ANTERIOR INTEROSSEOUS NERVE LESIONS

CLINICAL AND ELECTROPHYSIOLOGICAL FEATURES

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Lesions of the anterior interosseous nerve in the forearm are rare and often misdiagnosed as tendon injuries. A consecutive series of 13 patients with this condition referred for electrodiagnosis is reviewed. Only three had originally a correct clinical diagnosis and three were initially considered to have tendon ruptures.

Five cases were of mechanical origin and seven due to ‘neuritis’. All showed electrophysiological abnormalities, most commonly involving the pronator quadratus. Late spontaneous recovery was common, and only one case had surgical exploration.

PATIENTS AND METHODS

Thirteen patients with 14 complete or incomplete lesions of the AIN referred for electrophysiology from 1985 to 1994 are reported. For all patients the gender, age, side and type of lesion, presence and intensity of pain, any precipitating conditions or delay in development, outcome and the presence of associated nerve lesions, were recorded.

Electrophysiological examination consisted of bilateral examination of the AIN in all cases using techniques previously described (Seror 1986a); the entire upper limbs were studied to evaluate other nerve lesions, polyneuropathy, brachial plexus lesions or radiculopathy.

Needle examination was used at rest and at maximum voluntary contraction for pronator quadratus in all cases.
and for FPL and the index finger when the findings for pronator quadratus were normal. AIN conduction was studied after supramaximal stimulation of the median nerve at the elbow, with coaxial needle recording (Seror 1986a).

**RESULTS**

The complete and classical abnormality of pinch was present in seven of the 14 cases. There was partial motor weakness in the other seven with isolated palsy of the FPL in three (Fig. 2) and isolated palsy of the index finger in four (Fig. 3), with the middle finger also involved in one of these. Clinical palsy of pronator quadratus was never obvious because pronator teres was always normal. No patient had any sensory complaints or signs, but ten of the 14 had some pain. The clinical details are summarised in Table I.

The electrophysiological results confirmed the preservation of normal function in the main trunk of the median nerve in all 14 cases. There was evidence of suprascapular and axillary nerve lesions in one patient and of an associated lesion of the long thoracic nerve in another. Neither had any shoulder symptoms.

Needle examination of pronator quadratus was abnormal in 12 patients with spontaneous fibrillation and sharp waves in 11, and a neurogenic recruitment pattern in all 12. Pronator quadratus latency was abnormal or not obtained in seven (mean 8.2 ms (4.6 to none) as against normal values of 4.1 ± 0.6 ms). The compound motor action potential for pronator quadratus was low or very low in 12 patients (mean 1.1 mV (0.1 to 5) as against normal values of 7 to 24 mV). Needle examination and the compound motor action potential were abnormal in FPL in two patients and in FDP to the index finger in four.

The outcome remains unknown in six cases, and there was no recovery in one. Surgical release in case 10, with a one-year history, gave partial recovery seven months later. Surgery was recommended for four other patients with no recovery after more than six months, but all refused this because they had adapted well to the deficit; two of the four later recovered spontaneously. There was spontaneous recovery in seven patients which was complete in five, occurring between four and 15 months after onset.

**DISCUSSION**

Lesions of the anterior interosseous nerve are sometimes

| Table I. Details of 14 cases of lesions of the anterior interosseous nerve |
|---------------|----------------|---------------|----------------|----------------|----------------|
| Case | Sex | Age (yr) | Side | Form* | Causes | Palsy delay | Recovery† | Forearm pain | Other nerve lesions |
| 1 | M | 49 | R | C | Local pressure | Immediate | P/14 months | + | None |
| 2 | F | 31 | R | C | Forearm oedema | 3 days | Unknown | + | None |
| 3 | M | 56 | R | P1 | Unusual effort | 1 day | C/7 months | +++ | None |
| 4 | M | 63 | L | C | Forearm oedema | 21 days | None/21 months | +++ | None |
| 5 | M | 41 | R | P1 | Unusual effort | Progressive | C/14 months | + | None |
| 6 | M | 41 | R | C | Neuralgic amyotrophy syndrome | 8 days | Unknown | + | Subscapular, axillary nerves |
| 7 | F | 73 | R | P2 | Unknown | Unknown | Unknown | ++ | None |
| 8 | F | 73 | L | P2 | Unknown | Unknown | Unknown | None | None |
| 9 | M | 53 | L | C | Neuralgic amyotrophy syndrome | Unknown | Unknown | None | Long thoracic nerve |
| 10 | F | 50 | R | C | Unusual effort | 8 days | P/19 months | ++ | None |
| 11 | M | 41 | R | P1 | Forearm fracture | Immediate | C/5 months | ++ | None |
| 12 | F | 35 | L | P2 | Viral? influenza | 10 days | C/15 months | + | None |
| 13 | F | 55 | R | P2, 3 | Influenza | 15 days | Unknown | None | None |
| 14 | M | 12 | L | C | Humeral fracture | 15 days | C/6 months | None | None |

