On-line Case Report

Extensor tendon injury to the index and middle finger secondary to Kirschner wire insertion for a distal radial fracture

SAYYIED JAMSHEAD KIRMANI, SHAHEEL BHUVA, WILLIAM LO, AJEET KUMAR

Department of Orthopaedics, Queen Elizabeth Hospital, Woolwich, London, UK

ABSTRACT

We describe a case with the highly unusual complication of attritional ruptures to both the extensor tendons to the index and middle finger following Kirschner wire placements for a distal radial fracture. This particular complication has never been previously described in the literature. We also review the literature, identifying certain techniques in the management of distal radial fractures with Kirschner wires which are considered to increase the risk of tendonous or neurovascular injury. Finally, recommendations are made that should reduce the complications of iatrogenic soft tissue injury associated with this very common procedure.

Keywords: Extensor tendon – Attritional rupture – Kirschner wire – Iatrogenic – Distal radial fracture

Distal radial fractures are extremely common. Percutaneous pinning, often with Kirschner wires of various diameters, is the usual form of treatment for extra-articular or even simple intra-articular distal radial fractures.¹ The following case report highlights a rare complication with this procedure.

Case report

An 82-year-old woman sustained a comminuted closed extra-articular distal radius fracture to her right dominant wrist when she fell onto her outstretched hand.

She underwent a manipulation under anaesthesia and Kirschner (K-) wire fixation of the fracture. Through a skin stab incisions, soft tissues were bluntly dissected away and protected by the aid of a sleeve. Thereafter,

three 1.6-mm K-wires were inserted. The first wire was introduced into the radial styloid, producing a trans-fragmentary fixation. The two remaining wires were introduced through the dorsal aspect of the wrist and utilised a Kapandji technique. One was placed in the region of the sub-scaphoid fossa of the distal radius, and the other in the region of the sub-lunate fossa. The wires were subsequently bent, cut and left protruding from the skin. Intra-operative imaging confirmed a stable fixation when passive movements of the wrist were carried out. Towards the end of the operation, the surgeon checked that the patient had a full range of passive movements of the fingers and thumb, to ensure there was no tethering of the tendons. Finally, a backslab, which still permitted a full range of movement for the fingers, was applied and soon thereafter the patient was sent home.

Correspondence to: SJ Kirmani, 7 Atkins Road, Balham, London SW12 0AA, UK

E: ymmij26@hotmail.com

Figure 1 Demonstrable extensor lags for the index and middle finger.

Two weeks postoperative check-up revealed no signs of pin tract infections, no neurovascular injury, and the patient had full range of active assisted movements of her digits.

Four weeks postoperatively, the cast and K-wires were removed. Unfortunately, it was noted that she was unable to extend her index finger at the metacarpophalangeal (MCP) joint, and that the extensor tendons to this finger were not palpable over the dorsum of the hand. Furthermore, the extensor tendon to the middle finger

was not palpable. There was a weakness in extending the middle finger MCP joint, and there remained a lag of 20° at the MCP joint of this finger in its fully extended position. However, collateral bands from the extensor hood of the adjacent ring finger were palpable and intact and it was felt their action allowed a residual degree of extensor activity in this finger. These signs indicated that the K-wires had caused an attritional rupture to the extensor tendons of the index and middle finger (Fig. 1).

The patient was taken back to theatre where a complete rupture of the extensor indicis proprius and extensor digitorum communis slip to the index finger, as well as the slip of the extensor digitorum communis to the middle finger was found (Fig. 2).

It was not possible to retrieve the proximal ends of these ruptured tendons, and so their distal ends were attached to the remaining intact extensor digitorum communis slips to the ring and little finger. Post-operatively, the hand was placed in a splint which held the fingers out in extension for a further 4 weeks. Thereafter, physiotherapy was commenced.

Three months following the second operative intervention, the patient displayed good functional ability. She was able to extend all her fingers fully, with only a 5° extensor lag remaining at the MCP joint of the index finger.

Figure 2 Ruptured extensor tendons to the index and middle finger.

Discussion

Recognised complications of K-wiring at any anatomical site include pin track infections, loosening of the K-wire placement, and K-wire migration.²

Specific complications of K-wiring distal radial fractures are often associated with soft tissue injury. Wires may cause damage by either piercing or abutting structures which, in turn, potentially leads to attritional extensor tendon ruptures or disabling neuritis.

Nonnenmacher *et al.*³ examined 350 cases and found tendon ruptures in two cases and tendonitis in five cases. They felt this to be secondary to friction of the tendons against the K-wires. Milliez *et al.*⁴ found complications of wire migration and tendon rupture in a group of patients that were mobilised soon after pinning, while the wires were still *in situ*. This suggests early mobilisation of the wrist with pins in place, while its intention is to prevent stiffness, increases the likelihood of tendon rupture. Dowdy *et al.*⁵ suggested that when K-wires are cut beneath the skin, which is performed to reduce the risk of pin-site infections, there is an increased risk of tendon attrition by the cut/sharp end of the wire.

