Acute carpal tunnel syndrome secondary to iatrogenic hemorrhage. A case report

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Abstract Carpal tunnel syndrome is a common compression neuropathy of the median nerve. Acute carpal tunnel syndrome (aCTS) is rare, associated with a variety of conditions. In this case report we present a patient who developed aCTS and volar forearm compartment syndrome after a radial artery line placement, while receiving intravenous heparin. The patient underwent immediate forearm fasciotomy and surgical release for restoration of nerve function, which resulted in improved hand function and mild residual median nerve neuropathy. There is controversy whether to discontinue or not anticoagulation in a patient with aCTS. In our patient, heparin therapy was restarted on the second postoperative day.

Keywords Carpal tunnel syndrome · Iatrogenic hemorrhage · Radial line placement · Forearm compartment syndrome · Anticoagulation

Introduction

Carpal tunnel syndrome (CTS) is a median nerve compression neuropathy at the level of the wrist. Compression

occurs within the carpal tunnel where median nerve and flexor tendons pass through a channel defined by the carpal bones and the transverse carpal ligament. Any process that increases the volume within the carpal tunnel can compress the median nerve, causing symptoms, such as pain and paresthesias, and findings such as functional deficits of the thumb and fingers, atrophy of the thenar musculature and prolonged nerve latencies on nerve conduction testing. CTS can be either chronic (cCTS) or acute (aCTS). In aCTS, the intracarpal pressure rises above a threshold of 20–30 mmHg [18] and capillary blood flow is reduced below the level of median nerve viability.

aCTS is a rare event that most commonly occurs following trauma. In the following case report, we present a patient who developed aCTS after a radial artery line placement, while receiving intravenous heparin.

Case Report

The patient is a 40-year-old right-hand-dominant female with a history of congenital transposition of the great vessels, dextrocardia and situs inversus. Twelve years prior to presentation, she underwent a mechanical aortic valve replacement and was on long-term warfarin therapy (10 mg/day). At the time of admission to an outside hospital, she presented with an aortic valve thrombus, diagnosed by transesophageal echocardiogram and with symptoms of respiratory distress. Thrombolytic, as well as intravenous heparin therapy was initiated following intubation. The international normalized ratio (INR) at the time of admission was 1.7. A left radial arterial line placement was unsuccessfully attempted. The patient was then transferred to Duke University Medical Center and admitted to the intensive care unit for further treatment. She was extubated

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the next morning, 12 h after her admission, and noted increasing pain in the left hand and forearm. Physical examination revealed a tense volar compartment, with pain on passive extension of the fingers and decreased sensation over the volar aspect of the thumb, index, middle, and the radial side of the ring finger. There was evidence of bruising and a large hematoma was noted in the area where the left radial artery was placed unsuccessfully. Both the radial and ulnar artery pulse were palpable. Examination by ultrasound demonstrated a patent left radial artery, no thrombus formation or pseudoaneurysm and extensive edema around the arterial puncture site was noted. Coagulation studies at the time of consultation revealed an INR of 1.3, prothrombin time (PT) of 15.3 s and partial thromboplastin time (PTT) of 24.1 s.

The clinical diagnosis of aCTS and left forearm compartment syndrome was made, and IV heparin was held to prepare the patient for immediately operative intervention. A left volar forearm fasciotomy and an open carpal tunnel release and median nerve decompression were performed under general anesthesia. During the exploration, fresh blood of approximately 20 ml and blood clots were noted in the carpal tunnel (Fig. 1). No active bleeding was noted. The volar forearm skin was only partially closed. Re-initiation of heparin therapy occurred on postoperative day 2. The patient was discharged on post-operative day 10 with a vacuum assisted closure to the remaining forearm wound. She was discharged on coumadin, the INR at the time of discharge was 2.6, the PT was 31.1 s.

