Mallet Finger

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The term *Mallet finger* refers to a common injury of terminal extensor mechanism at the level of distal interphalangeal (DIP) joint resulting in a 'dropped finger' at the DIP joint. The condition has also been referred to as drop, hammer (because of the appearance) or baseball finger. This can be secondary to tendon substance disruption or to a bony avulsion of the insertion site of the terminal extensor tendon. Disruption of the extensor tendon leads to imbalance in the disturbance of extensor force between proximal interphalangeal (PIP) and DIP joints resulting in flexed posture of the DIP joint and hyperextended posture of the PIP joint. This injury commonly resulted due to sports, traumatic, and cut injuries.

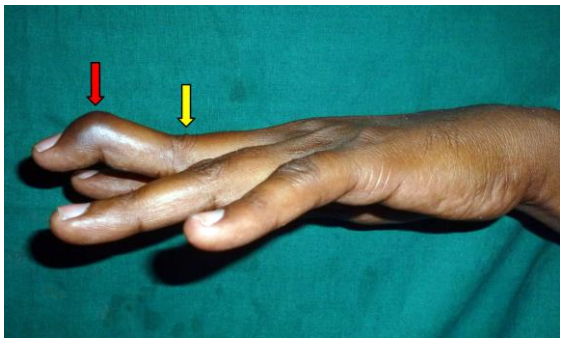

Figure 1- A Typical Mallet finger (red arrow) deformity. The compensatory hyperextension at the proximal interphalangeal joint (yellow arrow) results in swan-neck deformity.

History

Mallet injury was first described by Segond in 1880 and Shoeing described the first soft tissue mallet finger in 1887.

Incidence

Most commonly seen in young and middle aged male patients. 74% of bony mallets involve dominant hand and more than 90% of injuries were found in the ulnar 3 digits.

Mechanism of injury

The most common mechanism of injury in mallet finger is a sudden flexion of the DIP joint with axial force directed along the long axis of the finger. This leads to terminal extensor tendon tear or tendon avulsion with a bony fragment. This mechanism is a common cause of mallet finger in athletes and baseball players resulting from a forceful blow to the tip of the finger.

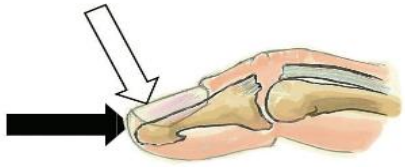

Figure 2: Axial force and hyperflexion at DIPJ resulting in a Soft tissue mallet injury

DIP joint hyperextension injuries can cause mallet finger secondary to dorsal lip fracture as the hyperextended distal phalanx (DPX) impacts on the head of middle phalanx (MPX).

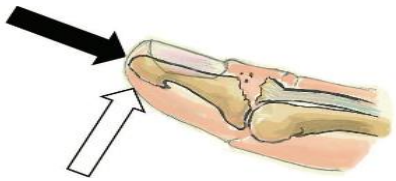

Figure 3: Axial force and hyperextension at DIPJ resulting in a Bony mallet injury

Open injuries are caused due to lacerations, deep abrasions, or crush.

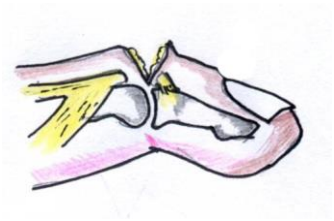

Figure 4- An open mallet finger resulting from a laceration over the DIP joint

Clinical Presentation

In early stage, patients present with painful and swollen DIP joint with finger flexed at DIP joint. There is inability to fully extend the finger at the DIP joint. In delayed presentations, patients develop a compensatory hyperextension posture at the PIP joint causing a swan-neck deformity [Figure 1]. This is due to proximal migration of extensor mechanism and increased

extensor tone across the proximal interphalangeal joint. In fact in clinical setting, it is common for patients to present with complaints of hyperextension at the PIP joint after a mallet finger injury.

All patients (both acute and chronic) will have extension lag at DIP joint. The passive range of DIP joint should be evaluated especially in chronic cases as fixed flexion deformity is a contraindication for reconstructive procedures.

Radiological evaluation

It is essential to have an exact lateral view else the flexed position of the DIP joint, subluxation of the DIP joint and the fracture of the distal phalanx in cases of bony mallet may be missed. Also, an exact lateral view is a must to quantify the size of the avulsed fragment which may have an impact on the modality of the treatment chosen.

Figure 5: An exact lateral view showing the avulsion bony fragment in a mallet finger.

