Ilizarov circular external fixator for open olecranon fractures—a report of 3 cases

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Case 1 (Figure 1)

A 27-year-old male banker who was a body-builder suffered fractures of the left olecranon, left proximal humerus and left distal radius in a motorcycle accident. The olecranon fracture was a Gustilo-Anderson grade IIIA open and Shatzker type D comminuted fracture with 4 major fragments (Gustilo and Anderson 1976, Goldstock et al. 1996). He had a two-part surgical neck fracture of the humerus and an intra-articular, grade I open and comminuted fracture of the distal radius. After irrigation and debridement, an open reduction of the olecranon fracture was performed and the fracture fragments were fixed with an Ilizarov circular external fixator. The soft-tissue coverage was satisfactory. Open reduction and internal fixation, with a Seidel nail for the proximal humerus fracture and closed reduction and external fixation for the distal radius fracture, were performed. Early flexion-extension exercises for the elbow and pendular exercises for the shoulder were started. The hospitalization time was 10 days. His wounds healed in 3 weeks, without complications. At the 4th week the wrist fixator was removed. At the 8th week, the Ilizarov fixator on the elbow was released and the fracture was tested for stability. Since this was our first experience, although the fracture was thought to be stable, fixation was resumed and continued for an additional 3 weeks. After removal of the fixator, no additional external support was needed. At the last examination in 1997, 6 years after the accident, he had 10° extension and 135° flexion at the elbow, and his supination and pronation were normal. He could continue body-building and radiographs showed good joint congruity.

Case 2 (Figure 2)

A 33-year-old male taxi driver had no major injury, but a fracture of his right olecranon, after a traffic accident. It was a grade II open and Shatzker type C fracture. After open wound care, the fracture fragments were reduced by using C-clamps and fixated with an Ilizarov circular external fixator. The fixator was removed after 8 weeks. At the last examination, in 1997, 6 years after the accident, his elbow motion was 15°–115° extension and flexion. There was less then 5° restriction in supination. He occasionally had mild elbow pain and avoided heavy lifting. Radiographs showed a less than 2 mm step-off in the joint surface at the olecranon.

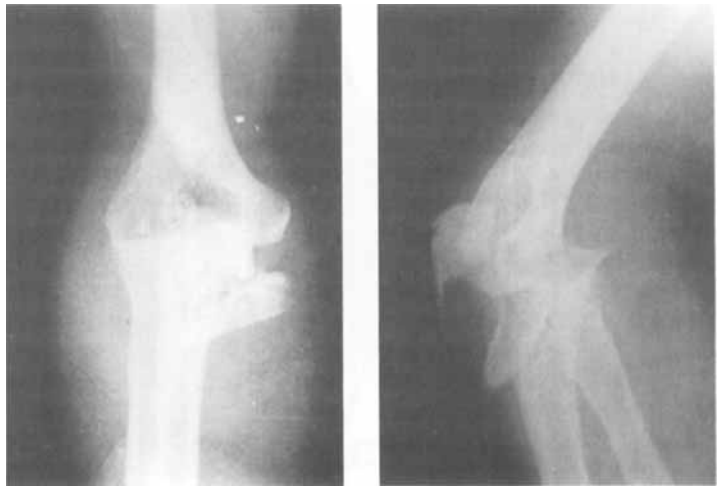
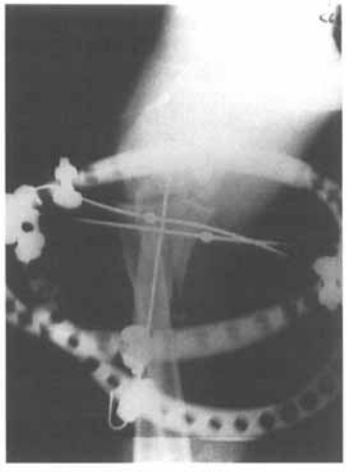
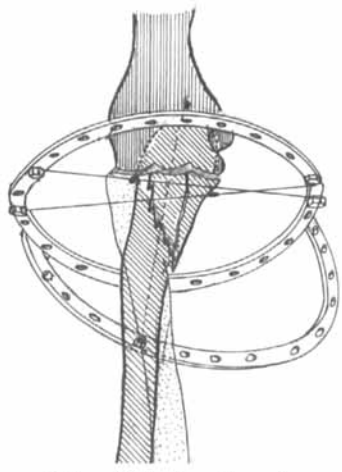


Figure 1. Case 1. Comminuted (Shatzker type D) and open (Gustilo-Anderson Grade III-A) fracture of the left olecranon.



