

The Deep Motor Branch of the Ulnar Nerve and Its Role in Hand Spasticity: A Narrative Review for Surgical Applications

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ABSTRACT

The deep motor branch of the ulnar nerve (DMBUN) plays a critical role in intrinsic hand function and deformities related to spasticity. Traditionally described as a single motor trunk, recent anatomical studies demonstrate multiple branching patterns and gender-based differences that challenge classical descriptions. These findings have important implications for selective surgical procedures, particularly hyperselective neurectomy (HSN), which has emerged as a promising treatment for hand spasticity. Evidence from cadaveric mapping, case series, and clinical outcome reports suggests that HSN targeting the DMBUN can achieve durable tone reduction and functional improvement with minimal complications. Conversely, the DMBUN is also at risk of iatrogenic injury during carpal tunnel release, underscoring the importance of respecting anatomical landmarks. Although current outcomes are encouraging, the literature is limited by the use of small cohorts and the absence of randomized controlled trials. Future studies should prioritize patient-specific anatomical mapping and long-term prospective data. Integrating anatomical precision with selective surgical strategies offers the best opportunity to improve outcomes for patients with hand spasticity.

KEYWORDS: Ulnar nerve, Deep motor branch, Hyperselective neurectomy, Hand spasticity, Anatomical variation, Carpal tunnel surgery.

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INTRODUCTION

Spasticity of the hand is a major sequela of upper motor neuron lesions, including stroke, cerebral palsy, and spinal cord injury. It produces deformities such as thumb-in-palm and clawing, impairing hand function and hygiene. Among the neural structures involved, the deep motor branch of the ulnar nerve (DMBUN) is particularly relevant because it

innervates intrinsic muscles such as the adductor pollicis and first dorsal interosseous, which frequently contribute to disabling deformities.

Classical anatomy texts describe the DMBUN as a single trunk emerging in Guyon's canal to supply most intrinsic muscles [1–3].

However, recent cadaveric and clinical studies demonstrate far greater complexity, with

multiple branches, gender-based variations, and fascicular organization that influence surgical practice [4–7]. Selective neurectomy of the DMBUN has long been proposed for spasticity, but only in the last decade has hyperselective neurectomy (HSN) been systematically studied, offering tone reduction without functional loss [8–12].

This review synthesizes evidence on the DMBUN, focusing on (i) anatomical variability and 3D mapping, (ii) clinical applications in selective neurectomy, (iii) iatrogenic risks during hand surgery, and (iv) its role in spasticity management. It highlights both practical recommendations for surgeons and knowledge gaps requiring further research.

ANATOMY OF THE DMBUN

Traditional accounts describe the DMBUN as a consistent motor branch passing through Guyon’s canal [1,2]. Modern dissections challenge this simplicity. Bini and Leclercq dissected 21 hands, showing that the adductor pollicis (AP) and first dorsal interosseous (FDI) received multiple branches in most specimens, with >95% of AP muscles innervated by more than one fascicle [4]. Thus, “complete” neurectomy is rare, and partial transection supports hyperselective approaches.

Costa et al. reported gender-based dimorphism: in males, the DMBUN lay ~4 mm distal to Kaplan’s line, whereas in females it was ~5 mm proximal [5]. Pautler et al. used 3D mapping to show predictable fascicular arrangement, with volar sensory fascicles radial and dorsal cutaneous fascicles ulnar [6]. These findings underscore the need for individualized planning rather than reliance on textbook descriptions. A schematic representation of the course and branching pattern of the DMBUN is shown in Figure 1, highlighting its relationship to the hook of hamate and its distribution to the hypothenar, adductor pollicis, and first dorsal interosseous muscles.” Bini and Leclercq [4] further demonstrated the feasibility of hyperselective neurectomy by describing reproducible surface landmarks (Landmark A and Landmark B) to localize the DMBUN and guide selective

sectioning of the adductor pollicis and first dorsal interosseous muscles (Figure 2).

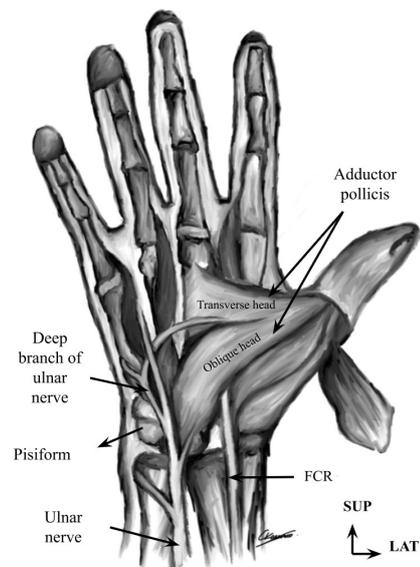


Fig. 1: Schematic course of the deep motor branch of the ulnar nerve (DMBUN) in the palm. The branch emerges from Guyon’s canal, courses around the hook of hamate, and divides to supply the hypothenar muscles, adductor pollicis, and first dorsal Interosei.

