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## Case Report

# Hypothenar hammer syndrome: Case report and literature review

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## ABSTRACT

Hypothenar hammer syndrome is a rare but serious cause of digital ischemia and morbidity. Presented here is a case of a manual laborer who had symptoms of digital ischemia after acute hyperextension injury to the ring finger. Magnetic resonance imaging revealed thrombosed ulnar artery aneurysm. Etiology, presentation, and current treatments are reviewed.

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## Introduction

Acute osseous and soft-tissue injuries to the hand are commonly encountered in the adult population. Acute arterial occlusion secondary to acute-on-chronic microtrauma, however, is a less frequent occurrence. An example is hypothenar hammer syndrome (HHS) where the ulnar artery is injured secondary to repetitive trauma to the hypothenar eminence of the hand. The ulnar artery is susceptible to mechanical injury along the hypothenar eminence as it exits Guyon's canal and branches into the superficial and deep palmar arches (Fig. 1).

This syndrome is rare but of clinical significance due to the risk of amputation following digital ischemia. We are reporting a case of HHS in a 47-year-old mechanic who presented after acute hyperextension injury of the left ring finger.

## Case report

A 47-year-old engine mechanic presented to orthopedic hand surgery, 3 weeks after initial injury where his left ring finger was caught in a set of keys, resulting in traumatic hyperexten-

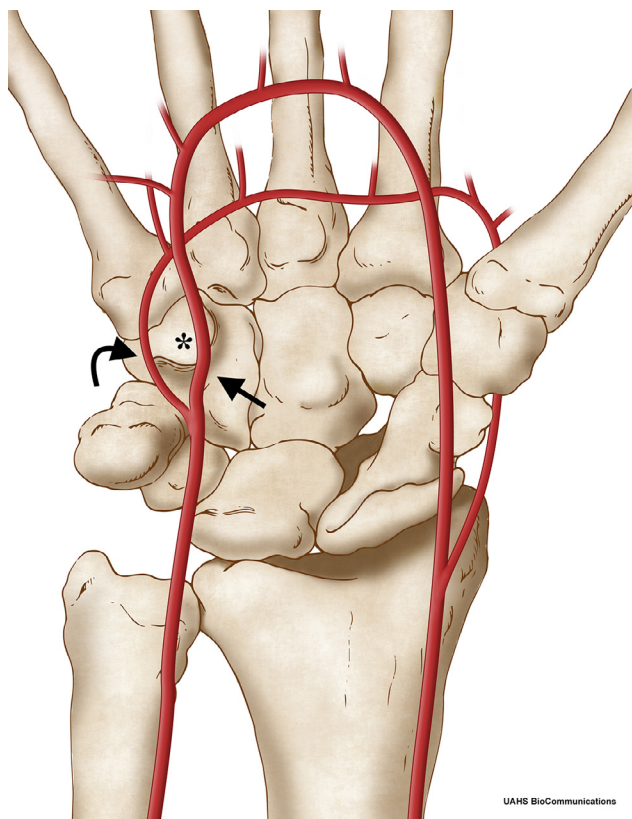
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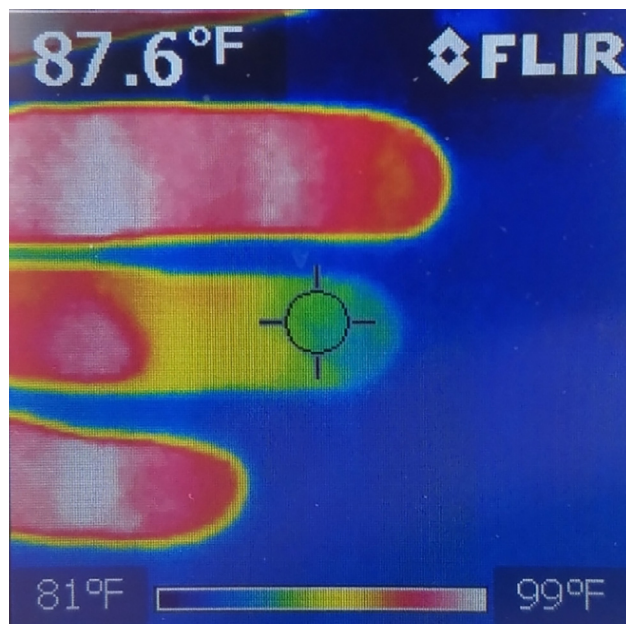
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**Fig. 1 – Artist drawing of the superficial and deep ulnar artery along Guyon’s canal. The superficial (straight arrow) and deep (curved arrow) ulnar artery near the hook of the hamate bone (asterisk).**