Case 1. Olecranon fixation was done by using 2 olive wires perpendicular to the ulnar axis and one cut-end olive wire parallel to the ulnar axis.



Schematic drawing of case 1.

Case 1. Flexion at 4 weeks.

At 6-year follow-up

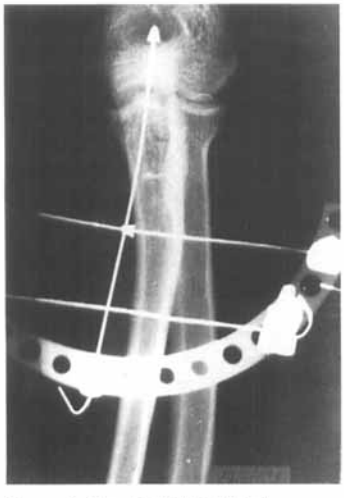
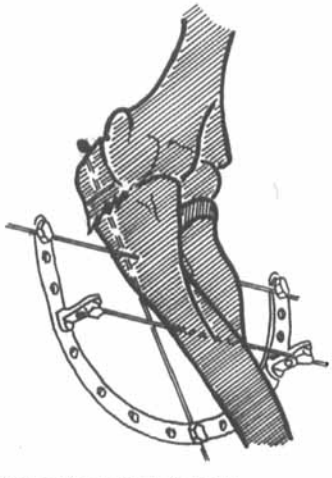


Figure 2. Case 2 postoperatively.



Schematic drawing of case 2.

Function of case 2 after 4 weeks.

Case 3

A 41-year-old male farmer had a severe traffic accident with a Grade II open and Shatzker type C right olecranon fracture, a 4-part fracture of his right proximal humerus, a right acetabulum posterior lip comminuted fracture with posterior dislocation of the femoral head and an AO type IV fracture of his right tibial plateau. Because of intra-abdominal bleeding, he was operated on by general surgeons. During this operation, his elbow wound was closed primarily. When his general condition had normalized 5 days after the accident, he was operated on for his orthopedic injuries. Open reduction and Ilizarov external fixation were applied for the olecranon fracture. The wounds healed without problems. After 9 weeks, his external fixator was removed. At the last follow-up, 4.5 years after the accident, his elbow motion was 15°–110° extension and flexion. He had 10° restriction in supination and 5° in pronation. On lateral radiographs there was a 2-mm step-off of the joint surface. He had pain during vigorous activities, without restriction of his daily life.

Operative technique

Operations were performed under regional (cases 1 and 2) and general (case 3) anesthesia, with pneumatic tourniquet control. After debridement and irrigation, the fracture fragments were reduced by using C-clamps. All operations were performed under fluoroscopic control. In case 1, because of fragmentation of the fracture, 2 olive wires at right angles to the ulnar axis were placed at the olecranon and fixed on a full ring placed around the elbow, to provide interfragmentary compression to the horizontal fracture line. Another cut-end olive wire was passed from the tip of the olecranon at right angles to other wires and fixed on a half ring and all the wires were tensed (Figure 1). In cases 2 and 3, two parallel 1.5 mm wires were placed at the proximal third of the ulna, at right angles to the ulnar axis 3 cm apart and 3 cm from the fracture line. They were fixed on a half ring and tensed. A third olive wire was passed from the tip of the olecranon through other fragments at approximately 90° to the fracture line and fixed at the central part of the half ring (Figure 2). The distal end of the wire was cut from the end of the olive and the wire was tensed manually until there was no movement at the fracture line. Rotatory stability was satisfactory and no additional wires were used. Soft tissues were closed primarily. The fixators were removed under local and sedation anesthesia.

