Cerebral metabolism during vegetative state and after recovery to consciousness

One way to approach the study of consciousness is to explore lesional cases in which impairment of consciousness is the prominent clinical sign. Vegetative state is such a condition wherein awareness is abolished whereas arousal persists. It can be diagnosed clinically soon after a brain injury and may be reversible (as in the following case report) or progress to a persistent vegetative state or death. The distinction between vegetative state and persistent vegetative state is that the second is defined as a vegetative state that has continued or endured for at least 1 month. We present a patient who developed a vegetative state after carbon monoxide poisoning and in whom we had the opportunity to measure brain glucose metabolism distribution during the vegetative state and after recovery to consciousness. Using [(F]fluorodeoxyglucose (FDG) PET and statistical parametric mapping (SPM) we compared both patient’s sets to a normal control population. Our findings offer an insight into the neural correlates of “awareness”, pointing to a critical role for posterior associative cortices in consciousness.

A 40 year old right handed woman attempted suicide through CO intoxication and was found unconscious. She was treated with hyperbaric oxygen but evolved to a vegetative state diagnosed according to the following criteria: (1) spontaneous eye opening without evidence of awareness of the environment; (2) no evidence of reproducible voluntary behavioural responses to any stimuli; (3) no evidence of language comprehension or expression; (4) intermittent wakefulness and behaviourally assessed sleep-wake cycles; (5) normal cardiorespiratory function and blood pressure control; (6) preserved pupillary, oculocephalic, corneal, and vestibulo-ocular reflexes. Brain MRI performed 14 days after admission was normal. Electroencephalography showed a 6 Hz basal activity with more pronounced slowing on the left parietal regions. Auditory evoked potentials of the median nerve showed normal latency and amplitude of P14 and N20 potentials without any late cortical components. After remaining in a vegetative state for 19 days the patient regained consciousness. Her sequelae consisted of a bilateral spastic paresis of upper and lower limbs. Neuropsychological evaluations 1 month after admission showed an attention deficit with moderate impairment of short term memory. One year after the accident she showed a spastic gait with altered fine motor function, most prominently in the right, a slurred speech, and minor short term memory disturbances. FDG-PET was performed during the vegetative state (day 15 after admission) and after recovery to consciousness (day 57).

The control population consisted of 48 drug free, healthy volunteers, aged from 18 to 76 years (mean: 42 (SD 21) years). The study was approved by the ethics committee of the University of Liège. Informed consent was obtained by the husband of the patient and for all control subjects. Five to 10 mCi FDG was injected intravenously; PET data were obtained on a Siemens CTI 951 R 16/31 scanner in bidimensional mode. Arterial blood samples were drawn during the whole procedure and cerebral metabolic glucose rates (CMRGlu) were calculated for all subjects. PET data were analysed using SPM software (SPM96 version; Welcome Department of Cognitive Neurology, Institute of Neurology, London, UK). The use of SPM to assess between subject (rather than within subject) variability is unlikely to alter the relevance of our results given their high degree of significance. Data from each subject were normalised to a standard stereotactic space and then smoothed with a 16 mm full width half maximum isotropic kernel. The analysis identified brain regions where glucose metabolism was significantly lower in each patient scan compared with the control group. The resulting foci were characterised in terms of peak height over the entire volume analysed at a threshold of corrected p<0.05.

During the vegetative state, average grey matter glucose metabolism was 38% lower than in controls (4.5 ± 7.3 (SD 1.4) mg/100 g/min). No substantial change in mean CMRGlu was found after recovery (4.7 mg/100 g/min). During the vegetative state, significant regional CMRGlu decreases were found in the left and right superior parietal lobule; the left inferior parietal lobule; the precuneus; the left superior occipital, superior and middle temporal gyri; and the premotor and postcentral and precentral cortex (figure, yellow colour). After recovery, metabolic impairment was confined to the left and right precentral and postcentral gyri and premotor cortices (figure, blue colour).

This case report offers an insight into the neural correlates of human consciousness (at least, external awareness as it can be assessed at the patient’s bedside). Given that global glucose utilisation levels remained essentially the same, the recovery of consciousness seems related to a modification of the regional distribution of brain function rather than to the global resumption of cerebral metabolism. The main decreases in metabolism seen during the vegetative state but not after recovery were found in parietal areas, including the precuneus. This is in agreement with postmortem findings in persistent vegetative state, in which involvement of the association cortices is reported as a critical neuroanatomical substrate and with PET studies in postanoxic syndrome, in which the parieto-occipital cortex showed the most consistent impairment. The functions of these areas are manifold: lateral parietal areas are involved in spatial perception and attention, working memory, mental imagery, and language, whereas the precuneus is activated in episodic memory retrieval, modulation of visual perception by mental imagery, and attention. Our data point to a critical role for these posterior associative cortices in the emergence of conscious experience.

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Localisation of voxels in which cerebral glucose metabolism was impaired during vegetative state (in yellow) and after recovery to consciousness (in blue), compared with the control population. SPM(2) threshold was set at voxel level corrected p<0.05 and projected on the patient’s coregistered MRI, normalised to the stereotaxic space of Talairach.
Electrical inexcitability of nerves and muscles in severe infantile spinal muscular atrophy

Spinal muscular atrophy (SMA) is one of the most common fatal autosomal recessive disorders, characterised by progressive degeneration of anterior horn cells. Before the advent of genetic testing, the diagnosis of SMA was based on clinical, histopathological, and electrophysiological features. In 1992, the International SMA Consortium defined diagnostic criteria of proximal SMA based on clinical findings. In SMA type I (severe; Werdnig-Hoffmann disease), affected persons have onset of symptoms before 6 months of age and are never able to sit without support. A positive family history of SMA demonstrates de novo mutations. In early 1995, the candidate gene, the survival motor neuron (SMN) gene, was identified, making the confirmation of SMA by DNA analysis possible.

With the availability of a genetic test for SMA, many investigators are refining the diagnostic criteria published by the Consortium. Studies involving hundreds of patients with SMA have identified a subset of patients who fulfill at least one exclusion criterion defined by the Consortium. We identified an infant with severe SMA who fulfilled two exclusion criteria and also showed involvement of all nerves as well as muscles. This report will further delineate the wide range of phenotypes for this particular gene mutation.

A 2945 g male infant was born at term. First fetal movements were noted at 13 weeks of gestation. Chorionic vilius sampling at 10 weeks of gestation disclosed normal chromosomal decreases. Decreased fetal movement and polyhydramnios were noted at about 34 weeks of gestation. At delivery, the infant was cyanotic with no respiratory effort and was subsequently intubated. On physical examination, the infant had no spontaneous movements. He opened his eyes with brief fixation but no corneal responses. Tongue fasciculations were present. Other cranial nerves seemed intact. Mild flexion contractures of both elbows, knees, and ankles were noted. Tone was flaccid in these extremities and lower limbs, and there was no movement response to painful stimuli. Deep tendon reflexes were absent.

Brain MRI disclosed mild diffuse cortical atrophy. His EMG was severely abnormal, with widespread fibrillations and absent voluntary motor units except in the geniohypopharyngeus, where mildly neurogenic motor units with decreased recruitment were seen. Stimulation of the median, ulnar, tibial, and peroneal nerves with a maximal stimulus demonstrated recruitment of low voltage motor units with decreased recruitment were seen. Stimulation of the median, ulnar, tibial, and peroneal nerves with a maximal stimulus was also performed. Median, ulnar, and sural sensory potentials were not obtainable. DNA testing showed a homozygous deletion of exons 7 and 8 in the telomeric SMN gene, confirming the diagnosis of SMA. The infant expired at 3 weeks of age, and the parents confirmed the diagnosis of SMA. The infant in our report with SMA type I showed electrical inexcitability of motor nerves as well as the characteristic alteration of the SMN gene.