Discussion

The anatomy of the carpal tunnel was first described in 1854 by Paget [24]. One hundred years later, Phalen [27]

Fig. 1 Exploration of the carpal tunnel revealed fresh blood and blood clot was seen in the carpal tunnel

defined the pathogenesis, clinical diagnosis, and treatment of carpal tunnel syndrome. Currently, carpal tunnel syndrome is subdivided into common cCTS and rare aCTS.

aCTS is caused by multiple etiologies, mainly traumatic and nontraumatic events. aCTS is commonly seen after fractures of the distal radius [11, 12, 16, 25] and carpal bones [14, 22], as well as after carpometacarpal fractures [1, 36]. A traumatic rupture of the median artery has also been reported as a rare etiology of aCTS [7]. Fractures can cause aCTS either secondary due to hemorrhage and/or edema [22], or due to fracture dislocation and direct contact with the median nerve [31].

Nontraumatic aCTS is a rare event that can occur with spontaneous bleeding such as occurs in hemophiliacs [19], patients with von Willebrand's disease [26], acute myelomonocytic leukemia [10], patients on anticoagulants [3–5, 20], after strenuous exercise [2], and due to hemorrhage secondary to diffuse giant cell tumor of the tendon sheath [35]. Other nontraumatic etiologies of aCTS not attributed to hemorrhage have also been reported such as gout [21] or pseudogout [6] or the presence of a foreign body within the carpal tunnel [33]. A rare case of aCTS due to idiosyncratic reaction of a patient to a tricyclic (Amitriptyline) overdose has also been reported [8].

According to the current literature, there is no “golden standard” algorithm reported for the diagnosis of aCTS. Imaging techniques, like wrist X-rays are useful in demonstrating a displaced fracture but do not demonstrate a hematoma in the carpal tunnel [1, 2, 9, 14]. A CT scan [1, 10] or MRI [35] may demonstrate fluid within the carpal tunnel. Some authors have employed the wick catheter or the STICK device (Stryker, Kalamazoo, MI) to establish the diagnosis of aCTS with a pressure greater than 40 mmHg [13, 17, 31]. Although pressure gradients represent the objective foundation for the diagnosis, Ortiz and Berger [23] stressed the importance of high clinical suspicion in the context of the history and physical examination.

In the reported case, the diagnosis was purely based on clinical findings, similar to other reported cases [8, 22, 26]. A forearm fasciotomy was performed simultaneously due to the combined clinical diagnosis of volar forearm compartment syndrome. There is controversy whether an invasive pressure measurement should be performed on a routine basis [31] to establish the diagnosis. Ortiz and Berger [23] and Sparkes et al. [32] suggest that the diagnosis of forearm compartment syndrome can be solely based on clinical findings, particularly with pain on passive stretch [17].

The radial artery remains the most common site for arterial cannulation and multiple complications have been reported. In 2002, Scheer et al. [30] published a review of radial, femoral, and axillary artery catheterization, and their complications. The most common complication of radial artery cannulation is temporary occlusion (19.7%), hematoma (14.4%), local

infection (0.72%) sepsis (0.13%), and pseudoaneurysm formation (0.09%). In addition, radial artery cannulation has been reported to cause forearm compartment syndrome [28, 30] or carpal tunnel syndrome [15, 29, 30]. In the presented case, the unsuccessful attempt of a radial artery placement likely led to an iatrogenic carpal tunnel syndrome and volar forearm compartment syndrome. The patient reported increasing pain and paresthesia, approximately 12 h after the attempted placement of an arterial line. In contrast to cCTS, immediate surgical release is mandatory to prevent median nerve damage and to maintain capillary blood flow [34]. With early operative intervention, the chances for full nerve recovery are high. Full hand function commonly recurs within 3–6 weeks independent of the etiology [1, 2, 9, 14, 31]. Our patient recovered fully from surgery with improved hand function and mild residual median nerve neuropathy.

The decision as to whether a patient with aCTS should remain on anticoagulant therapy is unclear. According to Black et al. [4], the risk of thrombosis outweighs the benefit of discontinuing or reversing anticoagulant therapy. In contrast, Bonatz and Seabol [5] recommend discontinuation of anticoagulation. In this reported case, the patient was restarted on heparin therapy on the second postoperative day due to her aortic thrombus posing greater risk than bleeding in the carpal tunnel. We believe that the decision should be made on a case-by-case basis.

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