

Hook of Hamate Fracture

Overview

- Hook of hamate fractures are rare injuries [7, 15].
- The most usual mechanism for hook of hamate fractures is a direct blow to the area of the hook [7, 15].
- Fractures of the hook of the hamate have been infrequently reported in the literature [2].
- Hook of hamate fractures with normal standard x-rays may be difficult to diagnose, especially for a nonhand surgeon [1].
- A specific radiographic view is recommended in addition to standard views in all cases of suspected fractures of the hook of the hamate [8].
- The incidence of acute hook of hamate fracture in association with high-energy distal fractures in patients undergoing CT evaluation of the wrist is 2.7% [18].
- Hamate hook fractures can be successfully treated acutely by immediate immobilization [3].
- Non-displaced acute fractures and delayed union of the hamate hook can be treated successfully by dorsal percutaneous cannulated mini-screw fixation with minimal morbidity and complications [5].
- The dorsal percutaneous approach is a reliable method that provides safe fixation of non-displaced fractures of the hook of hamate [23].
- Surgical excision as treatment for hook of hamate fractures is safe and allows a relatively rapid return to play in most cases [4].
- Surgical excision of the hook of the hamate resulted in good postoperative outcomes with a mean follow-up of 6 years in athletes [19].
- Early and late surgical excision of the hook of the hamate leads to excellent results with return to preinjury levels of activity [13].
- Surgical excision of hook of hamate fractures in high-level amateur athletes allows for successful return to sports participation at preinjury performance levels, achievement of normal function as measured by validated objective outcome measures, significant reduction in pain, and high overall patient satisfaction [27].
- Surgical excision is the treatment of choice for fractures of the hook of the hamate in any athlete, as the incidence of nonunion precludes the use of open reduction internal fixation [30].

- The treatment of choice for a symptomatic nonunion, and possibly for an acute fracture, appears to be surgical excision of the hook of the hamate [9].
- Symptomatic partial union of the hook of the hamate fracture in athletes should be managed with excision of the hook of the hamate and repair of the ligament attachments [10].
- The open carpal tunnel approach is a successful technique for open excision of symptomatic ununited hook of hamate fractures due to its familiarity, ease of performance, excellent visualization, and low morbidity [22].
- Both surgical procedures appear to yield acceptable outcomes in the treatment of hook of hamate fractures [11].
- Repair by open reduction and internal fixation for ununited fracture hook of the hamate is feasible and desirable for preservation of grip strength and complete relief of pain [14].
- In younger patients with nonunion of the hook of the hamate, repair of the nonunion rather than simple excision should be aimed for to preserve grip strength [20].
- Hook of hamate regeneration can occur after fracture fragment excision [12].
- The incidence of a hypoplastic hook of the hamate is common in patients with carpal tunnel syndrome [47].

Anatomy & Pathophysiology

BONY ANATOMY

- The hamate consists of a body and a hook (hamulus) [59].
- The hook of the hamate serves as an attachment site for the transverse carpal ligament [59].
- The hook of the hamate serves as an origin for the flexor digiti minimi and opponens digiti minimi muscles [59].
- The distal end of the transverse carpal ligament is located 10 mm from the hook of the hamate [36].
- The boundaries of Guyon's canal include the hook of the hamate radially and the pisiform ulnarly [56].

VASCULAR SUPPLY

- The extraosseous blood supply to the carpus is provided by terminal branches of the radial, ulnar, and anterior interosseous arteries through dorsal and palmar transverse arterial arches [62].
- The dorsal intercarpal arch is the largest of the dorsal arches and supplies the distal carpal row [62].
- The deep palmar arch at the level of the metacarpal bases is consistent and communicates with the dorsal basal metacarpal arch and palmar metacarpal arteries [62].
- The hamate hook has a poor blood supply, which is a main reason for the increased risk of nonunion [48].
- The hamate hook is vulnerable to osteonecrosis and nonunion due to its vascularity [3].

LIGAMENTOUS ANATOMY

- The capitolunate ligament is a thick ligament with a cross-section of 5×5 mm [57].
- The capitolunate ligament has extensions to the third or fourth metacarpals [57].
- The distal row of carpal bones is rigid with little motion between its bones due to stout intercarpal ligaments [57].