Although there has been a delay in bringing a severely affected patient to hospital, there is still a chance to administer the disease-modifying treatment. However, the infant in our report also exhibited a universal absence of sensory potentials. In both cases, DNA analysis disclosed the 5q deletion. It is unclear whether this finding represents a distinct entity or merely the severe end of classic Werdnig-Hoffmann disease. The diagnostic criteria produced by the International SMA Consortium currently includes “abnormal sensory nerve action potentials” as an exclusion criterion. Our finding of absent sensory potentials in a 5q deletion established case of SMA indicates further need for revision of the Consortium criteria. Studies involving large numbers of patients with SMA have identified cases of SMA variants. These patients were diagnosed as infantile SMA by the presence of proximal weakness and atrophy, hypotonia, and evidence of neurogenic alterations in EEG and muscle biopsy. In addition, these patients also exhibited one of the exclusion criteria defined by the Consortium—for example, diaphragmatic weakness, involvement of the CNS, or arthrogryposis. Although these patients did not show the typical SMA deletion and were therefore probably not linked to chromosome 5q, they could have had point mutations. The infant in our report showed no respiratory effort after birth, indicating diaphragmatic weakness. He did, however, progress with the characteristic SMN gene alterations. This finding suggests that diaphragmatic weakness should be reconsidered as an exclusion criterion by the Consortium.

Review of the literature disclosed no previous reports of electrically inexcitable muscles in SMA. This phenomenon is known to occur in a few other neuromuscular conditions such as periodic paralysis and critical illness polyneuropathy. Fibrillations, as seen in the infant in our report, are commonly seen in acute denervation and are thought to be caused by perturbation of the sarcocellular membrane, rendering it unstable. One possibility may be that the acute severe denervation in SMA type I can result in abnormal function of the membrane to make it electrically inexcitable. Further electrophysiological studies at the cellular level are required to delineate this interesting finding.

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Acute overdosage and intoxication with carbidopa/levodopa can be detected in the subacute stage by measurement of 3-0-methylpoda

Although the effects of a chronic overdose with levodopa are well known, few cases of acute intoxication have been described. A particular problem in establishing a diagnosis of levodopa overdose is the relatively short half life in the circulation of levodopa. If there is a delay in bringing an acutely intoxicated patient to hospital, perhaps due to late discovery, the blood concentration of levodopa could already be normal, corresponding to the peak levodopa concentration in Parkinson’s disease (after 6-8 hours).

Depending on the extent of the overdose, the time could be even shorter. This report describes the clinical effects and the plasma concentrations of levodopa and specific metabolites over a period of 132.5 hours after ingestion of 30 tablets of carbidopa/levodopa (50 mg/200 mg tablets).

A 76 year old patient had a pre-existing mild akinetic rigid Parkinson’s syndrome, which had been treated for the past 1.5 years with 3x1 tablets of carbidopa/levodopa (50 mg/200 mg) a day without a substantial response. The weight of the patient was 74 kg. A known chronic obstructive airway disease was treated with a home oxygen appliance. At about 8.30 pm, the patient had attempted suicide by taking 30 tablets of carbidopa/levodopa. About 1.00 hour later, he was found to be unresponsive and had been psychically altered, crying without reason, anxious, and depressed. After about 30 minutes he was increasingly inadequate, vomiting, and subeuphoric, and was experiencing visual hallucinations; he was restless, tossing and turning, and getting out of bed. He did not present peak dose dyskinesia or other extrapyramidal clinical features. At 10.00 pm he showed bilaterally maximally dilated pupils. The muscle stretch reflexes were absent, there were no pyramidal tract signs, and he did not show any signs of Parkinson’s syndrome or dyskinesia. Arterial hypotension and sinus tachycardia could be registered.

After an empty box of Striaton (carbidopa/levodopa, 50 mg/200 mg) was found in the patient’s flat, 1 g of carbon was given by stomach tube after gastric lavage. The patient’s flat was carried out before the diagnosis of intoxication had been made; it showed a pronounced subcortical arteriosclerotic encephalopathy with reduced brain volume. The patient was moved to the medical intensive care unit and observed for 24 hours. The ECG showed a P pulmonale, but no other unusual features. Echocardiography showed normal right and left ventricular function with suspicion of right ventricular hypertro-
movements is variable but in some patients can be very marked. Progression over time of the movement disorder in Huntington’s disease can be monitored using the quantitative neurophysiological examination (QNE). This measure has three subscales, an eye movement scale, a motor impairment scale (MIS) quantifying voluntary movement capability, and a chorea scale measuring involuntary movement. Pharmacological control of the symptoms has been shown to be effective with dopamine antagonists, but their use is limited because of the side effects. Clonazepam, which has been shown to be effective in improving the movement disorder. However, in a double blind randomised trial of clozapine which included patients who were already receiving traditional antipsychotic medication, a group who had not received drug treatments for their movement disorder, chorea was reduced in those who were antipsychotic naïve only and the authors concluded that clonazepam was of little additional effect in Huntington’s disease. Olanzapine is a new atypical antipsychotic drug. It is a thienobenzodiazepine structurally very similar to clozapine. Unlike clozapine it is not associated with the potentially serious side effects of agranulocytosis and therefore frequent blood monitoring is not necessary. This report describes the progress of a man who has Huntington’s disease. He developed a marked movement disorder and was unable to tolerate both sulpiride and risperidone but still had symptomatic improvement when treated with olanzapine. He is a man in his early 50s who had a confirmatory genetic test for Huntington’s disease in 1994, after the development of clinically obvious motor symptoms. It is likely that the onset of symptoms had occurred a few years previously as he had experienced difficulties in concentration and work, attributed at the time to stress, leading to the loss of employment. In addition his family, watching family videos of a few years earlier, thought that there were early signs of his movement disorder. However there was no known family history of Huntington’s disease which might have led to an earlier diagnosis. By May 1995 his involuntary movements were becoming more noticeable, although control of voluntary movement was good. A trial of sulpiride commencing at 200 mg twice daily and increasing over 1 week to 800 mg daily was undertaken with a subsequent decrease in frequency and extent of involuntary movement recorded in case notes; unfortunately the QNE was not repeated at this time. However, the patient experienced a subjective slowing of his cognitive processes, concurrently became depressed, and decided to stop the treatment within 3 weeks. Paroxetine, a selective serotonin reuptake inhibitor antidepressant, was started at a dose of 20 mg a day, which led to an improvement in his low mood. His involuntary movements continued to cause difficulties in his daily living. He was unable to sit comfortably in a chair and when out he felt that he was disorganised and knocking into them. He agreed to a trial of

Distribution into muscles rather then metabolism may largely determine the plasma half life of levodopa and explain why this was only slightly altered with overdose. The measured peak concentration of 66 763 ng/ml is about 30 times higher than the peak concentrations to be expected after taking one tablet of carbidopa/levodopa (50 mg/200 mg). It is apparent that the 30 tablets did not interfere with absorption or lead to a gastrointestinal paralysis due to the high dose of levodopa; the relation between amount ingested and plasma concentration seems to be linear, at least in this dose range. We conclude from these findings that in cases of suspected levodopa intoxication some hours previously, it could be important to measure the concentration of 3-0-methyldopa, so as not to overlook an overdose with levodopa, which may be due to a suicide attempt. In addition to the diagnostic uncertainty in relation to the immediate treatment of the patient, this would also have an effect on further psychiatric and psychological therapy.
risperidone. This was started at a dose of 1mg twice daily, increasing to a dose of 1mg four times a day over a period of 2 weeks, stopped after a brief period. He developed hypotension (blood pressure 100/60 mg Hg), complaining of dizziness after the initial dose. His blood pressure remained stable, although low, after this and as there was improvement in his movements the drug was continued. However, he decided to stop the risperidone after 4 months because of his subjective experience of slowed thinking and occasional dizziness. A repeated trial of sulpiride was carried out in March 1997. Sulpiride was started at a dose of 200 mg twice a day and increased to a total daily dose of 1000 mg over 2 weeks. He was on sulpiride for 4 weeks with no improvement in his movements, so it was discontinued. The patient continued to experience low mood and after the discontinuation of sulpiride, his antidepresant drug was changed to lofepramine commencing at 70 mg once a day and increasing after a few days to 140 mg daily. There were no changes noted in his movements during this change.

