior to being countersunk below the articular surface.

Methods: We performed a retrospective review of 56 consecutive scaphoid fixations using this device in patients with both acute and chronic fractures.

Results: Union rates were 100% in acute and 87% in chronic fractures. 16% of patients required screw removal for protrusion.

Conclusion: Despite placement of the screw in line with technical guidance, protrusion was significant and can be a source of ongoing morbidity.

1. Introduction

Scaphoid fractures are increasingly being managed surgically with specifically designed implants and evolution of different techniques.[1–6]

The Headless Compression Screw® (HCS, Synthes Inc, West Chester, PA, USA) is a cannulated self-drilling, self-tapping, non-variable pitch screw available in 2.4 mm and 3 mm diameters that can be used in the management of scaphoid fractures. The proximal thread length is fixed and the distal thread length increases with screw length, although standard and short thread lengths are available. Compression of the fragments is achieved before the screw head is countersunk beneath the level of the articular cartilage into the subchondral bone.

The HCS system has been used at our institution since 2010 for the fixation of both acute scaphoid fractures and scaphoid non-unions with bone grafts. A percutaneous technique is used in acute cases when appropriate and an anterograde screw placement is used for proximal pole and proximal waist fractures to ensure that screw alignment is perpendicular to the fracture site. In non-union surgery, the choice of graft is dependent of the pathology. Iliac crest graft is used in simple non-unions. Vascularised grafting is used when there are poor prognostic factors: proximal pole non-union, avascular necrosis demonstrated on gadolinium enhanced dynamic magnetic resonance imaging (MRI), previous failed surgery, non-union for more than 5 years. Vascularised grafts include either pedicled 1:2 supraretinacular artery[7] or free vascularised medial femoral condyle.[8] This paper reviews the outcomes

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of scaphoid surgery using the HCS in our institution and also addresses the technical challenges experienced.

2. Patients and methods

A retrospective review of all patients who had the HCS used for scaphoid fracture fixation between June 2010 and June 2012 was carried out by evaluation of theatre logbooks, implant logbooks, case notes and radiological investigations. All patients in this study had their surgery carried out by the senior authors using a standard technique[9] and mini C-arm guidance or by senior hand surgery fellows under their direct supervision. The standard technique used was as recommended by the implant manufacturer. A 1.1 mm guidewire is placed across the fracture site in the optimum position. During retrograde fixation, when necessary a trapezium burr is used to optimise the entry point. Measurement is taken using the standard guide with imaging to ensure that the depth gauge is in contact with the scaphoid. The screw length is chosen after deductions for the fracture gap, the head length and the degree of countersinking required. If the fragment into which the screw tip will engage is small, a short thread length is chosen to minimise the risk of screw threads bridging the fracture or graft and to minimise the risk of joint penetration. The screw is passed with compression achieved prior to advancing the screw into its final position beneath subchondral bone, and continuous screening on the mini C-arm used to assess adequate placement.

The size of the scaphoid fragments, screw diameter, screw length and thread length were recorded in all cases through standardised measurements on the GE PACS imaging system. Follow-up records and imaging were examined to identify time to union and any complications including screw protrusions.

There were four categories of patients:

Group 1. Acute fracture treated with percutaneous fixation
Group 2. Acute fracture treated by open reduction and internal fixation (ORIF)
Group 3. Chronic fracture treated with ORIF and non-vascularised bone graft
Group 4. Chronic fracture treated with ORIF and requiring vascularised bone graft (Fig. 1)

2.1. *Acute fracture fixation*

Undisplaced acute proximal pole fractures have a high rate of non-union (30%)[10] and as such fixation is the preferred management technique. Displaced waist fractures should be reduced and fixed. If satisfactory closed reduction is achieved, then fixation can be through a percutaneous technique. Undisplaced waist fractures were offered the choice of percutaneous fixation or cast treatment, and those opting for surgical management were included in the study. The advantage of percutaneous fracture fixation is minimal disruption to stabilising ligaments and carpal blood supply permitting faster rehabilitation.

Post-operative management in all acute fixation cases involved immediate gentle mobilisation, with a review at 2 weeks for wound evaluation and commencement of physiotherapy, and 6 weeks for X-ray evaluation.

2.2. *Chronic fracture non-union fixation*

Scaphoid non-union can lead to carpal instability dissociative and early osteoarthritis. Fixation is indicated to relieve pain, restore function and slow down the progression of osteoarthritis. Anatomical reduction restores scaphoid length and alignment and therefore restores carpal kinematics. Structural autologous bone graft aids restoration in length as well as providing osteoinductive and osteogenic potential. The additional use of vascularised bone graft was preferred in cases of avascular non-union or longstanding non-unions with adverse prognostic features. Post-operative immobilisation in plaster cast was continued for 6 weeks. Computed tomographic imaging was obtained if there was no evidence of union by 3 months on plain radiographic imaging.

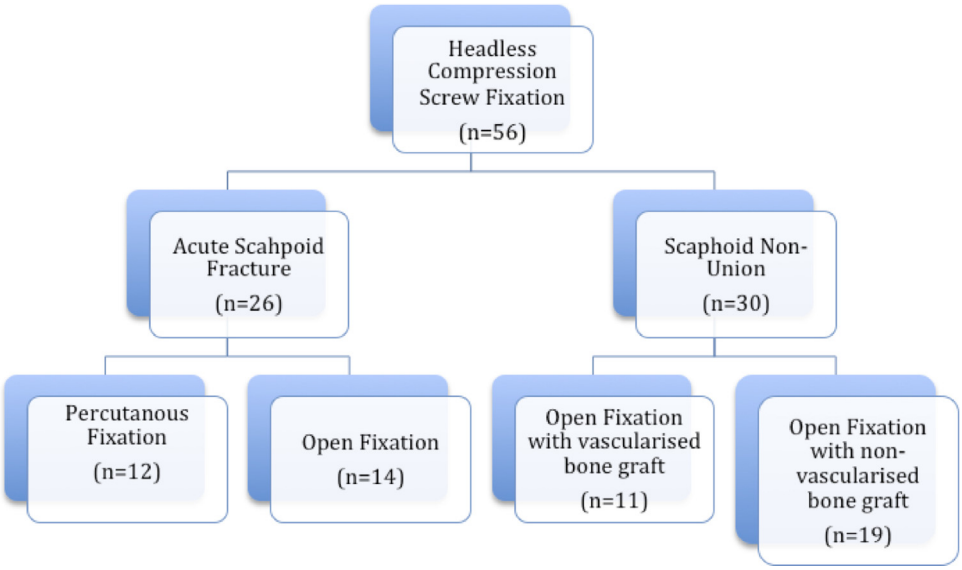

Fig. 1 – Patient groups.