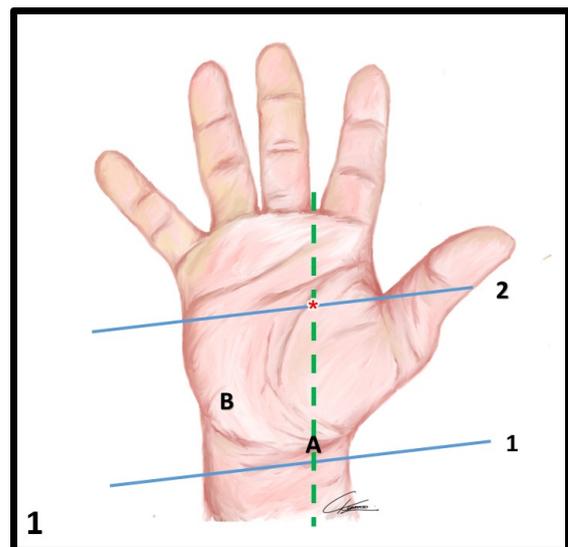


Fig. 2: Surface landmarks for localization of the deep motor branch of the ulnar nerve (DMBUN) during hyperselective neurectomy, as described by Bini and Leclercq (2019). Landmark A = intersection of the flexor carpi radialis axis and bi-styloid line; Landmark B = pisiform bone. The red asterisk indicates the entry point of the DMBUN between the heads of the adductor pollicis.

SURGICAL LANDMARKS AND VARIATIONS

The DMBUN reliably enters between the two heads of the adductor pollicis [4], providing a consistent landmark. However, accessory branches to the hypothenar and thenar muscles have been described [13], with overlapping innervation complicating complete

denervation. Surgeons must expect multiple branches during neurectomy and be aware of increased risk of injury during unrelated procedures such as carpal tunnel release.

CLINICAL RELEVANCE IN SPASTICITY

Hand spasticity commonly involves DMBUN-innervated muscles, producing deformities that limit function and hygiene. Early attempts at phenol neurolysis were limited by sensory complications [14]. Modern approaches include ultrasound-guided alcohol injection with preserved sensation [15]. Cadaveric evidence supports hyperselective neurectomy, as multiple branches permit partial transection to reduce tone while sparing voluntary function [4]. Clinical series confirm durable spasticity reduction without strength loss, with follow-up beyond two years [8,9,16].

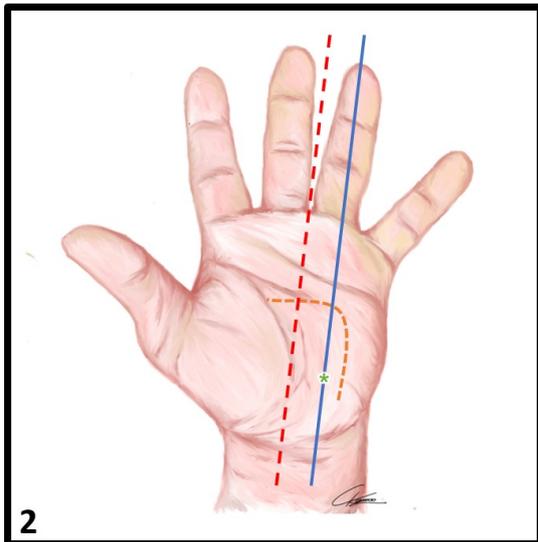


Figure 3. Course of the deep motor branch of the ulnar nerve (DMBUN) in relation to the hook of hamate and transverse carpal ligament. The blue line marks the central axis of the ring finger, the orange dashed line indicates the turning point of the DMBUN, and the red dashed line highlights the recommended safe zone for surgical incision. Modified from Siri Wittayakorn et al. (2023).

IATROGENIC RISKS IN HAND SURGERY

DMBUN injury is a feared complication of carpal tunnel release. Siri Wittayakorn et al. measured the DMBUN turning point at ~11 mm distal to the hook of hamate, beneath the transverse carpal ligament [7]. Nearly all reported transections during open release occurred with incisions along or ulnar to the ring-finger axis [17]. A recent case confirmed complete motor branch transection with isolated intrinsic paralysis but preserved sensation [18]. These findings emphasize incision planning and anatomical vigilance. To illustrate these surgical correlations, Siri Wittayakorn et al. [7,18] mapped the DMBUN relative to the hook of hamate and proposed a ‘safe zone’ for open carpal tunnel release, minimizing the risk of iatrogenic injury (Figure 3).

LONG-TERM OUTCOMES OF SELECTIVE NEURECTOMY

Leclercq et al. reported on 42 patients undergoing HSN, showing sustained tone reduction and functional improvement at a mean follow-up of 31 months, without sensory loss or weakness [9]. Gras and Leclercq demonstrated stable results at 12 months [8]. Emamhadi et al. examined spastic finger flexors, with significant improvements in pain, hand function, and House scores after fascicular HSN [19]. While direct evidence for DMBUN neurectomy remains limited, anatomical data [4–6] and indirect evidence from extrinsic muscles support its application. Representative clinical series on hyperselective neurectomy are summarized in Table 1, showing consistent evidence of durable tone reduction and functional improvement across different cohorts.

Table 1: Summary of published clinical outcomes of hyperselective neurectomy (HSN) for upper limb spasticity.

Author (Year)	Sample size	Target muscles	Follow-up duration	Main outcomes
Gras & Leclercq (2017)	21 patients	Upper limb (mixed sites)	12 months	Stable tone reduction, functional improvement
Leclercq et al. (2021)	42 patients	Upper limb (various muscles, incl. intrinsic)	31 months (mean)	Sustained reduction in tone, improved function, no weakness
Sze et al. (2025)	Long-term follow-up cohort (n not specified)	Upper limb spasticity (mixed)	> 2 years	Durable benefit, minimal complications
Emamhadi et al. (2023)	12 patients	Flexor digitorum superficialis (FDS)	Mean 18 months	Reduced pain, improved House score, functional gain