Although the patient was subjectively aware of the extent of his movements his everyday life continued to be affected. The social venues he felt able to attend were becoming more limited and activities he wanted to pursue such as travelling abroad by air were problematic. A trial of olanzapine was then instituted. He was started on 5 mg a day in the morning. There was a marked improvement in his involuntary movements within 1 week but once again he experienced slowed thinking. However, adjusting the time of medication to the evening led to an improvement in this. Six months later the improvement in his involuntary movements is maintained.

Quantitative neurological examination scores showing the progress of the movement disorder. 06/95: before risperidone, no medication; 05/96: before risperidone, 20 mg paroxetine daily; 07/96: 1 mg risperidone four times daily and 20 mg paroxetine daily; 03/97: before retri, sulpiride, 20 mg paroxetine daily; 04/97: 400 mg sulpiride in the mornings 600 mg at night and 20 mg paroxetine; 04/97: before olanzapine, 140 mg lofepramine daily; 06/97: 5 mg olanzapine at night, 140 mg lofepramine daily.

Patient characteristics

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age at surgery</th>
<th>Sex</th>
<th>Years with PD</th>
<th>H and Y*</th>
<th>UPDRS off</th>
<th>Pd/Pallidotomy</th>
<th>Pallidotomy side</th>
<th>Transient side effects</th>
<th>Medication additional to levodopa</th>
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<tbody>
<tr>
<td>1</td>
<td>66</td>
<td>M</td>
<td>8</td>
<td>2/3</td>
<td>57/NP†</td>
<td>R</td>
<td></td>
<td></td>
<td>Tryptizol, temazepam, alprazolam, apomorphine</td>
</tr>
<tr>
<td>2</td>
<td>43</td>
<td>F</td>
<td>7</td>
<td>2/2.5</td>
<td>2/2.5</td>
<td>L</td>
<td></td>
<td></td>
<td>Triflavinid</td>
</tr>
<tr>
<td>3</td>
<td>43</td>
<td>M</td>
<td>15</td>
<td>2/3</td>
<td>55/15</td>
<td>L</td>
<td></td>
<td></td>
<td>Perigolde, amantadine</td>
</tr>
<tr>
<td>4</td>
<td>50</td>
<td>M</td>
<td>12</td>
<td>2/2</td>
<td>45/22</td>
<td>L</td>
<td></td>
<td></td>
<td>Perigolde, selegiline</td>
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<tr>
<td>5</td>
<td>53</td>
<td>M</td>
<td>14</td>
<td>2.5/4</td>
<td>69/36</td>
<td>R</td>
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<td></td>
<td>Perigolde, selegiline</td>
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<tr>
<td>6</td>
<td>58</td>
<td>M</td>
<td>13</td>
<td>2.5/3</td>
<td>40/27</td>
<td>L</td>
<td></td>
<td></td>
<td>Perigolde, biperideen</td>
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<tr>
<td>7</td>
<td>61</td>
<td>F</td>
<td>15</td>
<td>2.5/4</td>
<td>55/NP†</td>
<td>R</td>
<td></td>
<td></td>
<td>Clozapine, temazepam, cisapride</td>
</tr>
</tbody>
</table>

*H and Y=Hoehn and Yahr; †UPDRS off=unified Parkinson’s disease rating scale part 3 (motor examination), in a standardised off state, 12 hours without anti-parkinson medication; N=not performed.

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Transient hiccups after posteroventral pallidotomy for Parkinson’s disease

Hiccup is defined as an abrupt intermittent, involuntary, contraction of the diaphragmatic and external (inspiratory) intercostal muscles, with inhibition of expiratory intercostal activity. This results in a sudden inspiration, abruptly opposed by closure of the glottis. Hiccup may result from various structural or functional disorders of the medulla, the afferent or efferent nerves to the respiratory muscles, and the gastrointestinal tract. * * * Newson Davis performed a study of hiccup with electrophysiological techniques and concluded that hiccup is served by a supraspinal mechanism distinct from that generating rhythmic breathing. The principal site of interaction of the hiccup discharge with other descending drives to the respiratory motoneuron is at the spinal level. Neurogenic hiccup is particularly associated with structural lesions of the medulla oblongata.

Since 1994 we have performed 66 pallidotomies for Parkinson’s disease in 60 patients. So far, we have seen transient hiccups in seven patients after the operation (table). Our target coordinates for the posteroventral globus pallidus at the border of the medial and lateral segments are 2–3 mm anterior to the midcommissural point, 5 mm below the intercommissural plane, and 22 mm lateral to the midline of the third ventricle. Ventriculography was performed for target...
localisation. Patients started with a short schedule of corticosteroids (5 days) the night before surgery.

The hiccups started immediately after the operation or the next day, were intermittent, and the bouts of hiccup of six patients, with a duration of hours, resolved within 3 days after the procedure. One patient complained of yawning more often and frequent bouts of hiccup for 6 months.

Five patients were men. All patients were right handed. The mean age at surgery was 54 years and the mean duration of Parkinson’s disease was 12 years. All patients were taking levodopa. In four patients the hiccup occurred after a left sided pallidotomy. Patient 2 had a right sided thalamotomy 4 years before the pallidotomy. Patient 5 underwent a left sided pallidotomy 10 months before the right sided pallidotomy which caused the hiccup. The pallidotomy improved parkinsonism in the “off” state (table), contralateral dyskinesias, and pain accompanying Parkinson’s disease. Six patients had transient adverse events: four patients had a transient facial paresis postoperatively and two a slight transient dysarthria (table). Two patients had choreatic movements after the pallidotomy at the contralateral side which resolved spontaneously within 2 hours and is associated with a favourable surgical outcome.5

Postoperative MR scans were obtained in the first six patients, and showed that in five patients the lesions were located in the posterior part of the globus pallidus pars externa (GPe) and interna (figure). In patient 5 the lesion was situated slightly more anterior in the GPe and putamen. In patient 3 there was a small separate lesion more dorsal, probably a small separate lesion more dorsal, probably a small separate lesion more dorsal, probably in the GPe and putamen.

A possible cause for the transient hiccup could be the lesion in the ventral medial segment of the globus pallidus or pressure, due to oedema, on an adjacent structure like the internal capsule or putamen. We could not find other reports of hiccup as an adverse event after functional stereotactic surgical interventions, nor after lesions of other aetiology involving the striatum.6 Based on our experience we hypothesise that the globus pallidus or a neighbouring structure may be involved in a supramedullary system involved in triggering hiccups.

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5 Bathia KP, Marsden CD. The behavioral and motor consequences of focal lesions of the basal ganglia in man. Brain 1994;117:859–76.

Psychological adjustment and self reported coping in stroke survivors with and without emotionalism

Emotionalism after stroke is common, occurring in 10%–20% of a community sample.1 Psychological factors in its cause or maintenance have not been studied; research has tended to concentrate instead on location of the stroke lesion. We suspect that one reason for this neglect of psychological aspects of emotionalism is that most people do not make a distinction between emotionalism, and pathological crying and laughing. As a result all disorders of emotionality after stroke are stereotyped as being related to brain damage and therefore psychologically meaningless.

