Physical Examination of Upper Extremity Compressive Neuropathies

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KEYWORDS

• Compressive neuropathy • Physical examination • Radial neuropathy • Median neuropathy
• Ulnar neuropathy

KEY POINTS

- Upper extremity compressive neuropathies remain a clinical diagnosis, with scant high-level evidence to offer guidance.
- A thorough understanding of the anatomic course of the median, ulnar, and radial nerves are required to effectively perform a physical examination.
- Provocative maneuvers targeting the potential sites of compression are essential to locate the site of pathology.
- Electrodiagnostic testing is not without limitations, and therefore a thorough history and physical examination is essential to form the most accurate clinical picture.

INTRODUCTION

The primacy of anatomy cannot be understated with respect to the clinical diagnosis of compressive neuropathies. The examiner must assess motor and sensibility function of the nerve in question, as well as perform provocative maneuvers that may elicit neurologic symptoms. Evaluation should begin with a detailed history, as this is essential to formulate a differential diagnosis and guide physical examination.

Physical examination is fundamentally subjective; therefore, little evidence exists regarding the reliability and validity of physical examination for the upper extremity.[1] Electrodiagnostic studies represent the best source of objective data for the diagnosis of chronic nerve compression.[2,3] Electrodiagnostic testing is not without limitations, and therefore a thorough history and physical examination, with selected diagnostic testing, combine to form the most accurate clinical picture.

MEDIAN NERVE

Anatomy

The medial and lateral cords of the brachial plexus, which have contributions from the sixth, seventh, and eighth cervical and the first thoracic nerve roots form the median nerve. In the upper arm, the course of the median nerve is in close proximity to the brachial artery, both of which pass along the anterior aspect of the intermuscular septum on the medial side of the arm. The median nerve and brachial artery enter the antecubital fossa medial to the biceps brachii and superficial to the brachialis muscle, then course through three successive arches as they enter the forearm. Each of these arches represents a potential site of nerve compression.

Funding sources: None.
Conflict of interest: Dr Schaffer: Scientific Advisory Board of GenOssis LLC. Dr Popinchalk: None.
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Orthop Clin N Am 43 (2012) 417–430
http://dx.doi.org/10.1016/j.ocl.2012.07.011
0030-5898/12/$ – see front matter

The first arch is formed by the bicipital aponeurosis (lacertus fibrosis) as it connects the biceps brachii to the flexor-pronator mass and the ulna. The median nerve is superficial to the brachialis tendon, but deep to the bicipital aponeurosis. The two heads of the pronator teres (PT) muscle form the second arch. The median nerve lies superficial to the ulnar head and deep to the humeral head. Finally, the median nerve travels between the humeroulnar and radial heads of the flexor digitorum superficialis (FDS) muscle, under the thick fibrous structure between them, known as the sublimis ridge.

In the forearm, the median nerve runs along the radial side of the flexor digitorum profundus (FDP), deep to the FDS. The anterior interosseus nerve (AIN) branches from the median nerve in the proximal half of the forearm. True to its name, the anterior interosseus nerve runs along the anterior, or volar, aspect of the interosseous membrane before terminating deep to the pronator quadratus (PQ) muscle. At approximately five cm proximal to the wrist crease, the median nerve emerges superficially between the flexor carpi radialis (FCR) tendon radially and the palmaris longus (PL) tendon ulnarly. The PL is reportedly absent in approximately 5% to 65% of the population, with wide variation across ethnic lines.[4] The palmar cutaneous branch of the median nerve arises approximately five cm proximal to the distal wrist crease and passes outside of the carpal tunnel.

The median nerve then crosses the wrist as the most superficial of the 10 structures traversing the carpal tunnel. The transverse carpal ligament forms the roof of carpal tunnel volarly. The hook of the hamate, pisiform, and triquetrum form the ulnar wall, and the distal pole of the scaphoid and tubercle of the trapezium form the radial wall of the carpal tunnel.

Once in the hand, the thenar motor branch (or recurrent motor branch) emerges radially. The median nerve goes on to divide into radial and ulnar divisions in the plane between the flexor tendons (deep), and the palmar arch (superficially). The radial division splits to form the common digital nerve to the thumb and the proper digital nerve to the radial half of the index finger. The ulnar division splits to form the common digital nerves of the second and third web spaces.

Physical Examination

The median nerve innervates muscles involved in forearm pronation, wrist flexion, flexion of the digits, and thumb opposition and abduction (**Table 1**). The median nerve carries sensory innervation from the radial aspect of the palm via the palmar cutaneous branch, and the volar surfaces of the thumb, index, middle fingers, and the radial half of the ring finger. Sensibility, therefore, is best tested over the thenar eminence to assess the palmar cutaneous branch and over the volar aspect of the distal index and middle fingers to assess the sensory fibers that pass through the carpal tunnel. This sensory information is essential for fine motor tasks.

Compressive Neuropathies of the Median Nerve

The ligament of Struthers

Approximately 1% of people have an accessory condyle or supracondylar spur approximately five cm proximal to the medial epicondyle of the humerus.[5] The ligament of Struthers attaches this bony prominence proximally to the medial epicondyle distally. The median nerve is susceptible to compression as it passes underneath this ligament along with the brachial artery. The patient will often complain of a deep aching pain in the proximal forearm with an insidious onset, hand weakness, and numbness in the median-nerve distribution. On examination, this pain is often exacerbated with testing of the PT and FCR. Worsening of symptoms often occurs with repetitive pronation and supination. The ability to palpate this bony prominence on physical examination is variable, depending on the patient's body habitus. Radiographs can reveal the supracondylar spur if palpation is equivocal. These patients can present with paresthesia or numbness in the median-nerve distribution as well as weakness in all muscles innervated by the median nerve, although frequently weakness of muscles innervated by the AIN is most prominent. A Tinel sign may be present proximal to the medial epicondyle. Compression of the median nerve as it passes under the bicipital aponeurosis is rare and may present similarly to compression at the ligament of Struthers.[6]

Pronator syndrome

Pronator syndrome results from compression of the median nerve as it passes between the 2 heads of the PT.[7] The patient often complains of aching discomfort in the forearm, weakness in the hand, and numbness in the thumb and index finger.[8] Commonly the patient will report a history of performing forceful repetitive forearm pronation movements. On physical examination, tenderness on palpation of the PT muscle is a common finding. A Tinel sign may be present in the antecubital fossa. Testing of motor function can be difficult secondary to pain. The PT muscle receives its innervation proximal to the site of compression, and therefore might be the only muscle innervated by the median nerve spared in this syndrome. The Phalen test may be positive in 50% of patients with