Classification

Several classification systems have been described for mallet fingers. The most widely used classification is that proposed by Doyle [1]. Patel et al [2] defined acute mallet fingers as those presenting within 4 weeks of injury and chronic mallet fingers as those presenting after 4 weeks of injury. Other classifications are- Wehbe & Schneider Classification and Tubiana Classification. Doyle proposed a classification for soft tissue and bony mallet finger based on the mechanism of injury and the size of the bony fragment [Figure 6].

Doyle Classification and proposed treatment:

Type	Description and Treatment
Type 1	Closed injury, with or without a small dorsal avulsion fracture. This is the commonest type. These are best managed with a rigid splint for the DIP in neutral alignment or mild hyperextension for 6-8 weeks followed by 2 weeks of night splinting. If patient compliance is a concern, it is best to fix the DIP in extension with a transarticular K-wire. The degree of displacement of the bone fragment does not influence the outcome.
Type 2	Open laceration of the tendon at the DIP can be repaired with a figure of eight non-absorbable suture or a mattress suture and splinted as above, or with a temporary K-wire across the DIP.
Type 3	Deep abrasion with loss of tendon and overlying tissues requires thorough debridement and soft tissue cover. Delayed reconstruction of the tendon or DIP arthrodesis may be required.
Type 4A	Transphyseal fracture in a child. This is also known as a Seymour fracture. These can be managed by closed reduction and fixation with a K-wire spanning the DIP joint for 3 to 4 weeks. One must be very vigilant for frequent open nature of this injury. Failure to debride adequately can lead to osteomyelitis of the distal phalanx. Also, one should be careful to avoid interposition of the nail bed in between the fracture fragments.
Type 4B	Hyperflexion injury with a fracture involving 20–50% of the articular surface. The management is similar to type 1 injury. Extension blocking pin technique can be sometimes be helpful to achieve good position of the avulsed fragment along with stabilization of the DIP joint in extension.
Type 4C	Hyperextension injury causing a fracture of the distal phalanx (involving >50% of the articular surface) with dorsal displacement. The management of this is controversial. Some authors feel that it can be best managed by open reduction and fixation with an interosseous wire loop. This is a tricky procedure and there is an argument for treating these injuries by simple splinting.

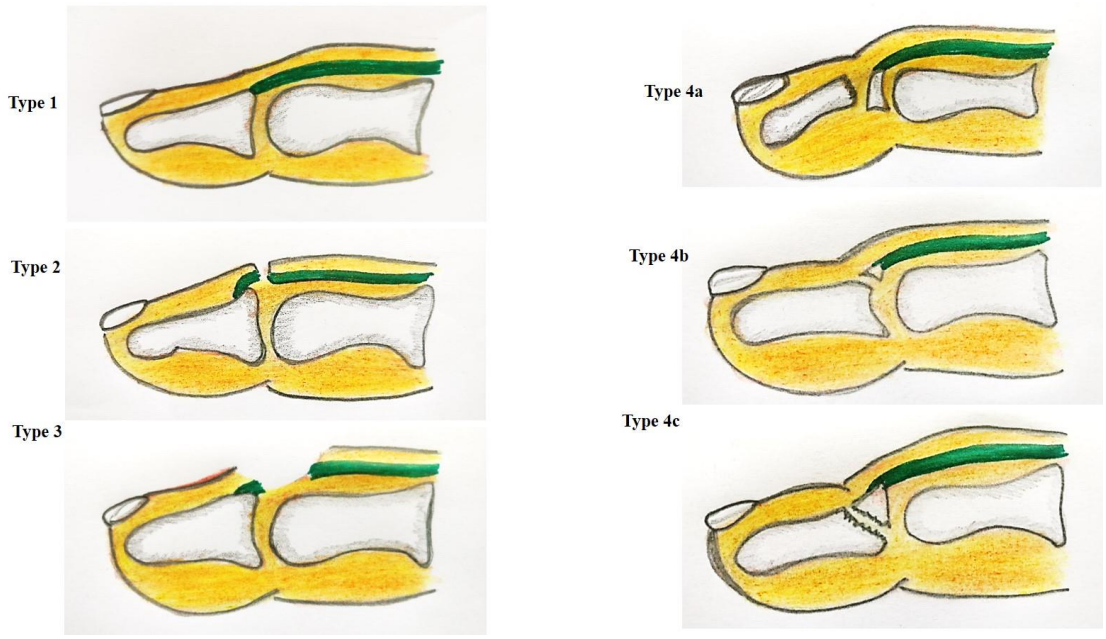

Figure 6: Doyle Classification of Mallet finger

Treatment

Main objective of treatment is to achieve extension at DIPJ of the finger, the injured extensor tendon should heal or avulsed bony fragment should unite with distal phalanx and DIP joint subluxation should be corrected.

