Sensory Nerve Conduction Study in the Medial Antebrachial Cutaneous Nerve

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Sensory nerve conduction in the medial antebrachial cutaneous nerve was studied in 40 normal subjects utilizing both antidromic and orthodromic methods. Using the antidromic method the distal sensory latency to the take-off point of the sensory action potential (SNAP) was 1.54±0.17 msec, latency to the peak of the SNAP was 2.11±0.16 msec, the amplitude of the SNAP was 18.8±7.1 μv and the nerve conduction velocity was 65.9 m/sec. Using the orthodromic method the values were 1.55±0.17 msec, 2.10±0.15 msec, 15.7±6.3 μv and 65.5±8.5 m/sec, respectively. Amplitude of the medial antebrachial cutaneous SNAP was usually smaller than that of the lateral antebrachial cutaneous nerve (p<0.01). This technique should be useful in the electrodiagnostic differentiation between eighth cervical or first thoracic root involvement and postganglionic lesions including the lesions of the inferior trunk or the medial cord of the brachial plexus and also in confirming involvement of this peripheral nerve due to other focal causes.

medial antebrachial cutaneous nerve; lateral antebrachial cutaneous nerve; sensory nerve conduction; electrodiagnosis

The medial antebrachial cutaneous nerve (MACN) is a purely sensory nerve. It arises from the eighth cervical (C8) and first thoracic (T1) roots, passes through the lower trunk and medial cord of the brachial plexus. It runs down the ulnar side of the arm medial to the brachial artery, and about the middle of the arm, divides into anterior and posterior branches. The anterior branch is larger and passes superficial to the basilic vein. It continues on the anterior part of the ulnar side of the forearm down to the wrist. The posterior branch is smaller. Both branches supply the skin of the medial aspect of the forearm (Gray 1959). Schematic location of the MACN and lateral antebrachial cutaneous nerve (LACN) is shown in Fig. 1.

The lateral antebrachial cutaneous nerve is a sensory branch of the musculo-cutaneous nerve and originates from the fifth and sixth cervical (C5-6) roots and passes through the upper trunk and the lateral cord of the brachial plexus (Gray

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Conduction study of the LACN may be useful in differentiating C5 or C6 root lesions from lesions of the upper trunk or the lateral cord of the brachial plexus (Stanwood 1971; Spindler and Felsenthal 1978).

Nerve conduction study of the medial antebrachial cutaneous nerve is rarely used in the electrodiagnostic laboratory (Pribyl et al. 1979). No established method for measurement of this nerve conduction has been reported. We are herein describing a simple method for evaluating the MACN conduction and normal values obtained in our laboratory.

**MATERIALS AND METHODS**

Eighty nerves in 40 adults (20 men and 20 women) from 19 to 79 of age (mean age 46.5) were studied. All subjects were screened by the history and physical examination to exclude those with any suspicion of neurological diseases.

A TECA TE4 electromyograph (White Plains, New York) was used to elicit and record responses on photosensitive paper for measurement. Rectangular pulse stimuli of 0.1 msec duration were used for percutaneous nerve stimulation. The low-frequency and high-
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frequency filters were set at 32 Hz and 3.2 kHz, respectively.

Electrode setting for the antidromic method for the MACN and LACN is shown in Fig. 2. The anterior branch of the MACN was stimulated antidromically by the surface stimulating electrodes (TECA 9523) with the cathode placed distally, medial to the biceps brachii tendon at the junction of the medial third and lateral two thirds of a line connecting the biceps tendon to the medial epicondyle. Recording electrode (TECA 6080) of 10 mm diameter was placed over the nerve, 10 cm distal to the cathode of the stimulating electrodes along a line connecting the cathode to the pisiform bone at the wrist. The orthodromic method was also used, the electrode placement being the same as for the antidromic method except that the skin of the medial forearm was stimulated and the SNAP recorded from the nerve at the elbow crease. The ground electrode was placed between the stimulating and recording electrodes. Sometimes it was necessary to move the ground electrode to the back of the forearm to decrease the stimulus artifact.

