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Review

An overview of mallet finger injuries

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Abstract. Mallet finger describes a fingertip deformity where the distal interphalangeal joint (DIPJ) of the affected digit is held in flexion, unable to extend the distal phalanx actively. The deformity is typically a consequence of traumatic disruption to the terminal extensor tendon at its insertion at the proximal portion of the distal phalanx or slightly proximally at the level of the DIPJ. Patients typically present with a history describing the event of injury with a typical mallet deformity. Common mechanisms include sport activities causing a direct blow to the finger, low energy trauma while performing simple tasks such as pulling up socks or crush injuries from getting the finger trapped in a door. The DIPJ can be passively extended, but this extension of the joint cannot be maintained once the passive extension is stopped. The Doyle classification can be used to categorise and dictate treatment. The extensor lag associated with the deformity does not improve spontaneously without treatment. Inappropriate management can lead to chronic functional loss and stiffness of the finger. The majority of closed mallet splints are Doyle type I, which can be managed non-surgically with external splints, worn full-time to keep the fingertip straight until the tendon injury or fracture heals. Surgical techniques is considered for other types of mallet injuries. Techniques used include closed reduction and Kirschner wire fixation, open reduction and internal fixation, reconstruction of the terminal extensor tendon and correction of swan neck deformity. (www.actabiomedica.it)

Key words: mallet, finger, fracture, fingertip, tendon

Introduction

Mallet finger describes a fingertip deformity where the distal interphalangeal joint (DIPJ) of the affected digit is held in flexion, unable to extend the distal phalanx actively. The deformity is typically a consequence of traumatic disruption to the terminal extensor tendon at its insertion at the proximal portion of the distal phalanx or slightly proximally at the level of the DIPJ (1-3). The unopposed action of FDP tendon results in the DIPJ to be held in a flexed position with the patient unable to extend the distal phalanx actively (4).

The disruption can be due to rupture or division of the tendon (soft-tissue mallet), or secondary to an avulsion fracture, which is referred to as bony mallet injury. The injury can be further classified depending on whether the overlying skin is disrupted or not, as either open or closed mallet injury

The term mallet finger was used to describe the hammer-like deformity associated with sports injuries in the 19th century. The condition is otherwise known as baseball finger due to its frequent association with the sport, where players sustain axial-loading injury from catching accidents (1). However, such injuries can occur with other sporting activities, and from seemingly trivial daily activities such as tucking in bed sheets or shirts into trousers. Other mechanisms of injury include traumatic laceration and abrasion, causing an open mallet injury with a division of the terminal extensor tendon and/or skin loss (5).

The most commonly affected fingers are the long middle finger, followed by the ring finger, little finger and the index finger. Involvement of the thumb is rare (6). This injury is frequently seen in young men in the third and fourth decade, although there is no gender difference seen after the fifth decade. Around 74% of the cases involve the dominant hand (4).

Patient Presentation

Patients typically present with a history describing the event of injury with a typical mallet deformity. Common mechanisms include sport activities causing a direct blow to the finger, low energy trauma while performing simple tasks such as pulling up socks or crush injuries from getting the finger trapped in a door. The DIPJ can be passively extended, but this extension of the joint cannot be maintained once the passive extension is stopped (1).

The injury can be relatively painless, but typically there is some evidence of pain, swelling and bruising over the dorsum of the finger. There may be associated subungual haematoma or nailbed injury.

Diagnosis

Clinical Examination

Extensor lag at the DIPJ with the absence of active extension associated with the mallet finger injury can be readily observed in clinical examination. In an open mallet injury, an overlying soft tissue injury to the skin would be seen on the dorsum of the finger around the DIPJ. It is essential to isolate the DIPJ for accurate clinical assessment and diagnosis (4).

