mark and the brain tumour is perpendicular to the floor of the operating room; d) osmotic drugs that produce excessive cerebral dehydration should not be administered during the operation; c and d are carried out to avoid the brain moving with gravity.

After the dura has been opened, the removal of the tumour is carried out with the help of an operating microscope. If the tumour is not visible at the cortical surface, it is necessary to confirm its position by accurately measuring the distance between the wound edges and the site of the corticotomy; this must be equal to the distance between the wound edges and the scalp mark. Furthermore, a careful evaluation of the relationship between the tumour and the near cortical sulci, shown both on high resolution CT scan and on the operating field, allows confirmation of the site for corticotomy. In some cases this evaluation permits removal of the tumour through a microsurgical trans-sulcal approach (fig).

In the past few years the possibility of integrating the precision of stereotactic methods with new sophisticated instruments, has resulted in the successful treatment of small cerebral lesions. Unfortunately, these facilities are not available to most neurosurgeons, and small subcortical brain tumours can be easily removed by free-hand microsurgery even when located within or near critical cerebral areas. To do this it is necessary to know the exact location of the tumour. This is not a difficult problem when the lesion is in a cerebral area easily recognisable both on the CT slices and at operation (that is, the poles of the subcortical lobes). When the tumour is located in other sites, especially in or near critical areas, the identification and removal of the tumour without risk of damaging healthy brain tissue can be very difficult. In these cases it is essential to localise the lesion as accurately as possible both on the scalp and on the cortical surface.

Many methods have been proposed to relate the data provided by the CT scan to the patient’s scalp using bony landmarks, or reference markers attached to the scalp. Other techniques have been described to locate the tumour, as seen on the CT slices, to skull radiographs. Nevertheless, all these methods are prone to error.

Our method has the following advantages:

- a) it is simple, safe, inexpensive and reliable in localising small subcortical brain tumours;
- b) the exact localisation of the tumour permits the smallest possible craniotomy and corticotomy to be performed. Apart from the necessity of exact tumour localisation on the scalp there is the need for careful surgical technique.
- c) whilst our method is useful for removal of subcortical tumours, stereotactic procedure is the treatment of choice for deep-seated tumours.

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ETTORE FIUMARA
CARLO DE GRANDI
MASSIMO FERRARA
CLAUDIO CORONA
VINCENTO D’ANGELO
MASSIMO COLLICE

Departments of Neurosurgery and Radiology,
Niguarda Hospital, Milan, Italy

Correspondence to: Dr Fiumara, Via Foppa 60,
20144 Milan, Italy

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Mononeuropathy associated with hyperthyroidism

Thyrotoxic polyneuropathy has been reported by some authors, but mononeuropathy associated with hyperthyroidism has received little attention. We report two patients with thyrotoxicosis who presented with mono-
neuropathies.

Case 1 was a 37 year old male cook who had a three month history of hyperthyroidism and noticed distal weakness of his legs with gait disturbance and hypoesthesia and dysaesthesia of his feet for two months. Before administration of thiamazole, the hypoesthesia and dysaesthesia developed on the lateral aspect of his thighs. He had minimal diffuse weakness of the proximal muscles of the arms and legs including the shoulder and hip girdle. However, weakness of the tibialis muscles were out of proportion to the muscle weakness elsewhere, causing complete foot drop of the right and impairment of dorsiflexion of the left. The deep tendon reflexes were brisk. Hypoesthesia and dysaesthesia of his feet and thighs were localised to the sensory distributions of the peroneal and lateral cutaneous nerves of the thigh. Taps on the inguinal ligament just medial to the anterior superior iliac spine (ASIS) and on the fibular head resulted in an electric tingling sensation in each of the mentioned nerve distributions. The combination of peroneal nerve palsy and meralgia paraesthetica suggested mono-neuritis multiplex. Tinel’s sign of median nerve was positive bilaterally without sensory disturbance on his fingers. Diagnosis of thyrotoxic Graves’ disease was made on the basis of laboratory findings (TSH, T3, T4, and anti-TSH receptor-antibody) and thyroid scintigram.

