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TECHNIQUE

Minimally Invasive Intramedullary Rod Fixation of Multiple Metacarpal Shaft Fractures

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ABSTRACT

Metacarpal shaft fractures tend to shorten and angulate. This tendency is accentuated with the fracture of multiple metacarpals. A variety of methods for treatment have been described. The purpose of this study is to present the results of treatment in patients with multiple metacarpal shaft fractures, treated in a minimally invasive manner, with an intramedullary rod device.

Keywords: metacarpal fracture, intramedullary rod fixation, minimally invasive surgery

The potential deformities of metacarpal shaft fractures are shortening, dorsal angulation, and malrotation. Of these, dorsal angulation is the most significant and deforming. These tendencies all become accentuated when more than one metacarpal is involved. Multiple fractures represent only about 0.6% of upper extremity fractures.[1] Many single metacarpal fractures can be treated nonoperatively. When several metacarpals are fractured, there is a greater potential for deformity. These injuries are usually treated by surgical stabilization.[2] Most methods of internal fixation involve fracture exposure, moderately extensive surgical incisions, and manipulation of the extensor tendons and the intrinsic muscles. Postoperative stiffness, unattractive scars, and prolonged rehabilitation are frequent consequences of open treatment.[3]

Orbay and Touhami[4] introduced an intramedullary device for fixation of small bone fractures (Hand Innovations, Miami, Fla). The principal advantage of this device is that it can be used as a minimally invasive technique. This article demonstrates that minimally invasive fixation in conjunction with early motion can lead to results as good as, or superior to, other techniques.[5,6]

INDICATIONS/CONTRAINDICATIONS

The best candidates for this technique are simple transverse fractures or slightly oblique fractures. I do not recommend this method for long spiral oblique or highly comminuted fractures. In the ring metacarpal, one should check to be sure that there is, in fact, a medullary canal. There is an occasional ring metacarpal without one, and clearly, that prohibits the passage of an intramedullary device.

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Using a mini C-arm fluoroscopic machine and an 18-gauge hypodermic needle, locate the introduction site on the proximal end of the fractured metacarpal. Make a small 0.5-cm incision with a sharp narrow awl, and penetrate the proximal side cortex of the metacarpal shaft. This should be very near the proximal articular surface, but not through the joint surface. The manufacturer provides an awl with these devices, but I prefer a narrower, sharper, almost ice-pick–thin awl (item no. 275–563 bone awl; Jarit-Integra). I find such an instrument easier to control, and it permits easier penetration into the cortex. Once the awl is in the medullary canal as seen on the fluoroscope, the awl is removed and the rod introduced.

These rods are provided, mounted on a handle. They are flexible and easily contoured. Using fluoroscopy, the tip of the rod is advanced across the fracture line into the distal end of the metacarpal shaft. The rod is introduced and advanced by a twisting motion. However, excessive force can also easily bend the rod. It is wise to have backup rods available. Usually, 1 rod per metacarpal is sufficient. However, if there is some displacement or rotational tendency, a second rod can be introduced. One can use the same point of introduction and by rotating the rod achieve separation of the tips of the rod. Alternatively, you can introduce a second rod, if needed, from the opposite cortex, through a different entrance portal. The manufacturer supplies a locking device, which I have used only once and no longer utilize.

The locking device is a small tube with a spike on its leading end. The tube is slipped over the end of the rod after the handle has been cut off and the rod bent. Orbay and Touhami[4] use it to catch the near cortex to supplement fixation. I found it difficult to use and too prominent below the skin. I do not feel it adds enough to the fixation to justify the problems with its use.

Once the rod is placed in the various metacarpals, the handle is cut off. The rod is bent over about 70 to 90 degrees and cut short, below the skin, with a medium pin cutter. One can either cut the rod short well below the skin, or, by using a needle holder, the rod end can be rotated, bent, and then rotated back to the original position away from the extensor tendons. If doing the latter, one should preplan the final location of the distal end of the rod, so as not to create any deformity.

Because longitudinal rods provide only moderately fair rotational stability, I always use buddy taping of adjacent digits, for supplemental control.

Although the radiographic appearance of the these devices is similar to those of Kirschner wires, the flexibility and handling characteristics are quite different. I find them more flexible and easier to mold. The affixed handle makes manual insertion practical. There is no similar way to insert a Kirschner wire. These observations, although difficult to quantify, are readily felt by the surgeon.

■ REHABILITATION

Active motion exercises should be started at the earliest opportunity, certainly within the first week after surgery. No postsurgical splints were used in this group.

