PES CAVUS
THE VALUE OF ELECTRODIAGNOSIS
Major VIVIAN B. WHITTAKER,

Introduction

Wiles (1951) states that pes cavus is in most instances accompanied by clawing of all the toes including the big one. The cause was recognized many years ago by Duchenne to be due to dysfunction or paralysis of the interossei and lumbrical muscles of the feet, and also of the short flexors and abductors of the big toe. Most cases are due to lack of proper co-ordination of these muscles, of unknown etiology. However, some cases are associated with neurological diseases including the hereditary ataxias, old poliomyelitis, Charcot Marie Tooth disease and the peripheral neuropathies. The mechanism by which the deformity is produced is as follows.

The inter-phalangeal joints of the toes are flexed by the long flexors and extended by the small muscles; the metacarpo-phalangeal joints are extended by the long extensors and flexed by the small muscles. When the synergic action of the interossei is lost, the toes claw and the long extensors and flexors overact to deform the foot as well. If this occurs before growth has ceased, then permanent distortion of the bones and soft tissues of the foot occurs.

It would seem, therefore, that in considering the management of pes cavus the following factors should be borne in mind: Passive correctability of the deformity; presence or absence of bony deformity; presence or absence of neurological disease. Clinical and radiological examination will elucidate the first two and often the presence of the third. However, it has been well established by Kinnear Wilson (1954) and Russell Brian (1951) that pes cavus may be the only clinical evidence present of these neurological diseases, and that in families prone to the hereditary ataxias some members have pes cavus only. It is in these cases that electrodiagnosis is of value.

Discussion

It is not intended in this article to discuss the principles of electrodiagnosis and for further information the reader is referred to an article written for the orthopedic surgeon by Wynn Parry (1961).

Intensity duration curves are difficult to perform on the interossei of the feet and are unreliable in these conditions. An electromyograph needle electrode is inserted into the small muscles of the foot, usually the first dorsal interosseus first, for estimation of motor nerve conduction, the posterior tibial, medial popliteal and when possible, the sciatic nerves are stimulated. A similar procedure is carried out for the hand muscles when necessary.

Anterior Poliomyelitis

Fibrillation potentials are found in about 10 per cent of cases. Motor unit activity shows normal or giant potentials and the interference pattern may be incomplete with
reversed recruitment of motor units. Motor nerve conduction shows normal conduction times.

**Peripheral Neuropathies**

Pes cavus will be seen either in conjunction with more widespread evidence or as a residual effect of incomplete recovery. Fibrillation potentials will be found in about 30 per cent of cases. Motor unit activity will show normal or long duration polyphasic potentials and the interference pattern will be incomplete with normal recruitment. Motor nerve conduction will be delayed.

**Charcot Marie Tooth Disease**

It has been suggested recently by Christie (1961) that this disease is due to a failure of the axon pump mechanism in the anterior horn cell and that the longest axons are the ones to fail first. Thus the small muscles of the feet and hands are the first affected. Anterior poliomyelitis affects only some of the anterior horn cells, leaving others intact. Therefore nerve conduction remains essentially normal, whilst in Charcot Marie Tooth all anterior horn cells are affected, and therefore no distal axon remains intact, and probably suffer from a condition of axonocachexia described by Bauwens (1960). This explains most of the differences in the electrodiagnostic findings in anterior poliomyelitis and Charcot Marie Tooth disease. Fibrillation potentials are found in about 40 per cent of cases and high-frequency discharges in about 15 per cent. Motor unit activity shows giant potentials and short-duration polyphasic potentials. Christie (1961) says that temporal dispersion does not occur. Compare this with peripheral neuropathies; the interference pattern shows reversed recruitment and the motor nerve conduction shows, contrary to anterior poliomyelitis, distal slowing. A similar picture is said to occur occasionally in old people.

**Friedrich's Ataxia**

Wasting of the small muscles of the feet occurs either in combination with overt signs or occasionally in isolation. The ankle jerks are usually absent. Electrodiagnosis is not of much value here except to exclude the neurological conditions. Occasionally an H reflex may be found on motor nerve conduction. This is not conclusive evidence but it is believed that these reflexes occur more commonly in upper motor neurone lesions than in the normal. The H reflex is seen on stimulating the motor nerve and production of a motor unit potential some 10-20 m.sec.; afterwards the potential is repeated on the oscilloscope screen. It is thought to be due to stimulation of the afferent fibre of the servo-loop mechanism either directly or following muscle spindle activity.

All cavoid feet seen at the Army Medical Rehabilitation Unit in the last year have been investigated clinically and electrodiagnostically. The following cases showing electrodiagnostic abnormalities have been seen:

**Case Notes**

**Case 1.** Cavoid feet of long standing. Mother and brother also have cavoid feet. Clinically no neurological disease found. No fibrillation potentials were found, motor unit activity showed normal and large units, some of which were polyphasic. The interference pattern was incomplete, motor nerve conduction was normal. This was thought to be a case of old poliomyelitis.
Pes Cavus

Case II. Cavoid feet which were symptomless until he started wearing boots. Clinically no neurological disease found. No fibrillation potentials were found either in the hand or feet. Motor unit activity showed large polyphasic potentials in the foot and normal in the hand. Incomplete interference pattern in both hand and foot and distal slowing of conduction in both the posterior tibial and ulna nerve. These findings are highly suggestive of Charcot Marie Tooth Disease.

Case III. Bilateral cavoid feet of long standing. Clinically no neurological disease present. No fibrillation potentials were found and motor unit activity showed giant and polyphasic potentials in the left foot and normal in the right. The interference pattern was normal with reversed recruitment in the left extensor digitorum brevis. Unfortunately no nerve conduction time studies were done. This case was considered equivocal and further investigation should have been done. However the presence of giant potentials (10 milli volts) and the reversed recruitment were thought to be significant.

Case IV. Originally admitted to Physical Development Centre because of the shoulder girdle muscles. He failed to improve after six weeks and was transferred to the Army Medical Rehabilitation Unit. He eventually managed to pass the standard Physical Efficiency tests and was returned to his unit. A few months later he started to complain of pain in his feet, which were cavoid. Clinically no neurological deficit was found except that he tended to be clumsy and had absent ankle jerks. Electromyography of the small muscles of his feet and hands showed large motor units with a full interference pattern and normal recruitment. H reflexes were easily elicited. This case was thought to be an abortive Friedrichs ataxia.

Conclusion

Whilst cavoid feet are usually of the idiopathic type, some are undoubtedly connected with either overt or abortive neurological disease. The cases quoted demonstrate some of the abnormal electrophysiological findings.

REFERENCES


