Use of sutures as Kirschner wire and tension-band wire for olecranon fractures: a technical note

JF Henseler,1 P van der Zwaal,2 PDS Dijkstra1
1 Department of Orthopaedics, Leiden University Medical Center, Leiden, The Netherlands
2 Department of Orthopaedic Surgery and Trauma, Medical Center Haaglanden, Den Haag, The Netherlands

ABSTRACT

Open reduction and internal fixation using tension-band wires for displaced olecranon fractures enables restoration of extensor function. We report on 3 elderly patients with a displaced olecranon fracture who underwent open reduction and internal fixation using sutures as the Kirschner wire and tension-band wire and achieved good outcome.

Key words: elbow joint; olecranon process; sutures

INTRODUCTION

Olecranon fractures account for 10% of all fractures of the upper extremities.1 They are caused by direct impact on the elbow joint, abrupt triceps contraction, or falling on the extended arm combined with rotation of the trunk. Undisplaced olecranon fractures in elderly patients should be treated conservatively, whereas open reduction and internal fixation is necessary for displaced olecranon fractures to restore extensor function.2 The use of Kirschner wires and metal tension-band wires is recommended,3,4 but this is associated with complications such as infection, malunion/nonunion, hardware-related symptoms, and ulnar palsy.2,5,6 The proximal ends of the metal wires irritate the surrounding soft tissue. Hardware prominence secondary to migration causes implant cut-out.5 Displacement of the wires leads to protrusion and skin breakdown. Revision surgery or removal of the wires after consolidation may be necessary.6

This study reports the surgical technique for the use of sutures as the Kirschner wire and tension-band wire for displaced olecranon fractures (Fig. 1) in 3 elderly patients.

SURGICAL TECHNIQUE

Patients with displaced olecranon fractures (types 21A1 and 21B1 of the AO classification or type IIA of the Mayo classification) were placed in a supine position, with an axillary block over the lateral decubitus to reduce pulmonary complications. An
Incision was made through the standard dorsal approach, and the olecranon was exposed and initially reduced. Two 2-mm holes were drilled in the distal ulnar fragment as near to the ventral ulna as possible. Two other holes were drilled in the proximal fragment above the triceps insertion to avoid cutting the triceps insertion. A thick non-absorbable suture (no. 6 Ethibond; Ethicon, Somerville [NJ], USA) was used. Each end of the suture was passed through each distal drill hole into the intramedullary canal through the fracture site and retrieved from the proximal ulna above the triceps insertion (Fig. 2a). The fracture was then reduced anatomically, and the suture was tied firmly with a simple non-sliding knot (Fig. 2b). Two additional holes were drilled in the distal fragment similar to those for conventional cerclage wiring. Another suture was passed through the 2 additional drill holes and configured in a figure of 8 and tied lateral to the triceps insertion to compress the fracture, similar to polyester tension-band wiring7 (Fig. 2c). In case of cut-through of the triceps, a FiberTape suture8 (Arthrex, Naples [FL], USA) was used. FiberTape is a 2-mm wide and 18-cm long multi-stranded high-strength polyethylene suture highly resistant to tissue cut-through. The first suture acted as a Kirschner wire, and the second suture acted as a tension-band wire. The second suture converted the distraction force of the triceps brachii on the dorsal part of the fracture into compression force on the ventral part of the fracture.

Postoperatively, a compression bandage was applied for 2 weeks. Mobilisation of the elbow was recommended. Low load bearing was allowed as tolerated.

All 3 patients achieved bone union at week 12. No patient had failure of the suture, malreduction, displacement of the fracture, ulnar neuropathy, or infection. All patients achieved complete active extension of 0°, with the extension force being M4 in 2 patients. Their range of flexion was 120° to 130°, and their flexion force was M4. All 3 patients achieved full supination and pronation.

**Figure 1** Pre- and post-operative radiographs showing a displaced olecranon fracture (AO type 21B1) fixed with sutures used as the Kirschner wire and tension-band wire.

**Figure 2** (a) A non-absorbable suture is passed from the distal drill holes through the intramedullary canal to the proximal drill holes, and is tied above the triceps insertion. (b) After reduction of the olecranon fracture, the suture is tied firmly with a simple non-sliding knot. (c) Another suture is passed through 2 additional drill holes in the distal fragment and configured in a figure of 8 and tied lateral to the triceps insertion to compress the fracture.
DISCUSSION

The use of sutures as the Kirschner wire and tension-band wire for olecranon fractures enables stable fixation without the risk of implant cut-out, hardware-related symptoms, irritation of the surrounding soft tissues, and implant migration with secondary skin breakdown. This technique is preferably used in combination with regional anaesthesia (axillary block) to avoid side effects of general anaesthesia in elderly people.9

Fixation implants for olecranon fractures include pin, screw, plate, and tension-band wire.3,4 No immediate clinical and biomechanical difference was noted between the different fixation techniques.10,11 Displacement of the olecranon fracture may occur when the load is over 100 N.12 The use of multi-stranded high-strength polyethylene sutures is comparable with the use of tension-band wire for both olecranon and patellar fractures.8,13,14 Braided polyethylene sutures have less tissue reactivity and greater stiffness and tensile strength and are thus mechanically superior to other non-absorbable sutures.7 In our patients, no cut-through or weakness of the triceps was noted, nor malreduction or displacement of the fracture or weakness of the extensor secondary to malposition of the sutures.

Techniques using non-absorbable sutures for osteosynthesis of simple displaced olecranon fractures have been reported.7,8,13 In children with low demand on the arm, the use of sutures as the tension band wire for olecranon fractures enables quick bone union and excellent outcome and avoids the need for revision surgery.16 Nonetheless, suture cut-through of osteoporotic bone or tissue is difficult to detect owing to the radiolucency of the suture; thus, care must be taken if malreduction or displacement of the fracture develops after surgery.

CONCLUSION

In elderly patients, the use of non-absorbable high-strength polyethylene sutures as the Kirschner wire and tension-band wire for simple displaced olecranon fractures is an alternative to the conventional treatment using Kirschner wire and tension-band wire.

DISCLOSURE

No conflicts of interest were declared by the authors.

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