sion. The patient heard a “pop” and felt immediate pain over the palm, with continued pain and swelling for 2 days. Numbness and coldness of the ring finger set in approximately 10 days after initial injury. A day later, the patient’s little finger had also started to become cold to the touch. At work, the patient performed an infrared image of the left hand using a Forward-Looking Infrared camera, which is commonly used by mechanics to detect abnormal heat build-up in engine compartments, which showed decreased surface temperature of the ring finger relative to the other digits of the left hand (Fig. 2). The numbness resolved, but the coldness and pain persisted so the patient presented to the emergency department where physical exam revealed a cooler left ring finger tip compared to other digits. Radiographs of the left hand excluded acute osseous injury. There was a history of remote fracture of the right hand 2 years prior, but no injuries to the left hand. Given the concern for vascular injury the patient was referred to orthopedic hand surgery. On clinic review, the patient’s left ring and small fingers were cooler to the touch, with normal color, but with slight delay in capillary refill. There was normal sensation and strength. A tender mass was noted on the ulnar aspect of the hook of the hamate. Allen’s test suggested compromise of the ulnar arterial supply to the hand. The patient underwent MR Angiogram (MRA) of the left hand, given concern for HHS. This showed a 2.3 cm ulnar artery aneurysm

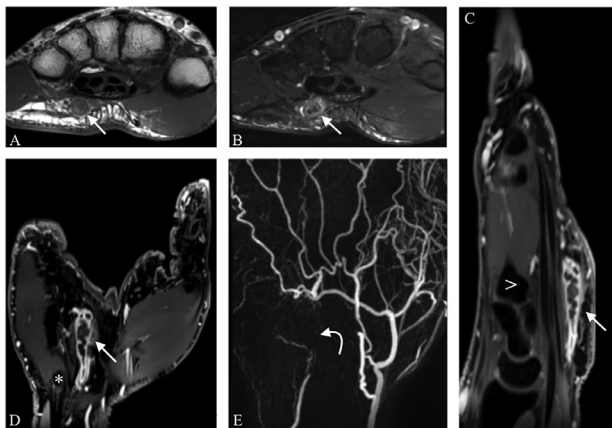


**Fig. 2 – Decreased temperature of the patient’s left ring finger. Forward-Looking Infrared (FLIR) camera image of the patient’s left fingers demonstrates decreased surface temperature of the ring finger relative to the other digits.**

with thrombus at the level of the hook of the hamate extending from the pisiform to the metacarpal base (Fig. 3). The patient was subsequently scheduled for aneurysm excision and ulnar artery bypass grafting. However, his symptoms significantly improved without medication or other treatment before surgery, and so he opted for continued nonoperative management. At the time of submission for publication, the patient has been asymptomatic for 8 months and decided not to pursue any follow-up unless his symptoms returned.

## Discussion

HHS was first described by Von Rosen in 1934 in a factory worker who repetitively used his hand as a hammer, and then one day experienced acute pain and subsequently digital ischemia a few weeks later. On surgical exploration of the hand, a thrombosed ulnar artery was found overlying the hamate bone as it exited Guyon’s canal (a fibro-osseous tunnel at the volar ulnar aspect of the wrist) [1]. The terminal ulnar artery and its proximal superficial palmar branch are most susceptible to mechanical injury as they exit Guyon’s canal due to the superficial location when crossing over the hook of the hamate for approximately 2 cm before penetrating the ulnar aponeurosis [2–4]. Later, Conn et al [2] described 13 cases of injury to the ulnar artery and superficial palmar arch in the same anatomic location. They named this injury “hypothenear hammer syndrome” (HHS), as the patients would use the hypothenear aspect of the palm to repetitively hammer objects, causing damage to the ulnar artery. This repeated trauma to the ulnar artery causes intimal and medial wall degenera-



**Fig. 3 – MR imaging and MRA of the hypothenar hammer syndrome.** Axial (A) T1-weighted and (B) T2-weighted with fat saturation MR images of the left hand show a heterogeneous hypointense signal within the ulnar artery lumen consistent with thrombosis (arrows). (C) Sagittal and (D) coronal and post-contrast T1-weighted with fat saturation MR images show a 2.3 cm thrombosed ulnar artery aneurysm with a central non-enhancing thrombus (arrows) extending from the pisiform (asterisk) to the metacarpal bases (arrowhead). (E) Coronal MRA image shows discontinuity of the ulnar artery in the region of Guyon's canal consistent with occlusion of the thrombosed aneurysm (curved arrow).

tion and thrombosis, with or without aneurysm, and subsequent embolic occlusion of the digital arteries, which results in symptomatic ischemia [2,5,6].

