Surgical significance of the motor fascicular group of the ulnar nerve in the forearm

The topography of the fascicular group of the ulnar nerve at the wrist and forearm was studied focusing on the motor (muscle) fascicular group. In 109 of 111 specimens studied (98%), the motor fascicular group of the ulnar nerve is located at the ulnar dorsal or straight dorsal position at the wrist and the distal forearm. This motor fascicular group may be identified as a distinct entity up to 90 mm proximal from the level of the radial styloid. The relatively constant location of the motor fascicular group is significant since most lacerations of the major peripheral nerves of the upper extremity are at the distal forearm or the wrist. In the surgical treatment of acute lacerations of the ulnar nerve at these levels, one should direct special attention to the correct identification, matching, and alignment of the motor fascicular group to enhance reinnervation of the intrinsic muscles of the hand. (J HAND SURG 10A:867-72, 1985.)

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In the surgical treatment of traumatic lesions of mixed peripheral nerves, the distal forearm is privileged anatomically for two reasons: (1) The fascicular groups are well defined, and (2) these fascicular groups remain as distinct anatomic entities for considerable distances.

We studied the topography of the fascicular group of the ulnar nerve at the wrist and forearm, focusing on the location and course of the motor (muscle) fascicular group.

Material and methods

A total of 111 upper extremities were used in this study: 45 were fresh-frozen or refrigerated speci-
Fig. 1. Histologic sections of the left ulnar nerve at 20 mm intervals apart. A is at 25 mm proximal to the radial styloid and B is at the 45 mm level. The motor fascicular group (M) is located at the ulnar dorsal position. Note the intraneural epineurium (arrows) that separates the fascicular groups.

Fig. 2, A-D. Conventional light photography of cross-sectional surface of consecutive segments of the left ulnar nerve at 5 mm intervals apart. A is at 50 mm proximal to the radial styloid.
Fig. 2, E-G. Conventional light photography of cross-sectional surface of consecutive segments of the left ulnar nerve at 5 mm intervals apart. G is at the 80 mm level. Note the motor fascicular group (M) at the ulnar dorsal position. This is separated from the sensory fascicular group (S) by the intraneural epineurium (arrows).
the motor fascicular group was located at the ulnar dorsal position (Figs. 1 and 2). In 32 specimens (29%), it was located at the straight dorsal position. In two specimens (2%), it was located at the radial dorsal position.

The motor fascicular group of the ulnar nerve can be identified as a distinct anatomic entity up to 90 mm proximal from the level of the radial styloid. In the distal third of the forearm, the motor fascicular group constitutes 30% to 35% of the total fascicular cross-sectional area of the ulnar nerve.

Diagrammatic mappings of the fascicular groups of...
the ulnar nerve at representative levels of the wrist and forearm are shown in Fig. 3. A schema of the fascicular groups of the ulnar nerve in the forearm is diagrammatically illustrated in Fig. 4. Note that the motor fascicular group from the intrinsic muscles of the hand can be readily identified up to 90 mm proximal to the radial styloid process, whereas the two sensory groups from the fingers merge with each other at the 50 mm level. The sensory fascicular group that gives rise to the dorsal cutaneous branch can be traced to the 250 mm level.

Discussion

For many years, false interpretation and unfounded extrapolation of Sunderland's diagrammatic model of the funicular plexus of the proximal musculocutaneous nerve have been made (Fig. 5). Many clinicians referred to this diagram to claim futility in the precise realignment of lacerated peripheral nerves. In 1945, Sunderland pointed out that despite the changing plexiform character of the individual fascicles, the fascicular groups from the terminal branches pursue a localized course in the nerve for considerable distances above the site of branching. This observation on the bundle groups (fascicular groups) has been generally neglected. The diagrammatic drawing of the distal median nerve in the article by Jabaley et al. illustrated...
the concept of group fascicular arrangement (Fig. 6). Our schema of the ulnar nerve (Fig. 4) was composed by averaging the anatomic data based on the study of 111 specimens of the upper extremity performed at the Uniformed Services University of Health Sciences. It agrees with Sunderland’s early work in Australia and again shows the group arrangement of the fascicles at the distal portion of the major peripheral nerves.

Sunderland reported that the fascicular pattern is continually modified along the entire length of each nerve by the repeated division, anastomosis, and migration of the fascicles, as well as that crossing over between individual fascicles occurring at distances of less than 2.5 mm. However, he also observed that the fascicles arrange themselves in groups and that this intraneural fascicular group arrangement is specifically well defined at the distal portion of the peripheral nerves. The following observations were noted in our study of 111 anatomic specimens. In the ulnar nerve at the wrist and the distal forearm, the fascicular plexus formation is mainly limited within each of the fascicular groups, whereas the fascicular groups remain as separate entities for several centimeters. Specifically, the motor fascicular group can be identified up to 90 mm proximal to the radial styloid (Fig. 4). Furthermore, the fascicular groups are surrounded by and separated from one another by the intraneural epineurium. This provides the anatomic basis for the techniques of group fascicular repair and nerve grafting.

We believe that the relatively constant location of the motor fascicular group of the distal ulnar nerve has important clinical significance. Most lacerations of the major peripheral nerves of the upper extremity are at the distal forearm or the wrist. In the surgical repair of acute lacerations of the ulnar nerve at these levels, one should direct special attention to the correct identification, matching, and alignment of the motor fascicular group to enhance reinnervation of the intrinsic muscles of the hand. The fascicular groups of the ulnar nerve at the distal portion of the forearm may be readily identified under the operating microscope.

In patients with significant segmental loss of peripheral nerve with a polyfascicular group arrangement, nerve grafts (interfascicular nerve grafting) are used to bridge the gap between the corresponding fascicular groups by means of the operating microscope. This method of grafting, as described by Millesi, is specifically applicable to the reconstruction of the motor fascicular group of the ulnar nerve at the wrist and distal forearm.

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