Hereditary aspects of median-ulnar nerve communications

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SUMMARY Median-ulnar nerve communications, resulting in anomalous innervation of intrinsic hand muscles, was found to occur in 28% of the general population and 62% of family members of five probands with this variant. This variant appears to be dominantly inherited.

Anomalous innervations of muscles in the extremities involving the median, ulnar, and peroneal nerves occur commonly. A study of the anomalous innervation of the extensor digitorum brevis muscle by the accessory deep peroneal nerve showed that hereditary factors were significant in the occurrence of this variation. It appears in as many as 28% of the general population and in 78% of relatives with the variation.¹

In the forearm, a communication between the median and ulnar nerves is a common variation. In its presence, axons descend in the median nerve joining the ulnar nerve in the forearm before innervating intrinsic muscles of the hand.

This anomalous variation has been reported to occur in as many as 15-31% of subjects.^{2,3} Most often the anomalous axons innervate the first dorsal interosseous muscle and less often the hypothenar and thenar muscles.³ An awareness of this variation is important in the evaluation and treatment of median and ulnar neuropathies.^{3,4} The present study was undertaken to investigate the occurrence of this anatomical variation in families and to compare this with a control population using electrophysiological techniques.

Methods

Fifty apparently healthy unrelated individuals, 15 men and 35 women, were studied to determine the innervation of the thenar, first dorsal inter-

osseous, and hypothenar muscles. All were students, faculty members or employees of West Virginia University. Ages ranged from 19 to 48 years with a mean age of 21 years. These individuals served as the initial control population. Five members of this original group, showing median-ulnar nerve communications, served as the probands of the family study. In addition, family members of two individuals without the variation were also studied.

Nerves were stimulated with a single supra-maximal rectangular electrical pulse from a Grass S-4 stimulator using percutaneous stimulating electrodes. Median and ulnar nerves were stimulated at the elbow and wrist in both arms. Amplitudes of the evoked muscle action potentials (MAP) were recorded with percutaneous electrodes from thenar, hypothenar, and first dorsal interosseous muscles in the case of each nerve stimulated. The MAP was amplified and displayed using Tektronix amplifier type 3A74, differential amplifier type 2A61, time base 2B67, and cathode ray oscilloscope type 561A. Data were recorded on Kodak Tri-X panchromatic 35 mm film.

The criteria used for the identification of the variation were (1) a MAP from first dorsal interosseous, hypothenar, and/or thenar muscles that was at least 1.0mV larger on median nerve stimulation at the elbow than wrist (fig 1), and (2) a MAP from one or more of these muscles that was at least 1.0mV larger when stimulating the ulnar nerve at the wrist than elbow (fig 2).

Results

The study showed the presence of median-ulnar

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Accepted 7 June 1979

Fig 1 Muscle action potential evoked from several muscles by supramaximal median nerve stimulation at elbow and wrist, from the *propositus* of family 1. Stimulation at elbow produced a much larger MAP from first dorsal interosseus than stimulation at wrist.

Fig 2 Muscle action potential evoked from several muscles by supramaximal ulnar nerve stimulation at elbow and wrist from *propositus* of family 1. Stimulation at wrist produced a larger MAP from first dorsal interosseus than stimulation at elbow, complementing change seen in fig 1.

communications in 14 of the 50 individuals tested (28%). Nine of these subjects showed the variation bilaterally. The pedigrees of five of these individuals showing median-ulnar communications served as the basis for the family study as shown in fig 3. In family 1, 10 subjects representing four generations were tested. Two siblings in each of the first three generations had the anomaly as did the single offspring in the fourth generation. The variation was unilateral in all individuals (four on the right and two on the left) except for the *propositus* in whom it was bilateral. In family 2, both parents and two of four offspring showed the anomaly (one on the right and two bilaterally). In family 3, two of four members showed evidence of median-ulnar communications (both on right). In family 4, both parents and five offspring were tested. One

parent and three children demonstrated the variation (one on left, one on right, and two bilaterally). The *propositus* (variation on right) of family 5 had two offspring neither of whom showed the anomaly.

In the 18 family members with the variation, the latter occurred in a total of 26 extremities. The variation involved only the first dorsal interosseus muscle in 20 extremities, the first dorsal interosseus and thenar muscles in three extremities, first dorsal interosseus and hypothenar muscles in one extremity, and all three muscle groups in two extremities. The more common involvement of the first dorsal interosseus muscle by the variation was also noted by Wilbourn and Lambert.³ There was no pattern of laterality or bilaterality in a given family.

Two subjects who did not possess the variation were selected as *propositi* for the control family study. All 10 individuals in two generations of these two families were studied and none showed the variation.

Fig 3 Pedigrees of five families with median-ulnar nerve communications and two control families in whom the *propositus* had no communications.

Discussion

The 28% incidence of median-ulnar nerve communications indicates that this is a common anatomical variant. This supports the conclusions of early investigations that this variation occurs in 15% to 31% of individuals.

In studying the family members of the five involved subjects, 18 of 29 individuals studied (62%) showed the variation. The variation was present in more than one generation of all but one of the families tested. These findings were similar to the reported incidence of hereditary factors in the anomalous innervation of the extensor digitorum brevis muscle by the accessory deep peroneal nerve, the latter being present in 78% of the family members.¹

The data in the present study were analysed using the chi squared test of independence and Fisher's exact test. A hypothesis that the pre-

sence of the variation is independent of familial relationships would be rejected ($p < 0.01$) in favour of an alternative that hereditary factors are present. The available data strongly suggest an autosomal dominant mode of inheritance.

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