■ CLINICAL RESULTS

This is a series of 11 patients with multiple metacarpal shaft fractures. I retrospectively reviewed my results in these 11 patients. There were also 3 patients whose injury required both the use of rods on 2 metacarpals and other surgical techniques on other metacarpals. These 3 cases are not included in the reported series.

The average follow-up time was 129 days. The average time to rod removal was 93 days. Six patients had essentially no stiffness at the first postoperative visit, at 1 week. The ability to touch the fingers to the midpalmar crease and 80 degrees of metacarpal flexion was taken as the absence of stiffness. Two patients had some stiffness, which was resolved by the 1-month postoperative visit. Three patients were somewhat stiff for more than 1 month, averaging 76 days. Ultimately, the stiffness did resolve in all patients. None of the patients demonstrated

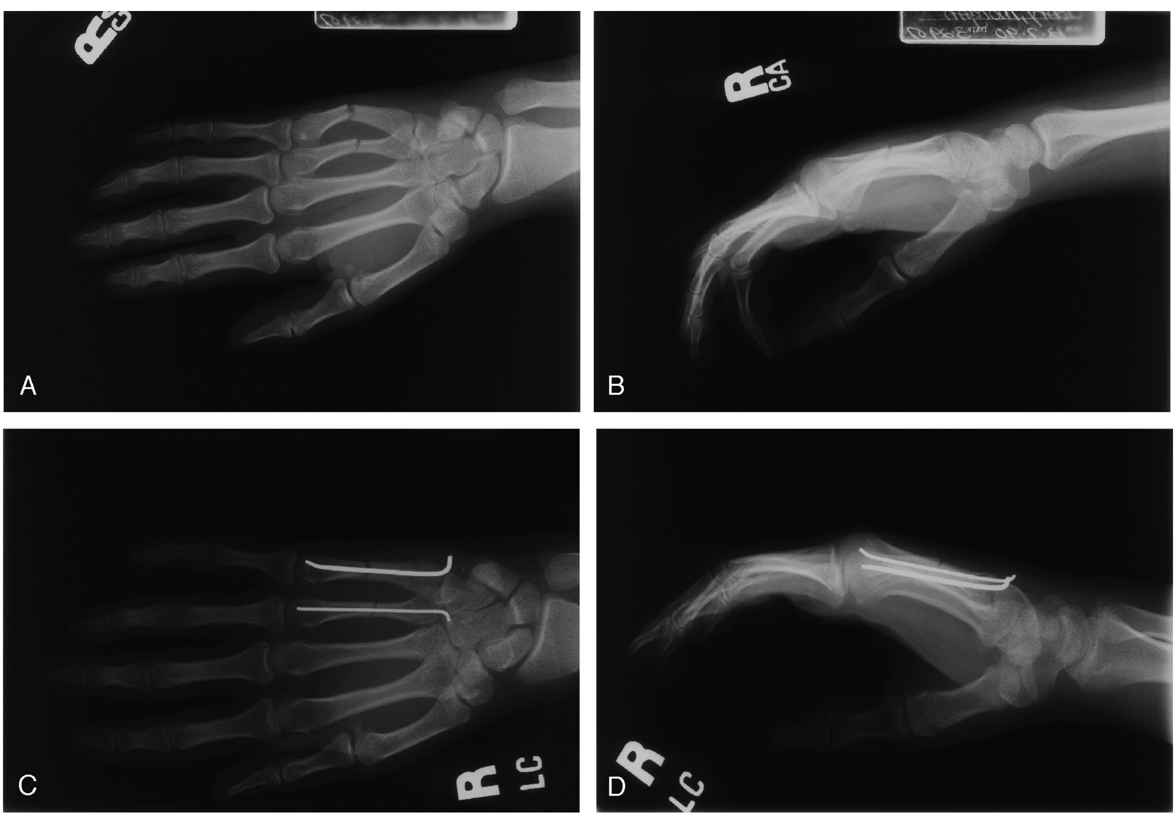

FIGURE 1. A and B, Preoperative radiographs. Fractures of ring and small finger metacarpals are demonstrated; note dorsal angulation. This small angulation was not apparent on inspection of the hand. C and D, Postoperative reduction films. The clinical deformity is resolved.

residual angular deformity. All but one patient was thought to have had a good or excellent result. That one patient developed some rotational displacement, noted on the first postoperative visit. This required a second procedure to correct, at which time a second rod was added. His final result was still good. However, I excluded him from the good or excellent group because it took 2 procedures to achieve that result.

CONCLUSIONS

I have found that this method of internal fixation of multiple metacarpal fractures is an excellent, easy, and minimally invasive technique in appropriately selected patients. There was only 1 complication. The restoration of function is rapid. The surgical scars are small: all less than 0.5 inch and cosmetically acceptable (Fig. 1).

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