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# Tension-band wiring of olecranon fractures with nonsliding pins

## Report of 20 cases

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**Twenty consecutive patients with displaced fractures of the olecranon were operated on using the tension-band wiring technique with a nonsliding pin. The patients were followed until clinical and radiographic healing or removal of the implant. Healing was uneventful in 19 patients after a median of 6 weeks. Redislocation occurred in 1 patient with a severely comminuted fracture. The design of the nonsliding pin eliminates outward pin migration, as well as migration into the medullary canal.**

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To eliminate pin migration after tension-band wiring of fractures of the olecranon, Netz and Strömberg (1982) designed a nonsliding pin that, in many cases, made the secondary removal of the device unnecessary. We have used the Netz pins (Larsen and Lyndrup 1987), but found some minor disadvantages. To improve these, a modified nonsliding pin was designed.

We report our results of this new technique.

## Patients and methods

Twenty consecutive patients—14 women and 6 men, who were operated on for olecranon fractures—were included. The median age was 64 (19–83) years. All the patients were operated on within the first 3 days after injury. The type of fracture was classified according to Murphy et al. (1987). The displaced fractures were transverse in 9 cases; transverse with one or two minor bone fragments in 5 cases; oblique, i.e., 25° or more, in 4 cases; and comminuted in 2 cases. The assessment of the operative reposition and position of the osteosynthetic device was evaluated on lateral radiographs the day after the operation and at the time of healing.

The patients were followed until radiographic healing or removal of the device 16 (5–26) weeks after the operation. Accompanying fractures present in 3 patients (proximal femur, ipsilateral humeral epicondyle, and femoral shaft) did not influence the healing time.

The modified nonsliding pin is made of stainless steel (W 14310-AISI 302), and its diameter is 2.0 mm above and 1.6 mm below the head (Figure 1). The head is flat, 2.5 mm wide, with an anchoring hole of 1.2-mm diameter, which is suitable for a 1.0-mm cerclage wire. This design facilitates the paralleling of the pins and eliminates the risk of sinkage of the pin into the bone. The point is lancet-shaped, smaller than the head, and the proximal part of the pin is preprepared for being cut off. The design of the point and the diameter of the pin reduces the risk of further fragmentation of small bony fragments. The pin is available in four lengths from 60 to 120 mm.

At operation, the fracture and joint are exposed through a posterolateral approach. The joint is cleaned, and the fracture is reduced and retained by a bone clamp. Two pins are drilled parallel to the diaphyseal axis of the ulna, but at this stage are left to protrude 0.5 to 1 cm from the bone. The holes are aligned to facilitate the insertion of the cerclage wire. A 2.0-mm hole is drilled perpendicular to the long axis of the ulna and 3 to 4 cm distal to the fracture. A 1-mm cerclage wire is inserted through the holes in the pin heads, and a similar wire is inserted through the hole in the ulna. The pins are impacted into the bone until stopped by the pin heads and cerclage wire. Further compression of the fracture is achieved by twisting the ends of the wires, making sure that equal tension is attained on both sides. The figure-of-eight technique is recommended (Figure 2). The loop ends are bent and countersunk to avoid nerve and skin affections, and the proximal part of the pins are cut off. Depending on the achieved stability, a *nonrigid bandage* is normally recommended, and active movements are encouraged after edema has disappeared (Netz and Strömberg 1982).

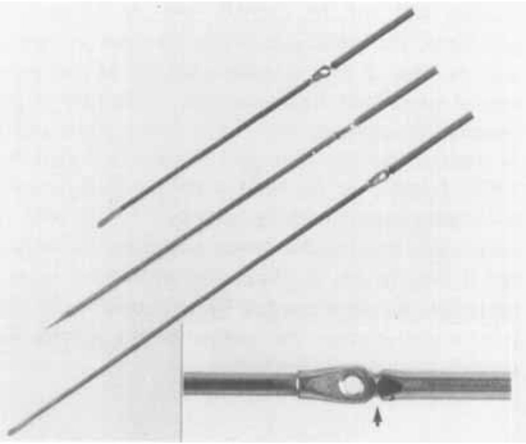

Figure 1. The modified nonsliding pin; magnification of the head is inserted. The arrow points to the notch, preprepared for cutting off.

Figure 2. Transverse fracture of the olecranon after osteosynthesis with two nonsliding pins and a cerclage-of-eight wire.