The Doyle classification was made according to osseous mallet finger injury's being closed or open and the magnitude of the fracture and is described in figure 1. Differential diagnoses include osteoarthritis,

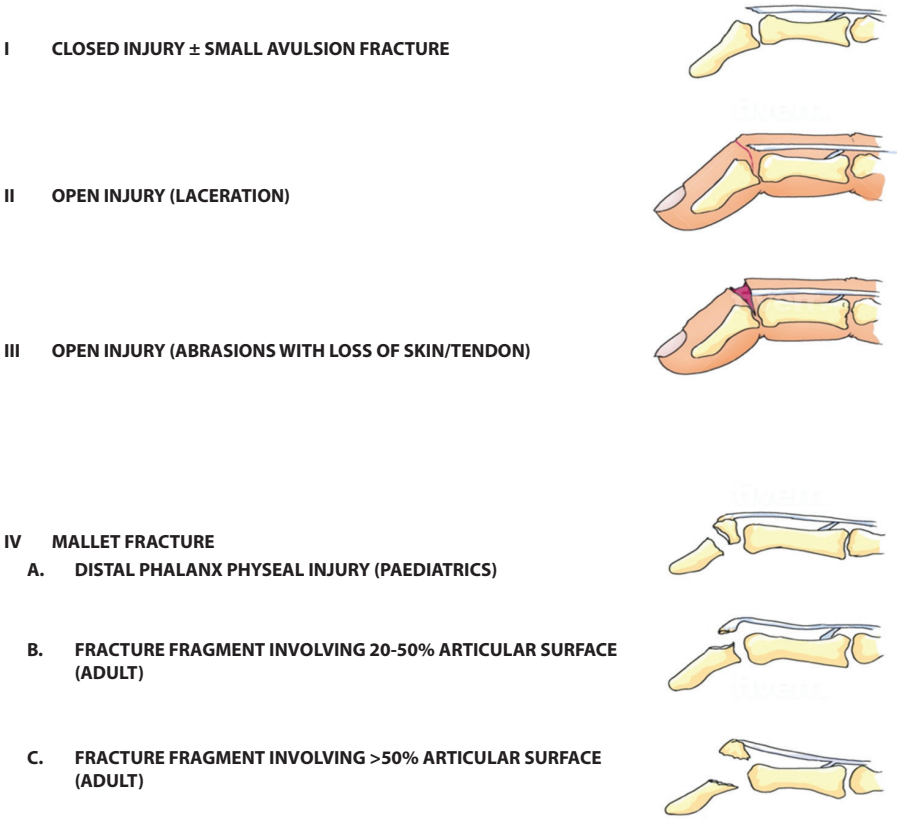

Figure 1. The Doyle classification for soft and bony mallet finger injuries.

phalangeal fractures, Seymour fracture, swan-neck deformity, metacarpophalangeal injuries, open wounds to the extensor tendon (7,8).

Radiological Investigations

Radiographs of the affected digit are required to distinguish between a bony and soft tissue mallet injury. Lateral view radiograph is essential to identify the presence of an avulsion fracture at the DIPJ and to assess the degree of joint involvement and joint subluxation in bony mallet injuries. The use of ultrasonography has been suggested as it can show extensor tendon injury and bony fragment clearly (9). The lack of availability to ultrasonography and relevant expertise out of hours compared to radiography has limited its use for such indications (1).

Complications and Sequalae

The extensor lag associated with the deformity does not improve spontaneously without treatment. Inappropriate management can lead to chronic functional loss and stiffness of the finger. In chronic cases, swan neck deformity can develop due to the extensor tendon imbalance causing a compensatory hyperextension of the proximal interphalangeal joint (PIPJ) (8). The resultant swan neck deformity can further cause reductions in hand function.

Surgery may be indicated in some instances where the fracture fragment is large, or the distal interphalangeal joint (DIPJ) subluxation, as such injuries can lead to chronic pain, traumatic osteoarthritis or chronic deformity (swan neck) if incorrectly managed (8).

Mallet finger injuries can often be missed in the paediatric population, as unlike adults, the deformity is usually a result of an avulsion fracture of the distal phalanx epiphysis and functional impairment is not always apparent (6).

Management

Jewellery on the affected hand should be removed at the time of injury, as this may act as a tourniquet once swelling develops. Simple analgesia or anti-inflammatories can be used as pain relief.

Non-Operative Management

The majority of closed mallet splints are Doyle type I, which can be managed non-surgically with external splints, worn full-time to keep the fingertip straight until the tendon injury or fracture heals. It is vital to obtain a post-splint radiograph on initial assessment in cases with avulsion fracture or joint subluxation to ensure the splint has achieved satisfactory fracture reduction and joint position. The typical duration of treatment is between six to eight weeks, with subsequent gradual weaning of splints the subsequent two weeks. The splint should be kept on at all times, as removal of the splint and flexion of the DIPJ would 'reset' the injury and thus delay the healing progress. It is vital to ensure good compliance though adequate patient education (10,11). The primary focus during the period of immobilisation and rehabilitation is to maintain range of motion and avoid stiffness in the other joints of the hand, particularly the PIPJ on the same digit.

