WJMER

World Journal of Medical Education and Research

An Official Publication of the Education and Research Division of Doctors Academy

DOCTORS ACADEMY

BETTER EDUCATION. BETTER HEALTH.

ISSN 2052-1715

Clinical Review
DAUIN 20160094

World Journal of Medical Education and Research:
An Official Publication of the Education and Research Division of Doctors Academy

Mallet Finger Injuries - A Review Article

Mr Bhavsar D; Mr Knight R

Institution
Walsall Manor Hospital,
Walsall, United Kingdom

WJMER, Vol 11: Issue 1, 2016

Abstract
The aim of this article is to review the epidemiology, anatomy, classification, clinical presentation and treatment of the mallet finger injury, which is characterized by a flexion deformity of the distal interphalangeal joints. Multiple treatment options are available in the management of mallet finger injuries, however the aim is always for restoration of tendon continuity and return to function.

Conservative management is generally regarded as the mainstay of treatment, and should be considered as the gold standard for acute, closed mallet finger injuries with articular involvement of less than 30%, and in the absence of phalangeal subluxation. Surgery is indicated in open injuries, and in cases in which conservative management has failed, however potential complications must be kept in mind when coming to this decision.

Key Words
Mallet finger; Trauma; Anatomy; Surgery; Hand

Corresponding Author:
Mr Bhavsar D: E-mail: d.bhavsar@doctors.org.uk

Background

Mallet finger is a term used to describe a deformity of the distal interphalangeal joint (DIPJ), and is caused by either disruption or complete rupture of the extensor mechanism from the base of the distal phalanx, leading to a flexion deformity of the DIPJ. They can be split into bony mallet finger injuries, or tendinous mallet finger injuries. Classically it is seen as a result of sporting injury, whereby the tip of the finger is struck by a ball, resulting in sudden, forced DIPJ flexion. Less commonly it occurs after a laceration to the dorsum of the DIPJ[1].

Patients can delay their presentation, as they may still be able to use the hand for their daily activities, however all individuals with finger injuries should receive a systematic evaluation. Management of these injuries is usually conservative, and good results can be seen with early treatment, however permanent disability may occur with a lack of treatment.

Epidemiology

Mallet finger is a relatively uncommon injury, with a documented incidence of 9.9/100,000[2]. In a study of 260 patients with soft-tissue mallet finger, 60% of these injuries were in males, with a mean age of 39.9, whilst in females the mean age was 48.4. The high incidence in males continues until the sixth decade, whereas in females the incidence is lower in the second and third decades, and then rises to a peak in the sixth decade, equalling the peak in males[2]. Following this, the incidence in both sexes falls. Regarding bony mallet fingers, Webhé and Schneider found the mean age in males to be 34 years, and 41 years in females. They also found 74% of injuries to involve the dominant hand, and 90% involving the ulnar three digits[3].

Anatomy

Extension of the digits is performed mainly by extensor digitorum communis, extensor indicis (to the index finger), and extensor digiti minimi (to the little finger). Distally, the extensor mechanism at the finger consists of a thin, flat tendon, measuring 4-5mm wide and 1mm thick. The tendon runs, as the central slip, over the dorsum of the finger to insert into the base of the middle phalanx (**Figure 1**). The tendons of the intrinsic muscles of the hand (dorsal interossei, palmar interossei and lumbricals) join together at the MCPJs to form lateral bands, which run up both sides of the fingers, to insert into the base of the distal phalanx.

