Anterior interosseous nerve syndrome
A case report with neurophysiological investigation

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SUMMARY Details of a 23 year old patient who suffered the spontaneous onset of an anterior interosseous nerve palsy are recorded together with the results of a full neurophysiological investigation.

Isolated lesions of the anterior interosseous nerve are rare and there are no recorded cases with comprehensive neurophysiological investigation. The anterior interosseous nerve is a purely motor nerve and supplies the flexor pollicis longus, flexor digitorum profundus to the index and middle fingers and pronator quadratus muscles. The detailed anatomy and its normal variation has been discussed by Sunderland (1945), Mangini (1960), and Spinner (1970).

NEUROPHYSIOLOGICAL INVESTIGATION The patient lay supine and relaxed on a couch. An infra-red lamp was used to maintain the surface temperature of both arms at 37°C.

Stimulation and recording Motor conduction studies and antidromic sensory action potentials were recorded from both median nerves after stimulation by cloth-covered silver electrodes, soaked in saline, placed 2.5 cm apart and applied over the nerve at the wrist or the elbow. The cathode was placed at the point of lowest threshold for M waves and 50 μsec rectangular electrical pulses were delivered by a Devices stimulator type 3072 at a voltage which was supramaximal for M waves by 50 V. The same electrodes and placements were used for recording orthodromic sensory action potentials when the digital nerves were stimulated by ring electrodes made of silver strip covered with electrode jelly. The cathodal electrode was placed round the terminal phalanx 2 cm from the tip.

Throughout the experiments a flat metal earth electrode covered in electrode jelly was attached to the dorsum of the hand.

A unipolar concentric needle electrode (Medelec Ltd.) was used to record the electromyographic interference pattern of the muscles and for the motor conduction studies. The potentials were fed into an amplifier of which the frequency response was 3 dB down at 2 Hz and 5 KHz. The signals were then displayed on a Hewlett Packard storage oscilloscope type 141A and photographed on Polaroid film. A gain of 5 μV/cm or 10 μV/cm was used for the recording of sensory nerve action potentials, but gains of up to 5 mV/cm were used during the recording of muscle action potentials.

During the sensory recordings the patient was encouraged to relax completely and the amplitude of

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the stimulus was raised until the maximum evoked response was obtained. Latencies were measured to the onset of the initial negative deflection; an accuracy of 0.1 msec was attempted after the central portion of the time base had been expanded. A series of 10 responses was measured. Each muscle was sampled at three sites with a concentric needle electrode and a search was made for spontaneous activity; the gain of the amplifiers was 20 μV/cm on the oscilloscope. The needle was usually inserted perpendicular to the skin surface but an oblique approach was used to record from the pronator quadratus muscle. The interference patterns of the muscles were assessed on a 100 msec sweep of the oscilloscope time base during minimal, moderate, and maximal voluntary contraction and the peak to peak amplitude of the patterns was measured on the screen. Each muscle was identified by surface anatomy and by the electromyographic activity during appropriate voluntary movements. Size and duration of motor unit action potentials were roughly assessed by a series of stored sweeps of the oscilloscope during minimal and moderate voluntary contraction of the sampled muscle. Some of these single sweeps were photographed to indicate the fullness of the interference patterns during maximal voluntary contraction.

RESULTS

Motor and sensory nerve conduction studies are summarized in Table 1 and Fig. 1. The results are within the normal limits for this department. Spontaneous activity was not detected in any

### TABLE 1

**MOTOR AND SENSORY NERVE CONDUCTION STUDIES**

<table>
<thead>
<tr>
<th>Recording</th>
<th>Site of recording</th>
<th>Stimulation (200 V, 50 μsec)</th>
<th>Point of stimulation</th>
<th>Size of response (mV)</th>
<th>Latency of response (msec)</th>
<th>Distance (cm)</th>
<th>Conduction velocity (m/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentric needle</td>
<td>Right abductor pollicis brevis</td>
<td>Surface electrodes</td>
<td>Wrist</td>
<td>14</td>
<td>3.5</td>
<td>26</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>Left abductor pollicis brevis</td>
<td>Median nerve</td>
<td>Elbow</td>
<td>11</td>
<td>8.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Right first dorsal interosseous</td>
<td>Surface electrodes</td>
<td>Elbow</td>
<td>13</td>
<td>3.4</td>
<td>25</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ulnar nerve</td>
<td>Wrist</td>
<td>11</td>
<td>7.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Above elbow</td>
<td>Elbow</td>
<td>25</td>
<td>3.8</td>
<td>25</td>
<td>62</td>
</tr>
</tbody>
</table>