BIOMECHANICS & KINEMATICS

- The hamate is part of the central column of the wrist, which controls flexion-extension of the wrist [60].
- The hamate is part of the metacolumn in Weber's three-column theory, which includes the triquetrum and hamate [60].
- The lunate, capitate, hamate, trapezium, and trapezoid function collectively as the "stable central column" in the Sandoz et al. model [60].
- The hamate hook provides a biomechanical advantage for flexor tendon function [43].
- Cadaveric changes in tendon force after hamate hook excision suggest that power grip may be decreased [43].
- No significant change in the position of deep or superficial digital flexor tendons relative to the hook of hamate was noted with finger extension or flexion [49].

PATHOPHYSIOLOGY & INJURY MECHANISMS

- Hook of hamate fractures are traditionally thought to be caused by direct trauma [69].
- Fracture of the hook of hamate is more likely to result from a fatigue response due to repetitive load applied by adjacent deep flexor tendons [69].
- Direct pressure of tendons on critical local vessels reduces blood flow, leading to mechanical and vascular effects that create pathological osseous change and weakening [69].
- These pathological changes predispose to stress fracture and nonunion in repetitive gripping activities [69].
- High-energy single-impact hamate fractures likely occur in otherwise healthy bone without pre-existing stress response [72].
- Fractures of the hook of the hamate can occur by direct impact applied to the hamate during a fall on the heel of the hand [48].
- Fractures of the hook of the hamate can occur by microtraumatism in sports requiring repeated use of a racquet or a bat [48].
- The growing popularity of golf and other racquet sports has led to an increase in stress fractures of the hamate hook [48].
- Mobility of the fracture site is a main reason for the increased risk of nonunion of the hamate hook [48].
- Delayed diagnosis is a main reason for the increased risk of nonunion of the hamate hook [48].
- Combined fracture of the hook of the hamate and palmar dislocation of the fifth carpometacarpal joint results from a sudden, violent contraction of the flexor carpi ulnaris against a fixed wrist [35].

- Chronic repetitive wear and fraying of flexor tendons against the rough surface of the hook is the proposed etiology for closed rupture of the flexor tendon [37].
- The misleading presentation of a hamate hook stress fracture in a professional bowler is related to a new drilling layout of the bowling ball and technical changes during ball release [29].
- Technical changes in bowling redistribute micro-constraints on the hook of the hamate using an indirect mechanism of injury through ligaments and flexor tendons [29].

Classification

EPIDEMIOLOGY AND MECHANISM

- Fractures of the hook of the hamate are rare injuries [7].
- Hamate hook fracture represents 2% of carpal bone fractures [48].
- The incidence of acute hook of hamate fracture in association with high-energy distal radius fractures is 2.7% [18].
- Combined intraarticular fracture of the body and hook of hamate is an extremely rare injury pattern [21].

DIAGNOSTIC CHALLENGES

- Fractures of the hook of the hamate are not seen on standard two or three view wrist examination [26].
- The similarities between a fracture of the hook of the hamate and other conditions that cause ulnar wrist pain can lead to failure of clinical diagnosis [17].
- Combined intraarticular fracture of the body and hook of hamate requires a high index of suspicion for diagnosis [21].

IMAGING AND PHYSICAL EXAMINATION

- The carpal tunnel radiographic view should be considered in addition to routine radiographic views for patients with a possible hook of the hamate fracture [6].
- The hook of hamate pull test is an easy, cheap, sensitive, and specific test that can be readily performed in the clinic to diagnose hook of hamate fractures [25].
- A CT scan has 95% specificity and 95% accuracy in diagnosing hamulus fractures [33].
- Pain is provoked by resistive extension of the ring and middle finger PIP joints in the diagnosis of hamulus fracture or nonunion [33].

Clinical Presentation

DIAGNOSTIC CHALLENGES AND RARITY

- These fractures are not seen on standard two or three view wrist examination [26].

CQ HAND + UPPER LIMB

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- Combined intraarticular fracture of the body and hook of hamate is an extremely rare injury pattern requiring a high index of suspicion for diagnosis [21].
- Hook of hamate fractures present with similarities to other conditions that cause ulnar wrist pain [17].