Electromyographic studies of sampled muscles showed a proximal myopathy and denervation potentials in the anterior tibial muscles. Nerve conduction studies revealed asymmetry of peroneal nerve motor conduction velocities and low amplitude evoked responses (right: 40.5 m/s, 1.0 mV; left: 53.0 m/s, 0.9 mV). The other nerves were normal. Muscle biopsy of the rectus femoris showed mild myopathy. The clinical course was marked by a resolution of neurological symptoms and electrophysiological findings that paralleled the remission of Graves’ disease after oral treatment with 30 mg thiamazole daily. The asymmetry of right to left peroneal nerve conduction velocity diminished and the amplitude of evoked responses normalised.

Case 2 was a 36 year old male industrial worker who was admitted because of a 12 month history of hyperhydrosis, weight loss and fine finger tremor. He had difficulty in carrying objects because of weakness in his arms. Two weeks before admission, he noticed dysesthesia on the lateral aspect of the left thigh with decreased superficial sensation. He showed mild weakness of proximal muscles. The deep tendon reflexes were brisk. All modalities of sensation were preserved except for the lateral aspect of the left thigh. A tap on the left inguinal ligament just medial to the ASIS resulted in an electric tingling sensation in the lateral aspect of the thigh. Tinel’s sign of median nerve was present bilaterally. Laboratory findings revealed hyperthyroidism with low TSH level and positive anti-TSH receptor antibody. Thyroid scintigram by 131 I Tc showed increased uptake and enlargement of the thyroid gland. Electromyographic studies of sampled muscles showed mild myopathy of proximal muscles. Muscle biopsy of the rectus femoris showed mild myopathy with changes that suggested neurogenic atrophy. Sensory nerve conduction studies revealed asymmetry of the lateral cutaneous nerve of the thigh, right: 63.1 m/s 7.5 μV, left: 45.6 m/s 0.8 μV. The other nerves had normal conduction velocities. Treatment with...
thiamazole 30 mg daily improved all the symptoms, including meralgia paraesthetica.

A year later, the left lateral cutaneous nerve of the thigh sensory conduction velocity had improved to 58.8 m/s with normal amplitude (5.6 μV).

To discover the frequency of localised sensory disturbances in hyperthyroidism, we studied clinically 20 patients with Graves' disease, including these two cases (10 I, hyper- thyroid patients, 10 euthyroid, after treatment). Symptoms consistent with mono- neuropathy such as localised sensory disturbance or muscle weakness, were present in nine (45%). These symptoms were dysesthesia, paraesthesia or hypoesthesia on fingers in five patients, hypoesthesia or dysesthesia on the lateral aspects of the thigh in seven patients, and bilateral foot drop in one patient (case 1). Tinel's sign of median nerve was present in seven of 10 hyperthyroid patients and five of 10 euthyroid patients. A positive Tinel's sign was found in 60% of thyrotoxic patients but also in 14.5% of 282 normal controls (Chi-square = 23.6, p < 0.0001).

Our two cases demonstrated a combination of mononeuropathy and thyrotoxicosis. These mononeuropathies were confirmed by nerve conduction studies and improved following treatment for thyrotoxicosis. In addition, the denervation findings and low amplitude evoked responses without conduction block of the peroneal nerve in case 1 suggest mono-anoxonopathy associated with thyrotoxicosis. The dissociation between complete foot drop and no conduction block of the peroneal nerve supports this possibility. In euthyroid patients, the frequency of both the symptoms and Tinel's sign diminished with the duration of treatment.