None the less, many patients with emotionalism describe their crying as provoked by emotionally congruent experiences, which makes the tearfulness seem understandable.1

In two previous studies1 4 we have shown that stroke patients with emotionalism have more symptoms of psychological disorder than those without emotionalism. In the present study, we explored further the psychological characteristics of stroke patients with and without emotionalism. Our aim was to determine whether they differed from patients without emotionalism in their psychological reactions to stroke, or in the coping strategies they reported.

Post-traumatic stress disorder is also characterised by recurrent episodes of intrusive and uncontrollable emotion, and we were therefore interested in whether patients with emotionalism also experienced thoughts typical of post-traumatic stress disorder. Because emotionalism is often described as uncontrollable, we were interested in the possibility that patients were more generally helpless, passively reacting, in their responses to stroke. Again, because of the reported uncontrollability of emotionalism, we postulated that patients with emotionalism would report a more external locus of control than those without emotionalism.

Participants were adults admitted to local general hospitals after stroke, and were interviewed within 1 month of admission. Exclusions were due to poor physical health, cognitive impairment, communication difficulties, or lack of consent. Approval for the study was obtained from the local research ethics committee.

All participants completed a standardised measure of distress—the general health questionnaire, GHQ-12; a widely used measure of intrusive thoughts of the sort encountered in post-traumatic stress disorder—the impact of events rating scale;2 a measure of cognitive coping—the mental adjustment to stroke scale (O’Rourke S, Dennis M, MacHale S, Slattery J. The development of the mental adjustment to stroke scale: reliability, patient outcome and associations with mood and social activity, manuscript in preparation); and a measure of beliefs about responsibility for recovery from illness—the recovery locus of control scale.3 All the measures are self report questionnaires.

A total of 177 stroke patients were screened, of whom 112 were excluded. The 65 participants (29 men, 36 women) had a mean age of 71.8 years (range 43 to 88 years). Nineteen (29.2%) patients met our criterion for emotionalism, a rate similar to that found in other studies. Their scores on the study measures are compared with the scores of patients without emotionalism in the table. It might be that these associations with emotionalism were accounted for by the greater general levels of distress experienced by those with emotionalism. We therefore undertook analysis of covariance with GHQ-12 and presence of emotionalism as the covariates, and each of the other test items in turn as the independent variable. The results showed an association, after adjustment for GHQ-12 score, between emotionalism and the impact of events subscales intrusion
Comparison of stroke survivors with and without emotionalism, assessed in hospital 1 month after stroke

<table>
<thead>
<tr>
<th></th>
<th>No emotionalism (n=45)</th>
<th>Emotionalism (n=19)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GHQ-12*</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Recovery locus of control scale</td>
<td>3.2 (2.4)</td>
<td>5.3 (3.5)</td>
</tr>
<tr>
<td>Impact of events scale intrusiveness**</td>
<td>33.2 (5.3)</td>
<td>34.1 (17.7)</td>
</tr>
<tr>
<td>Impact of events scale avoidance subscale*</td>
<td>2.9 (4.6)</td>
<td>9.2 (6.6)</td>
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<tr>
<td>MASS Fighting subscale</td>
<td>4.7 (4.6)</td>
<td>9.9 (6.1)</td>
</tr>
<tr>
<td>MASS Anxiety preoccupation subscale*</td>
<td>4.91 (4.3)</td>
<td>48.5 (8.2)</td>
</tr>
<tr>
<td>MASS Fatality subscale*</td>
<td>22.2 (2.8)</td>
<td>25.2 (4.0)</td>
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<tr>
<td>MASS Avoidance subscale</td>
<td>20.0 (1.9)</td>
<td>21.3 (2.2)</td>
</tr>
<tr>
<td>MASS Helplessness/helplessness subscale**</td>
<td>1.7 (0.8)</td>
<td>1.9 (0.8)</td>
</tr>
<tr>
<td>F Scale</td>
<td>10.9 (2.5)</td>
<td>14.1 (3.5)</td>
</tr>
</tbody>
</table>

MASS = Mental adjustment to stroke scale.

* p<0.05, ** p<0.01, t tests.

We thank those patients who participated in the study and the staff of local hospitals and the Leeds Stroke Database for their invaluable help. We also thank Dr Louise Dye for her statistical advice.

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Paraneoplastic stiff limb syndrome

Stiff man syndrome (SMS) is a rare, severe progressive motor disorder characterised by painful spasms, symmetric axial muscle rigidity, and uncontrollable contractions leading to distorted posturing. The disorder has been associated with the autoantigens, glutamic acid decarboxylase (GAD), and amphiophysin, which are cytoplasmic proteins in neurons of the CNS. A large series of patients with SMS found that most have antibodies against GAD, whereas amphiophysin is presumably the predominant autoantigen in paraneoplastic SMS. Recently, Barker et al. (2018) reported on four patients with a stiff leg syndrome marked by progressive rigidity and spasms of the lower extremities. This group of patients tested negative for anti-GAD antibody by immunoprecipitation and demonstrated distinct electrophysiologic features. By contrast, another report described two patients with stiff leg syndrome who tested positive for anti-GAD antibody. Finally, in presenting a group of 13 patients, Barker et al. proposed that the nomenclature "stiff limb syndrome" refers to the focal form of SMS when one or more distal limbs are involved; two of their patients were also anti-GAD antibody positive, but none were tested for antibodies to amphiophysin or identified as having an underlying neoplasia. We present a patient clinically consistent with the stiff limb syndrome who was found to have autoantibody to GAD and breast cancer. A 68 year old woman presented with a 1 month history of painful spasms in her legs. Cramps were associated with tactile stimuli and emotional upset. Within weeks, inversion began at the left and then right ankle, making ambulation difficult. Her medical history was significant for Graves’ disease treated with thyraddectomy and radioactive therapy, and hyperlipidaemia. She was a chronic smoker. General examination was noteworthy for lymphadenopathy in the right axilla. Her mental status was worse during periods of lower extremity spasms, during which she became anxious, diaphoretic, and tachycardiac. Cranial nerve and motor evaluations were unremarkable, but assessment of the left leg, due to painful spasms elicited by light touch, was difficult. Inversion and plantar flexion were essentially fixed at the left ankle but could be overcome on the right. Deep tendon reflexes were 3+ in the upper and lower extremities, with sustained clonus at the right ankle. Sensory examination showed equal loss of the exception of hyperalgesia in the distal lower extremities, and coordination testing were grossly normal. No hyperlordosis or myoclonus was noted. Gait was limited due to ankle posturing.

The laboratory evaluation was noteworthy for a CSF with increased IgG indices (2.5, 3.4; normal, 0.2-0.8) and oligoclonal bands (5, 5) but no pleocytosis. Serological testing for anti-Hu, anti-Yo, and anti-Ri antibodies was unremarkable, and the haemoglobin A1C was 6.6 (5.6-7.7)%. Skin biopsy at three sites on the patient’s leg showed diminished epidermal nerve fibre density and terminal axonal swellings distally, consistent with a small fibre sensory neuropathy. The patient would not tolerate EMG. Magnetic resonance images of the brain and the entire spinal cord were normal. Fine needle aspiration of the left cervical spine revealed well demarcated metastatic adenocarcinoma. On an open surgical procedure, infiltrating duct carcinoma of the breast was identified. Anti-GAD antibodies were positive on indirect immunofluorescence, chemical assay and immunoprecipitation, but antibodies to amphiophysin were not detected by immunocolum chromatography, immunoprecipitation, or western blotting (Dr P De Camilli, Yale University).

