

# Intraoperative Finding of Vascular Malformation During Carpal Tunnel Release: A Case Report

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## ABSTRACT

Carpal tunnel release is a common surgical procedure performed by hand surgeons. The procedure is typically straightforward; however, uncommon causes of median nerve compression encountered intraoperatively may add complexity. We describe a 67-year-old man with carpal tunnel syndrome and an intraoperative finding of a compressive vascular malformation during a mini-open carpal tunnel release. A space-occupying malformation of a persistent median artery was bisecting the nerve and thought to be responsible for the patient's symptoms. The compression was relieved through extended carpal tunnel release without requiring removal of the vascular malformation. The patient's symptoms improved postoperatively. Hand surgeons undertaking this procedure should be aware of a potential vascular malformation and be prepared to address the condition intraoperatively.

**Keywords:** Carpal Tunnel, Vascular Malformation, Persistent Median Artery, Median Nerve

## INTRODUCTION

Carpal tunnel release (CTR) is a common procedure used to treat carpal tunnel syndrome (CTS), which can be performed open or endoscopically.<sup>1</sup> CTS is a compressive neuropathy of the median nerve within the fibro-osseous confines of the carpal tunnel. The cause of chronic median nerve compression is divided into four categories: idiopathic, systemic, exertional, and anatomic.<sup>2</sup>

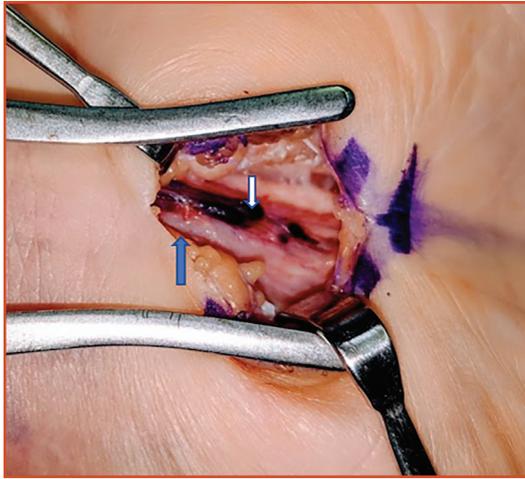
The most common cause is idiopathic, referring to tenosynovial edema and perineural fibrosis leading to compression.<sup>3</sup> Systemic causes refer to inflammatory disorders (eg, rheumatologic disorders and diabetes), or pregnancy-related changes.<sup>4,5</sup> Exertional causes refer to repetitive or vibratory tasks, usually work related, increasing pressure within the carpal tunnel. However, this relationship has not been definitively established.<sup>2,4</sup> Anatomical causes may be due to ganglion cysts,

tumors, or other space-occupying lesions such as vascular malformations.<sup>2,6</sup> Surgery is typically indicated if symptomatic CTS has failed nonoperative treatment.<sup>1,7</sup> We describe an adult man who underwent operative treatment of carpal tunnel syndrome, with additional findings noticed intraoperatively.

## CASE REPORT

A 67-year-old man presented to our office with right-hand numbness and pain that had been progressing for 9 months. The symptoms he described were isolated to the right hand and experienced both day and night. Conservative treatment with a wrist brace was attempted but failed to resolve his symptoms. On physical examination, the patient revealed no weakness or atrophy; however, findings of the compression test, Tinel sign, and Phalen Maneuver were positive for carpal tunnel. Findings of a preoperative electromyogram showed median nerve compression at the wrist with peak sensory latency of 5.68 ms and motor latency of 5.83 ms. The patient showed no cutaneous evidence suggestive of vascular anomaly. Medical history revealed that the patient had undergone lumbar spine fusion surgical treatment and prostate cancer treatment with a radiation seed implant.

The patient underwent CTR, with a mini-open approach using a 1.5-cm palmar incision distal to the wrist crease. A bifid median nerve was intraoperatively encountered, which included an enlarged and disorganized median artery suggestive of a vascular malformation. The malformation extended proximally and was unable to be fully inspected from the initial incision. A decision was then made to explore for further compression of the nerve. The incision was proximally extended an additional 1 cm to better visualize the nerve and vascular malformation to ensure complete decompression. It was found to be a space-occupying malformation that was compressing the nerve within the carpal tunnel, without further



**Figure 1.** Intraoperative view of the carpal tunnel, showing the median nerve (blue arrow) and the vascular malformation (white arrow) at the level of the carpal tunnel within the median nerve.

compression proximally. It was tethered to the transverse carpal ligament radially. The malformation was dissected free from the nerve to avoid injury. Should excessive bleeding have occurred, we were prepared to resect the lesion and ligate the persistent median artery proximally. After transverse carpal ligament release, exploration, and freeing the vascular malformation tether, we elected not to perform resection because the lesion was no longer compressing the nerve.

At 2 weeks postoperatively, the patient presented with preserved strength, resolution of pain and numbness, and no reported cold intolerance pre- or postoperatively. Therefore, we felt that he did not require any further scheduled follow-up; however, the patient wished to return if additional or worsening symptoms developed.

## DISCUSSION

Vascular malformations within the carpal tunnel arise from the persistent median artery. Reports are frequent regarding persistent median artery within the carpal tunnel, and many variations are possible.<sup>8,9</sup> A persistent median artery commonly presents with a bifid median nerve.<sup>10</sup> However, vascular malformations of the persistent median artery acting as space are uncommon.

Gutowski et al<sup>11</sup> reported a large arteriovenous malformation (5x4 cm) of a persistent median artery in a 12-year-old boy. The malformation extended from the forearm into the carpal tunnel. The patient's symptoms resolved after complete excision of the vascular malformation. González Porto et al<sup>12</sup> described a 2-year-old boy who presented with a 2.5-cm long intraneural venous malformation within the carpal tunnel, which was excised from the wrist and palm. At 10 years postoperatively, the mass reoccurred with symptoms and was subsequently reexcised, resulting in resolution of symptoms. Petrovici<sup>13</sup> reported two adults

with cavernous hemangiomas in the palm, which were excised surgically. Symptoms resolved after excision, but reoccurrence of lesion and symptoms were reported in one of the two patients. Hariri et al<sup>14</sup> described a 34-year-old man with venous malformation at the wrist level and 1 month of symptoms that resolved after excision of the lesion. Mauersberger and Meese<sup>15</sup> reported one patient with an aneurysmal dilatation of the persistent median artery in the carpal tunnel.

Contrasting to our case, these case reports included surgical resection of the malformation as treatment; however, many of the lesions presented were larger in size than that of our patient. Some cases have suggested that resection of the anomalous vasculature is unnecessary unless it is pathological (eg, aneurysm or thrombosis).<sup>6,9</sup> Mauersberger<sup>15</sup> described three cases of persistent median artery with anomalous vasculature causing median nerve compression within the carpal tunnel. In one case, they did not resect the vessel, as they suspected it was a major contributor of blood flow to the hand and resection risked compromising the vascular supply.

The surgeon must decide intraoperatively whether to resect the lesion when a vascular malformation is encountered. In our case, after releasing the transverse carpal ligament and freeing the malformation from surrounding adhesions, there was no further evidence of intraneural compression to indicate removal of the lesion. If no neural compression is identified after complete exploration of any proximal or distal compression, then we suggest avoiding resection of the malformation and simply decompressing the median nerve.

In summary, surgeons undertaking release of the carpal tunnel should be aware of anomalous anatomy that may complicate decompression. Knowledge of these anatomical variants and associated pathological features can aid the surgeon in intraoperative decision making.

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