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**Sensory nerve conduction (orthodromic), surface electrodes, 37° C**

<table>
<thead>
<tr>
<th>Recording</th>
<th>Site of recording</th>
<th>Stimulation (90 V, 50 μsec)</th>
<th>Point of stimulation</th>
<th>Size of response (μV)</th>
<th>Latency of response (msec)</th>
<th>Distance (cm)</th>
<th>Conduction velocity (m/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R median nerve</td>
<td>Wrist</td>
<td>Ring electrodes, digital nerve</td>
<td>Base of index finger</td>
<td>18</td>
<td>2.0</td>
<td>11</td>
<td>55</td>
</tr>
<tr>
<td>L median nerve</td>
<td>Wrist</td>
<td>Ring electrodes, digital nerve</td>
<td>Base of index finger</td>
<td>20</td>
<td>2.0</td>
<td>11</td>
<td>55</td>
</tr>
<tr>
<td>R ulnar nerve</td>
<td>Wrist</td>
<td>Ring electrodes, digital nerve</td>
<td>Base of little finger</td>
<td>10</td>
<td>1.9</td>
<td>10-5</td>
<td>55</td>
</tr>
</tbody>
</table>

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**Sensory nerve conduction (antidromic), surface electrodes, 37° C**

<table>
<thead>
<tr>
<th>Recording</th>
<th>Site of recording</th>
<th>Stimulation (70 V, 50 μsec)</th>
<th>Point of stimulation</th>
<th>Size of response (μV)</th>
<th>Latency of response (msec)</th>
<th>Distance (cm)</th>
<th>Conduction velocity (m/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R thumb</td>
<td>Base of thumb, ring electrodes</td>
<td>Surface electrodes, median nerve</td>
<td>Wrist</td>
<td>30</td>
<td>2.0</td>
<td>9.5</td>
<td>47</td>
</tr>
<tr>
<td>index finger</td>
<td>Base of index finger</td>
<td>Surface electrodes, median nerve</td>
<td>Elbow</td>
<td>30</td>
<td>2.3</td>
<td>11</td>
<td>48</td>
</tr>
<tr>
<td>index finger</td>
<td>Base of index finger</td>
<td>Surface electrodes, median nerve</td>
<td>Wrist</td>
<td>24</td>
<td>6.5</td>
<td>26</td>
<td>62</td>
</tr>
<tr>
<td>middle finger</td>
<td>Base of middle finger</td>
<td>Surface electrodes, median nerve</td>
<td>Elbow</td>
<td>30</td>
<td>2.3</td>
<td>11-0</td>
<td>48</td>
</tr>
<tr>
<td>ring finger</td>
<td>Base of ring finger</td>
<td>Surface electrodes, median nerve</td>
<td>Wrist</td>
<td>28</td>
<td>2.2</td>
<td>10-5</td>
<td>48</td>
</tr>
</tbody>
</table>
Anterior interosseous nerve syndrome

FIG. 1. 1–5 Antidromic digital sensory action potentials (SAP) in all five digits. Gain 10 μV/cm. 6 Orthodromic ulnar sensory action potential. Gain 5 μV/cm. 7 Antidromic median sensory action potential. 8 + 9 Maximal motor M waves. Right abductor pollicis brevis after stimulation of median nerve at wrist and elbow. Gain 500 μV/cm and 5 mV/cm.
muscle but the interference patterns during maximal volitional activity were greatly reduced in the right pronator quadratus, flexor pollicis longus, and part of flexor digitorum profundus muscles. The reduction in the interference patterns in the muscles supplied by the right anterior interosseous nerve is clearly shown in Fig. 2, while the normal findings in the other muscles, particularly those innervated by the median nerve, are shown in Table 2.