LACN conduction was studied antidromically utilizing a slight modification of the method described by Spindler and Felsenthal (1978). Stimulating electrode was placed at the level of the elbow crease just lateral to the biceps tendon. The recording electrode was placed over the anterior branch of the LACN, 10 cm distal to the cathode along a straight line connecting the distal stimulating electrode to the radial artery at the wrist.

Distal latency from the stimulus artifact to the onset and peak latency from the stimulus artifact to the peak of the first negative deflection of the SNAPs were measured for both MACN and LACN. Conduction velocity was calculated by dividing 100 mm by the distal latency (msec). Peak-to-peak amplitude of the SNAP was also determined.

RESULTS

The mean distal sensory latency obtained antidromically was $1.54 \pm 0.17$ msec with a conduction velocity of 51 to 81 m/sec and a mean value of $65.9 \pm 7.5$ m/sec.

<table>
<thead>
<tr>
<th></th>
<th>Medial antebrachial cutaneous nerve</th>
<th>Lateral antebrachial cutaneous nerve</th>
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<tbody>
<tr>
<td></td>
<td>Antidromic method</td>
<td>Orthodromic method</td>
</tr>
<tr>
<td>Distal latency</td>
<td>1.54±0.17*</td>
<td>1.55±0.17*</td>
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<tr>
<td>(msec)</td>
<td>(1.2-2.0)</td>
<td>(1.2-2.0)</td>
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<tr>
<td>R-L difference</td>
<td>0.05±0.05*</td>
<td>0.05±0.05*</td>
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<td>(msec)</td>
<td>(0-0.2)</td>
<td>(0-0.2)</td>
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<tr>
<td>Peak latency</td>
<td>2.11±0.16*</td>
<td>2.10±0.15*</td>
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<tr>
<td>(msec)</td>
<td>(1.9-2.4)</td>
<td>(1.9-2.4)</td>
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<tr>
<td>R-L difference</td>
<td>0.05±0.04*</td>
<td>0.05±0.04*</td>
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<tr>
<td>(msec)</td>
<td>(0-0.2)</td>
<td>(0-0.2)</td>
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<tr>
<td>Amplitude</td>
<td>18.8±7.1†‡</td>
<td>15.7±6.3†</td>
</tr>
<tr>
<td>($\mu$V)</td>
<td>(6-40)</td>
<td>(8-30)</td>
</tr>
<tr>
<td>R-L difference</td>
<td>0.89±0.10*</td>
<td>0.87±0.11*</td>
</tr>
<tr>
<td>($\mu$V)</td>
<td>(6-40)</td>
<td>(0.7-1.0)</td>
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</tbody>
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Values represent averaged values (mean±s.d.) of two sides in 80 nerves of 40 normal subjects.

* No significant difference at $p=0.01$, † Significant difference at $p=0.05$, ‡ Significant difference at $p=0.01$. 

TABLE 1. Normal values of the medial antebrachial cutaneous and lateral antebrachial cutaneous nerve conduction studies.
in the MACN. In the LACN, the mean distal sensory latency obtained antidromically was $1.57 \pm 0.19$ msec with a conduction velocity of 50 to 80 m/sec and a mean value of $65.0 \pm 8.0$ m/sec.

The mean and its standard deviation of difference between the latency in the right and left arms of the 40 subjects were calculated. The side to side difference in the amplitude of the SNAPs is expressed as a ratio with the larger response always placed as the denominator. Table 1 summarizes the results of antidromic and orthodromic conduction in the MACN and antidromic nerve conduction in the LACN. These values represent averaged value (mean ± s.d.) of two sides in 80 nerves of the 40 normal subjects.

At the significance level of $p = 0.05$, we found no statistical difference in the distal latency, peak latency, conduction velocity or amplitude of the SNAPs related to either right and left side or sex. There was no statistically significant difference in these four parameters related to age. The use of electronic averager was not necessary since all subjects showed responses with amplitude higher than 6 $\mu$V both with antidromic and orthodromic methods.

