

# Tortuous ulnar artery presenting as left distal forearm mass

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## ABSTRACT

Knowledge of anatomic variation in vasculature is critical to safe medical intervention as conduits vary in morphology, architecture, and course. Tortuosity is a common anatomic variant in certain arterial beds; however, its prevalence in ulnar arteries is not well documented in the literature. Here we report two cases of tortuous ulnar arteries in patients being evaluated for upper extremity hemodialysis access. (*J Vasc Surg Cases and Innovative Techniques* 2020;6:430-2.)

**Keywords:** Arterial tortuosity; Variant ulnar artery; Ulnar access; Forearm mass; Wrist mass

The ulnar artery is a branch of the brachial artery that traverses down the medial aspect of the distal forearm invested in the deep fascia between the bellies of the flexor digitorum laterally and the flexor carpi ulnaris medially.<sup>1</sup> It enters the hand through Guyon canal (ulnar tunnel) medial to the hook of the hamate.<sup>2</sup> It subsequently gives off its deep palmar branch before continuing onward as the superficial ulnar artery, which helps form the superficial palmar arch (SPA).<sup>2</sup> The SPA is a major blood supply of the hand and is classified as complete or incomplete on the basis of the existence of anastomosis between its supplying vessels.<sup>1,2</sup>

Anatomic studies of hand circulatory patterns reveal that complete SPAs are found in 81.3% of patients. In addition, they show that the most common variant is a radioulnar anastomosis (73.0%).<sup>3</sup> Physiologic studies using Doppler ultrasound and digital plethysmography showed that 85.5% of patients had normal hand perfusion after radial artery compression.<sup>4</sup> Nevertheless, anatomic and physiologic studies indicate that incomplete arches may be found in up to 18.7% of patients and may predispose to digit compromise if inflow vessels are lesioned.<sup>3,4</sup> Because of its deeper location and major role in supplying the SPA, the ulnar artery is rarely used for arterial cannulation. However, the use of the ulnar artery for the creation of ulnar-basilic arteriovenous (AV) fistulas has been described.<sup>5</sup>

Surgical planning requires a comprehensive understanding of anatomic variation. Arterial tortuosity is one such example, and its prevalence in relation to the ulnar artery is unspecified in the literature. Here we describe two cases of incidentally diagnosed tortuous ulnar arteries presenting as distal forearm masses in patients being evaluated for AV fistula creation. Both patients consented to the publication of these cases.

## CASE REPORTS

**Case 1.** An 80-year-old white man with chronic kidney disease stage 4 and no history of dialysis access surgery presented for AV fistula creation. During this initial evaluation, he complained of a lump in the ulnar aspect of his left distal forearm. It had been present for >10 years and did not cause him any pain or discomfort. He also denied having any prior numbness, tingling, or coolness in the ipsilateral hand. He indicated that the lump was cosmetically unappealing and consented to exploration with possible excision. Physical examination revealed a soft, nontender, nonpulsatile lump (*Fig 1, A*) with bilateral, 2+ palpable brachial and radial pulses. Of note, the ulnar pulse was not appreciated on physical examination. Based on clinical findings, it was thought to be a lipoma, ganglion cyst, or venous varicosity. Because it was nonpulsatile, a tortuous ulnar artery was not initially considered in our differential diagnosis, and hence preoperative imaging was not performed.

The patient underwent exploration of the left forearm 2 cm proximal to the wrist. Subcutaneous tissues were divided, and a lipomatous mass was not identified. It appeared that this lesion was subfascial. The fascia overlying the lump was carefully divided, and a coiled arterial structure was identified (*Fig 1, B*). Based on its location, it was thought to be a coiled ulnar artery. The adjacent tissue was explored both proximally and distally, and no other mass was found in this region. The decision was made to refrain from excising the ulnar artery as it appeared normal in diameter even though it was abnormal in phenotype. Thus, we closed the wound and proceeded with creation of the left radiocephalic AV fistula. The patient went on to have an uneventful postoperative recovery and successful maturation of the fistula. Postoperative duplex ultrasound confirmed our findings of ulnar artery tortuosity without any degenerative changes (*Video 1*).

