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CASE REPORT

Radial artery aneurysm secondary to dynamic entrapment by extensor pollicis longus tendon: a case of snapping thumb

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Abstract

Aneurysms of the distal radial artery at the level of the wrist are rare. Most reported cases are posttraumatic, either from iatrogenic arterial puncture for radial arterial access or from a penetrating injury. Other causes include infection and connective tissue disorders. Early diagnosis is important to avoid the potential complications of thrombus formation, distal digital ischemia, and rupture. Evaluation of the radial artery is typically performed using non-invasive modalities like ultrasonography, computed tomographic angiography (CTA), and magnetic resonance angiography (MRA). Invasive angiography can also be performed, particularly if minimally invasive treatment options are being considered. We report a case of a 35-year-old male mechanic who presented with pain at the base of the left thumb dorsally, with reproducible painful snapping on dynamic exam. Ultrasound demonstrated a fusiform aneurysm of the radial artery. At the level of the aneurysm, there was dynamic entrapment of the artery between the extensor pollicis longus (EPL) tendon and the underlying trapezium. The patient's symptoms improved with conservative management and avoidance of the snapping-producing maneuvers. To our knowledge, this is the first published case of snapping at the base of the thumb resulting in repetitive entrapment of the radial artery by the EPL tendon captured on dynamic ultrasound examination.

Keywords Radial artery · Extensor pollicis longus · Snapping thumb · Aneurysm · Ultrasound

Introduction

Aneurysms of the distal radial artery at the level of the thumb base are rare, most being post-traumatic. Pseudoaneurysms of the radial artery are a rare complication of radial artery access, and typically occur at the site of puncture at the volar wrist. Other causes such as connective tissue disorders and infection have been reported in the literature [1, 2]. Making an accurate diagnosis of an aneurysm is important due to potential risk of distal ischemia, thrombosis, or rarely rupture when large. While several mechanisms for aneurysm development have been described, we report a case of radial artery aneurysm at the thumb base resulting from abnormal repetitive entrapment and snapping of the artery under the EPL tendon on thumb flexion and adduction in a mechanic. To our knowledge, this is the first case of a documented snapping mechanism visualized on direct dynamic ultrasound reported in the literature to explain radial artery aneurysm formation at this site.

Case report

A 35-year-old right-hand-dominant man presented to the orthopedic service with progressive pain in the base of the thumb. There was no history of a specific traumatic incident. He worked as a bike mechanic, in particular repairing shocks. He ascribed the pain to be associated with popping and clicking at the base of his thumb, which he described as happening several hundred times per day as part of his manipulation of the bike parts and which he could reproduce on demand. His pain ranged from 4/10 at baseline, increasing to 7/10 by the end of the day depending on how much he worked. He was a non-smoker and otherwise healthy.

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On physical examination, the snapping sensation was reproducible by rolling his thumb back and forth when the thumb was in a flexed adducted position, as if rolling a nut. The snapping occurred dorsally at the base of the thumb. It was tender to palpation. There were no signs of distal digital ischemia or neurological impairment. No thumb subluxation could be elicited and there were no palpable bony osteophytes. A pulsatile mass was not felt. The clinical impression of the surgeon was "irritation of EPL tendon rubbing against some ascending structure". A non-contrast CT was performed, which was reported as normal and ultrasound imaging was requested.

Dynamic ultrasound evaluation at the base of the thumb revealed entrapment of the radial artery between the EPL tendon and the trapezium that resulted in a snapping producing pain as shown in the supplementary ultrasound video clip (Online Resource 1). Ectasia and mild fusiform aneurysm dilatation was present in the radial artery at the site of the snapping (Figs. 1 and 2) with a maximal diameter of 4 mm compared with a baseline measurement of 2.5 mm proximal to the aneurysm where the radial artery was morphologically normal. Doppler exam of the radial artery showed a normal pulse waveform with no mural thrombus formation (Fig. 3). The EPL tendon was normal with no sonographic features of tenosynovitis. More proximally at Lister's tubercle, the EPL was normal in location and morphology. The non-contrast CT performed 3 months prior to the ultrasound had excluded any carpal bone osteophytes and interestingly even in retrospect the radial artery dilatation was not evident, although limited due to the small size of the artery and the lack of iodinated contrast.

