Table Thermal thresholds and nerve conduction studies in peripheral neuropathy associated with AIDS

Patient	Thermal thresholds °C			Nerve conduction studies			
	Site	Hot	Cold	Ulnar SAP	Sural SAP	Med pl SAP	C per MCV
1	Wrist	0.1	0.1	4.0*	11.2	0*	45
	Ankle	0.8	3.8*				
2	Wrist	1.5*	0.3	3.2*	0*	0*	46
	Ankle	4.2*	0.3				
3	Wrist	0.1	0.1	18.4	0*	0*	37
	Ankle	4.2*	0.5*				
Normal values ^{2,3}	Wrist	<0.4	<0.3	>6.0	6-41	1-8	37-62
	Ankle	<2.8	<0.3				

The right side was tested in all 3 patients. Skin reference temperature 34°C. Abbreviations: * = abnormal; SAP, sensory nerve action potential (μ V); MCV = maximal motor conduction velocity (ms⁻¹); Med pl = medial plantar nerve; C per = common peroneal nerve.

a commercially available device (Medelec: Triple T).

Case 1. A 34 year old homosexual man had noted numbness in his fingers and difficulty in doing up buttons for 6 weeks. He had noted an increased sensitivity to painful stimuli in his legs for 3 months. He had been HIV antibody positive for 3 years, had *Pneumocystis carinii* pneumonia 17 months before and had received bleomycin (270 mg total) and vincristine (3 mg total) for Kaposi's sarcoma during the last year. He was on zidovudine, ketoconazole and cotrimoxazole. Neurological examination revealed no motor deficit with intact deep tendon reflexes. Pinprick and light touch were impaired in his fingertips and toes and he had hyperpathia and hyperaesthesiae to mid thigh and mid forearm. Proprioception and vibration sense were intact. Thermal thresholds and nerve conduction studies are shown in the table.

Case 2. A 31 year old homosexual man had a 4 week history of numbness and tingling in all his toes and the little finger in his left hand. This had become painful after 2 weeks. He had been HIV antibody positive for 3 years, had *Pneumocystis carinii* pneumonia 27 months before and CMV pneumonitis diagnosed 2 weeks before. He was on zidovudine and foscarnet. Neurological examination revealed normal power and intact deep tendon reflexes with no deficit of light touch, pinprick, proprioception or vibration sense. The result of thermal thresholds and nerve conduction studies are in the table.

Case 3. A 33 year old homosexual man complained of pain and tingling for 3 months that had begun in his feet and gradually spread to his knees. He had been HIV antibody positive for 18 months, had CMV oesophagitis a year before and was taking

acyclovir and ketoconazole. Neurological examination revealed no motor deficit and bilaterally absent ankle reflexes. Light touch and pinprick were absent to the ankle and impaired to the knees and vibration sense was absent to the knees bilaterally. Proprioception was normal. The results of thermal thresholds and nerve conduction studies are seen in the table.

All three patients had electrophysiological evidence of peripheral neuropathy. Cases 1 and 2 had exclusive impairment of either cooling or warming thresholds respectively. Case 3 had a disproportionate abnormality of warming threshold. There was no evidence of local cutaneous lesions, myelopathy or encephalopathy. The aetiology of the peripheral neuropathy in these cases is not clear.

It is of interest to note the association of spontaneous pain with the loss of warmth sensation and hyperpathia with the loss of the sensation of cooling. Although clinicians have long known that hot and cold sensations may be affected in different degrees⁴ the differential involvement of cooling and heating seen in these patients provides objective evidence that these modalities are conveyed separately. Such a dissociation was mentioned by Jamal *et al*⁵ in a variety of neuropathies but not discussed. Whether in our cases the pathology has affected differentially the receptors, the nerve fibres or both is not clear and further studies may provide more information.

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GN FULLER
RJ GUILLOFF

Department of Neurology,
Westminster Hospital,

Charing Cross and Westminster
Medical School,
17 Page Street,
London SW1P 2AP, UK.