**DISCUSSION**

Table 3 summarizes the clinical features of 23 previously reported patients with the anterior interosseous nerve syndrome; these accounts are the principal contributions to this subject which have appeared in the English language since the war. Parsonage and Turner (1948) described five cases in which a palsy of the anterior interosseous nerve complicated neuralgic amyotrophy. They also briefly described one patient with an isolated palsy. Thomas (1962) mentioned in discussion that he had seen two patients with a syndrome similar to that recorded by Kiloh and Nevin (1952). It is of interest to analyse the clinical features of the 23 cases which have been reported fully. Nine of these were due to injury

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**FIG. 2.** Interference patterns of median innervated muscles of right arm during maximal volitional activity. Concentric needle electrode. Amplifier frequency response 3 db down at 2 Hz, 5 KHz. A = abductor pollicis brevis, 100 msec, 1 mV/cm. B = opponens pollicis, 100 msec, 1 mV/cm. C = pronator quadratus, 100 msec, 1 mV/cm. D = flexor digitorum profundus, 100 msec, 1 mV/cm. E = flexor pollicis longus, 100 msec, 500 μV/cm. F = flexor digitorum sublimis, 100 msec, 1 mV/cm. Those muscles innervated by the anterior interosseous nerve (C, D, E) show reduced interference patterns.
to the forearm, including four patients with forearm fractures, two with lacerations, and three with other contusion injuries. Direct pressure to the forearm was the cause in a further three patients; one of these was due to a plaster, in one to carrying a handbag over the forearm, and in a third to leaning over a beam. Four of these 12 patients with a known cause for their lesion had evidence of involvement of the main trunk of the median nerve and a further two patients, with an apparently spontaneous palsy, also had evidence of involvement of the median nerve. Four patients had involvement of the flexor pollicis longus muscle only, presumably indicating involvement of the branch of the anterior interosseous nerve to this muscle, though
in these patients there may have been a separate nerve to this muscle from the main trunk of the median nerve. In three patients the palsy developed during the night, as in the present case. Lifting heavy weights and strenuous exercise involving the forearm muscles was a precipitating factor in three patients, presumably causing a compression of the nerve against a fibrous band, a mechanism which has been shown to apply to some patients with radial nerve palsy (Lotem, Fried, Levy, Solzi, Najenson, and Nathan, 1971). There remain eight patients in whom no certain cause could be identified; these include the three patients who developed the palsy during the night and pressure could not be excluded as a cause for these lesions. Pressure could have been a factor in the patient recorded in this paper, since he had had 10 pints of beer the night before and slept heavily so that his anterior interosseous nerve palsy could have been a form of 'Saturday night palsy'.

The prognosis seems to be very variable; some patients recover in a few weeks, while others show no satisfactory recovery and may require tendon transfer. Thirteen of the 23 patients reported were subjected to operation; in these a median nerve neurina was found in one and constricting fibrous bands were found in seven patients. Patients appeared to recover function more rapidly after operation than did those who were not operated upon. The indications for operation have been discussed by Spinner (1970). Surgery was not considered in the present patient because the electrophysiological findings indicate partial denervation probably due to segmental demyelination, with axonal preservation.

We are grateful to Dr. D. D. Barwick for permission to record details of the patient who was under his care, Professor A. J. McComas for his helpful comments regarding the neurophysiological investigations, and Professor J. N. Walton for his advice and encouragement.

**ADDENDUM**

Since the preparation of this paper two further cases have been reported from Scandinavia. One was a lady of 60 years who suddenly developed pain and the typical pattern of weakness at night; she was explored 10 weeks later and a fibrous band was found and divided. She had recovered completely at 16 weeks. The other patient was a woman of 40 years who suffered the sudden onset of typical pattern of weakness with no obvious cause and no pain. She was explored at two weeks and again a fibrous band was found and this was divided. She had fully recovered in a further three months. (Schmidt, H., and Eiken, O. 1971. The anterior interosseus nerve syndrome. *Scandinavian Journal of Plastic and Reconstruc tive Surgery*, 5, 53-56.)

**REFERENCES**


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