Subclinical disease has also been shown to be present in manual laborers who use the hypothenar palm as a hammer, and in athletes who sustain repeated force to the hand [3,7,8]. Ferris et al [5] later proposed that repetitive trauma was not the only risk factor for HHS, but that it was underlying fibromuscular dysplasia that predisposes the arterial intima to hyperplasia and intraluminal thrombus formation with subsequent digital embolic occlusion. Indeed, intimal hyperplasia and disruption of the internal elastic lamina have been confirmed in other studies [6,9], but fibromuscular dysplasia is considered by many to be an additional risk factor for HHS similar to smoking [6]. Even an accessory abductor digiti minimi muscle has been shown to be associated with HHS [10].

Acute traumatic cases causing the syndrome have also been reported [2,5,7,11–13]. Symptoms classically include pain over the hypothenar eminence, cold intolerance or cold sensation, numbness, cyanosis, ulceration and ischemia of the ring and small fingers, and possibly including the middle and index fingers [6,7,14,15]. Symptom severity depends on the amount of arterial damage, collateral vessels, and the extent of superficial palmar arch branching [5,11,15]. This is attributable to varying degrees of anastomosis between the terminal ulnar and radial arteries, of which only 34% of anatomic variants show communication of the distal aspect of the ulnar superficial palmar arch with the radial artery [14]. Allen's test (assessment of reperfusion rate of the hand following oc-

clusive pressure applied during clenched fist over the radial and ulnar artery at the wrist, followed by hand relaxation and release of either the radial or ulnar artery pressure) may be helpful to assess for palmar arch insufficiency, however, a negative Allen's test does not exclude the diagnosis [13,14]. Ulnar artery injury diagnosis may be made by digital subtraction arteriogram, CT angiography, MRA, or ultrasound [4,11,16]. Lesions to the ulnar artery include stenosis, saccular, or fusiform aneurysm, corkscrew appearance of the artery, with or without thrombosis of the ulnar, superficial palmar and digital arteries [4,14].

Treatment is initially conservative depending on severity of symptoms and digit ischemia, but if a large aneurysm is present, surgical intervention may be warranted [7,17,18]. Conservative treatment includes avoidance of the inciting trauma, palmar padding, smoking cessation, and pharmacologic antiplatelet and vasodilator therapy [7,14,18]. Failure of conservative management and relapse of symptoms is more common in patients who continue to smoke than those who abstain [7]. Surgical treatment is indicated when conservative management fails, aneurysm formation is present, or digital ischemia is severe. Interventions include sympathectomy, segmental excision of the thrombus or aneurysm with end to end anastomosis, or reconstruction with autologous venous or arterial graft [11,12,17,19]. After surgical reconstruction, injury of the dominant hand and continued manual labor was associated with more postoperative cold intolerance [12]. Long-term graft patency is variable, with up to 78% occlusion of vein grafts at 10 years [17]. Recently, de Niet and Van Uchelelen showed 11 out of 11 arterial grafts were patent at a mean follow-up of 63 months compared with prior data showing 9 out of 32 venous grafts being patent at a mean of 83 months follow-up [19].

## Conclusion

We present a case of HHS in a manual laborer who sustained acute hyperextension injury with subsequent ulnar artery aneurysm and thrombosis. The patient's symptoms resolved spontaneously without any conservative treatment (ie, palmar padding, antiplatelet, or vasodilator therapy), which was likely the result of collateral circulation from the radial artery since the ulnar artery is not known to recanalize. The etiology of HHS is discussed, with chronic microtrauma to the ulnar artery being the main factor. The most feared sequela of HHS is amputation following digital ischemia. Symptoms mainly include pain, coldness, and numbness to the little and ring fingers. Diagnosis can easily be made with MRI/MRA. Conservative treatment is first-line, unless digital ischemia is severe enough to warrant surgical vascular grafting.

## Supplementary material

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.radcr.2019.04.015.

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