Table 1. Presentation of patients, type of fractures, and results of treatment

| No. | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | M | 61 | 1 | 5 | 0 | 2 | 0 | 0 | 10 | 1 |
| 2 | F | 48 | 3 | 17 | 2–3 | 1 | 4 | >20 | <20 | 8 |
| 3 | F | 19 | 1 | 11 | 1–2 | 1 | 0 | 0 | 0 | 6 |
| 4 | M | 27 | 2 | 16 | 0 | 2 | 0 | 5 | 0 | 2 |
| 5 | F | 73 | 1 | 16 | 0 | 1 | 0 | <20 | 0 | 4 |
| 6 | F | 78 | 3 | 19 | 1–2 | 2 | 0 | 10 | 0 | 7 |
| 7 | F | 68 | 2 | 13 | 0 | 2 | 0 | 0 | 0 | 1 |
| 8 | F | 77 | 1 | 23 | 0 | 1 | 0 | >20 | 0 | 6 |
| 9 | F | 71 | 2 | 13 | 0 | 1 | 0 | 0 | 0 | 1 |
| 10 | M | 74 | 1 | 17 | 0 | 1 | 0 | 0 | 0 | 3 |
| 11 | F | 74 | 1 | 25 | 1–2 | 2 | 0 | <20 | 0 | 4 |
| 12 | M | 30 | 1 | 13 | 0 | 2 | 0 | 10 | 0 | 5 |
| 13 | F | 35 | 1 | 26 | 0 | 2 | 0 | 0 | 0 | 3 |
| 14 | F | 47 | 1 | 14 | 0 | 2 | 0 | 0 | 0 | 5 |
| 15 | F | 69 | 2 | 26 | 0 | 2 | 0 | 5 | 0 | 4 |
| 16 | F | 66 | 1 | 7 | 1–2 | 2 | 0 | 10 | 0 | 1 |
| 17 | F | 42 | 1 | 6 | 0 | 2 | 0 | 10 | 0 | 1 |
| 18 | F | 83 | 1 | 14 | 1–2 | 2 | 0 | 5 | 0 | 4 |
| 19 | M | 62 | 1 | 25 | 0 | 1 | 0 | 0 | 0 | 3 |
| 20 | M | 26 | 1 | 22 | 1–2 | 1 | 0 | 5 | <20 | 6 |

A Sex
B Age
C Type of fracture
  1 transverse
  2 oblique
  3 comminuted
D Follow-up time in weeks
E Fracture dislocation in millimeters the day after the operation
F Plaster cast after operation: 1 yes, 2 no
G Fracture redislocation in millimeters at follow-up
H Restriction of extension/flexion in degrees
I Restriction of supination/pronation in degrees
J Reason for removal of the device
  1 not removed
  2 young age
  3 routine
  4 pain upon pressure to elbow and pins
  5 skin compression by the cerclage wire
  6 pain unrelated to the device
  7 calcification around a pin
  8 fracture dislocation

In our material, 7 patients were immobilized with a plaster cast for 2 or 3 weeks, 1 patient with a comminuted fracture was immobilized for 4 weeks, and the remaining patients began active movement of the elbow the day after the operation.

## Results

Excluding 1 patient with a comminuted fracture, the median healing time was 6 (5–18) weeks and was independent of fracture type (Table 1). A severely comminuted fracture was not well reduced, and further dislocation occurred resulting in a second operation with a plate. Radiographs the day after operation showed anatomic reduction in 13 patients, a dislocation between 1 and 2 mm in 6 patients, and more than 2 mm in the comminuted fracture. No deterioration of the achieved reduction occurred in any of the other patients. At follow-up, flexion and extension were normal in 8 patients, restricted up to 20° in 10 patients, and more than 20° in 2 patients—1 with the comminuted fracture and the other with an additional humeral epicondyle fracture. The range of supination and pronation was normal in 17 patients and restricted up to 20° in 3 patients. Only 1 patient without anatomic reposition had unrestricted movements. The short immobilization time used in a few patients did not affect the range of movement.

In Case 18 the cerclage wire broke at the loop, but without pin migration or fracture redislocation. The metallic device was removed in 15 cases and left in situ in 5 cases. The reasons for removal were routine in 3 cases; pain upon pressure to the elbow and related to the pins in 4 cases, of which the pins had been incompletely compacted in 2; insufficient bending and sinkage of the cerclage wire with skin compression but no perforation in 2 cases; pain of unrelated causes in 3 cases: viz., calcification around a pin in 1 case, young age in 1 case, and fracture dislocation in 1 case (mentioned above). In 1 case a superficial infection was contracted after the removal of the device.

## Discussion

In transverse or oblique olecranon fractures, the tension-band wiring technique allows exact reduction, gives good stabilization (Fyfe et al. 1985), and early active movements may be allowed. Exact fracture reduction is of major importance to regain full range of motion. Using the conventional method with Kirschner and cerclage wires, the variance in the tension of the cerclage wire may result in reduced stability of the Kirschner pins, with the risk of pin migration. Thus, a rather high migration frequency (20–45 percent) of the Kirschner pins has been reported (Macko and Szabo 1985, Jensen and Olsen 1986, Larsen and Lyndrup 1987). Even when the ends of the Kirschner wires are bent, outward migration may occur when active movements are started owing of the rounded ends of the wires (Jensen and Olsen 1986). By passing the cerclage wire through the heads of the nonsliding pins, the compression force on the fracture will still be exerted, and pin slippage is prevented. The small size of the tip when compared with the head of the pin reduces the risk of comminution of small bone fragments and, in the case of pin removal, of migration into the medullary ulnar canal, as reported for the Netz pins (Larsen and Lyndrup 1987). Further, the flat head of the pin facilitates the positioning before threading with the cerclage wire. In many cases the metallic device causes no discomfort, and it may be left in place, thus avoiding a second operation. As demonstrated by our patient with the redislocated fracture, the method is not suitable for severely comminuted fractures.

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