PHYSICAL EXAMINATION FINDINGS

- Volar tenderness on palpation over the hook of hamate was present in 100% of cases in a study of acute hook of hamate fractures [67].
- The pull test was painful for all patients in a study of acute hook of hamate fractures [67].
- Pain over the ulnar-palmar base of the hand should prompt a presumptive diagnosis of fracture of the hook of the hamate until proven otherwise [31].

IMAGING AND DIAGNOSTIC MODALITIES

- Lateral trispiral tomography is clearly superior to other diagnostic methods for hamate hook fractures [41].
- An incidence of 2.7% of acute hook of hamate fracture was identified in association with high-energy distal fractures in patients undergoing CT evaluation of the wrist [18].

MECHANISM OF INJURY

- Hamate hook stress fractures can result from an indirect mechanism of injury through the ligaments and flexor tendons due to redistributed micro-constraints [29].

Investigations

CLINICAL EXAMINATION

- Fractures of the hook of the hamate have clinical similarities to other conditions that cause ulnar wrist pain [17].
- In institutions where this protocol is followed, any patient with pain over the ulnar-palmar base of the hand should have a carpal tunnel view obtained with a presumptive diagnosis of hook of hamate fracture until proven otherwise [31].

RADIOGRAPHY

- Hook of hamate fractures may be difficult to diagnose on standard x-rays, particularly for non-hand surgeons [1].
- A specific radiographic view is recommended in addition to standard views for all cases of suspected fractures of the hook of the hamate [8].
- Fractures of the pisiform and hamulus are not seen on standard two or three view wrist examinations [26].
- Three variations of the hook of hamate were identified with radiographic evaluation using the carpal tunnel view [80].

ADVANCED IMAGING

- MRI is the modality of choice for imaging radiographically occult fractures of the hand and wrist [58].
- Bone marrow edema on MRI may reveal fractures of the carpal bones that are radiographically occult [66].
- An incidence of 2.7% of acute hook of hamate fracture was identified in association with high-energy distal radius fractures in patients undergoing CT evaluation of the wrist [18].

Treatment

NON-OPERATIVE MANAGEMENT

- Hamate hook fractures diagnosed early may heal with nonoperative management [16].
- Acute hook of hamate fractures in athletes may be treated with casting [34].
- Ultrasound treatment might be useful for nonunion of the hook of the hamate caused by repeated stress [46].
- Low-intensity pulsed ultrasound may be useful in the treatment of ununited fractures of the hook of hamate [50].

OPERATIVE MANAGEMENT: EXCISION

- Surgical excision as treatment for hook of the hamate fractures is safe and allows a relatively rapid return to play [4].
- Surgical excision of the hook of the hamate resulted in good postoperative outcomes with a mean follow-up of 6 years [19].
- Surgical excision remains an effective method of management, with a low risk of minor complications for both acute and chronic hook of hamate fractures in professional baseball players [28].
- MLB players sustaining hook of hamate fractures can reasonably expect to return to their pre-injury performance levels following operative treatment [71].
- The open carpal tunnel approach is a successful technique for open excision of symptomatic ununited hook of hamate fractures because of its familiarity, ease of performance, excellent visualization and low morbidity [22].
- A modified surgical approach through Guyon's Canal and the proximal ulnar border of the carpal tunnel allows for safe excision of the hook of the hamate [32].
- The modified approach through Guyon's Canal and the proximal ulnar border of the carpal tunnel allows direct visualization of the vital structures most at risk, including the motor branch of the ulnar nerve, unlike blind or unilateral approaches [32].
- The modified approach through Guyon's Canal and the proximal ulnar border of the carpal tunnel preserves the nerve supply and blood supply to the hypothenar muscles [32].
- A lateral approach to the hook of hamate for its fracture is believed to replace the conventional volar approach because of its benefits in terms of time, safety, and simplicity [42].

- Functional recovery of the hand was satisfactory 2.5 months after surgical resection of the hamate's hook in a professional bowler with a stress fracture [29].