Conservative treatment: Considerations are the type of immobilization, position of DIPJ and PIPJ and duration of immobilization. Since biomechanical studies have demonstrated that PIPJ mobilization does not move the terminal extensor band, researchers no longer recommend PIPJ immobilization in the treatment of mallet finger [3]. A consensus exists that immobilization for a tendinous mallet finger injury should last longer than for a bony mallet injury because tendon healing takes longer than bone healing.

Splinting

Splinting is considered the first line of standard of care for all acute injuries with no associated fracture or less than 1/3rd of articular involvement with no volar subluxation. The aim is to maintain full extension or slight hyperextension at DIP joint.

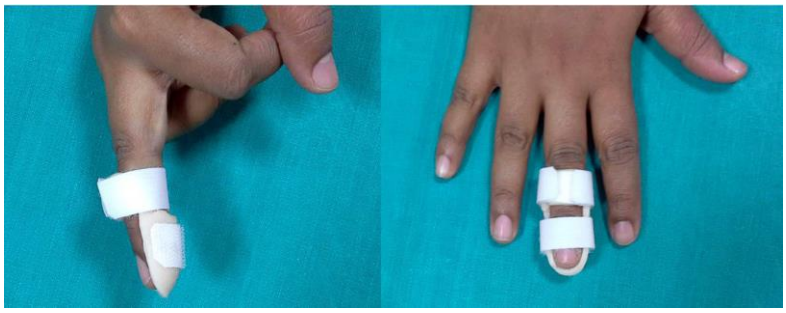

Figure 7: Mallet finger in place. Immobilizing the DIP joint with PIP joint free

Protocol of Splinting– full time splinting for 6-8 weeks followed by 2-4 weeks of night splinting depending on the extension lag at the DIP joint. Splint should be used continuous. During the time of cleaning and skin hygiene care the DIP should be held in hyperextension. If DIP was flexed in between the entire course of treatment should be restarted.

If patient's compliance for wearing the splint is considered poor then fixing the DIP joint in full extension with a longitudinal K-wire is recommended.

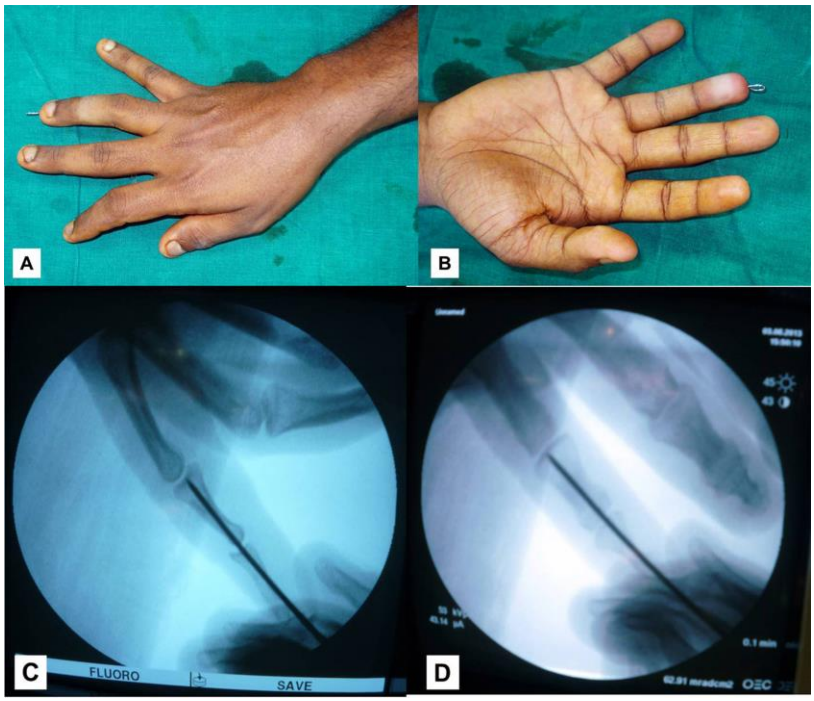

Figure 8: Stabilization of the DIP joint in full extension with a longitudinal trans-articular wire effectively maintains the position of the DIP joint for extensor tendon healing.

Surgical Treatment:

Though there are no strict indications for surgical intervention. However, the common indications for considering operative interventions are:

1. Open injury at DIPJ
2. Volar subluxation of distal phalanx
3. > 50% involvement of articular fragment
4. Displaced growth plate injury
5. Failed conservative treatment
6. Poor compliance for conservative treatment (as described above)

The commonest surgical intervention is the closed K-wire stabilization of the DIP joint in full extension (discussed above). This can be done under a digital block with all aseptic precautions. The K-wire should be maintained for 6 weeks and then a DIP joint splint is prescribed for another two weeks followed by night splinting for another two weeks.