Discussion

Operative treatment is necessary for displaced fractures of the olecranon to restore the articular surface and allow for rapid mobilization, thus preventing loss of motion and muscle wasting (Müller et al. 1991). Cerclage alone, cerclage plus wires or screw, screw alone and plates are the most frequently used techniques and the outcome is usually good (Weseley et al. 1976, Kiviluoto and Santavirta 1978, Murphy et al. 1987a,b, Wolfgang et al. 1987, Hotchkiss and Green 1991, Larsen and Jensen 1991, Hume and Wiss 1992, Rowland and Burkhart 1992, Morrey 1995, Goldstock et al. 1996, King et al 1996).

The tension band osteosynthesis with 2 parallel medullary K-wires and a figure of 8 cerclage wire, which was developed by the AO-group, is based on the idea of converting the tensile forces into compressive ones (Müller et al. 1991). Complications such as wire protrusion, skin breakdown at the proximal ends of protruding K-wires, pain at the implantation site and prominent K-wires may occur (Macko and Szabo 1985, Murphy et al. 1987b, Wolfgang et al. 1987, Hume and Wiss 1992, Rowland and Burkhart 1992). Symptomatic prominence of the Kirschner wires, being the commonest problem, has been noted in up to 80% (Murphy et al. 1987b). Various modifications of this technique have been reported to give better results (Larsen and Jensen 1991, Rowland and Burkhart 1992, Kozin et al. 1996, Paremain et al. 1997).

Various techniques have been developed to reduce the complications related to this type of implantation. Screw plus wire fixation gave better results in transverse fractures, but screw breakage, splintering of the proximal olecranon fragment by the screw and the need for a second operation for the implant removal were the main problems (Kiviluoto and Santavirta 1978, Murphy et al. 1987a,b). Plate fixation was popularized, especially for comminuted fractures (Weseley et al. 1976, Fyfe at al. 1985, Hume and Wiss 1992, Teasdall et al. 1993, King et al. 1996). The thin soft-tissue coverage around the elbow joint and the defective blood supply of the open fractures increase the infection risk and restricts its use, especially when heavy implantation is needed.

There are only a few reports in the literature about the use of fixation-distraction devices for comminuted olecranon fractures and nonunions (Papagelopoulos and Morrey 1994, Morrey 1995). We found no reports on Ilizarov treatment of olecranon fractures, but only a brief explanation in Ilizarov's book (1992).

The Ilizarov technique for open joint injuries allows early motion and weight bearing, without using hardware (Ilizarov 1992). There is no need for an ad-

ditional soft tissue stripping for the placement of large implants. The mechanism of action of Ilizarov's circular external fixator in olecranon fractures is similar to that of tension-band osteosynthesis since there are two groups of wires perpendicular to each other, compressing the fracture site during active elbow motion. The use of three 1.5 mm K-wires has the advantage of being the least invasive osteosynthesis method. Another advantage of this method is that the wires can be removed under local anesthesia, with minimal soft tissue injury. With this technique, we had a good outcome in our 3 patients.

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The crowded wrist—a case with accessory carpal bones

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An 18-year-old student had felt pain for 3 weeks in her dominant right wrist, localized to the midcarpal area. The onset was gradual and she reported no previous injury.

The right wrist had 20 degrees less flexion-extension movements than the left side (Günal et al. 1996). The patient had some pain at the extremes of range of motion and tenderness over the dorsal midcarpal area.

Anteroposterior radiographs of both wrists showed bilaterally separated ulnar styloid processes (accessory os ulnostyloideum). Careful examination of the radiographs revealed two other accessory carpal bones: os Gruber, between the capitate, hamate, and the third and fourth metacarpals, and os styloideum, which is associated with a well developed third metacarpal styloid process, between the trapezoid, capitate, and the