OPERATIVE MANAGEMENT: FIXATION

- The cadaveric study confirms that the dorsal percutaneous approach is a reliable method and provides safe fixation of non-displaced fractures of the hook of hamate [23].
- In younger patients with nonunion of the hook of the hamate, one should aim for the repair of the nonunion rather than simple excision to preserve grip strength [20].
- A simplified dorsal approach to fracture of the hamate hook with percutaneous fixation with screws avoids damage to the blood supply of the hamate, surrounding soft tissues, and the ulnar nerve [45].
- A simplified dorsal approach to fracture of the hamate hook with percutaneous fixation with screws preserves important stabilising ligaments [45].

OUTCOMES AND BIOMECHANICS

- Patient outcomes were good to excellent regardless of the treatment chosen, with minimal pain and good hand functionality [44].
- The hamate hook provides some biomechanical advantage for flexor tendon function [43].
- Cadaveric changes in tendon force after hamate hook excision suggest that power grip may be decreased after hamate hook excision [43].

DIAGNOSTIC CHALLENGES

- A specific radiographic view is recommended in addition to standard ones in all cases of suspected fractures of the hook of the hamate [8].
- Fractures of the hook of the hamate share similarities with other conditions that cause ulnar wrist pain, leading to failure of clinical diagnosis [17].

NONUNION AND HEALING COMPLICATIONS

- Hamate hook fractures that are diagnosed early may heal with nonoperative management [16].
- Symptomatic partial union of the hook of the hamate fracture in athletes should be managed no differently from a symptomatic nonunion [10].
- In younger patients with nonunion of the hook of the hamate, repair of the nonunion is preferred over simple excision to preserve grip strength [20].
- Range of motion and grip strengths were equivalent on the operated and unoperated sides following bone grafting for nonunion [24].

SURGICAL COMPLICATIONS AND OUTCOMES

- Surgical excision as treatment for hook of the hamate fractures is safe and allows a relatively rapid return to play in most cases [4].

- Dorsal percutaneous cannulated mini-screw fixation for non-displaced acute fractures and delayed union of the hamate hook is associated with minimal morbidity and complications [5].
- Both surgical procedures for hook of hamate fractures appear to yield acceptable outcomes [11].
- The open carpal tunnel approach for excision of symptomatic ununited hook of hamate fractures is associated with low morbidity [22].
- The dorsal percutaneous approach provides safe fixation of non-displaced fractures of the hook of hamate [23].
- Surgical excision for acute and chronic hook of hamate fractures in professional baseball players carries a low risk of minor complications [28].

ASSOCIATED INJURIES AND ANATOMICAL VARIATIONS

- The incidence of acute hook of hamate fracture in association with high-energy distal radius fractures is 2.7% in patients undergoing CT evaluation of the wrist [18].
- Preoperative evaluation of the morphology of the hooks may help predict adverse events in cases of hypoplastic hooks undergoing endoscopic carpal tunnel release [47].

Recovery

NON-OPERATIVE MANAGEMENT

OPERATIVE MANAGEMENT

- Dorsal percutaneous cannulated mini-screw fixation treats non-displaced acute fractures and delayed union of the hamate hook with minimal morbidity and complications [5].
- In younger patients with nonunion of the hook of the hamate, repair of the nonunion rather than simple excision is recommended to preserve grip strength [20].
- Range of motion and grip strengths were equivalent on the operated and unoperated sides following bone grafting of a hook of hamate nonunion [24].

Key Evidence

- [Paper] Hook of hamate fractures, with normal standard x-rays, may be difficult to diagnose, especially for a nonhand surgeon. [1] ([10.1016/j.hcl.2021.06.013](https://doi.org/10.1016/j.hcl.2021.06.013))
- [L4] Fractures of the hook of the hamate have been infrequently reported in the literature. [2] ([10.1016/0020-1383\(89\)90169-1](https://doi.org/10.1016/0020-1383(89)90169-1))
- [L5] The data support the recommendation that hamate hook fractures can be successfully treated acutely by immediate immobilization. [3] ([10.1016/0363-5023\(93\)90405-r](https://doi.org/10.1016/0363-5023(93)90405-r))

