Pullout Wire Fixation Together With Distal Interphalangeal Joint Kirschner Wire Stabilization for Acute Combined Tendon and Bone (Double Level) Mallet Finger Injury

Xu Zhang, MD, PhD, Xinzhong Shao, MD, Yong Huang, MD

This article describes a previously unclassified type of combined tendon/bone mallet finger. This supplements the conventional Doyle classification. The article also describes the technique for surgical treatment of such mallet fingers, which involves the use of a pullout wire with K-wire stabilization of the distal interphalangeal joint. *(J Hand Surg Am. 2015;40(2):363–367.*

Key words Fragment, K-wire, pullout wire fixation, stainless steel wire, combined tendon/bone mallet finger.

BOTH ISOLATED TENDINOUS AND BONY mallet fingers are often seen in sport- or work-related injuries,[1] but a combination of tendinous and bony mallet finger is less common. When this injury occurs, management may be challenging because of its more complex nature. In addition, this combined injury should be added to supplement the conventional Doyle classification of mallet fingers.

We have not found a published description of this combined tendon or bony mallet finger. The presumptive mechanism causing the injury is a sudden flexion force applied to the distal interphalangeal (DIP) joint while the extensor tendon is under tension.[2] The extensor tendon is first avulsed from the base of the distal phalanx with a bony fragment (Fig. 1A, B).[3] Second, in some circumstances, the force continues to be applied to the bony fragment, resulting in an avulsion (Fig. 1C, D). Thus, a combined tendon or bony mallet finger occurs. Alternatively, such a mallet finger may also possibly be the result of two separate injuries.

Doyle[4] classified mallet fingers into three types (I = tendon avulsion, possibly with a small avulsion fracture; II = an open laceration of the tendon; III = an injury with loss of skin, subcutaneous tissue, and tendon; IV A = a trans-epiphyseal injury; IV B = a hyper flexion injury with fracture between 20% and 50% of the joint space; and IV C = a hyperextension injury with fracture of the articular surface >50% with early or late volar subluxation). From our clinic findings, we suggest adding a type V to signify a combined bone and tendon injury. Type V may also have a small avulsion fracture (often less than 1 × 2 mm in size) in the tendon end (Fig. 2A, B).

Most tendinous mallet fingers are treated nonsurgically with an orthosis, with a reported failure rate of approximately 23%.[5] Surgical treatment is generally indicated for patients who have a fracture with subluxation of the DIP joint. Therefore, type V mallet finger may be found intraoperatively. Preoperatively, differentiation between a type V combined tendon or bony mallet finger without a bony fragment and an isolated bony mallet finger is very difficult, because they have

From the Hand Surgery Department, The Second Hospital of Qinhuangdao; the Hand Surgery Department, Third Hospital of Hebei Medical University; and the Department of Orthopaedics, Funing Hospital, Hebei, China.

Received for publication May 3, 2014; accepted in revised form November 12, 2014.

No benefits in any form have been received or will be received related directly or indirectly to the subject of this article.

Corresponding author: Xinzhong Shao, MD, Hand Surgery Department, Third Hospital of Hebei Medical University, Shijiazhuang, Hebei, 050051, China; e-mail: ahand@sina.com.