The patient recognized that the symptomatology was partially due to a learned habitual maneuver. He felt he could manage the symptoms and avoid the habitual maneuver. He elected against surgical intervention, which would have comprised transposition of the EPL with or without resection of the aneurysmal arterial segment. He was treated with a splint and limitation of any activity that might reproduce the snapping sensation. Following conservative treatment, the patient reported a decrease in symptoms. A follow-up ultrasound 6 month later showed a reduction in the size of the aneurysm measuring almost normal compared with the proximal artery at just 3 mm (Fig. 4). Snapping could still be elicited.

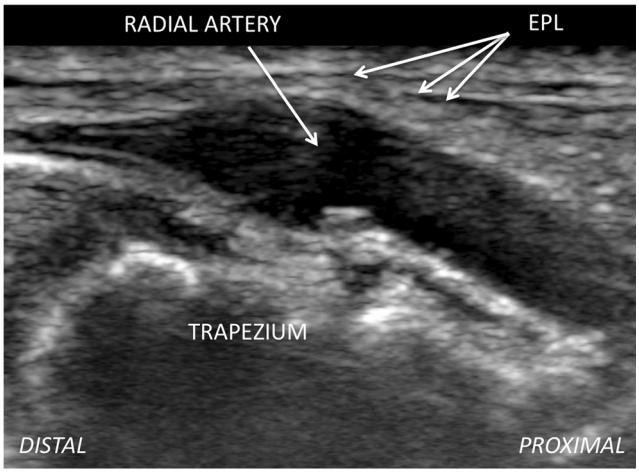

Fig. 1 Ultrasound images in sagittal oblique (Fig. 1) and axial (Fig. 2) planes at the base of the thumb dorsally showing the radial artery coursing deep to the extensor pollicis longus (EPL) tendon. Figure 1 shows focal fusiform aneurysmal dilatation. Deep to the radial artery are the carpal bones (trapezium and trapezoid)

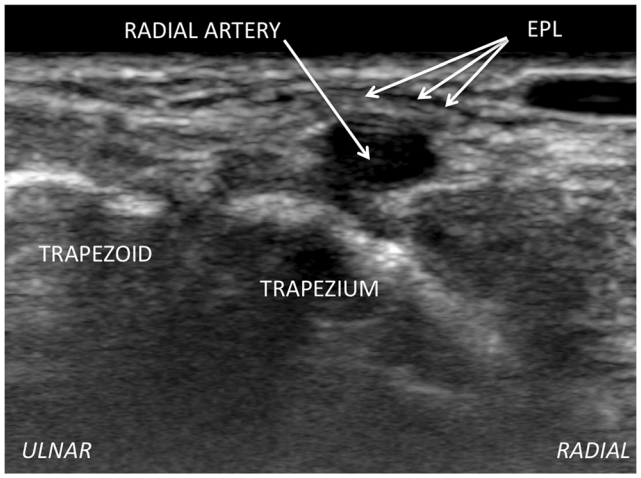

Fig. 2 Ultrasound images in sagittal oblique (Fig. 1) and axial (Fig. 2) planes at the base of the thumb dorsally showing the radial artery coursing deep to the extensor pollicis longus (EPL) tendon. Figure 1 shows focal fusiform aneurysmal dilatation. Deep to the radial artery are the carpal bones (trapezium and trapezoid)

Discussion

At the level of the distal forearm, the radial artery is located volar and radial to the flexor carpi radialis tendon. The artery gives off a branch contribution to the superficial palmar arch at

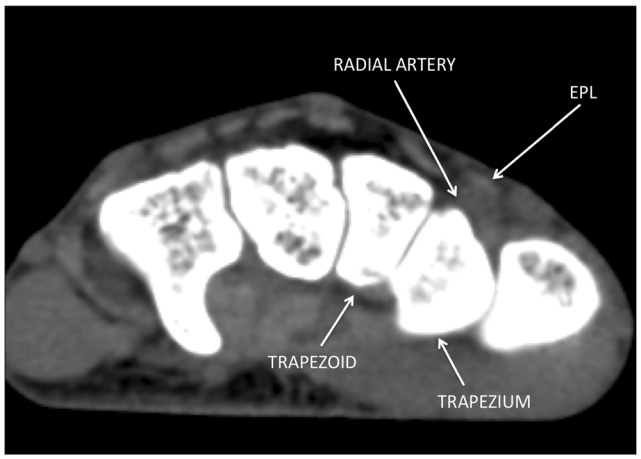

Fig. 3 Transverse axial non-contrast CT image from the patient prior to the initial ultrasound evaluation showing the relationship between the radial artery, EPL tendon, and the carpal bones

