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Case Report

Incidental Intraoperative Bifid Median Nerve in Two Cases of Carpal Tunnel Release

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ABSTRACT

Background: The bifid median nerve (BMN) is a common anatomical variation that, when encountered unexpectedly during carpal tunnel release (CTR), can increase the risk of iatrogenic injury and complicate the surgical approach. This report discusses the intraoperative management and outcomes of two such cases.

Case Presentation: We present two cases of severe carpal tunnel syndrome in which a BMN (lanz type IIIA) was discovered incidentally during open CTR performed under wide awake local anesthesia no tourniquet (WALANT). In the first case, the discovery led to an extended proximal release to ensure complete decompression of the bifurcated nerve. In the second case, a conventional open approach was considered sufficient. Both patients experienced complete resolution of symptoms at the 12-month follow-up.

Conclusion: The incidental discovery of a BMN during CTR requires a thorough anatomical examination to ensure complete decompression and prevent iatrogenic injury. As demonstrated by our two cases, the surgical approach, whether extended or conventional, can be successfully adapted to the intraoperative findings. The crucial factor is visual confirmation that all nerve components are fully decompressed.

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Introduction

Carpal tunnel syndrome (CTS) is the most common compressive neuropathy of the upper extremity [1]. Although the diagnosis is primarily clinical and electrodiagnostic, surgeons must be prepared for anatomical variations that may not be apparent preoperatively. The bifid median nerve (BMN), characterized by a high division of the nerve proximal to or within the carpal tunnel, is one of the most surgically relevant variations [2, 3].

The reported prevalence of BMN varies, with cadaveric studies suggesting 1-3%, while radiological studies using ultrasound (US) or magnetic resonance imaging (MRI) report rates as high as 18% [4, 5]. This variation is frequently associated with a persistent median artery (PMA) [6, 7]. The presence of a BMN can contribute to CTS due to an increased cross-sectional area within the rigid carpal tunnel and poses a significant risk of iatrogenic injury if not identified during surgery [8, 9].

We present two cases of severe CTS in which a BMN was an unexpected intraoperative finding, successfully managed with CTS under wide awake local anesthesia no tourniquet (WALANT) anesthesia.

Case 1

A 43-year-old right-hand-dominant woman presented with a two-year history of progressive numbness, tingling, and nocturnal pain in her left hand, distributed in the median nerve territory. She reported recent weakness and episodes of dropping objects. Her medical history was unremarkable.

Case 2

A 48-year-old right-hand-dominant woman presented with an 18-month history of progressively worsening symptoms in her left hand. Her chief complaints were constant numbness in the thumb, index, and middle fingers, frequent nocturnal awakening, and a feeling of clumsiness, causing her to drop small objects. Like the first patient, her medical history was unremarkable for systemic illnesses associated with CTS.

Physical examination of both patients revealed a positive Tinel's sign over the carpal tunnel and a positive Phalen's test. Sensory testing showed diminished sensation in the thumb, index, and middle fingers. Motor examination demonstrated mild but noticeable atrophy of the thenar eminence and Medical Research Council (MRC) grade 4 strength in thumb abduction.

Electrodiagnostic studies confirmed severe sensorimotor median neuropathy at the wrist with evidence of axonal loss. No advanced imaging (US or MRI) was performed preoperatively.

Both patients underwent open CTR under WALANT anesthesia. A standard longitudinal incision was made ulnar to the thenar crease. The palmar fascia and transverse carpal ligament (TCL) were exposed and divided.

In case one, the median nerve bifurcated under the TCL, with both the radial and ulnar divisions running parallel through the tunnel. The nerve trunks appeared compressed and hyperemic. The motor branch was identified as originating from the radial division. Notably, the antebrachial fascia over the proximal portion of the bifurcated nerve was tight and constrictive. Therefore, the dissection was extended proximally in a controlled manner to release this fascia, ensuring the proximal nerve segments were completely free of compression (Figure 1).

In case two, a similar BMN (lanz type IIIA) was identified. However, after division of the TCL, the nerve was observed indirectly to be well decompressed, with no proximal constriction at the antebrachial fascia. A conventional release was therefore deemed sufficient, and no proximal extension of the dissection was performed (Figure 2).

In both cases, the patients were awake and comfortable throughout and were able to move their fingers following the release, confirming the integrity of the motor branch.

