

# Firearm-related hypothenar hammer syndrome in a police officer

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## ABSTRACT

Hypothenar hammer syndrome (HHS) is an uncommon condition that is associated with occupational repetitive injury to the hand. The commonly associated occupations include auto mechanics, machinists, miners, and butchers or occupations requiring the worker to use the hypothenar portion of the hand as a tool. Until now, there has never been a case report of HHS secondary to firearm use. In this report, we highlight a unique presentation of firearm-related HHS. (*J Vasc Surg Cases and Innovative Techniques* 2018;4:223-5.)

**Keywords:** Work-related injury; Hand ischemia; Occupational injury

Hypothenar hammer syndrome (HHS) is classically described to have a higher incidence in male smokers with a concomitant history of repetitive blunt trauma to the hand.<sup>1-3</sup> Symptoms are usually in the dominant hand.<sup>5</sup> Each strike of the hand causes microtrauma to the intima or media of the ulnar artery and eventually leads to digital ischemia brought about by ulnar thrombosis or more commonly aneurysmal changes resulting in embolization of thrombus.<sup>2-7</sup> However, pathologic changes to the hand are not always recognized as patients can be asymptomatic or experience only mild symptoms.<sup>3,6</sup> Nonetheless, HHS is an important pathologic process to consider in the differential diagnosis of hand and finger pain.

Historically, the earliest documented HHS was in ironworkers,<sup>3</sup> and since then, a wide range of activities have been associated with the syndrome. These include many sports and recreational activities, such as ice hockey; occupations; and even routine daily activities, such as the chronic use of a cane or gardening.<sup>4,5,8,9</sup> We describe a Royal Canadian Mounted Police firearm instructor who developed HHS, probably related to occupational exposure. We obtained consent from the patient to publish his case details and images.

## CASE REPORT

Mr L.E. is a 36-year-old right-hand-dominant Royal Canadian Mounted Police firearm instructor for the past 14 years. The

vascular surgery service was consulted for sudden-onset, persistent, severe pain in his right index finger that began 1 month ago. Subsequently, a wound developed after an accidental injury and became the focal ischemic ulcer seen at his initial visit. In addition, he reported that his left fourth and fifth fingers were exhibiting similar symptoms. He was otherwise healthy with no other history of upper extremity trauma or operations. He denied any history of Raynaud phenomenon, features of connective tissue disease, or cardiac disease. He did not work with power tools and fired pistols and carbines only at work. As a firearms instructor, he handled different firearms but most recently had been handling a Colt C8 Carbine (assault rifle). This involved repetitive impact against his shoulder but also against his hands, particularly the hypothenar eminence (Fig 1). He was an ex-smoker and quit 9 years ago.

On physical examination, his cardiac and respiratory examination findings were normal. His lower extremity pulses were palpable bilaterally. Examination of the upper extremities revealed a small ischemic ulcer (5 mm in diameter, painful, pale, white, and cold) at the tip of his right index finger. The right index finger's distal interphalangeal joint was stiff, but all other joints had a full range of movement and strength. Adson and elevated arm stress test results were negative, and no subclavian bruit was heard throughout the full range of motion of the shoulder.

He was prescribed aspirin, amlodipine, and Nitrospray and advised to avoid the cold. Concurrently, he was also sent for a workup for a cardioembolic event with echocardiography and 24-hour Holter monitoring, which had normal recordings. He also underwent a computed tomography-guided cervical block of the right cervical sympathetic chain; angiography of the upper extremity; and arm, forearm, and digital pressure measurements. The right second finger digital pressure was decreased, and angiography (Fig 2) revealed an irregular ulnar artery at the level of the hamate bone. There were also occlusions of both digital arteries to the right index finger, which was consistent with HHS. Systemic vasculitis workup was negative. The patient was then scheduled to have a video-assisted thoracoscopic sympathectomy. The patient tolerated the procedure well, and no complications were observed.

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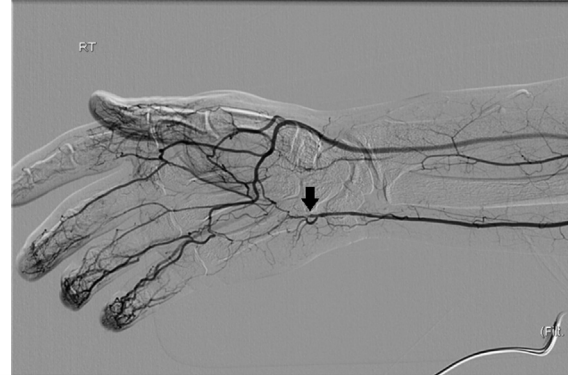
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**Fig 1.** Patient holding a carbine rifle with right index finger extended. The path of recoil is directly into the palm of the right hand.



**Fig 2.** Angiography of right hand showing an irregular ulnar artery at the level of the hamate and distal occlusion.

Postoperatively, he recovered quickly. He reported subjective decrease in pain and increase in temperature in his right index finger on postoperative day 1. Notably, he reported that his right index finger is now able to activate the touch screen on his smartphone, which was unresponsive to his index finger. He was discharged home on postoperative day 2. At his 3-week follow-up, he reported and showed further improvement in pain and healing of his right index finger's ischemic ulcer. Angiography of the left hand revealed minor changes in the left ulnar artery and digital artery occlusion. The patient's left hand symptoms do not interfere with his daily activities, so the plan was to observe the left hand for the time being.