0363-5023/15/4002-0031$36.00/0
http://dx.doi.org/10.1016/j.jhsa.2014.11.011

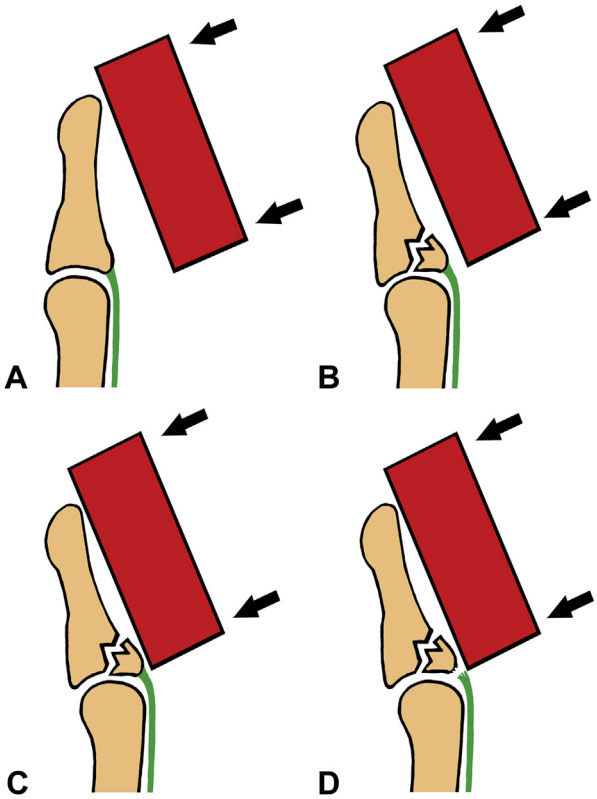

FIGURE 1: Diagrams showing possible mechanism causing a combined tendon or bony mallet finger. **A** A flexion force to the distal phalanx, or perhaps an axial load to the distal phalanx. The drawing shows more of a flexion force. Axial load combined with flexion is a potential mechanism of this type of injury. **B** A bony fragment is avulsed while the extensor tendon is under tension. **C** The flexion force is continuously applied to the avulsed fragment. **D** The extensor tendon is avulsed from its insertion.

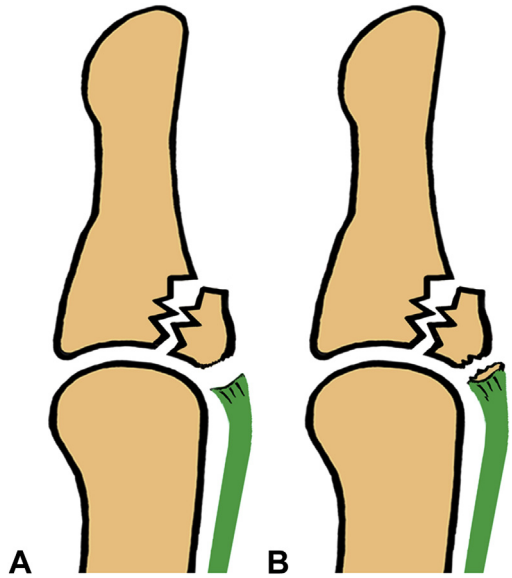

FIGURE 2: Type V mallet finger may result from a combination of fracture of the base of the distal phalanx at the site of the terminal tendon insertion, combined with a laceration of the tendon. **A** No bony fragment in the tendon end. **B** There is a small bony fragment in the tendon end.

the same clinical features, radiological features, and injury mechanisms, which provide little help in differentiating this mallet type. Therefore, such injury is often diagnosed intraoperatively. A type V injury with an intratendinous bony fragment, however, may be diagnosed preoperatively, because both the typical fracture fragment and a tiny avulsed bony fragment in the tendon end are demonstrated on the lateral radiograph indicating a double level injury (Fig. 3A).

Because the majority of mallet fingers are treated nonsurgically, assessment of the incidence of combined tendon or bony mallet fingers is difficult. It is not clear how many type V injuries without a small additional bony fragment are potentially missed, because the diagnosis can only be made at the time of surgery. Currently, we cannot draw any conclusions regarding the relative efficacy of the proposed surgical technique versus other surgical techniques or even nonsurgical orthosis management. In addition, we have no experience with the use of this technique in the chronic situation.

The objective of this study was to describe a surgical technique and provide the long-term results of the treatment of nine combined tendinous/bony mallet fingers, utilizing pullout wire fixation of the fracture fragment and K-wire stabilization of the DIP joint. Because the incidence of tendinous/bony mallet fingers is low, we had only three type V without a bony fragment and six type V mallet fingers with a small bony fragment in the tendon end. These cases were collected from three centers.

INDICATIONS AND CONTRAINDICATIONS

Indications

Indications for using this technique are acute combined tendon or bony mallet fingers that are confirmed pre- or intraoperatively, especially with DIP joint subluxation.

Contraindications

Patients with significant medical problems such as severe diabetes, infection, and recent myocardial infarction were excluded.

SURGICAL TECHNIQUE

We performed surgery under local anesthesia with finger tourniquet control. A lazy S-shaped incision is made over the dorsal aspect of the DIP joint. The tendon end and fracture are exposed (Fig. 3B, C). After