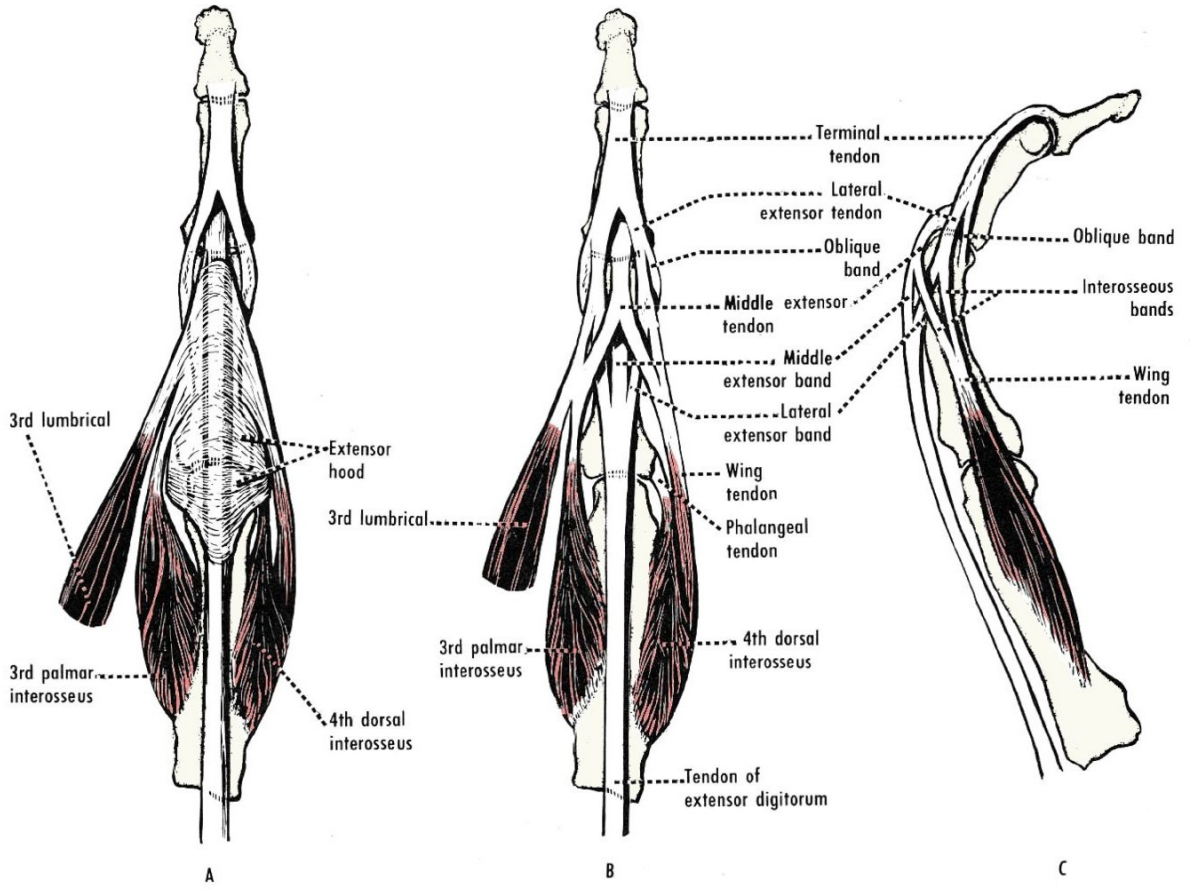

Figure 1: Extensor aponeurosis of the fourth finger. A, Dorsal view showing the extensor hood. B, Dorsal view with the hood removed. C, Medial view (Courtesy of Dartmouth Medical School).

Figure 2: Mallet finger deformity of index finger, with secondary Swan-neck deformity (Courtesy of Mr Rajive Jose).

Classification

Mallet finger injuries include both bony and soft tissue injuries. Bony mallet finger injuries can be classified according to the Webhé and Schneider classification system (**Table 1**), which is split into three main types, and further sub-typed depending on the degree of articular involvement[3]. Doyle's classification is based on the mechanism of injury. Type 1 injuries are closed, with or without the presence of a dorsal avulsion fracture. Type 2 injuries are open, resulting from superficial lacerations at the level of, or just proximal to the

World Journal of Medical Education and Research:
An Official Publication of the Education and Research Division of Doctors Academy

DIPJ, with loss of continuity of the extensor mechanism. Type 3 injuries are again open injuries, but result from deeper lacerations with loss of skin, subcutaneous tissue and tendon substance. Type 4 injuries can be split into three subtypes: A - trans-epiphyseal distal phalanx fractures in children, B - fracture of the articular surface with 20 to 50% involvement, and C - fracture of the articular surface with greater than 50% involvement[5].

Type	
1	No DIPJ subluxation
2	DIPJ subluxation
3	Epiphyseal and physeal injuries
Subtype	
1	<1/3 articular involvement
2	1/3 - 2/3 articular involvement
3	>2/3 articular involvement

Table 1: Webhé and Schneider classification of bony mallet finger injuries[3]

Figure 3: Lateral radiograph showing avulsion fracture of dorsal aspect of base of distal phalanx (Courtesy of Mr Rajive Jose).

