[Sports Physical Therapy]

Adductor Pollicis Longus Strain in a Professional Baseball Player: Case Report and Review of Thenar Pain

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Thenar pain can represent a significant morbidity for a baseball player who relies on manual dexterity for gripping a bat and precise and accurate throws. While osseous, ligamentous, and neurovascular pathologies are commonly considered, musculotendinous injuries are often neglected in the differential diagnosis of thenar pain. We present a case of adductor pollicis longus strain as a cause of acute thenar pain in a baseball player. Adductor pollicis longus strains should be considered in any baseball player sustaining a hyperabduction force to the thumb.

Keywords: thenar pain, baseball, hand strain

CASE PRESENTATION

A 29-year-old, right-hand dominant, professional baseball catcher presented with a 1-day history of right hand pain centered within the palm at the thenar eminence. A day earlier, he hyperabducted his thumb when it "jammed" while batting. Despite a dull, aching pain, he was able to continue playing and had little difficulty holding and swinging a bat. However, his pain worsened with gripping a baseball, and he had significant difficulty throwing the ball to second base. He denied any previous trauma or pain prior to the injury. He did not have numbness or tingling in the digits, including the thumb.

On examination, there was no ecchymosis, hematoma, masses, or gross deformities in the palmar or dorsal aspects of his right hand. He had tenderness to palpation at the base of the second metacarpal, worse volarly than dorsally. He did not have tenderness over the pisiform, hook of the hamate, scapholunate ligament, scaphoid tubercle, or snuffbox. There were no restrictions with motion; he had mild pain with passive thumb abduction and active thumb adduction greater than opposition and flexion. He had 2+ radial pulse and brisk capillary refill. He had negative Phalen and Tinel tests at the Guyon canal and carpal tunnel. There was no laxity with stress tests of the thumb metacarpophalangeal joint at 0° and 30° of flexion.

Because of his unusual symptoms and roster limitations, imaging studies, including radiographs and magnetic resonance imaging (MRI), were obtained. There were no abnormalities. MRI revealed feathery edema within the adductor pollicis muscle with few retracted fibers from the myotendinous junction involving the transverse head with milder feathery edema within the oblique head (Figure 1). There were fluid/inflammatory changes surrounding the muscle from the level of origin of the muscle at the third metacarpal diaphysis to its myotendinous junction. He did not have osseous, ligamentous, or vascular abnormalities. He was diagnosed with a grade 2 strain of the transverse head and grade 1 strain of the oblique head of the adductor pollicis longus and was cleared to return to baseball activities without limitations.

He returned to play the following day and wore a neoprene thumb spica while batting. Despite playing nearly every day, his symptoms completely resolved within 2 weeks. He had no recurrence of his symptoms the remainder of the season.

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Figure 1. T2 magnetic resonance images demonstrate feathery edema (arrow) within the adductor pollicis longus in (a) axial, (b) coronal, and (c) sagittal planes. (d) Normal axial T2 image of the hand with the adductor pollicis longus outlined, shown for comparison.

DISCUSSION

Thenar pain can represent a significant morbidity for a baseball player who relies on manual dexterity for gripping a bat and precise and accurate throws. Prompt assessment and recognition of common injury patterns can limit the amount of missed playing time and unnecessary angst. While injuries in the hypothenar area, such as hook of hamate fractures and hypothenar hammer syndrome, are commonly reported among baseball players and catchers in particular, injuries to the thenar region in these athletes have garnered little recognition. The differential diagnosis of thenar pain can be divided into 4 broad categories: osseous, ligamentous, neurovascular, and musculotendinous pathologies (Table 1). Knowledge of the mechanism, either acute trauma or repetitive overuse, is useful in narrowing the differential.

