Patients who use the palms of their hands as a hammer may cause irreversible damage to the radial or ulnar arteries. Damage to the intima may lead to arterial thrombosis, whereas damage to the media may cause aneurysm formation with embolization to the digital arteries, causing symptoms of ischemia. These patients may have symptoms of Raynaud syndrome, or they may have ischemic ulcersations of their fingers. Hypothenar hammer syndrome with involvement of the ulnar artery is much more frequently encountered than thenar hammer syndrome, which is caused by damage to the radial artery. We report a patient with symptomatic occlusion of both the radial and ulnar arteries secondary to repetitive trauma to the palm of his hand. In our review of the literature, we found two reports involving a total of four patients with similar findings. Both conservative and surgical treatments have been used successfully. Avoidance of the precipitating activities is important in long-term management of these patients. (J Vasc Surg 2008;48:741-4.)

**Combined thenar and hypothenar hammer syndromes: Case report and review of the literature**

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Patients with hand ischemia secondary to occlusive disease often present with symptoms of cold intolerance, rest pain, or ischemic ulceration of the fingers, a condition that has been termed Raynaud phenomenon or obstructive Raynaud syndrome.\(^1\)-\(^2\) Patients who use the palms of their hands to strike objects in their occupation or avocation may develop these symptoms secondary to injury to the ulnar or radial arteries.

Hypothenar hammer syndrome (HHS) was first described by Conn et al\(^3\) in a report of patients with hand ischemia secondary to repetitive trauma to the ulnar artery. The superficial palmar branch of the ulnar artery lies directly over the hook of the hamate bone and is therefore susceptible to repetitive trauma, which may result in arterial thrombosis or subsequent aneurysm formation with distal embolization. Initial descriptions of treatment of HHS involved primarily conservative therapy. More recent reports\(^3\)-\(^9\) however, have emphasized arterial reconstruction—both to remove the damaged arterial segment and prevent further embolic events, and to revascularize the hand.

Much less frequently encountered is thenar syndrome in which the radial artery is involved.\(^10\)-\(^11\) The distal radial artery overlies the scaphoid bone and is likewise susceptible to repetitive trauma and resulting aneurysm formation and distal embolization. These patients present with symptoms similar to those with HHS. Concomitant involvement of the radial and ulnar arteries appears to be distinctly uncommon. This report describes a patient with occlusion of both the radial and ulnar arteries secondary to repetitive trauma to the palm of his hand.

**CASE REPORT**

This 40-year-old gentleman presented in February 2007 with a history of constant pain involving the fingers of the right hand for several weeks. His past medical history was significant for having developed frostbite to this extremity 20 years previously. He had a 5-year history of symptoms compatible with Raynaud syndrome in his right hand. Over the previous 2 years, his hand had become more intolerant of exposure to cold temperatures. The patient had a 20-pack-year smoking history. His medical history was otherwise unremarkable. The patient was employed as a machinist and frequently used the palm of his right hand as a hammer.

On examination he had palpable brachial, radial, and ulnar pulses bilaterally. No ischemic lesions were noted in the fingers of his right hand. Capillary refill was delayed in all fingers of the right hand compared with the uninvolved extremity. Digital plethysmography demonstrated absent flow in the right second and third digits. Digital pressures in the right fourth and fifth fingers were diminished compared with the left hand. Laboratory studies included numerous tests to rule out a hypercoagulable state and an autoimmune disorder. All studies were normal. Arteriography demonstrated a normal aortic arch and normal arteries of the right upper extremity (Fig 1) down to the level of the wrist, at which point the radial and ulnar arteries were occluded (Fig 2). The contralateral upper extremity was not examined. “Corkscrew” collaterals were seen arising from the ulnar artery. There was no improvement in flow after administration of intra-arterial nitroglycerin. We felt that a bypass from the distal radial artery to the deep palmar arch should be done, because the superficial palmar arch seemed to be attenuated. Our plan was to revascularize the ulnar artery if the bypass of the radial artery did not provide sufficient relief of symptoms.
The patient was taken to the operating room in February 2007, at which time the right radial artery was exposed through a longitudinal incision at the wrist, which demonstrated a thrombosed radial artery aneurysm (Fig 3). A segment of saphenous vein, harvested from the dorsum of his right foot, was placed as an interposition graft in the radial artery with a running 7-0 Prolene suture (Ethicon, Cincinnati, Ohio) (Fig 4). The patient made an uneventful recovery.

At 6-month follow-up, a duplex image of the vein graft demonstrated a patent graft (Fig 5). In addition, digital pressures in the right hand were symmetric to those in the left hand. The patient continues to have some degree of intolerance to cold temperatures; however, his symptoms of rest pain have been relieved. He was advised to discontinue smoking.

DISCUSSION

Conn et al\(^3\) were the first to coin the term hypothenar hammer syndrome to describe patients with Raynaud syndrome, rest pain, or tissue loss with a history of repetitively striking the palms of their hands in their occupations. The superficial palmar branch of the ulnar artery is especially vulnerable to trauma, because it courses over the hook of the hamate bone in the wrist. The superficial palmar branch of the ulnar artery provides the primary source of arterial flow for most of the fingers of the hand. Repetitive trauma to the ulnar artery at this location may lead to formation of an aneurysm or thrombosis of the artery. Embolization to the digital arteries is responsible for development of symptoms, with the third, fourth, and fifth fingers being involved most frequently. Although HHS is most often

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**Fig 1.** Upper extremity arteriogram demonstrating patent proximal radial and ulnar arteries.