Mechanism of injury

While the finger is held in extension, any forced flexion can risk disruption to the extensor mechanism. Classically, end-on injury to the tip of the finger during sporting activities can result in a mallet finger injury. However, less commonly the injury can be a result of forcibly tucking in bedsheets, or taking off socks with extended fingers. Open injuries are due to lacerations, crush or abrasion injuries. Hyperextension of the DIPJ can cause an avulsion fracture of the base of the distal phalanx dorsally, as it impacts against the distal articular surface of the middle phalanx[1].

Diagnosis and management

The diagnosis of mallet finger injuries is based on a detailed history-taking, and clinical examination. History of a sudden forced flexion injury to an extended finger, and the presence of a tender, swollen finger, with flexion deformity of the DIPJ and an inability to actively extend at the joint (although with no limit to passive extension) should lead to a suspicion of mallet finger. As previously mentioned, hyperextension at the PIPJ resulting in a swan-neck deformity may be obvious in a late presentation (**Figure 2**). Plain films of the DIPJ of the finger in question, including AP and lateral views, are necessary in distinguishing between soft tissue and bony injuries, recording the presence of subluxation of the DIPJ, as well as excluding other injuries.

Multiple treatment options are available in the management of mallet finger injuries, however the aim is always for restoration of tendon continuity and return to function. Conservative management is the gold standard for closed injuries with no bony involvement, with a reported 60% success rate following six weeks of appropriate splinting[6]. The principle of splinting in mallet fingers is to maintain extension at the DIPJ, whilst allowing free movement at the PIPJ. Thermoplastic or aluminium splints are commonly available for the treatment of these injuries[4]. Continuous use of the splint is important, including during hygiene care, and so it is imperative that patients are advised on how to change the splint for cleaning purposes and examination of the skin, ensuring the DIPJ is not allowed to flex, whilst also allowing free movement at the PIPJ. Further splinting can be considered after this period if the tendon has failed to heal, however open repair may be considered. Complications of conservative management include skin lesions, such as dorsal maceration and ulceration[1]. An extension lag of 10% has also been reported in 40-70% of patients, however this does not appear to lead to a functional deficit[1,4].

Figure 4: Lateral radiograph showing avulsion fracture, with partial subluxation of DIPJ and >50% articular involvement (Courtesy of Mr Rajive Jose).

Indications for surgical management of mallet fingers include failed conservative management, open injuries, volar subluxation of the distal phalanx, and involvement of more than 30% of the articular surface. Occasionally patients cannot tolerate or comply with splints, and here surgical intervention would again be indicated[1]. The method of operative treatment will depend on the presence of bony injury. In mallet finger injuries with involvement of only the extensor tendon, the tendon may be repaired separately to the subcutaneous tissue and skin, however depending on surgeon preference mass repair of tendon and skin may also be performed. Surgery in bony mallet fingers consists of either closed reduction with percutaneous insertion of Kirschner wires (extension block pinning), or open reduction and internal fixation, with reports of small screws, hook plates, tension-band wiring, figure-of-eight wiring, pull-through wires, and external fixation in the literature[1,7-10].

Closed, percutaneous techniques are simpler than open procedures[9]. An average DIPJ flexion of 55 degrees, and extensor lag between 0-20 degrees has

been noted in patients managed with percutaneous wires[11]. Complications can occur however, such as nail ridging, dorsal scarring[9], secondary osteoarthritis if more than one attempt at pin insertion is required, pin site infection[10], and delayed union and redislocation if reduction is inaccurate[12]. In a study looking at hook plates versus extension block pinning, there was no statistical significance in mean DIPJ flexion or mean extensor lag in either group, however in the open surgery group there was a statistically significant reduction in both time for radiological bone healing and time to return to work[7]. In another comparison of fixation techniques, mean DIPJ flexion was looked at in extension block pinning (72 degrees), Kirschner wires as joysticks (58 degrees), and miniscrew fixation (54 degrees), however again these results were not statistically significant[13]. Regarding chronic mallet finger injuries, tenodermodesis may be performed, where an elliptical wedge of skin, tendon and scar tissue are resected followed by re-approximation of the skin and tendon[1].

All are considered technically complex procedures, and therefore where indicated, conservative management is preferred. Complications of surgical intervention include residual pain, infection, stiffness, nail deformity and implant failure.