Ongoing therapy with clonazepam and a trial of oral dexamethasone did not improve the lower extremity symptoms. The patient’s ankle posturing continued a slow progression to marked inversion, with spasm of hallucis longus. The patient died 18 months after symptom onset. Gross necropsy attributed the cause of death to aspiration pneumonia. Neuropathological evaluation showed a grossly normal spinal cord. Microscopically, the lumbar cord had mild reactive gliosis in the anterior horns but no evidence of inflammation. Sections of the frontal cortex, pons, and medulla showed mild diffuse reactive astrogliosis.

Stiff man syndrome is increasingly recognised as a heterogeneous disorder. Other case reports have documented patients with “focal” disease involving either lower extremity posturing, which contrast...
with the "diffuse" axial and subsequent proximal muscle distribution of the classic disorder. Our patient differs from those reported with stiff leg syndrome in that an occult malignancy was present. Unfortunately, we were unable to obtain electrophysiological studies for comparison. The search for a paraneoplastic process was based on the findings of axillary lymphadenopathy and an abnormal CSF. Our patient is only the second reported patient with paraneoplastic SMS associated with anti-GAD antibody; the other had upper limb rigidity in the setting of breast cancer and additionally mounted an immune response to amphiphysin.

Paraneoplastic processes can affect any component of the nervous system and, occasionally, multiple levels, as in the syndrome of sensory neuronopathy-encephalomyelitis. Our patient's findings were not entirely consistent with criteria for classic SMS in that an apparent encephalopathy and a small fibre neuropathy were identified—for example, her dysautonomia (tachycardia and relative hypertension) during spasms may have been a manifestation of involvement of small fibres. The role of autoantibodies in the pathogenesis of SMS and cancer is unclear. Via its probable function in endocytosis, amphiphysin has been postulated to play a part in the regulation of growth factor internalisation; however, the absence of an autoimmune response to this autoantigen in our patient suggests that other mechanisms of onconeogenesis in SMS exist. Given anecdotal evidence of improvement in paraneoplastic SMS after treating the underlying malignancy, we suggest that all patients with SMS, diffuse or focal, be screened for occult cancer.

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Tetrodotoxin intoxication in a uraemic patient

Tetrodotoxin intoxication results from ingestion of puffer fish or other animals containing the toxin. Clinical presentation is mainly acute motor weakness and respiratory paralysis. Death is common in the worst affected victims. Although the severity of the symptoms generally depends on the amount of toxin ingested, it may be influenced by the victim's medical condition, as described in this report. The patient was a 52 year old uraemic woman. The uraemia was of unde-
ally within an hour. She could open her eyes and she communicated and answered questions correctly by blinking. Pupillary reflex recovered and voluntary eye movements were limited only at the extreme lateral gaze. Muscle power was grade 3 and 4 in the proximal and distal parts of the four limbs. Tendon reflexes were still absent. She was taken off mechanical ventilation the next day. Her clinical condition continued to improve and her symptoms subsided in a stepwise pattern, in response to each course of haemodialysis (figure). When recalling, she could remember certain events such as the recording of the EEG, but was “too weak to move” at that time. She regained her initial strength by the time she was discharged on day 16.

When analysing the remains of the cooked fish (identified as *Youngichthys nebulosus*), tetrodotoxin was demonstrated by thin layer chromatography, high performance liquid liquid chromatography, and cellulose acetate membrane electrophoresis. Toxicity was assayed by using Institute of Cancer Research strain adult male mice and the toxicity score was 25 mouse units (MU)g in fish muscle (1 MUg = 0.178 µg in the ICR strain mouse).1

Tetrodotoxin exerts its effect through binding with and blocking the voltage dependent sodium channel.7 The voltage clamp experiments showed that tetrodotoxin diminished the sodium inward current responsible for the depolarisation of excita-
tory membrane. The gating properties of the sodium channel, such as the activation and inactivation mechanism, are not altered—that is, the sodium channel is not perma-
nently damaged and its function recovers when the bound toxin is released. In uraemia, ion conductance through the sodium channel is also impaired. Sodium permeability through excitable membranes is reduced and small inward sodium current and re-
duced action potential amplitudes are noted in experimental uraemic neuropathy.1 By contrast with the effects of tetrodotoxin, uraemia changes the basic property of the sodium channel by an increased inactivation and an impaired activation mechanism. The excitability of peripheral nerves will be more significantly depressed when these two condi-
tions coexist due to the synergistic effect of ura-
emia and tetrodotoxin is obvious in this incident in which the patient and her husband ingested roughly an equal amount of two kilograms of fish (about 200 µg, calculated from toxic score times the weight of ingested fish).

The amount is about 10% of the estimated lethal dose in humans—2200 µg/60 kg body weight—(body weights of the patient and her husband were 54.5 and 62 kg respectively)—and caused no clinical evidence of poisoning in the healthy person. It was of interest that the CNS was relatively spared from the toxicity as the EEG showed a posterior dominant, promptly reactive alpha rhythm and the patient retained consciousness when the symptoms were at their most severe. One of the most striking clinical features in our patient was the response to haemodialysis. Despite the small amount of toxin ingested, the dramatic improvement of her clinical condition was most likely attributed to the rapid elimination of absorbed toxin in the course of haemodialysis, rather than spontaneous recovery. The physical and chemical properties of tetrodotoxin are also supportive to this hypothesis.8 It has a low molecular weight (C9H17NO4S) is water soluble, but not significantly bound to protein—all these features are often found in toxins amenable to haemodialysis. Traditionally, the management of tetrodotoxin intoxication is mainly supportive, such as gastric lavage to remove unabsorbed toxin and machine as-
sisted ventilation when respiration is severely affected. We suggest that haemodialysis may be an effective method in the treatment of tetrodotoxin intoxication.

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3 Brismar T, Tegnèr R. Experimental uremic neu-

**Relation between critical illness polyneuropathy and axonal Guillain-Barré syndrome**

The clinical entity critical illness polyneuropa-
yth is almost exclusively in patients in critical care units and has been character-
ised as a complication of sepsis and multiple organ failure.1 Critical illness polyneuropa-
yth may be a common cause of the difficulty in weaning patients from the ventilator, particularly those who show intractable ventilator dependence. All the measures used to prevent ventilator dependence and multiple organ failure are the main methods now used to deal with critical illness polyneuropathy. Knowledge of this type of polyneuropathy is of help in making the choice of respiratory techniques, nursing care, prognosis, and overall management. Moreover, recognition of critical illness polyneuropathy indicates the need for physiotherapy, rehabilitation, and other supportive measures as the patient recovers. Bolton et al.2 have made an impor-
tant positive contribution to the care of patients with critical illness polyneuropathy. The actual aetiology, however, has yet to be determined. The pathogenesis needs to be clarified to treat patients more effectively.