Traditionally, wires are placed through certain 'safe zones' where it is felt soft tissue injury can be kept to a minimum. One such 'safe zone' is the anatomical snuff box, where the wire used to correct radial inclination and height is often placed. In this area, the bony landmark of the radial styloid is often utilised as the entry point. Nevertheless, numerous cadaveric studies have shown a risk to the superficial radial nerve or its branches at this entry point.^{6,7} Steinberg *et al.*⁶ quote a risk of around 20% to this nerve and Glanvill *et al.*⁷ a risk of around 12%.

Over the dorsal aspect of the distal radius, another 'safe zone' is felt to be just proximal and radial to the dorsally placed Lister's tubercle. This is in order to avoid the extensor pollicis longus tendon as it passes against the ulna aspect of the tubercle, as it is the most frequently quoted tendon injured in this approach.⁸ In this region, the wire is often used to correct the dorsal tilt of the injury. Hochwald *et al.*,⁹ in a cadaveric study, reported that pins placed via this dorsal approach injured extensor tendons in 41% of cases if they were placed percutaneously, and in 5% of cases if they were placed through a limited open approach.

One final consideration is the use of a third K-wire in order to aid fixation. The third wire is often introduced over the dorsal aspect of the wrist, in the region of the medial/ulna aspect of the distal radius, the 'intermediate column'. The purpose of this wire is to stabilise further the fixation correcting the dorsal tilt, particularly if there is an intra-articular component to the fracture causing a depression to the sub lunate fossa of the distal radius, and so creating a step deformity in the articular surface. Unfortunately, there is no defined 'safe area' for the placement of this wire, and so

placement is dependent on intra-operative imaging. Furthermore, there is nothing in the literature quantifying the risks to the extensor tendons for the placement of wires in this region. However, it seems reasonable that, during the placement of this wire, the tendons of the extensor digitorum communis and extensor carpi ulnaris are at risk.

Conclusions

Iatrogenic injury to both the extensor mechanism to the index and middle finger by Kirschner wire placement has not been previously described in the literature. The following suggestions should help keep complications to a minimum:

1. If possible, identify any bony landmarks, and utilise intra-operative imaging when establishing the ideal location for K-wire insertion, and hence skin incision locations.
2. Place wires through a limited open skin incision, as opposed to percutaneously.
3. Bluntly dissect down to bone, and utilise tissue protectors.
4. Ensure the non-threaded K-wire is on the bone before drilling.
5. Avoid multiple attempts at wire placement for a particular location.
6. Once a wire is in place, passively mobilise the wrist and finger to ensure no tendon has been pierced.
7. Leave wires protruding out of the skin.
8. Postoperatively, prevent wrist movements with the use of a splint, and allow passive exercises only for the fingers, until the K-wires are removed, to reduce the risk of attritional ruptures.

References

1. Rayhack JM. The history and evolution of percutaneous pinning of displaced distal radius fractures. *Orthop Clin North Am* 1993; **24**: 287–300.
2. Goodsett J, Pahl A, Glaspy J, Schapira M. Kirschner wire embolisation to the heart. *Chest* 1999; **115**: 291–3.
3. Nonnenmacher J, Kempf I. Dynamic fixation of fractures of the lower end of the radius by percutaneous wires. *Int Orthop* 1988; **12**: 155.
4. Milliez PY, Dallaserra M, Defives T *et al.* Effect of early mobilization following Kapandji's method of intrafocal wiring in fractures of the distal end of the radius: results of a prospective study of 60 cases. *Int Orthop* 1992; **16**: 39.
5. Dowdy PA, Patterson SD, King GJW, Roth JH, Chess D. Intrafocal (Kapandji) pinning of unstable distal radius fractures: a preliminary report. *J Trauma* 1996; **40**: 194–8.
6. Steinberg BD, Plancher KD, Idler RS. Percutaneous Kirschner wire fixation through the snuff box: an anatomic study. *J Hand Surg Am* 1995; **20**: 57–62.
7. Glanvill R, Boon JM, Birkholtz F, Meiring JH, Van Schoor AN, Greyling L. Superficial radial nerve injury during standard K-wire fixation of uncomplicated distal radial fractures. *Orthopedics* 2006; **29**: 639–41.
8. Wong-Chung J, Quinlan W. Rupture of extensor pollicis longus following fixation of a distal radius fracture. *Injury* 1989; **20**: 375–6.
9. Hochwald NL, Levine R, Tornetta P. The risks of Kirschner wire placement in the distal radius: a comparison of techniques. *J Hand Surg Am* 1997; **22**: 580–4.