* C = complete lesion; P = partial lesion; 1 = FPL; 2 = index finger; 3 = middle finger
† P = partial; C = complete
misdiagnosed, even by orthopaedic and hand surgeons or electrodiagnostic specialists, and very rarely recognised by other practitioners. Of the series of 13 patients only three were referred with the correct diagnosis made on clinical examination.

There appear to be several explanations for the incorrect diagnoses. Such lesions are rare; there are only three studies which report ten or more cases (Spinner 1970; Maeda et al 1977; Hill, Howard and Huffer 1985). Only three studies report normal data for anterior interosseous nerve conduction (Craft et al 1977; Nakano et al 1977; Seror 1986a). Complete lesions involving both thumb and index finger are reasonably well known by specialists, but incomplete lesions and the isolated involvement of one digit are often misdiagnosed (Spinner 1970; Hill et al 1985; Gaitzsch and Chamay 1986; Seror 1986a). Three of my patients (cases 3, 11 and 13) were initially considered to have tendon ruptures. The frequency of such incomplete lesions was reported for the first time by Hill et al (1985) who studied 21 thumb palsy and 12 index finger palsy. Apart from Hill’s series, study of 34 other references shows that isolated thumb palsy is mentioned in only 14 cases and isolated index finger palsy only once (Maeda et al 1977; Mabin 1985; Conway and Thomas 1990).

Both O’Neill et al (1990) and Mody (1992) describe a clinical test to distinguish between palsy of FPL and rupture of this tendon but the method requires a normal range of movement in the metacarpophalangeal and trapeziometacarpal joints and can be adapted to use for the index finger. This test, however, does not preclude the use of electrodiagnosis.

Pain is a common feature of lesions of the anterior interosseous nerve regardless of the aetiology; this was reported in 85% of the 117 cases which were collected from references and in ten of the 14 cases in the present series. Pain was not predictive of the inflammatory or mechanical origin as has been suggested by Gaitzsch and Chamay (1986).

Spontaneous recovery can take place even after more than 12 months, especially in lesions which are due to neuritis or the paralytic brachial neuritis syndrome (Parsonage et al 1957; Rennels and Ochoa 1980; Hill et al 1985; Seror 1986b). This is consistent with my results and those reported by Spinner (1970) and in other series managed without surgery (Kiloh and Nevin 1952; Parsonage et al 1957; Lake 1974; Nakano et al 1977; Hill et al 1985; Gaitzsch and Chamay 1986), and suggests that in the absence of trauma or another mechanical aetiology, surgery should not be undertaken for at least a year.

The anterior interosseous nerve syndrome differs from other lesions of the median nerve in that sensory complaints are essentially absent. The presence of any additional sensory complaints suggests the possibility of pronator teres or supracondylar process syndromes (Buchthal, Rosenfalck and Trojaborg 1974; Wertsch and Melvin 1982; Seror 1986b), a lateral cord brachial plexus lesion, median neuritis or a carpal tunnel syndrome in association with the AIN lesion. Expert electrodiagnosis is then essential to differentiate and assess the site of the lesion. This may demonstrate that some cases are not true AIN lesions (Lake 1974; Bouadid 1982; Mody 1992).

Associated nerve lesions were found in two of the 13 patients (cases 6 and 9). Careful systematic clinical and electrophysiological examination of the associated lesions was needed to confirm the diagnosis of the paralytic brachial neuritis syndrome (Parsonage et al 1957) and exclude compression as a cause, with need for surgery. One of these cases occurred after tetanus inoculation.