In a detailed electrophysiological study of patients with thyrotoxicosis, loss of functioning motor units with normal conduction velocities demonstrated motor neuron dys- function and the remarkable capacity of motor neurons to resume normal function. Individual nerves are more sensitive to mechanical damage if a generalised peripheral neuropathy is present. It seems likely to us that the fragility of nerve axons associated with hyperthyroidism predisposes to mononeuropathies.

S IJICHI
K NIINA
M TARA
F NAKAMURA
Division of Internal Medicine, Kagoshima Municipal Hospital, Kagoshima
N IJICHI
S IZUMO
M OSAME
The Third Department of Internal Medicine, Faculty of Medicine, Kagoshima University, Kagoshima, Japan

Correspondence to: The Third Department of Internal Medicine, Faculty of Medicine, Kagoshima University, 1208-1 Usuki-cho Kagoshima 890, Japan


Correction:
This letter was printed in the August issue with only one MRI image.

MRI of thoracic cord in tropical spastic paraparesis

Tropical spastic paraparesis (TSP) is a disease occurring in Afro-Caribbean following HTLV-1 retro-virus infection. There is some evidence that the geographical and ethnic distribution of HTLV-1 illness is even wider and HTLV-1 associated myelopathy (HAM) in Japan is probably the same disorder. Abnormalities are found on MRI of the brain in both TSP and HAM. High signal areas are found in the brain similar to those in multiple sclerosis (MS), though they tend to be less extensive. The thoracic cord (on which the brunt of the pathological process falls) has been examined in only three patients, one of whom had atrophy. Since the clinical picture of TSP may resemble that of progressive MS, we have made a systematic comparison of the MRI characteristics of the thoracic cord in the two conditions.

Nine patients with TSP who were born in the Caribbean were compared with an age and sex matched group of European white patients with clinically definite MS, all of whom had a progressive spastic paraparesis. Disability was scored using the Kurtzke Disability Status Scale. The patients with TSP were anti-HTLV1 positive and had HTLV1 genome integrated into leukocyte DNA. Eight were female. The mean age was 53 years (range 43–65 years), the mean symptom duration was 12 years (range 1.5–23 years), and the mean Kurtzke disability score was seven (range five to eight). The mean age of the MS patients was 42 years (range 35 to 53 years), the mean symptom duration was 11 years (range seven to 17 years), and the mean Kurtzke disability score was five (range 4 to 6). The spine was imaged by a Picker 0.5T superconducting machine with TI weighted (SE = 2000) 5 mm contiguous parasagittal slices using a surface coil. All MS patients and five TSP patients had additional T2-weighted sequences (SE = 2000) 5 mm contiguous parasagittal slices to detect abnormal signal. Images were reported without knowledge of the individual diagnosis by one of the authors (EH B).

Atrophy of the thoracic cord was seen in six of nine patients with TSP and five of nine patients with MS. Three of five patients with TSP who had T2-weighted images of thoracic cord had diffuse high signal and all three had atrophy (fig). Five of nine with MS had high signal return on T2 weighted images, one of whom did not have atrophy. The pattern of high signal was diffuse in two and focal or patchy in three (fig).

These results confirm the previous MRI finding of atrophy in the thoracic cord in a proportion of patients with TSP. However, a similar degree of atrophy is seen as frequently in patients with MS who had a progressive spastic paraparesis, a finding compatible with pathological studies where cord atrophy is present in 72% of patients with MS at necropsy. There was some difference in the pattern of high signal seen in the two groups, with more diffuse and uniform high signal in TSP and focal or patchy high signal in MS. However, these differences in the MRI findings are slight and a reliable distinction between the two conditions cannot be made on these grounds.

AG KERMODE
P BRIDGE
AJ THOMPSON
EPGH DU BOULAY
W1 MCDONALD
The Multiple Sclerosis NMR Research Group, Institute of Neurology, Queen Square, London

Figure The MRI on the left shows diffuse high signal with atrophy of the thoracic cord in TSP. The right shows the patchy high signal typically seen in MS. (SE = 2000, 5 mm sagittal slices.)