

A Simple Fixation Method for Unstable Bony Mallet Finger

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Closed treatment has provided good results in uncomplicated cases of mallet finger; however, surgical fixation is recommended when there is involvement of more than one third of the base of the distal phalanx. Various techniques have been described for this purpose. The goal of this report is to present a simple method of K-wire fixation and show our results with this procedure. (*J Hand Surg* 2004;29A:1051–1055. Copyright © 2004 by the American Society for Surgery of the Hand.)

Key words: Extensor tendon, avulsion fracture, mallet finger.

Mallet finger is a common lesion seen usually in sports- or work-related injuries.¹ It results usually from a sudden forced flexion of an extended distal interphalangeal joint producing interruption of the terminal extensor mechanism or an avulsion fracture at the base of the distal phalanx.² Multiple studies have shown that conservative treatment provides satisfactory results in those cases in which there is either pure extensor tendon avulsion or fracture-avulsion of less than one third of the base of the distal phalanx.^{3–7}

Surgery is recommended generally for the unstable lesion that is characterized by an avulsed fragment that involves more than one third of the articular surface or does not reduce with full extension of the distal interphalangeal (DIP) joint. Surgical fixation is also suggested for fragment displacement and/or rotation to prevent joint deformities, posttraumatic arthritis, and stiffness.^{8,9}

Various surgical techniques for mallet finger

have been described including open reduction and K-wire fixation,^{8–10} pin fixation alone,^{11–14} tension band wire,^{15–17} tenodesis^{18,19} and pull-out steel wires.¹⁵ Reported complications of open treatment include skin necrosis, recurrent flexion deformity, pin track infection, osteomyelitis, and nail deformity.²⁰

The Ishiguro technique¹⁴ avoids the drawbacks and difficulties of open surgery by performing closed reduction coupled with extension block and fixation of the distal interphalangeal joints with K-wires.

The objective of this report is to describe a technique that provides better control and reduction of the dorsal fragment via a joystick maneuver as opposed to indirect methods of reduction such as the Ishiguro technique.¹⁴ We present also our results in the treatment of bony mallet finger with this technique.

Technique

A magnifying fluoroscope is used throughout the procedure. Anesthesia is obtained by performing a digital block. After standard preparation and draping of the surgical field a 1.4-mm (0.045-in) K-wire is driven from the tip of the distal phalanx and across the DIP joint to hold it in extension (Fig. 1). The distal end of this wire is left out of the skin (2–3 mm). The second wire is then placed from the dorsal aspect of the distal phalanx to catch the avulsed dorsal fragment. The diameter of this K-wire has to be chosen according to the fragment

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Figure 1. Fifty-two-year-old man with a bony mallet of the left ring finger. First K-wire is being driven from the tip of the distal phalanx and is crossing the DIP joint to hold it in extension.

size. Fragment derotation and placement into the trough is then achieved by using this wire as a joystick (Fig. 2A). Once acceptable reduction of the joint surface is confirmed with fluoroscopy the K-wire is driven through the base of the distal phalanx and pulp (Fig. 2B). At this point the end of the second wire is bent and pulled with heavy pliers from the volar aspect. A small dorsal skin incision is performed to allow the hook of the dorsal end of the wire to sit subcutaneously on the dorsal cortex thereby securing it, maintaining the reduction, and preventing further dorsal displacement of this fragment (Fig. 3). The volar end of this wire is left out of the skin (2–3 mm). A small splint is used for 1 week followed by a finger plaster cast applied directly over the DIP joint but allowing active motion of the proximal interphalangeal and metacarpophalangeal joints. Both pins are removed after 6 weeks under a digital block performed in the office. The longitudinal pin is

pulled out with heavy pliers. The volar end of the dorsal pin is cut subcutaneously and then removed by performing a dorsal 3-to-5-mm incision and pulling from the hook. A removable splint is used at night for another 6 weeks.