**Fig 2.** Upper extremity arteriogram demonstrating occlusion of the distal right radial and ulnar arteries. There is marked attenuation of the superficial palmar arch.

**Fig 3.** The right radial artery aneurysm containing a large amount of thrombus.

**Fig 4.** Operative photograph following placement of the saphenous vein graft.
seen in patients who use the palms of their hands as hammers occupationally, it has been described in athletes as well.10-12 Ferris et al3 reported the largest series of patients with HHS. These authors described HHS as either a segmental occlusion of the ulnar artery or a patent ulnar artery with elongation and a corkscrew appearance associated with symptomatic embolic digital artery occlusion. These authors hypothesized that HHS results from trauma to an intrinsically abnormal artery. In their series of 21 patients, histologic examination of the excised ulnar artery demonstrated fibromuscular dysplasia with superimposed trauma in all 19 specimens examined. Bilateral upper extremity arteriograms were obtained in 13 of their patients; in 11 (92%) of these patients similar angiographic findings were noted in the contralateral, asymptomatic hand, suggesting an underlying predisposition to the development of HHS. The authors postulated that HHS does not develop in most patients with repetitive trauma to the hand, because their ulnar arteries are normal.

Much less frequently encountered is thenar hammer syndrome with involvement of the radial artery, which is also susceptible to trauma because it lies on the scaphoid bone. Similar to HHS, these patients have a history of repetitive trauma to the wrist and often present with similar symptoms.10-11 Anatomically, the radial artery gives rise to the deep palmar arch and the ulnar artery forms the superficial palmar arch. In most patients there is sufficient collateral flow between these arteries; however, some patients have an incomplete palmar arch. As Bergan11 has noted, most patients requiring surgical treatment of HHS have an incomplete palmar arch. Embolization from either the ulnar or radial artery to the palmar arches may result in inadequate collateral flow.

Repetitive trauma to the palm of the hand is a common etiologic feature in producing either HHS or thenar hammer syndrome. Little and Ferguson5 reported an interesting study in which they screened 79 “habitual hammerers” with digital plethysmographic studies and found that 11 (14%) of these individuals had evidence of ulnar artery occlusion in one or both hands. These authors also noted that the duration of employment was positively correlated with development of the syndrome. Those individuals with symptomatic HHS were older and had worked longer as mechanics.

Treatment options for HHS and thenar hammer syndrome involve conservative or surgical therapy. Conservative therapy includes avoidance of using the palm to strike objects, smoking cessation, and use of calcium-channel blockers. Kostianen and Orava11 reported a study involving three volleyball players in whom the vascular lesions appeared to be reversible with abstinence from playing volleyball and with the use of vasodilating agents that they did not define. The initial angiogram of one of these patients demonstrated occlusion of the ulnar artery and multiple stenotic areas in the radial artery of the affected hand. A follow-up arteriogram 2 months later demonstrated marked improvement in both arteries after conservative therapy. The two other patients did not undergo angiographic evaluation, but both had symptomatic improvement with conservative treatment.

Surgical options include cervical sympathectomy, ligation of the artery to prevent further embolic events, and resection of the artery with interposition grafting. For patients undergoing interposition grafting, Dalman9 recommended using a saphenous vein taken from the dorsum of the foot to minimize any size discrepancy between the artery and vein. Ferris et al4 reported a patency rate of 84% at 2 years in 21 patients treated with interposition saphenous vein grafts. Smith et al8 reported three patients with HHS in whom the inferior epigastric artery was used to reconstruct the ulnar artery, with all patients having patent grafts at follow-up. Similar to the experience of coronary artery bypass grafting in which radial artery grafts have superior patency rates compared with saphenous vein grafts, these authors felt the inferior epigastric artery grafts may have similar additional benefits over saphenous vein grafts. In patients in whom the arteriogram demonstrates thrombus within the palmar arch, preoperative thrombolytic therapy has been used successfully to lyse the thrombus followed by surgical treatment.7 Cervical sympathectomy is reserved for patients with rest pain or ischemic ulcerations in whom revascularization is not feasible.

Concomitant involvement of the radial and ulnar arteries, as occurred in our patient, appears to be distinctly uncommon. We found only two other reports, involving a total of four patients, in which the patients had both HHS and thenar hammer syndrome.10-11 In the report by Kostianen and Orava11 involving three volleyball players, all were treated conservatively with marked improvement in symptoms. The patient reported by Neill-Cage et al10 was treated with an interposition vein graft.

In patients with combined involvement of the radial and ulnar arteries who require surgical intervention, revascularization of either artery would appear to be appropriate. We chose
to revascularize the radial artery in our patient, because the deep palmar arch appeared to be better “preserved” than the superficial palmar arch.

CONCLUSIONS

The HHS and thenar hammer syndrome are well-described clinical entities in which patients present with symptoms of Raynaud syndrome and often with signs of digital ischemia caused by repetitive trauma to the palms of their hands. Avoidance of the precipitating factors and surgical treatment with resection of the involved artery with interposition grafting are required in many of these patients. Concomitant involvement of both the radial and ulnar arteries is uncommon.

REFERENCES


Submitted Jan 31, 2008; accepted Mar 30, 2008.