Osteocartilaginous and ligamentous are the more commonly recognized sources of thenar pain and can present as either acute (fracture) or chronic (arthritis). Acute palmar injury with associated bony tenderness along the thumb metacarpal and/

Table 1. Differential diagnosis of causes of thenar pain in baseball players

Osteocartilaginous injuries
Thumb metacarpal fractures (eg, Bennett and Rolando fractures)
Scaphoid fractures
Thumb metacarpophalangeal osteochondritis desiccans
Thumb metacarpophalangeal and carpometacarpal arthritis
Ligamentous injuries
Scapholunate injuries
Thumb metacarpophalangeal ulnar collateral ligament injuries
Neurovascular injuries
Thenar hammer syndrome
Musculotendinous injuries
Thenar muscle strains
Flexor carpi radialis tendinitis

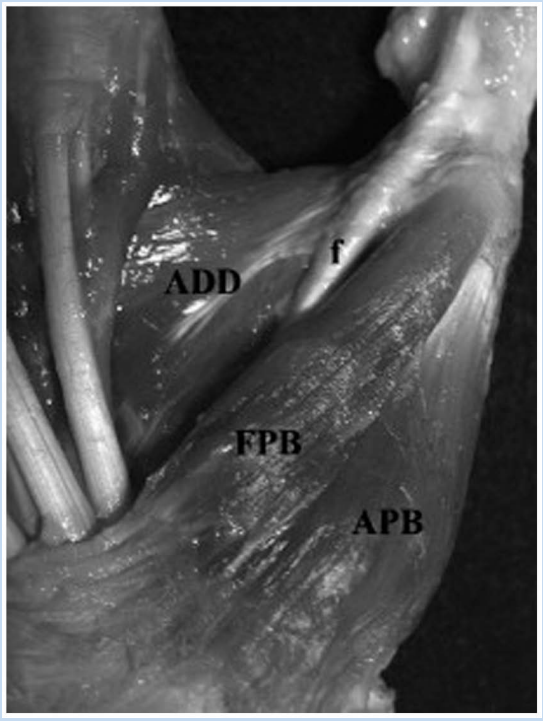

Figure 2. Palmar view of the thenar muscles. The adductor pollicis (ADD) muscle is bipennate and lies distal and deep to the abductor pollicis brevis (APB) and flexor pollicis brevis (FPB), which both originate from the transverse carpal ligament. Reprinted with permission from Leversedge.[9]

or scaphoid is concerning for a fracture of the thumb metacarpal and/or scaphoid and should prompt plain radiographic imaging, including lateral, oblique, and AP views in full ulnar deviation.[13] Nondisplaced fractures of the first metacarpal and scaphoid are usually managed nonoperatively with either a short-arm or long-arm thumb spica cast.[16] A potential exception is the athlete with a nondisplaced proximal pole or midthird body scaphoid fracture who elects to have percutaneous screw fixation to expedite the return to play.[5] A recent meta-analysis suggests that percutaneous fixation hastens union rates by 5 weeks and return to sports by 7 weeks compared with spica casting.[12] Indications for operative fixation of displaced metacarpal and scaphoid fractures depend upon the location and displacement of fracture and surgeon preference.[16] Intra-articular fractures of the thumb metacarpal base can consist of a single, variable-sized, volar-ulnar fracture fragment (Bennett fracture) or multiple fragments (Rolando fracture) and are treated with either closed reduction percutaneous pin fixation (if the fragment occupies less than 15%-20% of the articular surface) or, more commonly, open reduction and internal fixation.[17] Displaced scaphoid fractures are managed operatively to minimize the risk of nonunion, malunion, osteonecrosis, and posttraumatic arthritis.[10] Osteochondritis desiccans and arthritis are more uncommon, typically present more chronically, and are treated symptomatically. Surgical intervention is generally reserved for those that have failed an extensive trial of nonoperative management or those experiencing locking caused by an intra-articular loose body.[21]

Injury to the ulnar collateral ligament of the thumb metacarpalphalangeal joint is a frequent source of disability among athletes. Baseball players are particularly prone to this injury as they are frequently subjected to the proposed mechanism: radially directed force on the thumb when sliding head-first into a base. A key component of management is differentiating a partial tear from a complete tear with a Stener lesion, a distal avulsion of the ulnar collateral ligament that then herniates through the adductor aponeurosis.[17] Physical examination, stress radiographs, ultrasound, or MRI can assist in distinguishing complete versus partial tears. Complete disruptions demonstrated valgus laxity at 0° and 30° of thumb metacarpophalangeal flexion, while partial injuries have no laxity in full extension.[10,17] Partial tears may be treated nonoperatively with immobilization, while complete tears usually require surgical repair or reconstruction.[17]