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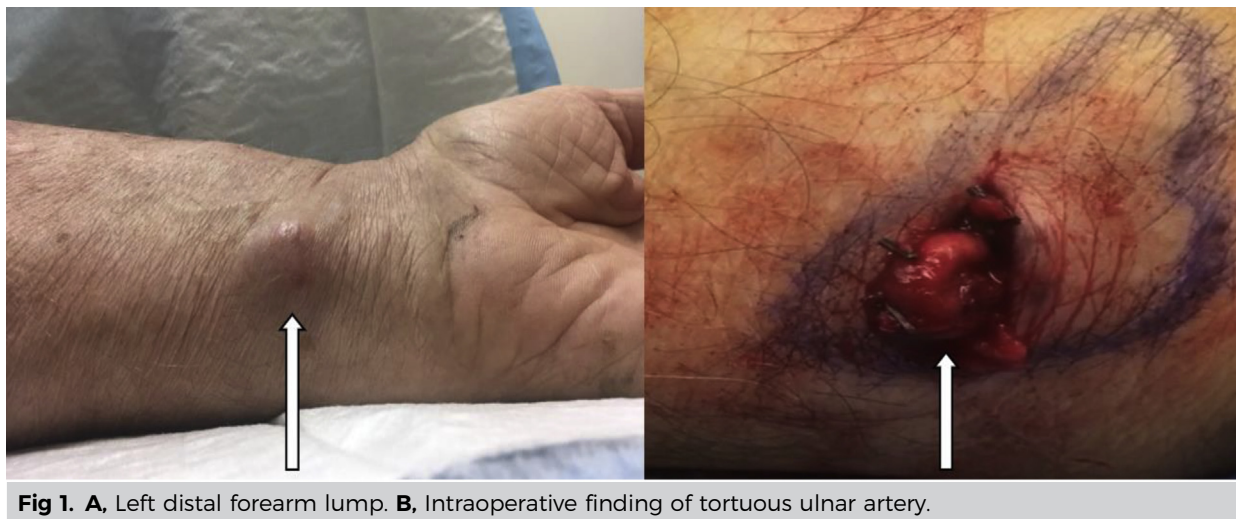
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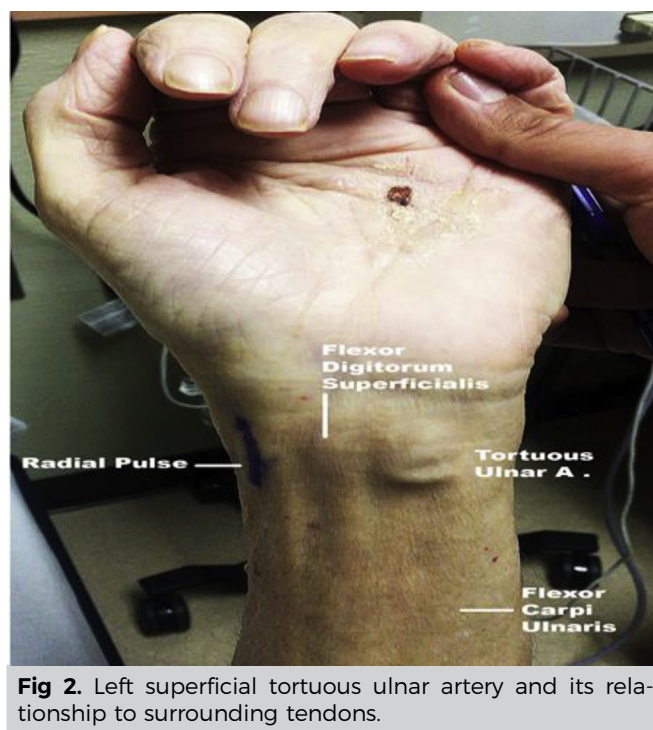
**Fig 1. A,** Left distal forearm lump. **B,** Intraoperative finding of tortuous ulnar artery.

**Case 2.** A 62-year-old white man with chronic kidney disease stage 5 and no prior history of AV access surgery was evaluated for dialysis access creation. Physical examination revealed a left-sided nontender, pulsatile lump with bilateral, 2+ palpable brachial, ulnar, and radial pulses (Fig 2; Video 2). The Allen test result was normal. Based on physical examination and the patient's history, it was thought to be a superficial tortuous ulnar artery. The patient subsequently underwent creation of a left radiocephalic fistula. Postoperative arterial duplex ultrasound confirmed the presence of the tortuous ulnar artery and successful maturation of the AV fistula.

## DISCUSSION

Arterial tortuosity is a commonly encountered anomaly in the human body. It can be localized (focal) or widespread (diffuse).<sup>6</sup> Multiple risk factors, such as trauma, aging, collagen vascular disease, and genetic predisposition, have been associated with its development.<sup>6</sup> It may be manifested morphologically as curved, single or multiple looped, angulated, kinked, or spiral twisted.<sup>7</sup> The extent of a vessel's tortuosity can be found by performing angiography and calculating a tortuosity index. This ratio is obtained by taking the length of a vessel's curved segment and comparing it with the length of a straight vessel.<sup>8</sup> Tortuosity in elastic arteries, such as the innominate, subclavian, and internal carotid, and muscular arteries, such as the coronary, is well documented.<sup>7,9-11</sup> In contrast, tortuosity in peripheral arteries of the upper extremity, such as the ulnar, is not well defined in the literature.