Fig. 4 3D volume-rendered image from a contrast CT angiogram in a different patient shows the relationship between the radial artery passing under the EPL tendon at the dorsal aspect of the wrist and thumb base

the level of the scaphoid before passing underneath the first extensor compartment tendons, abductor pollicis longus, and extensor pollicis brevis. The artery runs through the floor of the snuffbox over the radial aspect of the scaphoid, the scapho-trapezial-trapezoid joint and the trapezium before passing between the bases of the first and second metacarpals to the volar aspect of the hand (Figs. 5 and 6). A large branch to the thumb, the princeps pollicis artery, takes off before the artery becomes the main contributor to the deep palmar arch [3].

Due to the anatomical variation in hand arterial vascular supply, the superficial palmar arch branch of the ulnar artery provides the main source of blood for most of the fingers. In 16–22% of patients, the palmer arch is incomplete from the ulnar side and the radial artery plays a major role in supplying the thumb and the radial aspect of the index finger [4, 5].

The extensor pollicis longus muscle is one of the forearm extensors. The muscle mainly originates from the dorsal middle third of the ulna and the interosseous membrane, and becomes the sole tendon of the 3rd extensor compartment. The EPL tendon passes obliquely at 45 degrees at the level of the Lister's tubercle in the distal radius towards the thumb to enter the extensor retinaculum and eventually inserts at the posterior surface of the distal phalanx of the thumb. Between the 45 degree turn of the EPL and the tendon insertion, the EPL passes over the extensor carpi radialis longus and extensor

Fig. 5 Doppler interrogation of the radial artery at the time of the initial ultrasound evaluation shows a normal arterial waveform with no mural thrombus

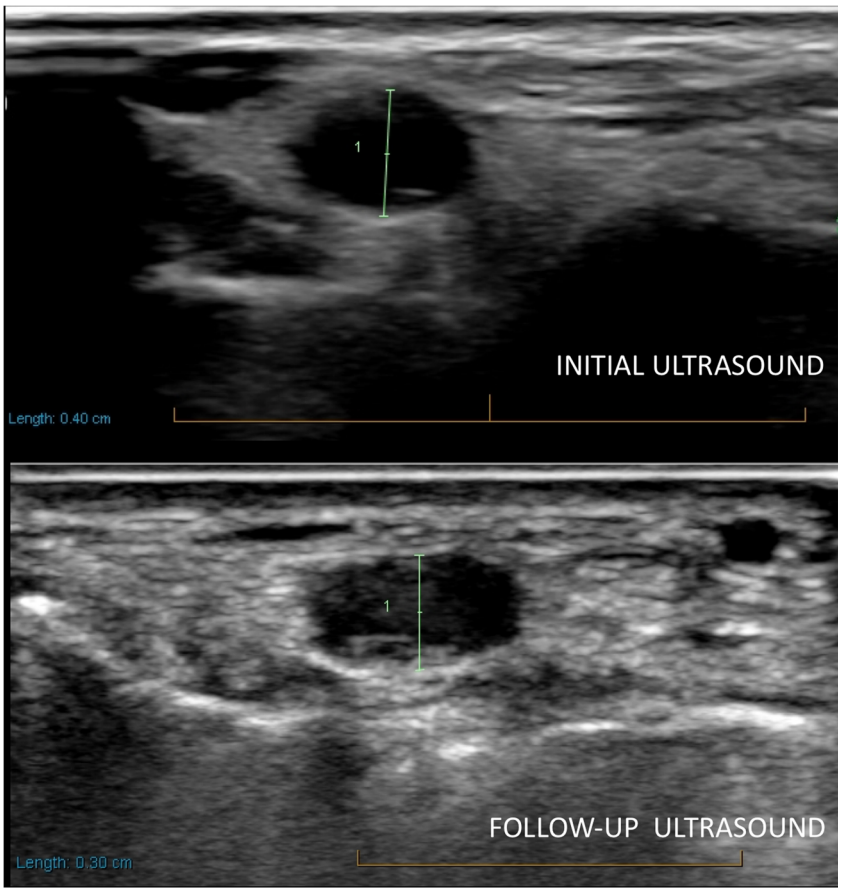

Fig. 6 Transverse ultrasound images with measurements of the radial artery taken at the time of the initial ultrasound evaluation (*top*, 4 mm) and after 6-month follow-up (*bottom*, 3 mm)

carpi radialis brevis tendons, a location called the distal intersection [6]. Just beyond this intersection, the EPL passes over the radial artery at the anatomical snuffbox.