Conclusion

Mallet finger injuries will result in an imbalance in the extension forces at the PIPJ and DIPJ. Untreated, the loss of integrity of the extensor mechanism at the DIPJ can lead to forces becoming concentrated at the PIPJ, and over time hyperextension may be seen (particularly with a lax volar plate), resulting in a swan neck deformity[4]. Treatment is therefore imperative, to ensure return of function for the patient in the shirt-term, and to reduce the risk of deformity in the long-term.

Conservative management, even in the presence of bony injury, is the mainstay of treatment and should be considered as the gold standard for acute, closed mallet finger injuries with articular involvement of less than 30%, and in the absence of phalangeal subluxation. A true lateral radiograph of the joint in splint is required to confirm adequate congruency of the articular surface. Satisfactory results are found in 60%, and another 20% in due course[6]. Results are reliant on patients complying with medical advice. A common result of conservative management is a slight extensor lag; whereby full extension at the DIPJ is not possible, however this is not usually a deficit that results in functional loss[14]. Surgery is indicated in open injuries, and in cases in which conservative management has failed, however potential complications must be kept in mind when coming to this decision.

References

1. Alla S, Deal N, Dempsey I. Current concepts: mallet finger. Hand. February 2014. Vol 9, pg 138-144.
2. Clayton R, Court-Brown C. The epidemiology of musculoskeletal tendinous and ligamentous injuries. Injury, Int. J. Care Injured. June 2008. Vol 39, pg 1338-1344.
3. Webhé M, Schneider L. Mallet fractures. J Bone Joint Surg Am. June 1984. Vol 66(5), pg 658-669.
4. Mauffrey C. Mallet Finger: A Review. Internet J. Orthopaedic Surg. 2005. Vol 3(1), pg 1-3.
5. Doyle J. Extensor tendon - acute injuries. In: Green D, Hotchkiss R, Pederson W. Green Operative Hand Surgery (4th ed). Philadelphia, PA: Churchill Livingstone pg 1962–1971.
6. Pulvertaft R. Mallet finger. Proceedings of the second hand club. British Society for Surgery of the Hand. 1975. Pg 156.
7. Acar M, Güzel Y, Güleç A, Uzer G, Elmadağ M. Clinical comparison of hook plate fixation versus extension block pinning for bony mallet finger: a retrospective comparison study. J. Hand Surg (E). October 2015. Vol 8, pg 832-839.
8. Wada T, Oda T. Mallet fingers with bone avulsion and DIP joint subluxation. J. Hand Surg (E). Jan 2015. Vol 40(1), pg 8-15.
9. Lee Y, Kim J, Chung M, Baek G, Gong H, Lee S. Two extension block Kirschner wire technique for mallet finger fractures. J. Bone Joint Surg (Br). July 2007. Vol 91B, pg 1478-81.
10. Ishigurp T, Itoh Y, Yabe Y Hashizume N. Extension block with Kirschner wire for fracture dislocation of the distal interphalangeal joint. Orthopaedics and Traumatology. June 1999. Vol 7(1), pg 105-111. February 2003. Vol 28B, pg 15-17.
11. Lubahn J. Mallet finger fractures: A comparison of open and closed technique. J. Hand Surg. March 1989. Vol 14(2), pg 394-396.
12. Pegoli L, Toh S, Arai K, Fukuda A, Nishikawa S, Vallejo L. The Ishiguro Extension Block Technique for the Treatment of Mallet Finger Fracture: Indications and Clinical Results. J Hand Surg (Br).
13. Lucchina S, Badia A, Dornean V, Fusetti C. Unstable mallet fractures: a comparison between three different techniques in a multicenter study. Chin. J. Traumatol. Aug 2010. Vol 1:13(4), pg 195-200.
14. Medscape. Meals R. Mallet Finger Treatment & Management [Internet]. 2015 [cited 13 December 2015]. Available from: http://emedicine.medscape.com/article/1242305-treatment#d4.

The World Journal of Medical Education & Research (WJMER) is the online publication of the Doctors Academy Group of Educational Establishments. It aims to promote academia and research amongst all members of the multi-disciplinary healthcare team including doctors, dentists, scientists, and students of these specialties from all parts of the world. The journal intends to encourage the healthy transfer of knowledge, opinions and expertise between those who have the benefit of cutting-edge technology and those who need to innovate within their resource constraints. It is our hope that this interaction will help develop medical knowledge & enhance the possibility of providing optimal clinical care in different settings all over the world.

WJMER

World Journal of Medical Education and Research

An Official Publication of the Education and Research Division of Doctors Academy

ISBN 978-93-80573-47-2

9 789380 573472