Discussion

It has been shown that mallet finger due to intra-articular fractures of the base of the distal phalanx involving more than 30% of the joint surface require surgical fixation to obtain precise reduction and to avoid osteoarthritis and stiffness;^{2,8,9} however, the perfect method remains controversial. Multiple techniques have been described for the management of bony mallet injuries.^{8–19}

Bischoff et al¹⁶ reported on 51 bony mallet fractures treated with tension band fixation. In their series 21 of the 51 bony mallet injuries displayed poor clinical and radiographic results. Postsurgical complications in their patients included skin breakdown, superficial and deep infection, and redisplacement of the dorsal fragment. They recommend caution when using tension band fixation. Contrary to Bischoff's experience, Damron and Engber¹⁵ obtained good results in 18 patients at a follow-up time of 8.2 years with the tension band technique. Mallet deformity was absent in 89% of the patients and the range of motion of the DIP joint averaged 1° of hyperextension to 69° of flexion.

Yamanaka and Sasaki¹³ used 1 or 2 1.2-mm compression percutaneous pins to fix the dorsal avulsed fragment to the distal phalanx in 15 patients with bony mallet fingers. They obtained exactly the same final range of DIP motion as Damron's study¹⁵ (1° of hyperextension to 69° of flexion).

Takami et al¹⁰ reported their experience with open reduction and K-wire fixation on 33 fractures. Thirteen patients presented with volar subluxation. The results in this series showed a final DIP flexion of 67° and an extension lag of 4°. In the final radiographic studies 27 fingers had a normal DIP joint and 6 displayed degenerative changes.

Pegoli et al¹⁴ obtained 46% excellent, 32% good, 20% fair, and 2% poor results using Ishiguro's extension block-pinning technique in 65 patients. Inoue¹² obtained satisfactory results in 12 out of 14 patients with extension block pinning. Tetik and Gudemez¹¹ applied a modification of the original technique of extension block pinning in 18 patients and obtained a final DIP flexion of 82° with an extension lag of 2°. Fanfani et al²¹ reported good functional and radiographic results in 5 patients

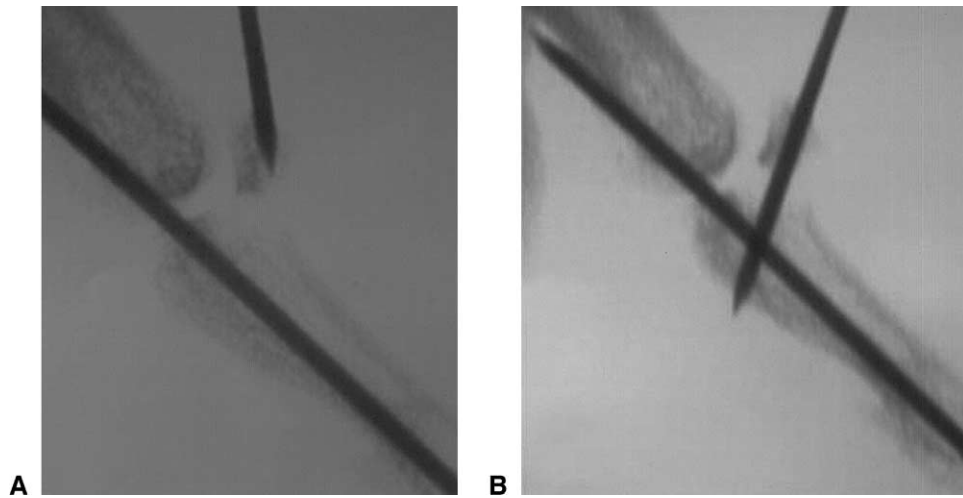


Figure 2. (A) As opposed to other techniques the second wire catches and joysticks the dorsal fragment to facilitate manipulation and reduction. (B) Once proper reduction is confirmed with fluoroscopy this wire is driven through the base of the distal phalanx and pulp.

treated with the “umbrella handle system.” His technique used a similar hooked K-wire but did not control directly the fragment and did not transfix the DIP joint, which could lead to failure.