Authors preferred technique for bony mallet finger is the Ishiguru technique [4]- figure 9. It involves fully flexing the DIP joint and first passing an extension blocking wire just proximal to the avulsed bony fragment into the head of the middle phalanx at an angle of 45 degrees to the middle shaft. Then the DIP joint is extended to reduce the avulsed fragment on to the distal phalanx. In this reduced position the DIP joint is fixed with an axial K-wire in full extension. The dorsal wire can be removed at four weeks and the axial wire is removed at 6 weeks. This is followed with two weeks of night splint and mobilisation.

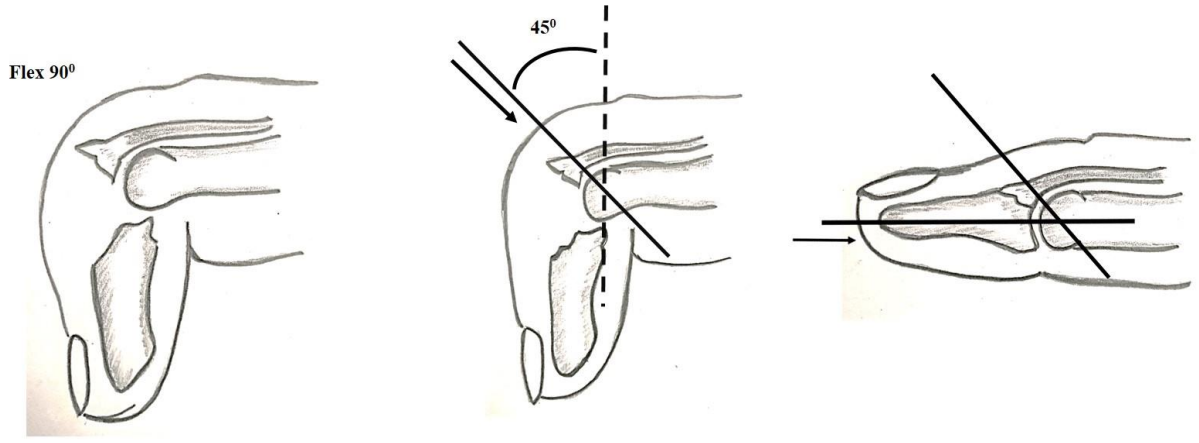

Figure 9: illustration and clinical case showing the Ishiguru technique for bony mallet finger

Other techniques described for fixation of the bony fragment include screw fixation, hook plate, pull-through wires, tension band wire, umbrella handle wire fixation, suture anchor and external fixator. One has to be very careful with techniques requiring extensive exposure and dissection at the DIP joint level as the soft tissue complications could be very high [5].

There are no specific recommendations as to till what time since the injury the closed treatment (splint or percutaneous wire) can be considered effective. However, authors practice the closed treatment even in chronic cases till around 8 weeks post injury. If patient is presenting later than 8 weeks we consider open extensor tendon plication and stabilization of the DIP joint in full extension for 6 weeks. The other techniques described to deal with chronic mallet finger are tenodermodesis and central slip tenotomy described by Fowler [3]. In cases with swan-neck deformity reconstruction of the oblique retinacular ligament has been recommended. The authors preferred incision for the exposure of the DIP joint is the H-shaped incision across the DIP joint [Figure 10]. Greater than 3mm of gap should be there between the distal tips of the H-incision and the nail plate to have an adequate vascularity for the distal skin flaps.

Figure 10: The authors' preferred exposure for the DIP joint

A mallet finger treatment outcome assessment classification was proposed by Crawford.

Excellent- no pain with full range of motion at the DIP joint

Good- less than 10 – degree extension deficit

Fair – 10-25 degree of extension deficit with no pain

Poor- more than 25 – degree extensor lag or persistent pain.

Stiff and arthritic DIP joint is a contraindication for reconstructive surgery and authors prefer fusion of the DIP joint in full extension. This corrects the mallet deformity and also the secondary swan-neck deformity in the PIP joint.

Conclusion:

Mallet finger is a common injury and is commonly neglected by patients. All acute injuries are best treated by splinting. Splinting must be full time to have a good outcome. If there is a doubt regarding the compliance with splintage, stabilization of the DIP joint in full extension with a K-wire should be considered. Bony mallet fingers with articular involvement of greater than 30% with subluxation of the joint are better managed surgically. Extension block wiring is our preference. Literature greatly favours conservative and lesser interventive modalities. Some extensor lag and restriction of terminal flexion is expected with both conservative and surgical treatment but does not correlate with patient satisfaction. Functional outcome with appropriate treatment is generally satisfactory.

References:

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