True aneurysms of the radial artery are rare and mostly occur in the snuffbox region [7–11]. Pseudoaneurysms are more common either from iatrogenic causes particularly given the recent increase in radial artery access procedures. Occupational repetitive injuries causing radial artery aneurysm have been reported in the case of 'tailor's thumb' at the snuffbox region [12], and a cheese maker who presented with a mass in the thenar region associated with ischemic manifestation in his index finger [13]. In the tailor's thumb case, the aneurysmal dilatation was more proximal than the handle of the scissors the patient was using repetitively, and the authors postulated that the repetitive force might cause a backpressure effect, which results in arterial dilatation. It is possible that the cause in this case was not the handle of the scissors as suggested, but actually snapping of the radial artery under the EPL as in our case, which would better explain the anatomic location of the aneurysm in that case. Halbach et al. reported a case of true radial artery aneurysm secondary to compression by the EPL, but did not postulate a cause or report any snapping or clicking [14].

Hypothenar hammer syndrome is caused by repetitive trauma to the ulnar aspect of the hand. Typically, a mechanic may use the ulnar aspect of the hand as a hammer, resulting in impact to the ulnar artery in its fixed location in Guyon's canal between the pisiform and the hook of the hamate, causing aneurysmal dilatation of the ulnar artery [15–17]. A similar syndrome on the radial side has been proposed, called the 'thenar hammer syndrome' in which the superficial radial artery branch contribution to the palmar arch at the volar aspect of the thenar eminence gets injured with the same mechanism as it lies against the scaphoid bone with potential aneurysm formation with or without occlusion [18, 19], however this term has gained less traction, with only a few case reports in the literature to date. This occurs at a different location to the entrapment under the EPL that we present.

Clinical presentation of radial artery occlusion includes ischemic pain, paresthesia, cool surface temperature, and pale discoloration of the thumb and often the radial aspect of the index finger. Occlusion of the radial artery in the presence of incomplete palmar arch can cause hand ischemia, whether due to aneurysm thrombosis, embolism, trauma, or external compression. When the palmar arch is complete, occlusion of both the radial artery and the superficial palmer arch branch is required due to collateral supple from the palmar arch [20]. Increased sympathetic neural discharge from an occluded vessel may cause additional ischemia to the collateral circulation

due to arterial vasospasm [21]. External compression of the radial artery, resulting in sluggish arterial blood flow, has been proposed as a cause of arterial thrombosis. McNamara et al. reported entrapment of the radial artery between the EPL and the trapeziometacarpal joint in four out of nine patients suffering from non-traumatic radial artery thrombosis however did not describe a snapping phenomenon in any of these patients [22].

Our patient was offered surgery as a treatment option, however he declined and opted to be treated conservatively with a splint. He went from performing several hundred of these antagonistic snapping maneuvers per day to stopping altogether. The natural history of this may well be for the aneurysm to continue to grow, but in the absence of the inciting 'snapping', it may not. In fact, we demonstrated a subtle decrease in size of the aneurysm over the 6-month follow-up. This decrease in size may be explained by a reduction in swelling of the vessel wall following cessation of snapping. We will continue to follow him clinically for any evidence of an enlarging pulsatile mass in this area and have counseled him on being aware of any symptoms or signs of digital ischemia.

Conclusions

We present a case of fusiform radial artery aneurysm resulting from dynamic snapping of the radial artery between the EPL tendon and the fixed trapezium diagnosed with direct sonographic visualization. To our knowledge, this is the first proven mechanism of radial artery aneurysm formation in this location and may explain the etiology of radial artery aneurysms at the dorsal thumb base in manual workers.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflicts of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

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