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Fowler replies:

When a temperature testing device which can measure thresholds for warming and cooling separately is used in neuropathic patients, the finding of a differential loss affecting one thermal modality more severely than the other is common. In general we have found more marked impairment of perception of warming than cooling in diabetics. In some patients with mild diabetic neuropathy who have erectile dysfunction as the only manifestation of small fibre neuropathy, perception of warming on the sole of the feet may be absent while perception of cooling remains within normal limits.¹ Also in diabetics with plantar ulcers occurring in the context of severe generalised neuropathy, we have shown a more severe abnormality in warming perception than cooling on the feet, hands and face.² Indeed, using our particular testing system,³ such a pattern is almost the rule in diabetics; only in patients with Fabry's disease have we observed the converse, a more severe abnormality for cooling than warming.

However, some caution should be exercised in the interpretation of such results. In our paper on the extent of small fibre neuropathy in diabetics with plantar ulcers² we point out that selective damage to unmyelinated fibres may not be the only explanation for relatively high thresholds of warming: that the perception of cooling is a

less difficult psychophysical task may also contribute to the result.

The point we wanted to draw attention to in our paper,⁴ illustrated by measurements of reaction times and supported by a review of the literature, was that the sensations of warming and cooling are not part of a continuum. These thermal sensations belong to separate systems and are conveyed by different classes of peripheral nerve fibres. Perhaps the neurological examination should be modified in the light of this knowledge.

CLARE J FOWLER

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Individual motor unit analysis in the diagnosis of urethral sphincter innervation

Sir: Needle electromyography of sphincter and other perineal and pelvic floor muscles is a time honoured method for diagnosis of neurogenic lesions in the sacral nervous system, and we can still refer to the early reports on the method¹ regarding technique and interpretation. Analysis of motor unit action potentials (MUAPs) has been made easier by modern EMG machines having the option of triggering, delaying and storing of MUAPs; such an approach has also been proposed in analysis of sphincter EMG.² Single fibre EMG with fibre density measurements has already made important contributions to our understanding of the "microphysiology" of the motor unit,³ and has also been introduced into routine EMG diagnostics. It has (among other uses) been proposed as a sensitive diagnostic tool in diagnosing neurogenic changes of sphincter muscles,⁴ but already the early reports have claimed that it is not superior to concentric needle EMG in this particular use.⁵ In our

experience SFEMG recordings of sphincter muscles could not be depended upon for yielding information on abnormal spontaneous muscle activity and have (when used for diagnostic purposes) needed more needle adjustments in the muscle (meaning more pain and a longer examination procedure) as compared with concentric needle EMG. SFEMG recordings of sphincter muscles have, however, stayed en vogue in Britain.⁶ Furthermore the stability of MUAPs can be estimated rather accurately (and polyphasia interpreted more easily) by low frequency filtering of the conventional EMG signal. Trontelj (personal communication;⁷) has introduced this modification in the early seventies in our laboratory, but it has also been proposed by Payan.⁸ While the MUAP is triggered and its recording "optimised" the low frequency cut-off is adjusted to 500 Hz or even 2000 Hz ("extreme filtering").

Thereby the features of complex MUAPs are very nicely exposed, especially the number of phases and any instability of complex potentials (fig; cf fig 4 from ref 2).

In conclusion, a well conducted concentric needle EMG examination in my mind represents the method of choice (and not SFEMG) in determining (neurogenic) involvement of muscles innervated by lower sacral segments. Not only can it give information about abnormal spontaneous activity and the characteristics of MUAPs, but also a more wide insight into the patterns of voluntary and reflex activation of the muscle examined; also, last but not least, the concentric needle electrode can in the same diagnostic session be used for dependable and selective recordings of direct and reflex responses.⁹

DAVID B VODUŠEK,

Institute of Clinical Neurophysiology,

Fig Motor unit action potential from the urethral sphincter muscle in a young nulliparous female patient with micturition problems examined five months after traumatic fracture of the first lumbar vertebra. The "jitter" and blocking of the middle component is well seen in this series of 13 consecutive firings of the MUAP, indicating reinnervation (that is, immaturity of axons/end plates). Concentric needle electrode, frequency range 500-10000 Hz).

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