Minimally Invasive Plate Fixation of the Distal Radius

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Objectives

Displaced distal radial fractures are commonly internally fixed with a volar locking plate using a moderate sized incision with pronator quadratus raised at its radial insertion.

Minimally invasive techniques have evolved using a smaller incision and sparing pronator quadratus by sliding the plate under the muscle thus reducing soft tissue damage.

This study documents a consecutive series of minimally invasive distal radius volar plate fixation. Following fixation, patients underwent hand therapy and were provided with a thermoplastic splint for use as much or a little as the patient felt required.

Patient demographics, fracture morphology and reduction, post-operative grips strength, VAS pain, and DASH scores were collected.

Methods

The fracture is provisionally reduced closed, then a 15 mm incision is made 15-20 mm proximal to the proximal wrist crease, just radial to the flexor carpi radialis (FCR) tendon. The FCR sheath is incised to reveal the pronator quadratus (PQ) muscle and flexor tendons.

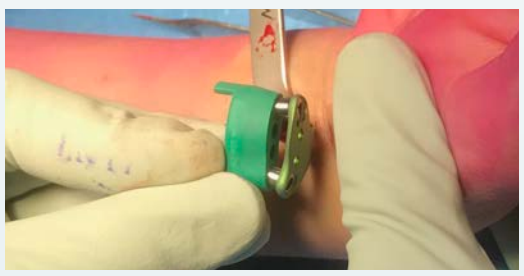
The PQ tendon is incised distally. The fracture is reduced using indirect and direct reduction techniques. The plate is slid under the muscle using a minimally invasive jig and secured with K-wires.

Fluoroscopy confirms implant and fracture position which can be adjusted as required. Distal plate position needs to consider the proximal plate position. The central distal screws are placed then the jig removed and the remaining distal screws are placed.

The proximal aspect of the plate is fixed onto the shaft of the radius using the non-locking oblique incision just under the surface of the PQ muscle, ensuring the extra-articular portion of the fracture is accurately reduced and check fluoroscopy images taken.

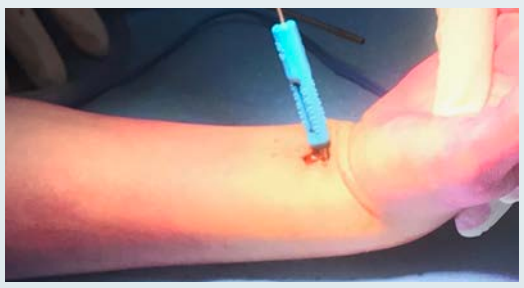
Via tiny puncture incisions on the surface of the PQ, the most proximal locking screws are inserted leaving the PQ relatively uninjured and final fluoroscopy images recorded.

Sub-PQ dissection to allow for plate

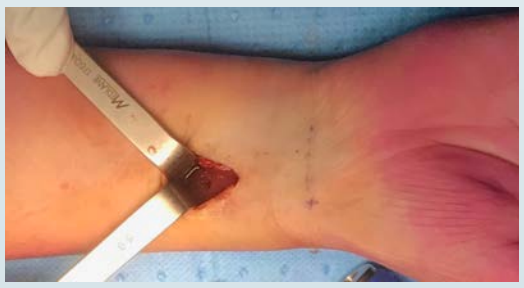


Sliding plate under PQ with assistance of jig

Drilling for distal screws via jig which has been secured with K-wires



Placing proximal locking screw following complete fracture reduction



Relatively un-injured appearance of PQ post-fixation

Results

In this series, 25 minimally invasive distal radial fixations occurred with prospective measurement of patient outcomes.

There were 16 females and 9 males with a mean age of 45. Minimum follow-up was 12 months. 14 injuries were left sided (all non-dominant) and 11 right handed (all dominant). 13 of the injuries were extra-articular and 12 intra-articular.

Reduction was on average anatomical with a mean radial inclination post-operatively of 21 degrees and volar tilt of 10 degrees.

At six weeks, the average grip strength was 55% of the contralateral side and at 12 weeks it was 70%. Mean incision length was 16 mm and mean tourniquet time 47 minutes (range 34-82 minutes).

One patient ruptured extensor pollicis longus post-operatively with a well reduced fracture and no protruding dorsal metalwork, requiring tendon transfer. Three other patients had their plates removed due to patient preference. No other complications were noted.

Patients were mobilised immediately post-surgery but had a splint which they could wear if and when they wished to.

8 weeks post-operative

Conclusion

The minimally invasive volar plate internal fixation technique is a relatively straightforward technique with good results.

There is a learning curve to the technique and it is sensible to commence with slightly longer incision length and reduce over time to a more minimal incision.

The author has subjectively observed less post-operative discomfort and a more rapid recovery of function following this minimally invasive technique compared to a more conventional open reduction and internal fixation with a standard incision length and raising and repairing PQ.

A formal prospective randomised study comparing standard versus minimally invasive PQ sparing surgery would provide an objective assessment of the relative benefits and dis-advantages of each type of surgery.

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Altered incision placement to minimize tattoo disruption