Fig. 3 shows relationship of the mean amplitude of the both sides of the MACN sensory action potential obtained with antidromic and orthodromic methods in the 40 normal subjects. The regression line, as determined by the method of least squares, is represented by the equation

$$Y = 0.7X + 6.3$$

and the correlation coefficient between these two groups is 0.74.

Fig. 4 shows the mean amplitudes of the sensory nerve action potential of the

![Graph](image-url)

Fig. 3. Relationship of the medial antebrachial cutaneous SNAP amplitude obtained with antidromic and orthodromic methods. The regression line is represented by the equation, $Y = 0.7X + 6.3$ ($r = 0.74$).

Fig. 4. Relationship of the amplitude of SNAPs of the medial antebrachial cutaneous nerve (Medial cutaneous nerve) and lateral antebrachial cutaneous nerve (Lateral cutaneous nerve). The regression line is represented by the equation, $Y = 0.5X + 5.6$ ($r = 0.72$).
both sides in the MACN and in the LACN obtained by the antidromic method in the 40 normal subjects. The regression line between two groups is represented by the equation

\[ Y = 0.5X + 5.6 \]

and the correlation coefficient is 0.72.

**DISCUSSION**

We have described a simple, reliable technique of evaluating conduction in the MACN using surface stimulating and recording electrodes. A well-defined response was obtained in subjects of all ages without using electronic averager, though MACN is said to be absent or small occasionally in normal persons (Kaplan and Spinner 1980). The mean amplitude of the medial antebrachial cutaneous SNAP was significantly smaller than that of the lateral antebrachial cutaneous SNAP \((p < 0.01)\).

Occasionally, some difficulty was noted in getting a well-defined response owing to artifact from muscle contraction and stimulus artifact. The problem could be eliminated by moving the ground electrode to the back of the forearm and by moving the anode of the stimulating electrode without moving the cathode. Since threshold of the cutaneous nerves was low, the intensity of the percutaneous nerve stimulation was low usually below 100 volts with a duration of 0.1 msec in almost all subjects. Only light pressure of the stimulating electrode on the nerve was necessary to obtain a well-defined response and to eliminate the muscle contraction artifact.

Maximal nerve conduction velocity of the MACN ranged from 51 to 83 m/sec with both antidromic and orthodromic methods. The mean conduction velocity was \(65.9 \pm 7.5\) m/sec with antidromic method and \(65.5 \pm 8.3\) m/sec with the orthodromic method. These values are faster than those obtained by Pribyl et al. (1979). We measured the latency to the take-off point of the SNAP whereas Pribyl et al. measured the latency to the peak. This may explain the difference in the results. MACN conduction velocity corresponded to the LACN conduction velocity in our laboratory-65.0 m/sec. Our results of the LACN conduction studies are also in agreement with those of Spindler and Felsenthal (1978) and Trojaborg (1976).

In general, antidromic method for measurement of the sensory nerve conduction offers some advantage when compared with orthodromic method (Wainapel et al. 1978; Kimura et al. 1983). The mean amplitude of the medial antebrachial cutaneous SNAP obtained antidromically was significantly higher than that with antidromic stimulation \((p < 0.05)\). In these patients, supramaximal stimulation could not be attained by antidromic stimulation at the elbow because of the simultaneous stimulation of the neighboring motor fibers of the ulnar and/or median nerves and the resulting muscle action potentials interfering with the recording of the SNAPs whereas no such problem was present with orthodromic
stimulation. When a poor sensory response is obtained with the antidromic method one should use the orthodromic method.

Nerve conduction studies of the MACN may be useful especially to differentiate between C8 and T1 root involvement and postganglionic lesions such as lesions of the lower trunk and medial cord of the brachial plexus. This technique is somewhat similar to usefulness of the ulnar SNAP in differentiating pre- and post-ganglionic lesions at C8 segmental level.

We have seen several patients in whom the electrophysiological studies confirmed isolated lesion of the MACN. In patients with peripheral neuropathy and absent median, ulnar or radial SNAP, conduction studies of the more proximal sensory nerves such as the LACN and MACN may give information as to the type of underlying neuropathy.

References