- [L4] In most cases, surgical excision as treatment for hook of the hamate fractures is safe and allows a relatively rapid return to play. [4] ([10.1016/j.jhsa.2017.06.108](#))
- [L4] This pilot study demonstrates that non-displaced acute fractures and delayed union of the hamate hook can be treated successfully by dorsal percutaneous cannulated mini-screw fixation with minimal morbidity and complications. [5] ([10.1142/s0218810412970039](#))
- [L4] The carpal tunnel radiographic view should be considered in addition to routine radiographic views for patients with a possible hook of the hamate fracture. [6] ([10.2519/jospt.2010.0408](#))
- [L4] Fractures of the hook of the hamate are rare injuries, with the most usual mechanism being a direct blow to the area of the hook. [7] ([10.1016/0266-7681\(85\)90019-1](#))
- [L5] We recommend this view, in addition to the standard ones, in all cases of suspected fractures of the hook of the hamate. [8] ([10.1016/s0363-5023\(88\)80026-1](#))
- [L4] The treatment of choice for a symptomatic nonunion, and possibly for an acute fracture, appears to be surgical excision of the hook of the hamate. [9] ([10.1016/s0363-5023\(88\)80107-2](#))
- [L4] This condition should be managed no differently from a symptomatic nonunion, with excision of the hook of the hamate and repair of the ligament attachments. [10] ([10.1177/03635465030310010201](#))
- [L4] Both surgical procedures appear to yield acceptable outcomes in the treatment of hook of hamate fractures. [11] ([10.1016/j.jhsg.2023.11.011](#))
- [L4] Hook of hamate regeneration can occur after fracture fragment excision. [12] ([10.1016/j.jhsg.2024.08.008](#))
- [L4] Early and late surgical excision of the hook of the hamate leads to excellent results with return to preinjury levels of activity. [13] ([10.1053/j.otsm.2010.03.003](#))
- [L5] The author maintains that repair by open reduction and internal fixation for ununited fracture hook of the hamate is not only feasible but also desirable, both for preservation of grip strength and complete relief of pain. [14] ([10.1016/0363-5023\(89\)90032-4](#))
- [L4] Fractures of the hook of the hamate are rare injuries, with the most usual mechanism being a direct blow to the area of the hook. [15] ([10.1016/0266-7681_85_90019-1](#))
- [L4] Our results show that hamate hook fractures that are diagnosed early may heal with nonoperative management. [16] ([10.1016/0363-5023\(92\)90363-t](#))
- [L4] These cases are reported to emphasize the similarities of a fracture of the hook of the hamate to other conditions that cause ulnar wrist pain. [17] ([10.1016/s0363-5023\(85\)80258-6](#))
- [L4] The series identified an incidence of 2.7% of acute hook of hamate fracture in association with high-energy distal fractures in patients undergoing CT evaluation of the wrist. [18] ([10.1177/1753193411436293](#))
- [L4] Surgical excision of the hook of the hamate resulted in good postoperative outcomes with a mean follow-up of 6 years. [19] ([10.3109/17453679308993670](#))
- [L5] In younger patients with nonunion of the hook of the hamate, the author believes one should aim for the repair of the nonunion rather than simple excision to preserve grip strength. [20] ([10.1016/s0363-5023\(86\)80127-7](#))