Electrodiagnosis is essential to assess and define the severity of AIN lesions and to follow recovery. It is also useful to confirm normal median nerve function in the forearm and the wrist and to exclude polynuropathy (Buchthal et al 1974; Seror 1986a).

Only three studies of AIN conduction have been reported. Craft et al (1977) described the use of surface electrodes, but this technique is of little value since other median-innervated forearm muscles retain normal latencies and amplitudes and mask AIN lesions. Nakano et al (1977) studied the AIN in 46 control subjects (84 nerves); they found a pronator quadratus latency of 5.1 ms above the elbow and 3.6 ms at 10 cm below the elbow. They did not report side-to-side differences in either latency or amplitude. In 1986, in a series of 40 AINs in 20 normal subjects, the pronator quadratus latency from elbow level was recorded with a bipolar coaxial needle electrode (Seror 1986a). The mean was 4.4 ± 0.52 ms with a maximal side-to-side latency difference of 0.8 ms. Recently, a new study has been performed using monopolar needle electrodes. The results were very similar to previous findings (Nakano et al 1977; Seror 1986a), but gave a better initial onset of the negative phase, a greater amplitude of the compound motor action potential (CMAP) and smaller standard deviations. Side-to-side latency and the CMAP amplitude differences are more important than absolute data (Seror 1986a), since bilateral lesions are very unusual. In addition, the CMAP amplitudes are more often abnormal (12 of 14 cases) than the latency (7 of 14 cases). Needle examination of the FPL or the index finger FDP have rarely been performed, but this can sometimes be valuable since it may demonstrate abnormality when studies of pronator quadratus are negative as in cases 7 and 8. All my cases had a positive electrodiagnosis and 12 of the 14 were confirmed by a single needle examination of pronator quadratus.

In other lesions of the proximal median nerve (Buchthal et al 1974; Craft et al 1977; Maeda et al 1977; Seror 1986a), depending on the site and the pathophysiology of the lesion, electrodiagnosis has shown abnormal findings on needle examination in the abductor pollicis brevis and the ‘medial forearm muscles’ with abnormal sensory action potentials and abnormal motor and/or sensory conduction velocities. Pathophysiology demonstrates that anterior interosseous
nerve lesions may be due to trauma, microtraumatic injuries or to ‘neuritis’ (Kiloh and Nevin 1952; Parsonage et al 1957). Five of the 14 cases reported here were related to mechanical causes: one after a forearm fracture (case 11), three after minor injuries (cases 3, 5 and 10) and one due to sleeping with the head on the forearm causing local pressure (case 1). Six had the characteristics of neuritis (Kiloh and Nevin 1952; Parsonage et al 1957; Rennels and Ochoa 1980; Gaitzsch and Chamay 1986): two (cases 12 and 13) occurred after severe influenza, two (cases 6 and 9) had associated involvement of the shoulder girdle muscle and were considered to be cases of neuralgic amyotrophy, and two cases localised to the index finger had an unknown cause. Three were associated with forearm oedema due to postoperative intravenous infusion in two and to a humeral fracture in one, but post-traumatic neuralgic amyotrophy may be involved (Kiloh and Nevin 1952; Parsonage et al 1957). As only one patient underwent surgery, the frequency of a fibrous band as a possible compressive agent of the anterior interosseous nerve cannot be evaluated (Fearn and Goodfellow 1965; Spinner 1970; Lake 1974; Maeda et al 1977; Nakano et al 1977; Hill et al 1985; O’Neill et al 1990).

Conclusions. Lesions of the anterior interosseous nerve are rare and may be due to mechanical or inflammatory conditions. The clinical features are usually typical, but in 50% of this series they mimicked rupture of a single tendon. Clinical tests can help the differentiation but electrodagnosis is necessary to identify the site and determine the severity of the lesion. The most sensitive electrodagnostic test is based on examination of the pronator quadratus. The outcome varies considerably, but in the absence of a traumatic origin, surgery should not be considered for at least one year, since late spontaneous recovery may occur.

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REFERENCES