## DISCUSSION

The anatomy of the ulnar artery makes it vulnerable to injury at the hypothenar eminence with repetitive trauma to the palm.<sup>2,3,5,6,10,11</sup> The ulnar artery travels in Guyon canal, which is bordered by the hook of hamate laterally and pisiform medially and is relatively superficial in this region of the palm covered only by skin, subcutaneous tissue, and the palmaris brevis muscle.<sup>5,7,11</sup> The use of the palm in pushing, pounding, or twisting actions compresses the artery against the hook of the hamate, which acts as an anvil, leading to vessel injury. The resulting injury can lead to the development of ischemic symptoms due to thrombotic occlusion of the ulnar artery or more commonly through embolization from the aneurysmal degeneration of the artery due to repeated arterial trauma.<sup>1,3,11</sup> The pathophysiologic mechanism has been described to be secondary to vasospasm and direct intimal injury resulting in platelet aggregation and thrombosis or direct injury to the media

leading to aneurysmal degeneration.<sup>2,3,6</sup> Classically, the disease was described in laborers who habitually use their hands as a hammer.<sup>1-3,6-8,10,12</sup> Case reports have also described HHS to be secondary to sports, but the common theme is trauma to the palm.

HHS has never been reported to be associated with firearm use. In our patient, the cause of the angiographic findings is likely to be resultant from repetitive impact from high-power carbine recoil over the hypothenar eminence. Similar to other causes of HHS, the impact likely traumatized the ulnar artery, leading to the aforementioned injury and progressive stenosis and thrombosis, which was demonstrated on the angiogram. Although there are papers discussing different aspects of firearm use-associated musculoskeletal injuries, there are no reports on ischemic injury secondary to firearm use.<sup>13</sup> Thus, we think it is important to document this case.

Firearm use leading to HHS can have work-related ramifications. Patients presenting with hand ischemia would be recognized to be associated with firearm use and appropriately compensated as a work-related claim. There may be modifications, such as using gloves with appropriately placed padding, to prevent work-related injury. In addition, the patient may also be appropriately advised to cease use of firearms to prevent future recurrence after surgical repair. Early recognition of the inciting event can lead to proper management and counseling.

## CONCLUSIONS

HHS has never been described to be associated with firearm use. This case report is the first to describe repetitive firearm use leading to the diagnosis of HHS. The impact of recoil from firearms, especially for occupational use, could have implications for insurance and work-related injury claims. More important, given the widespread use of this and similar assault carbines by police forces, preventive measures could be implemented to minimize this injury. Similar to other HHS-associated activities, the mechanism is likely to be due to repetitive trauma from firearm recoil into the

hypothenar eminence. Thus, this case highlights the importance of keeping a high index of suspicion for HHS in patients with repetitive trauma to the hand from either occupational or recreational firearm handling to facilitate timely diagnosis and treatment.

## REFERENCES

1. Gardiner CA, Tan A. Repetitive blunt trauma and arterial injury in the hand. *Cardiovasc Intervent Radiol* 2017;40:1659-68.
2. Carter PM, Hollinshead PA, Desmond JS. Hypothenar hammer syndrome: case report and review. *J Emerg Med* 2013;45:22-5.
3. Ablett CT, Hackett LA. Hypothenar hammer syndrome: case reports and brief review. *Clin Med Res* 2008;6:3-8.
4. Marie I, Hervé F, Primard E, Cailleux N, Levesque H. Long-term follow-up of hypothenar hammer syndrome: a series of 47 patients. *Medicine (Baltimore)* 2007;86:334-43.
5. Gupta A, Gupta S, Harris S, Naina H. Hypothenar hammer syndrome. *BMJ Case Rep* 2016;2016. doi:10.1136/bcr-2015-213678.
6. Swanson KE, Bartholomew JR, Paulson R. Hypothenar hammer syndrome: a case and brief review. *Vasc Med* 2012;17:108-15.
7. Iannuzzi NP, Higgins JP. Acute arterial thrombosis of the hand. *J Hand Surg Am* 2015;40:2099-106.
8. Orrapin S, Arworn S, Wisetborisut A. Unusual cases of hypothenar hammer syndrome. *Ann Vasc Dis* 2015;8:262-4.
9. Zayed MA, McDonald J, Tittley JC. Hypothenar hammer syndrome from ice hockey stick-handling. *Ann Vasc Surg* 2013;27:1183.e5-10.
10. Scharnbacher J, Claus M, Reichert J, Rohrl T, Hoffmann U, Ulm K, et al. Hypothenar hammer syndrome: a multicenter case-control study. *Am J Ind Med* 2013;56:1352-8.
11. Seldén A, Hermiz F, Östlund B. [Hypothenar hammer syndrome is rare—or simply an unusually overlooked condition]. *Lakartidningen* 2016;113. PMID: 27727416.
12. Zhang F, Weerakkody Y, Tosenovsky P. Hypothenar hammer syndrome in an office worker. *J Med Imaging Radiat Oncol* 2017;61:774-6.
13. Knapik JJ, Spiess A, Swedler D, Grier T, Hauret K, Yoder J, et al. Retrospective examination of injuries and physical fitness during Federal Bureau of Investigation new agent training. *J Occup Med Toxicol* 2011;6:26.

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