Critical illness polyneuropathy invariably occurs at the peak of critical illness and sepsis, but in Guillain-Barré syndrome there is a brief period of recovery after a relatively minor illness or inoculation. Except for differences in the predisposing causes, as Bolton et al.2 reported, it is difficult to distin-
guish critical illness polyneuropathy from Guillain-Barré syndrome on purely clinical grounds. In both, polyneuropathy runs a monophasic course, the onset being relatively acute but with subsequent improvement in most instances. The clinical features also are similar; evidence of muscle weakness in all four limbs, occasional involvement of facial muscles and frequent involvement of the muscles of respiration, the depression or absence of deep tendon reflexes, and some evidence of distal sensory in-

The first step by Bolton et al.1 in determin-
ing exact aetiology was to differentiate critical illness polyneuropathy from Guillain-Barré syndrome. In reviewing the patients with critical illness polyneuropathy and Guillain-Barré syndrome who were studied in their EMG laboratory, they found marked differ-
ces between the two types of polyneuropa-
yth. Patients with Guillain-Barré syndrome had greater slowing of the speed of impulse conduction, and, in the initial stages, abnor-
mal spontaneous activity in the muscle was absent, indicative of a predominantly demy-
elinating polyneuropathy. The CSF was only mildly increased in patients with critical illness polyneuropathy, but it was much increased in patients with Guillain-Barré syndrome. Comprehensive studies done at necropsy and nerve biopsies of patients with critical illness polyneuropathy showed the presence of primary axonal degeneration of the motor and sensory fibres, mainly distally, with no evidence of inflammation.2 Zochodne et al.3 (including Bolton) therefore concluded that the two types of polyneuropathies most probably are separate entities.

Guillain and colleagues enumerated the clinical and spinal fluid features of two pathology-physiology syndromes, and proposed a classification system identifying critical illness polyneuropathy as a distinct entity. This classification system differentiates critical illness polyneuropathy from Guillain-Barré syndrome, and physiological abnormalities consistent with demyelination have been taken as supportive evidence for the diagnosis of Guillain-Barré syndrome. Feasby et al.1 (with Bolton) further called attention to patients who were clinically con-
sidered as having Guillain-Barré syndrome, but who were characterised electrophysi-
ologically as having early axonal degeneration of the motor and sensory nerves. The evidence included a rapid fall in compound muscle action potentials and sensory nerve action potentials, and no evidence of demyeli-
nation. Such patients often had severe paralysis and made a slow recovery, presumably reflecting the need to regenerate axons rather than remyelination. Pathological find-
ings are consistent with axonal degeneration without demyelination. Feasby et al.1 termed this pattern axonal Guillain-Barré syndrome and suggested that there is a fundamental difference in the underlying pathophysiology, resulting in primary axonal damage rather than demyelination. Griffin et al.4 then con-
firmed the existence of the acute motor-sensory axonal neuropathy (AMSAN) pat-
tern of Guillain-Barré syndrome described by Feasby et al.1.
of acute diarrhoea, commonly precedes the development of Guillain-Barré syndrome. There is a close association between axonal Guillain-Barré syndrome and C jejuni infection. The antecedent infectious symptom was diarrhoea in three of five polyneuronal Guillain-Barré syndrome described by Feasby et al. Observations by Griffin et al confirmed that C jejuni follows C jejuni infection. Serum samples from patients with axonal Guillain-Barré syndrome subsequent to C jejuni enteritis often have high class autoantibodies to gangliosides GM1, GM1b, GD1a, or GaINAc GD1a in the acute phase of the illness, and there is molecular mimicry between these gangliosides and the lipopolsaccharides of C jejuni isolates from patients with Guillain-Barré syndrome. This ganglioside mimicry may trigger high production of the IgG anti-ganglioside antibodies and these autoantibodies may cause motor nerve dysfunction in patients with GBS.

Interestingly, Hagensee et al reported a case of "C jejuni bacteremia and subsequent Guillain-Barré syndrome" that occurred in a patient with chronic graft versus host disease and autologous marrow transplantation. Because there was acute flaccid paralysis associated with sepsis, some physicians might have diagnosed critical illness polyneuropathy. Conversely, the existence of this case strongly suggests that some diagnosis of critical illness polyneuropathy should actually be axonal Guillain-Barré syndrome or AMSN. Our hypothesis of the nosological relation between critical illness polyneuropathy and Guillain-Barré syndrome is shown in the figure. Serum IgG antibodies against GM1, GM1b, GD1a, or GaINAc GD1a could be used as immunological markers for axonal Guillain-Barré syndrome. To examine the aetiology of critical illness polyneuropathy and its nosological relation to axonal Guillain-Barré syndrome, it is necessary to investigate whether patients with critical illness polyneuropathy have anti-ganglioside antibodies during the acute phase of the illness.

**Repetitive transcranial magnetic stimulation in the treatment of chronic negative schizophrenia: a pilot study**

Recently, a new technology known as repetitive transcranial magnetic stimulation (RTMS) has been developed. In 1994, the use of magnetic stimulation in clinical psychiatry was suggested. Since then, it has been used in the study or treatment of obsessive-compulsive disorder, conversion disorder, schizophrenia, and particularly, depression.

Our pilot study aimed to assess the possible adverse effects of this treatment in chronic schizophrenic patients with severe negative symptoms; to evaluate if direct RTMS of the prefrontal cortex might improve negative symptoms or cognitive impairments in patients with chronic schizophrenia; and thirdly, to note if RTMS might modify the deficit in prefrontal cortical activity, often reported to hypertrophy in schizophrenia, specially under conditions of task activation.

Six right-handed patients with chronic schizophrenia were identified at the outpatient psychiatric ward of the Hospital Clinic of Barcelona. There were two men and four women (mean age 39). Exclusion criteria included alcohol or substance abuse, previous or current use of anxiolytics, antipsychotics, antidepressants, or mood stabilizers, and a score of 2 or higher on the negative symptoms subscale of the PANSS.

All patients were taking neuroleptic drugs, but a stable dose for at least 3 months was required. All patients were studied off benzodiazepines for at least 1 week before beginning the treatment. During the RTMS, psychotropic medications were continued at the initial dosage.

All patients were admitted to hospital. Inpatients underwent the UKU side effects scale, the positive and negative symptom scale (PANSS), and a neuropsychological battery, the day before beginning the treatment and at the end of the treatment. The UKU scale was also administered after each session.

An equivalent neuropsychological battery was used on both occasions, which consisted of the block design, the Trail making test, the FAS verbal fluency test, and two subtests of the Wechsler memory scale (visual memory reproduction and the verbal paired associates subtests).

A brain SPECT study was performed by rotating a dual head gamma camera, fitted with high resolution fanbeam collimators. Two Tc-HMPAO SPECT scans with cognitive activation, such as the Wisconsin card sorting test (WCST), were performed on each patient (24 hours before the beginning of the treatment and 24 hours after the last session).

RTMS was given with a Mag Pro magnetic stimulator, 5 days a week, during 2 weeks, at the beginning of the treatment and 24 hours after the last session.

### Table: Neuropsychological tests and PANSS scores

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean (SD)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block design</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>49 (11.95)</td>
<td>NS</td>
</tr>
<tr>
<td>Post</td>
<td>50 (8.69)</td>
<td>NS</td>
</tr>
<tr>
<td>Trail making test A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>38 (4.6)</td>
<td>NS</td>
</tr>
<tr>
<td>Post</td>
<td>42.6 (14.1)</td>
<td>NS</td>
</tr>
<tr>
<td>Trail making test B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>38.3 (4.5)</td>
<td>NS</td>
</tr>
<tr>
<td>Post</td>
<td>41 (10.03)</td>
<td>NS</td>
</tr>
<tr>
<td>Immediate visual reproduction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>50.5 (4.82)</td>
<td>NS</td>
</tr>
<tr>
<td>Post</td>
<td>54.8 (11.2)</td>
<td>NS</td>
</tr>
<tr>
<td>Delayed visual reproduction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>46.18 (2.83)</td>
<td>p&lt;0.05</td>
</tr>
<tr>
<td>Post</td>
<td>53.8 (13.84)</td>
<td>NS</td>
</tr>
<tr>
<td>Delayed verbal paired associates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>8.8 (1.1)</td>
<td>NS</td>
</tr>
<tr>
<td>Post</td>
<td>8.8 (1.17)</td>
<td>NS</td>
</tr>
<tr>
<td>PANSS-PD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>37.67 (11.15)</td>
<td>NS</td>
</tr>
<tr>
<td>Post</td>
<td>31.67 (8.26)</td>
<td>p&lt;0.02</td>
</tr>
<tr>
<td>PANSS-N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>31.67 (8.26)</td>
<td>NS</td>
</tr>
<tr>
<td>Post</td>
<td>27.83 (8.47)</td>
<td>NS</td>
</tr>
<tr>
<td>PANSS-P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>16.83 (7.28)</td>
<td>NS</td>
</tr>
<tr>
<td>Post</td>
<td>15.33 (7.55)</td>
<td>NS</td>
</tr>
</tbody>
</table>

Pre=preatreatment; Post=post-treatment; PANSS=positive and negative syndrome scale; PG=general psychopathology scale; N=negative scale; P=positive scale.