Vascular injuries to the hand have been reported after repetitive impact to the hand in baseball players. While the repetitive vascular injuries tend to involve the hypothenar region, thenar hammer syndrome has been described[11] and is attributed to injury to the superficial palmar branch of the radial artery.[7] Catchers who are subjected to repetitive palmar trauma are particularly susceptible to "hammer" injuries.[20] In a study of 8 catchers, the index finger of the catcher's "mitt" hand is the most likely digit to experience ischemia due to

Table 2. Estimated time to return to play (without rigid brace) for acute thenar injuries

Injury	Treatment	Estimated Time to RTP
Bennett and Rolando fractures	ORIF/CRPP	6-10 weeks[2,13]
Scaphoid fractures	Spica cast	8-12 weeks[1,13,18]
Nondisplaced	Percutaneous IF	4-6 weeks[4]
Displaced, proximal pole	ORIF	Minimum 6 weeks and after CT evidence healing[8,13]
Thumb MCP ulnar collateral ligament injury	Cast/splint	6 weeks[13]
Incomplete	ORIF	12 weeks[6]
Complete	Cast/splint	6 weeks[8]

ORIF = open reduction, internal fixation; CRPP = closed reduction, percutaneous pinning; IF = internal fixation.

repetitive trauma.[20] Any history of Raynoaud phenomenon, cold intolerance, numbness, or hypersensitivity of the hand or digits in a catcher should warrant a further vascular workup, which may include cold stress testing using thermistors and Doppler ultrasound and/or conventional, computed tomography, and/or MRI angiography to determine the patency of the superficial and deep arch.[11,14,22] For those baseball players with diagnosed digital ischemia due to repetitive trauma, nonoperative management including cold avoidance, increased padding, and if applicable, smoking cessation can be effective in limiting symptoms.[7,11,15]

Musculotendinous injuries to the thenar region are not commonly recognized as a source of injury for a baseball player. While flexor carpi radialis tendinitis caused by a malunited trapezial ridge has been reported in a baseball player,[19] no athletic injury to the adductor pollicis has been described.

The thenar mass consists of the 4 intrinsic muscles of the thumb: abductor pollicis brevis, opponens pollicis, flexor pollicis brevis, and adductor pollicis[3] (Figure 2). The adductor pollicis is a bipennate muscle primarily responsible for thumb adduction (moving the thumb toward the second metacarpal in the plane of the palm)[3] and, to a lesser extent, thumb flexion at the metacarpophalangeal joint. Its oblique head originates from the base of the second and third metacarpals and capitate while the transverse head arises from the distal two-thirds of the third metacarpal diaphysis.[3] The 2 heads converge to insert onto the medial side of the proximal phalanx of the thumb.[3] Unlike other muscles of thenar eminence, which are supplied by median nerve, both heads of the adductor pollicis are usually innervated by the deep branch of the ulnar nerve derived from C8 and T1. The adductor pollicis longus is positioned dorsal to the second and third flexor digitorum superficialis and profundus tendons and the lumbricals, volar to the second and third metacarpals and their palmar interosseous muscles, and is divided by the deep palmar arch and deep motor branch of the ulnar nerve, which both pass between the 2 heads.[9]

In conclusion, thenar pain can represent a significant functional limitation for baseball players who require manual strength to grip a bat and hold a baseball. The differential diagnosis for thenar pain in the baseball player includes osteocartilaginous, ligamentous, vascular, and musculotendinous causes. Careful history and physical examination with attention to injury mechanism are important to limit differential. While many thenar injuries can require lengthy recovery periods (Table 2), this case demonstrated an adductor strain that resolved within 2 weeks. Adductor strains should be considered in any baseball player who sustains thumb hyperabduction force, such as being "jammed" while batting, and has increased pain with resisted thumb adduction.