Bauze and Bain²² described an internal suture technique used in 10 patients with mallet finger fractures. The final range of DIP motion was 13° to 49°

and their complications included 2 nail deformities, a superficial infection, and a pin track infection.

Hamas et al⁸ reported that final functional results were not compromised by division of the extensor tendon; however, Kang et al²⁰ found that 24 out of 59 mallet fractures (41%) treated by open reduction and transarticular fixation across the DIP joint developed

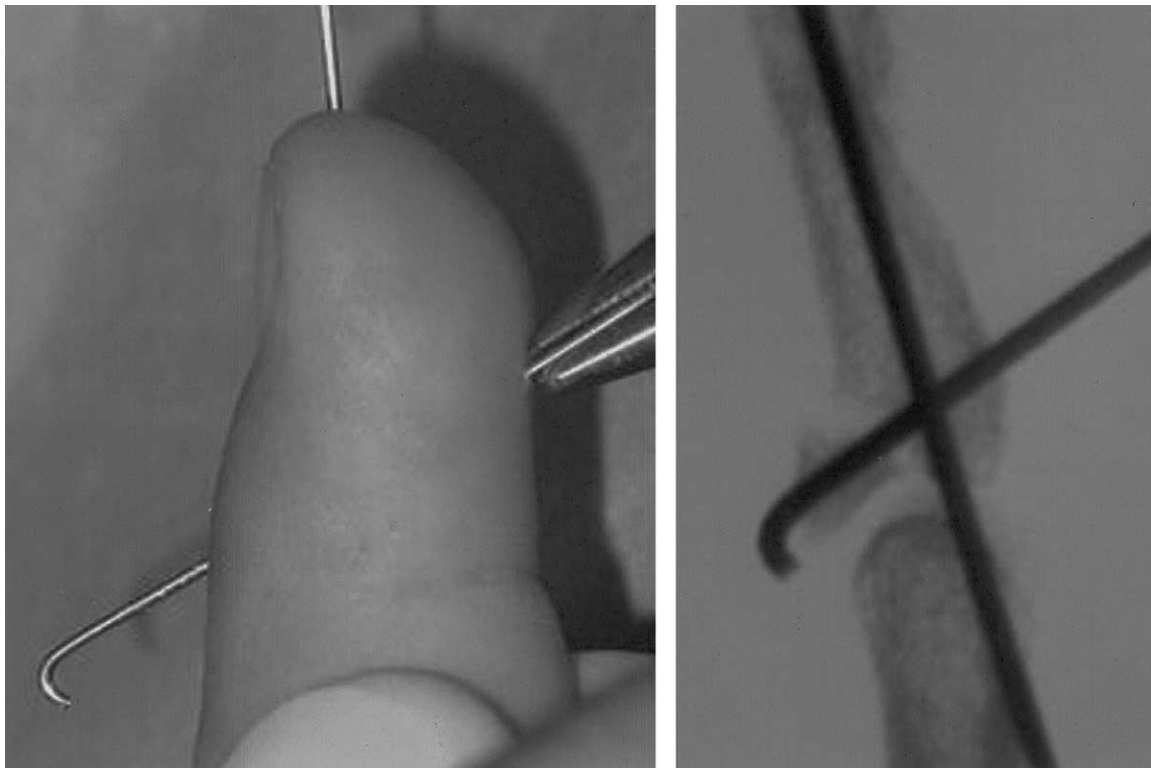


Figure 3. The wire is bent and pulled with heavy pliers from the volar aspect until the hook of the dorsal end sits on the dorsal cortex to secure it and to prevent further displacement.



Figure 4. After 6 months the DIP joint appears reduced and the dorsal fragment has healed in proper position.

postsurgical complications including marginal skin necrosis on the dorsal aspect of the distal phalanx, recurrent extension lag, permanent nail deformities, and osteomyelitis.