We found that all patients (except one, who was always within the normal range) diminished their number of perseverative answers and errors on WCST (items characteristically altered in schizophrenia) after the RTMS. However, significance was not achieved on any WCST scores.

Two patients who initially did not perform any categories on WCST, after the treatment, achieved one category, a possible indication of improvement of their attentional capacity. This change leads us to consider a research strategy previously reported, in which the WCST is used as a screening test for selecting schizophrenic patients. Those initially achieving low category scores would be compared to higher category scorers in an effort to identify a subgroup most likely to benefit from RTMS.
hypofrontality after treatment, we are considering extending the treatment course to 20 sessions, each at 30 Hz for 1 second, at 90% of motor threshold. It was also suggested that other positions of the coil and other kinds of coils might give better results.

The clinical change in our cohort after the RTMS could be attributed to both the treatment and the supportive environment of the psychiatric ward, and even to enhancement compliance to medication during hospital admission. We are aware that the small sample size and lack of controls compel a very careful interpretation of the results. Nevertheless, in the light of these, we suggest further prospective studies to evaluate the efficacy of RTMS in negative symptoms of schizophrenia, not only as an add-on technique but also as a sole therapeutic procedure. Research on RTMS also requires some controlled studies aimed to the complexity of the methodology (dosage, duration, and localisation), as this form of intervention may prove to be an economical and convenient therapy in treating several psychiatric disorders.

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CORRESPONDENCE

Sensory alien hand syndrome

The case report by Ay et al of alien hand syndrome and review of the literature neglected the intriguing issue of why in every case so far reported the patient seems to be terrified of the alien limb. Not believing that you are any more in control of a limb is not likely to be a pleasant experience.

Those with alien hand syndrome seem to jump to extremely negative conclusions concerning the intent of the limb. Typically, as in the report of Ay et al, the common belief is that the limb has deeply malevolent intentions towards the victim.

It is this aspect of alien hand syndrome that I suggest also needs incorporating into its neurological explanations, and which provides a clue as to why our everyday experience of being in charge of our bodies, and so initiating all personal action, itself has a neurological basis. In other words, while the brain is the seat of all our conscious experiences, experiences, there is also a part of our nervous system which is responsible for our belief that we have free will over our behaviour. Patients with alien hand syndrome think that they are no longer in control of a limb because the part of the brain that gives us the sensation of control over our bodies has been damaged. When that happens, our limbs seem to act independently of us.

Research conducted in the 1980s has found that the same electrical brain wave changes that characteristically preceed all limb movements, occur several 100 ms before we seem to consciously decide to move a limb. If our conscious decision to act is preceded by brain changes that anticipate action, then our “decision” to choose how to behave or “freedom”, as in free will, is in fact illusory. Our choices have in a sense been decided beforehand by our brains.

Spence’ asserts that evidence such as this, combined with phenomena such as alien hand syndrome, means that philosophers have to reconsider whether we have free will. He argues that these data suggest that our sense of agency is illusory and it follows that most of us share in common the useful delusion that we have free will. Patients with alien hand syndrome have lost this experience in relation to a particular limb. There is a sense then that those who experience the syndrome are closer to the reality of how much we are responsible for our actions than the rest of us.

This is because alien hand syndrome is a misconnection syndrome. As such, it means that the part of the brain that normally works to fend them off, is malfunctioning. Hence it would seem that one way to explaining why schizophrenic symptoms are frightening to the patient. So it seems we know that our limbs belong to us because they obey us. When they seem to stop responding to our wills, we conclude that our limbs are no longer our own, and try to fend them off. Hence it would seem that one of the prices we had to pay for our awareness of ourselves to evolve as a function of the brain, is the delusion that we are responsible for all our actions. If we had conscious awareness of ourselves, but no sense of free will, our bodies would feel alien to us.

The philosophical importance of alien hand syndrome is that it shows emphatically via neurology that it is possible to drive a wedge between consciousness and the experience of free will. The brain had to develop the sensation of free will after developing consciousness, because being without the sensation of free will produces extremely negative emotional experiences. So the fact that in every case, so far reported of alien hand syndrome impuutes negative intent to the alien limb might not be an incidental finding, but a core aspect of the disorder.

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The authors reply:

We appreciate Persaud’s comments regarding the alien hand syndrome, “the perceived malevolence of the affected limb towards its victim, and the question of whether with loss of the conscious sense of voluntary control over our bodies, our minds... decide that if ourselves are not in control then someone or something else must be”. We would offer that the value of our particular case is that it was due to a central deafferentation—therefore the term “alien hand syndrome”. As
opposed to the idea that “we know our limbs belong to us because they obey us”, we know that our limbs belong to us because they provide us with sensory input that is recognised as self. Many patients with movement disorders or paralysis lose control of their limbs but still have no difficulty in realising them as self. Indeed even in “phantom limb” there is sense of self due to central processes in the absence of a limb. Our patient, as do others with anosognosia and primary abnormalities of central sensory systems, shows perhaps that it is central sensory processes that are the key to identifying “self”. We know our limbs not because they obey us but because of a pattern of sensory integration that accompanies our own limb movements. When this pattern never reaches specific cortical regions, then the limb is not perceived as self; called “amorposynthesis” by Denny-Brown and Banker. Selective disconnection by the centrally deafferented limb in “sensory” or “posterior” alien hand syndrome, or kinaesthetic stimuli due to movement of the limb as in the “anterior” or “anterior” alien hand syndrome, is perceived as due to another person or thing without critical questioning. This raises the most interesting question of what brain region is deafferented in the anterior alien hand syndrome where movement processing is intact.

It is not our clinical experience nor the conclusions based on published reports that all patients suffering with alien hand syndrome are influenced by the affected limb. In one author’s experience (BHP), two patients with alien hand syndrome and related intermanual conflict were irritated by but not terrified by their opposing limbs simultaneously vacillating between book or box. The other patient was amused but rather indifferent to his affected left side. The most terrifying situation we have heard is when the patient identified his affected left side as belonging to his mother-in-law and patient separated by Heilman’s group with persistent alien hand syndrome referred to it as “my little sister”. Similar to our experience, they suggest that a pseudoanomalousity type may be necessary given that most patients with collosal infarcts or tumours do not emphasise this complaint.

Unlike our case of limited duration, the persistence of alien hand syndrome is time dependent on mesial frontal dysfunction. These patients rarely deny that the affected limb belongs to them. Instead, they understand it in terms of their “anarchic hand”. Hence, although the initial syndrome may result in disjointed and terrifying perceptions, it seems that the brain quickly re-establishes its control by presently unknown adaptive capacities. Furthermore, why it almost exclusively involves the left body side in right handed people remains unknown. Studying this syndrome in greater detail may yield additional insights into the pathophysiology of denial and misidentification.