REFERENCES

1. Cooney WP III, Dobyns JH, Linscheid RL. Nonunion of the scaphoid: analysis of the results from bone grafting. *J Hand Surg Am.* 1980;5(4):343-354.
2. Fufa DT, Goldfarb CA. Fractures of the thumb and finger metacarpals in athletes. *Hand Clin.* 2012;28(3):379-388, x.
3. Gupta S, Michelsen-Jost H. Anatomy and function of the thenar muscles. *Hand Clin.* 2012;28(1):1-7.
4. Haddad FS, Goddard NJ. Acute percutaneous scaphoid fixation. A pilot study. *J Bone Joint Surg Br.* 1998;80(1):95-99.
5. Inoue G, Shionoya K. Herbert screw fixation by limited access for acute fractures of the scaphoid. *J Bone Joint Surg Br.* 1997;79(3):418-421.
6. Johnson JW, Culp RW. Acute ulnar collateral ligament injury in the athlete. *Hand Clin.* 2009;25(3):437-442.
7. Koulaxouzidis G, Kalash Z, Zajonc H, Stark B, Bannasch H. Case of combined thenar and hypothenar hammer syndrome: case report and brief review of the literature. *J Reconstr Microsurg.* 2011;27(6):373-376.
8. Kovacic J, Bergfeld J. Return to play issues in upper extremity injuries. *Clin J Sport Med.* 2005;15(6):448-452.
9. Leversedge FJ. Anatomy and pathomechanics of the thumb. *Hand Clin.* 2008;24(3):219-229, v.
10. Mack GR, Bosse MJ, Gelberman RH, Yu E. The natural history of scaphoid non-union. *J Bone Joint Surg Am.* 1984;66(4):504-509.

11. McCready RA, Bryant MA, Divelbiss JL. Combined thenar and hypothenar hammer syndromes: case report and review of the literature. *J Vasc Surg.* 2008;48(3):741-744.
12. Modi CS, Nancoo T, Powers D, Ho K, Boer R, Turner SM. Operative versus nonoperative treatment of acute undisplaced and minimally displaced scaphoid waist fractures—a systematic review. *Injury.* 2009;40(3):268-273.
13. Morgan WJ, Slowman LS. Acute hand and wrist injuries in athletes: evaluation and management. *J Am Acad Orthop Surg.* 2001;9(6): 389-400.
14. Muller LP, Rudig L, Kreitner KF, Degreif J. Hypothenar hammer syndrome in sports. *Knee Surg Sports Traumatol Arthrosc.* 1996;4(3):167-170.
15. Nuber GW, McCarthy WJ, Yao JS, Schafer MF, Suker JR. Arterial abnormalities of the hand in athletes. *Am J Sports Med.* 1990;18(5): 520-523.
16. Rettig AC. Athletic injuries of the wrist and hand. Part I: traumatic injuries of the wrist. *Am J Sports Med.* 2003;31(6):1038-1048.
17. Rettig AC. Athletic injuries of the wrist and hand: part II: overuse injuries of the wrist and traumatic injuries to the hand. *Am J Sports Med.* 2004;32(1):262-273.
18. Saeden B, Tornkvist H, Ponzer S, Hoglund M. Fracture of the carpal scaphoid. A prospective, randomised 12-year follow-up comparing operative and conservative treatment. *J Bone Joint Surg Br.* 2001;83(2):230-234.
19. Soejima O, Iida H, Naito M. Flexor carpi radialis tendinitis caused by malunited trapezial ridge fracture in a professional baseball player. *J Orthop Sci.* 2002;7(1):151-153.
20. Sugawara M, Ogino T, Minami A, Ishii S. Digital ischemia in baseball players. *Am J Sports Med.* 1986;14(4):329-334.
21. Ueda D, Ikeda M, Oka Y. Locking of the metacarpophalangeal joint of the thumb by a loose body: a case report. *Hand Surg.* 2006;11(1-2):59-62.
22. Winterer JT, Ghanem N, Roth M, et al. Diagnosis of the hypothenar hammer syndrome by high-resolution contrast-enhanced MR angiography. *Eur Radiol.* 2002;12(10):2457-2462.