Some researchers such as Wehbe and Schneider²³ have used conservative treatment even in bony mallet injuries. In their series they assessed 21 avulsion fractures of the distal phalanx. Six were treated sur-

gically and 15 were just splinted. At final follow-up evaluation (mean, 3.25 years) all but 1 had good results despite the type of treatment. They observed poor patient compliance when conservative treatment was used. Doyle² and Crawford²⁴ concluded that anatomic reduction of the dorsal fragment is needed to obtain proper outcomes. In our experience we believe that unstable pattern fractures with volar sub-

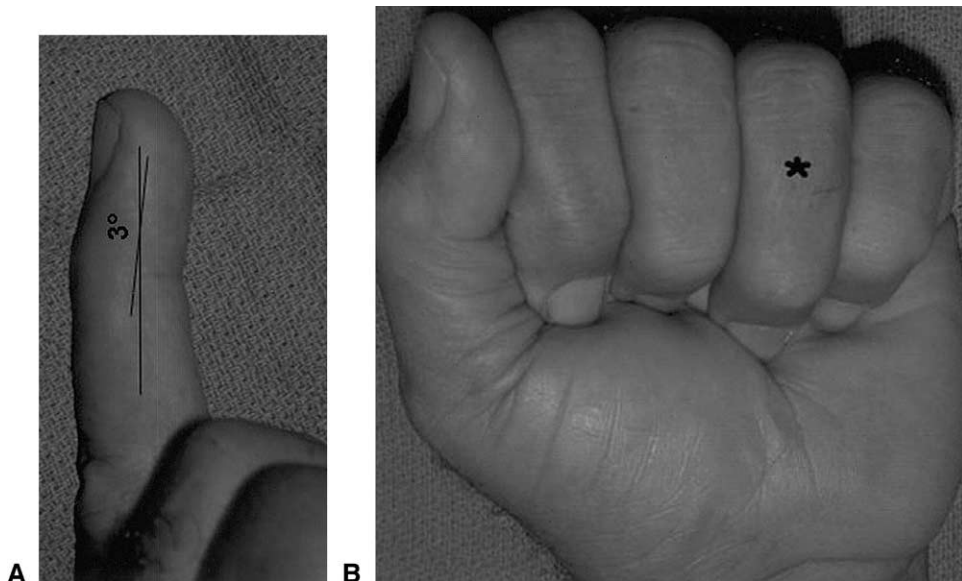


Figure 5. Range of motion at 6 months showing 3° of extension lag and 75° of DIP flexion.

luxation of the distal phalanx require precise reduction of the subluxation, adequate joint reduction, and proper buttressing of the dorsal fragment to obtain satisfactory remodeling to prevent further deformity, stiffness, arthritis, and other complications.

To date the senior author (A.B.) has used this technique in 16 patients (9 women, 7 men) who presented with a type IVB mallet finger lesion (hyperflexion injury with fracture of the articular surface of 20%–50%)² with an average age of 36 years (range, 22–56 years). All the patients were right-handed and the dominant hand was involved on all of them. Two index, 3 long, 5 ring, and 6 small fingers were compromised. Mechanisms of injury included house-related trauma in 8 patients and sports activities (football, basketball, softball) in 8 patients. Average time from initial injury to surgery was 12 days (range, 1–29 days). Average follow-up time was 22 months. Surgical indications included involvement of more than one third of the articular surface, volar subluxation, and fragment diastasis. The average joint surface involvement was 42% (range, 35%–55%). There was no damage of the dorsal fragment during the procedure. There were no cases of pin track infection in our series. At final follow-up evaluation the lateral x-ray view showed congruency of the DIP joint and healing of the fracture in all cases (Fig. 4). The DIP joint had an average extension lag of 2° (range, 0°–7°) and the final flexion was 75° on average (range, 65°–80°) (Fig. 5). There were no residual deformities on the proximal interphalangeal joint. Patients did not complain of pain at final follow-up evaluation. Ours is a simple, reliable, and easy technique for reduction of unstable mallet fractures and is associated with low morbidity.

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