- [L5] Combined intraarticular fracture of the body and hook of hamate is an extremely rare injury pattern requiring a high index of suspicion for diagnosis. [21] ([10.1007/s12593-012-0070-2](#))
- [Paper] The study highlights the open carpal tunnel approach as a successful technique for open excision of symptomatic ununited hook of hamate fractures, because of its familiarity, ease of performance, excellent visualization and low morbidity. [22] ([10.1016/j.injury.2014.05.008](#))
- [L5] The cadaveric study confirms that the dorsal percutaneous approach is a reliable method and provides safe fixation of non-displaced fractures of the hook of hamate. [23] ([10.1177/1753193421991761](#))
- [L4] The range of motion and grip strengths were equivalent on the operated and unoperated sides. [24] ([10.1016/s0363-5023\(89\)80008-5](#))
- [L4] The hook of hamate pull test is an easy, cheap, sensitive, and specific test that can be readily performed in the clinic to diagnose hook of hamate fractures. [25] ([10.1016/j.jhsa.2010.08.024](#))
- [L4] These fractures are not seen on standard two or three view wrist examination. [26] ([10.1016/s0736-4679\(98\)00016-x](#))
- [L4] Surgical excision of hook of hamate fractures in high-level amateur athletes allows for successful return to sports participation at preinjury performance levels, achievement of normal function as measured by validated objective outcome measures, significant reduction in pain, and high overall patient satisfaction. [27] ([10.1016/j.jhsa.2012.10.011](#))
- [L4] Surgical excision remains an effective method of management, with a low risk of minor complications for both acute and chronic hook of hamate fractures in professional baseball players. [28] ([10.1016/j.jhsa.2021.03.015](#))
- [L5] [29] ([10.1016/j.hansur.2016.06.007](#))
- [L5] Surgical excision is the treatment of choice for fractures of the hook of the hamate in any athlete, as the incidence of nonunion precludes the use of open reduction internal fixation. [30] ([10.1016/j.hcl.2012.05.013](#))
- [L5] The author states that in their institution, anyone with pain over the ulnar-palmar base of the hand should have a carpal tunnel view with the presumptive diagnosis of fracture of the hook of the hamate until proven otherwise. [31] ([10.1016/s0363-5023\(86\)80125-3](#))
- [L4] This modified approach allows direct visualization of the vital structures most at risk, including the motor branch of the ulnar nerve, unlike blind or unilateral approaches, and preserves the nerve supply and blood supply to the hypothenar muscles. [32] ([10.1016/j.jhsa.2019.07.015](#))
- [L5] [33] ([10.1016/j.jhsa.2013.06.004](#))
- [L5] Acute hook of hamate fractures in athletes may be treated with casting or allowed to return to play with nonunion addressed later via excision; definitive treatment for stress fractures is excision. [34] ([10.1016/j.hcl.2012.05.012](#))
- [L5] These findings suggest that such an injury results from a sudden, violent contraction of the flexor carpi ulnaris against the fixed wrist. [35] ([10.1016/s0266-7681\(96\)80043-x](#))
- [L5] The distal end of the transverse carpal ligament was located 10 mm from the hook of the hamate. [36] ([10.1016/0363-5023\(94\)90073-6](#))

- [L4] The proposed etiology of the tendon ruptures is chronic repetitive wear and fraying against the rough surface of the hook. [37] ([10.1142/s2424835516720164](#))
- [L4] Lateral trispiral tomography is clearly superior to other diagnostic methods for hamate hook fractures. [41] ([10.1016/0363-5023\(88\)90217-1](#))
- [L5] The authors believe this lateral approach should replace the conventional volar approach because of its benefits in terms of time, safety, and simplicity. [42] ([10.1016/0266-7681\(86\)90028-8](#))
- [L5] The hamate hook provides some biomechanical advantage for flexor tendon function and cadaveric changes in tendon force after its excision suggest that power grip may be decreased after hamate hook excision. [43] ([10.1053/jhsu.2003.50005](#))
- [L4] Patient outcomes were good to excellent regardless of the treatment chosen, with minimal pain and good hand functionality. [44] ([10.1177/1753193417729603](#))
- [L4] This minimally invasive technique avoids damage to the blood supply of the hamate, surrounding soft tissues, and the ulnar nerve, while preserving important stabilising ligaments. [45] ([10.3109/02844310801956714](#))
- [L4] Ultrasound treatment might be useful for nonunion of the hook of the hamate caused by repeated stress, and we consider that the ultrasound treatment for nonunion of the hook of the hamate is one option in various treatment methods. [46] ([10.1007/s00167-003-0425-0](#))
- [L4] The incidence of a hypoplastic hook of the hamate is common in patients with carpal tunnel syndrome, and preoperative evaluation of the morphology of the hooks and indications for endoscopic carpal tunnel release in cases of hypoplastic hooks may help predict adverse events. [47] ([10.1016/j.jhsg.2023.12.010](#))
- [L5] [48] ([10.1097/bth.0b013e31826577f8](#))
- [L4] No significant change with finger extension or flexion was noted in either the deep or superficial digital flexor tendons. [49] ([10.1142/s2424835519500139](#))
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- [L4] [67] ([10.1016/j.jhsa.2019.01.014](#))
- [L5] [69] ([10.1177/17531934241235803](#))
- [L3] MLB players sustaining hook of hamate fractures can reasonably expect to return to their pre-injury performance levels following operative treatment. [71] ([10.1123/jsr.2017-0071](#))
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