The wound was closed, and the hand was placed in a soft dressing and dorsal short splint. The patients were discharged with instructions for finger mobilization. The sutures were removed at 2 weeks, and formal physiotherapy was initiated. Follow-up assessments were conducted at 6 weeks, 12 weeks, 6 months, and 12 months. The patients reported complete resolution of their nocturnal pain and paresthesia within the first month. Sensory function improved progressively, and at the 12-month visit, they were entirely asymptomatic. Thenar atrophy had stabilized, with slight improvement in muscle bulk, and thumb abduction strength had returned to MRC grade 5.

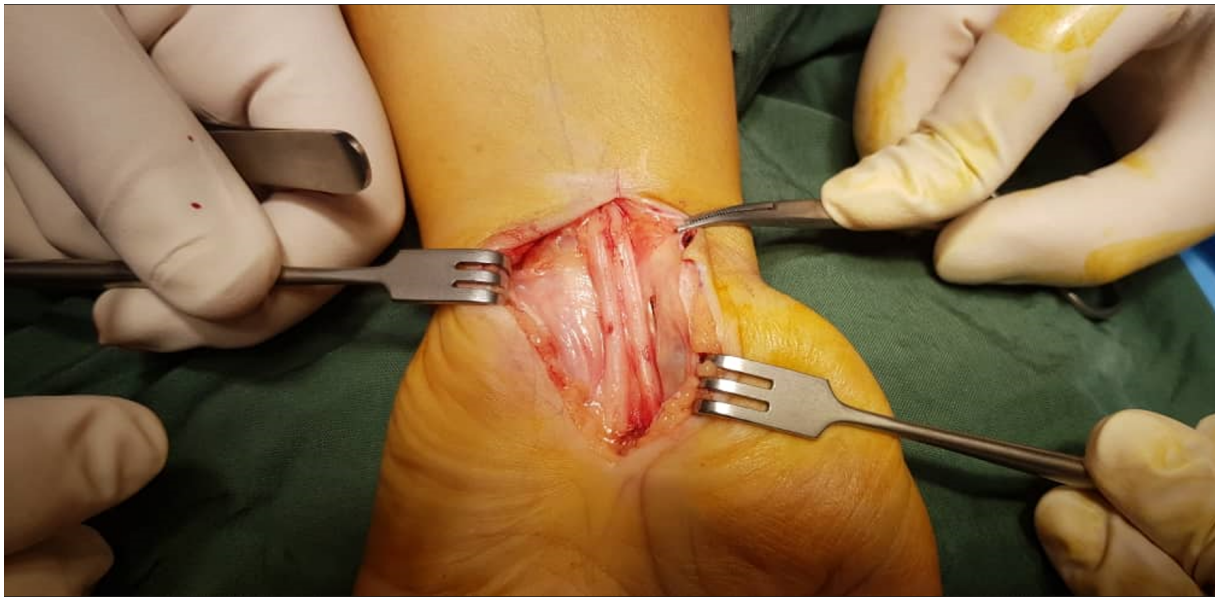

Figure 1. Intra-operative photograph showing a BMN with an extended approach

Discussion

These cases highlight the unexpected encounter of an anatomical variant of the median nerve during CTR surgery. As demonstrated in systematic reviews, variations of the median nerve are not rare [1]. The BMN, in particular, is a well-documented entity [2, 4]. Surgeon familiarity with the Lanz and Al-Qattan classifications enables immediate intraoperative recognition and classification, which guides subsequent surgical steps [2, 10]. In our cases, upon opening the carpal tunnel, a BMN was encountered as an incidental finding. As noted by Propeck et al., the two branches of a BMN may be contained within separate tunnels, which can lead to incomplete release and iatrogenic injury if not thoroughly explored [11].

The choice of surgical approach is validated. While endoscopic techniques are popular, an open approach provides the versatility to manage unexpected findings safely [9, 12]. These two cases illustrate successful out-