Our literature search identified four cases of symptomatic tortuous ulnar arteries. Three cases tie their presence to Guyon canal syndrome or ulnar tunnel syndrome.<sup>12-15</sup> In these cases, the tortuous vessel contorted and compressed the adjacent ulnar nerve in Guyon canal, a fibro-osseous tunnel in the wrist.<sup>2</sup> This caused patients to experience classic ulnar nerve compression symptoms like hand pain, tingling, and numbness in the fourth and



**Fig 2.** Left superficial tortuous ulnar artery and its relationship to surrounding tendons.

fifth digits.<sup>12-15</sup> In the fourth case, the patient experienced focal neuropathy after a tortuous ulnar artery impinged on the ulnar nerve proximal to Guyon canal in the distal forearm.<sup>15</sup> Symptoms arose after a traumatic event in three of the four cases, and surgical decompression of the ulnar nerve was required in all cases to ensure symptom resolution.<sup>12-15</sup> In contrast to the cases described in the literature, our patients had focal tortuosity in ulnar arteries located proximal to Guyon canal and did not have any ulnar nerve compression symptoms. The cause of their tortuous ulnar arteries cannot be determined with certainty.

**CONCLUSIONS**

A tortuous ulnar artery should be considered in the differential diagnosis of a distal forearm or wrist mass. A diagnosis can be confirmed with duplex ultrasound if there is any clinical uncertainty. Intervention is seldom indicated unless the patient is symptomatic.

**REFERENCES**

1. Roddy SP, Paty P. Upper extremity arterial disease: revascularization. In: Cronenwett JL, Johnston KW, editors. *Rutherford's vascular surgery*. 8th ed. Philadelphia: Saunders Elsevier; 2013. p. 1881.
2. Chen S, Tsai T. Ulnar tunnel syndrome. *J Hand Surg Am* 2014;39:571-9.
3. Zarzecki MP, Popieluszko P, Zayachkowski A, Pekala PA, Henry BM, Tomaszewski KA. The surgical anatomy of the superficial and deep palmar arches: a meta-analysis. *J Plast Reconstr Aesthet Surg* 2018;71:1577-92.
4. Rodriguez E, Ormont ML, Lambert EH, Needleman L, Halpern EJ, Diehl JT, et al. The role of preoperative radial artery ultrasound and digital plethysmography prior to coronary artery bypass grafting. *Eur J Cardiothoracic Surg* 2001;19:135-9.
5. Al Shakarchi J, Khawaja A, Cassidy D, Houston JG, Inston N. Efficacy of the ulnar-basilic arteriovenous fistula for hemodialysis: a systematic review. *Ann Vasc Surg* 2016;32:1-4.
6. Ciurica S, Lopez-Sublet M, Loeyes BL, Radhouani I, Natarajan N, Vikkula M, et al. Arterial tortuosity. *Hypertension* 2019;73:951-60.
7. Jakob M, Spasojevic D, Krogmann ON, Wiher H, Hug R, Hess OM. Tortuosity of coronary arteries in chronic pressure and volume overload. *Cathet Cardiovasc Diagn* 1996;38:25-31.
8. Dougherty G, Johnson MJ, Wiers MD. Measurement of retinal vascular pathologies and its application to retinal pathologies. *Med Biol Eng Comput* 2010;48:87-95.
9. Bousvaros G, Sandler IA. Tortuosity of the innominate artery: failure of retrograde catheterization of left side of heart by brachial artery route. *JAMA* 1968;205:466-7.
10. Cha KS, Kim MH, Kim HJ. Prevalence and clinical predictors of severe tortuosity of right subclavian artery in patients undergoing transradial coronary angiography. *Am J Cardiol* 2003;92:1220-2.
11. Weibel J, Fields WS. Tortuosity, coiling, and kinking of the internal carotid artery. I. Etiology and radiographic anatomy. *Neurology* 1965;15:7-18.
12. Emel E, Guzey KF, Alatas I. Guyon's canal syndrome due to tortuous ulnar artery: a case report. *Turk Neurosurg* 2003;13:107-10.
13. Zeeshan M, Ahmed F, Kanwal D, Khalid QS, Ahmed MN. Guyon's canal syndrome due to tortuous ulnar artery with DeQuervain stenosing tenosynovitis, ligamentous injuries and dorsal intercalated segmental instability syndrome, a rare presentation: a case report. *Cases J* 2009;2:9390.
14. Jose RM, Bragg T, Srivastava S. Ulnar nerve compression in Guyon's canal in the presence of a tortuous ulnar artery. *J Hand Surg Br* 2006;31:200-2.
15. Segal R, Machiraju U, Larkins M. Tortuous peripheral arteries: a cause of focal neuropathy. Case report. *J Neurosurg* 1992;76:701-4.

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