There are several prefabricated splints options available. Examples include stack/mallet splints, aluminum foam splints (Zimmer splints) and custom-made thermoplastic splints. Prefabricated orthoses were found to increase the risk of developing skin complications as compared with custom-made orthoses, but there were no differences in treatment success, failure, or extensor lag between the three types of splints (12, 13). The availability of custom-made splints is limited by the presence of relevant hand therapy services.

The dorsal glue splint was designed to be glued onto the fingernail in order to free up the fingertip. The use of this splint was compared to the Stack splint and showed no difference in pain, swan neck deformities, nail dystrophy or maceration (14).

Thus, there is no gold standard option for non-operative management in mallet injuries. The use of an aluminum foam splint or a custom-made thermoplastic splint over the stack splint may reduce soft tissue complications and in turn increase patient compliance. While the use of the dorsal glued splint would give the added advantage of leaving the fingertips free and preventing stiffness (12-14).

At the end of the treatment course, there may be some reduction in DIPJ flexion or residual extensor lag. In bony mallet injuries, a small lump on the

dorsum may remain. It is uncommon for patients to experience residual pain at the end of the treatment course (15).

Operative Management

If there is evidence of subungual haematoma or nail plate avulsion, operative management may be indicated. In the paediatric population, Seymour fracture may mimic mallet finger and will require nailbed repair and fracture fixation (6, 16).

Surgical intervention may be indicated in those with fracture involving a third or more of the joint surface, type II and III injuries, joint malalignment, open or chronic injuries, unstable or large fractures, volar joint subluxation of the distal phalanx, inadequate DIPJ extension after splinting, persistent pain, a background of arthritis and those with delayed presentation and Swann neck deformity (11). Surgical techniques used include closed reduction and Kirschner wire fixation, open reduction and internal fixation, reconstruction of the terminal extensor tendon and correction of swan neck deformity (16).

Acute mallet finger injuries are those presenting within 4 weeks of injury. Surgical options for those that are open, involving a large fracture fragment or subluxation of the distal phalanx include the Ishiguro technique which produces an extension block using Kirshner wires. This method initially keeps the distal phalanx in maximal flexion and the fracture fragment is supported with a Kirshner wire inserted dorsally through the terminal extensor tendon into the proximal phalanx. The joint is then extended and blocked with a second wire. This technique is quick, minimally invasive, does not disrupt the remaining extensor mechanism and prevents the bone fragment from becoming comminuted. It allows for early active mobilisation, making it ideal for those needing early use of their hands. An open approach can be used if this is not suitable, using small screws or tension band wiring (17).

Those presenting after 4 weeks have a chronic mallet finger and surgery can be considered in cases with an extensor lag of 40 degrees or if there is a functional deficit. Two commonly described methods include tenodermodesis and central slip tenotomy (Fowler's release) (18, 19). Tenodermodesis involves excision of part of the tendon and skin over the DIPJ and repairing the full thickness defect with non-absorbable sutures. The DIPJ is then splinted in extension by internal fixation. Fowler's release aims to rebalance the extensor mechanism by releasing the pull on the middle phalanx and transmitting the increased extensor force to the terminal tendon and extending the distal phalanx (20, 21).

Surgery may also be considered if splint wear is not feasible or if nonsurgical treatment is not successful in restoring adequate finger extension. Surgical treatment of the tendon injury may involve direct repair, tendon grafts or joint fusion (11).

Closed reduction with Kirschner wire fixation, open reduction and internal fixation and block pinning are equally effective at achieving anatomical reduction and bony fixation in acute (< 3 weeks) mallet injuries. While open reduction and internal fixation are considered more time consuming and technically demanding than Kirschner wiring, the procedure allows for early mobilisation and return to work (22).

There is no statistically significant difference between surgical and nonsurgical management, with treatment choice being tailored to the individual patient (11).

Conclusion

Mallet finger deformity is a common presentation seen in both primary and emergency care. While the injury may appear innocuous and trivial, inadequate management can lead to significantly impaired hand function. Early recognition, initial management and appropriate referral is vital to ensure good treatment outcome.

Conflicts of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

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