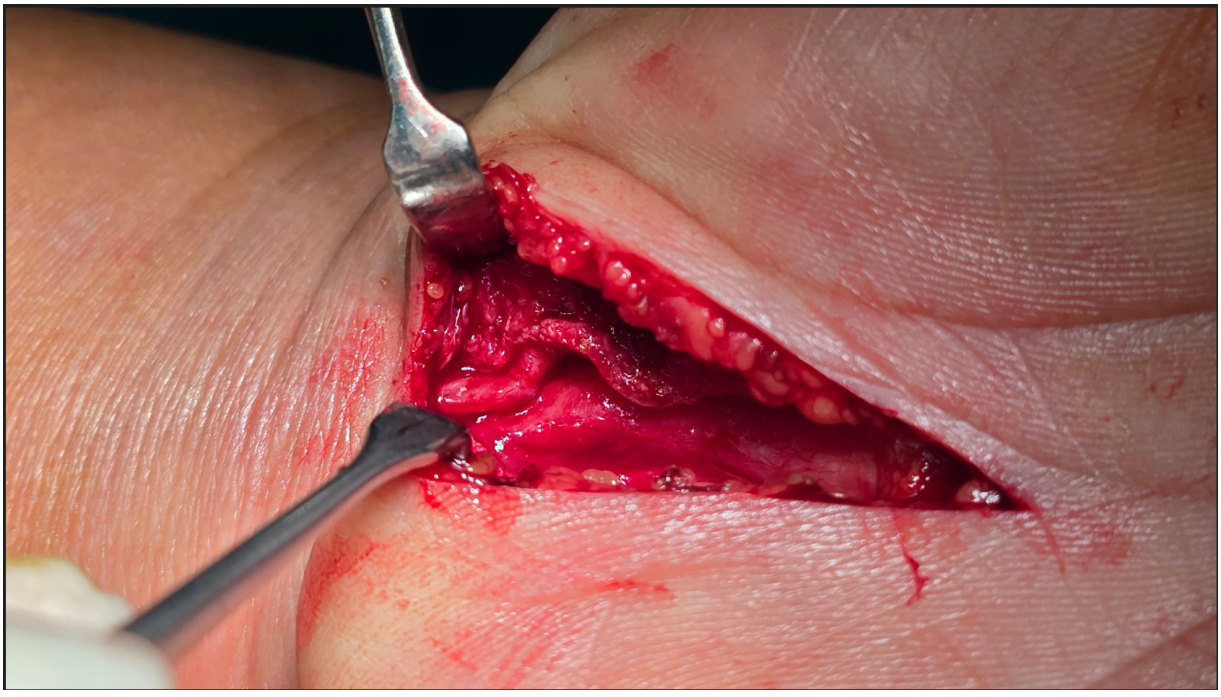

Figure 2. Intra-operative photograph showing a BMN with a conventional approach.

comes with contrasting surgical strategies: one using extended exposure and the other a conventional approach. Although the essential surgical principle is thorough anatomical exploration of the median nerve after dividing the TCL, the clinical necessity of extending the incision specifically for a bifurcated nerve has not been established.

The WALANT technique proved exceptionally beneficial in this unplanned complex scenario. It provided a bloodless field without a tourniquet, excellent patient comfort, and the ability to check the range of motion intraoperatively [13]. There was no need to convert to a different anesthetic modality, streamlining the procedure despite the altered anatomical landscape.

Although we did not perform an US and MRI on these two patients before surgery, MRI and US can proactively identify variations of the median nerve or a persistent median artery [4, 5, 14]. As Bayrak et al. demonstrated, the prevalence of BMN is significantly higher in CTS patients, making it an important preoperative consideration [4]. Preoperative detection allows for precise surgical planning and informed patient consent, potentially preventing surprises during surgery.

While this report adds to the literature on managing incidental anatomical variations during CTS, it has several limitations. First, the findings are based on only two cases, which limits the generalizability of the conclusions. The small sample size precludes any definitive recommendations on when an extended or conventional release is necessary for a BMN. Second, the absence of preoperative US or MRI means the anatomical variation was an unexpected finding. Although this reflects a common real-world surgical scenario, preoperative imaging could have enabled planned surgical management and provided more detailed anatomical characterization, such as confirming the presence or absence of a persistent median artery. Finally, the outcomes were assessed clinically; postoperative electrodiagnostic studies or imaging to objectively confirm complete decompression of both nerve trunks were not performed, with reliance instead on excellent clinical outcomes and intraoperative visual inspection. Future studies with larger cohorts and systematic preoperative imaging would be valuable to establish more robust guidelines for the surgical management of this anatomical variant.

Conclusion

The incidental discovery of a BMN during CTS requires a thorough anatomical examination to ensure complete decompression and prevent iatrogenic injury. As demonstrated by our two cases, the surgical approach, whether extended or conventional, can be successfully adapted to the intraoperative findings. The crucial factor is visual confirmation that all nerve components are fully decompressed.

Ethical Considerations

Compliance with ethical guidelines

Informed consent was obtained from the patients for the publication of this case report.

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Authors' contributions

Conceptualization and methodology: Farid Najd Mazhar; Software and validation: Bushra Zareie; Investigation, resources, and data curation: Reza Mohammadi; Writing the original draft: Reza Mohammadi and Meisam Jafari Kafiabadi; Review and editing: Meisam Jafari Kafiabadi; Visualization, supervision, project administration, and funding acquisition: Omid Mahmoudi nasab and Hooman Shariatzade.

Conflict of interest

The authors declared no conflict of interest.

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