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Baumgartner and Baumgartner reply:

We are grateful for the response of Kaplan to our short report. We agree that somatic inhibitory seizures may mimic transient ischaemic attacks (TIAs). Such TIAs are associated with negative symptoms such as sensorimotor deficits and difficulty with speaking, EEG evidence of seizure activity, and cessation of the TIAs after the administration of an anticonvulsant drug.1–4. Limb shaking TIAs, however, differ from TIAs related to inhibitory seizures in several ways.1–4. They are associated with positive phenomena (limb shaking), and the involuntary movements do not affect the facial muscles. Patients with attacks of shaking movements of the limbs have no EEG evidence of epileptic activity, and involuntary movements do not stop after administration of anticonvulsant therapy.3–5. Although the patient presented by Kaplan had a 95% stenosis of the left internal carotid artery, it is unclear whether haemodynamic failure was present or not, because no studies evaluating the haemodynamic reserve of the homolateral hemisphere were presented. This is in accordance with the finding that the involuntary movements as well as the sensorimotor deficits of Kaplan’s patient were not related to pastures in the middle cerebral artery.4–5. The pathophysiological conditions may therefore be due to disinhibition of subcortical control mechanisms as a result of ischaemia.

In our opinion, it is not clear whether the ataxia-like movements of the outstretched right arm of Kaplan’s patient are due to epileptic seizures, because unilateral ataxias of the outstretched arm has been reported with contralateral vascular lesions affecting almost all cerebral structures involving the homolateral control including ischaemia in the territory of the middle cerebral artery.5

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BOOK REVIEWS


To the MRCP candidate neurology is one of the more daunting specialties. The unfamiliar nerve conduction study and the frankly mysterious EEG can distress an otherwise well rounded senior house officer. Despite the fact that much of neurology is commonly seen on a general medical ward—strokes, dementias and so forth—the general perception is of an unimaginable list of eponymous syndromes and obscure signs. Rather than dwell on the last, in this book Dr Smith tries to address the commoner complaints as examination style questions each with a "simple clinical les-
tive". The "grey area" section, for instance, includes questions on multiple sclerosis, cluster headache, and HSV encephalitis, while broadening the topics to include postinfective demyelination, chronic herni-
crania, and acute haemorrhagic encephalo-
myelitis. There is, however, a tendency for the discussion after each question to be rather brief. A fuller explanation, with more allowance for the reader's ignorance, would have been appreciated. The data interpretation section is somewhat better, covering CSF, EEG, and other data extremely well. Perhaps a little too well; would an MRCP candidate really be expected to recognise the character-
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This monograph is the latest to be produced by the American Association of Neurological Surgeons as part of their Neurosurgical Topics series. It begins by tracing the history of cal-
varial reconstruction from ancient times. There follows a discussion of the different autologous donor sites and synthetic materi-
als currently used. There is a fair amount of calvarial and facial defects. The merits, disadvantages, and contraindications of each are considered. Dural substitutes are then dealt with in simi-
lar fashion. Specific problems, such as scalp re-
construction, are mentioned. A detailed review of commi-
nutated frontal sinus fractures, and reconstruc-
tion of the anterior skull base are the subject of separate chapters. The final part of the book is devoted to craniomucosynthesis. A review of current knowledge on pathogenesis is followed by a good account of some of the more common techniques used to treat single suture synostosis. Understandably, in a book of this type there is space only for an overview of the treatment and complications of multi-
suture involvement, but the chapter provides well chosen references for further reading.

The reconstruction of traumatic and post-
surgical calvarial defects occupies the bulk of this volume, and is dealt with very effectively. Operative techniques and the relative merits of various materials are covered in a clear and concise manner. By contrast, the section on aural substitutes is a little disappointing because it does not provide the reader with reasoned argument on how to select the most appropriate graft from the sometimes bewil-
dering variety of autologous, synthetic, and xenograft materials which are available when vascularised pericranial tissue is not an option.

Craniomucosynthesis is a topic which is cov-
ered very well in standard paediatric neuro-
surgical texts and it is not worth buying this book for that section alone. However, the account of techniques for repair of calvarial defects is excellent and merits the inclusion of this text in a departmental library.

ROBERT MACFARLANE


Transcranial colour duplex sonography is an ultrasound technique which is becoming increasingly available for the non-invasive imaging of intracranial structures, particularly the basal cerebral arteries. There are now four principal components to the technique: B mode ultrasound which can be used to image the brain parenchyma; colour coded Doppler which provides a colour image of the basal vessels; spectral analysis of pulsed wave Doppler which is used to derive blood flow velocities; and latterly "power" Doppler which is also used to provide a col-
ouring following analysis of the amplitude rather than the frequency of the reflected ultrasound beam. In addition, echonocontrast agents are now available which can increase the signal to noise ratio and thus help diminish the detrimental acoustic effects of the skull.

This volume of 400 pages and liberal colour diagrams and prints is edited by three exponents of the technique. Thirty one chapters contain a further 200 pages which may be a popular choice for some practitioners. An Atlas of Multiple Sclerosis. Edited by Charles M Poser. (Pp 134, £48.00/$85.00). Published by Parthenon Publishing, CArnforth 1998. ISBN 1-85070-946-7.

This book, after a short introduction to some of the fundamental features of the disease goes on to provide some 117 illustrations of aspects of the disease from Cruveihier's plates to histopathological specimens and also a heavy leaning to imaging particularly magnetic resonance imaging. In summary, this is a creditable first edition. I pontine myelinolysis MRI are beautiful. In Sturge-Weber skull radiograph and central ination but it is let down by the poor quality


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introduction setting the scene for the five main disease sections covering developmental/geneic disease, spinal injury, infection, tumour, and the effect of neurological and systemic disease on the spinal cord. This chapter covers a wide area from multiple sclerosis to motor neuron disease to vascular disease to metabolic diseases. Then follows a section on investigation considering imaging, neurophysiology, and urodynamics. Finally, there is a miscellaneous section covering clinically important entities such as pain, sexual problems, and terminal care associated with spinal cord disease but also including a highly specialised chapter on the role of occupational injury on spinal cord injury.

This is an ambitious attempt at being comprehensive. The editors themselves worry that the emphasis favours surgical conditions. Although this might be the case, many surgical conditions are considered by the neurologist or rheumatologist, care for spinal disease often falling between several specialties. Therefore, it is of benefit to the clinician to have all aspects of spinal disease in one volume. The standard and style of the individual chapters varies, that on motor neuron disease being up to date and topical, malignancies being covered in depth. That on sexual problems associated with spinal cord disease is excellent for the particularly practical and a must for both doctors dealing with spinal disease and for patients themselves who are often uninformed (our fault, not theirs). The chapter on depression illness will be food for thought for many doctors who enjoy recreational diving, for although studies have not yet shown adverse affects on the quality of life in those who dive frequently but without incident the evidence for cumulative neurological damage from neurophysiological imaging, and pathological studies is compelling.

The quality of illustration is high. Perhaps not surprisingly, this is particularly evident in the imaging section (where there is a rather spectacular sagittal T2 weighted MRI of a intramedullary arteriovenous malformation).

In addition to imaging many of the chapters also make good use of schematic diagrams and line drawings to enhance the text.

Drs Engler, Cole, and Merton end their preface by commenting that “Our main hope, however, is that the chapters will read as a series of views on the spinal cord and its disease, so that a surgeon may learn about current practice as well as the wide range of conditions affecting the cord that are outside the field of surgery”. While I agree that educating surgeons is an admirable aim, I think that the authors rather undersell themselves and that this book’s main strength, as I have said above, is that it will appeal to all disciplines that deal with spinal cord disease, bringing together neurological, rheumatological, and surgical disease that is often covered in separate textbooks.

GILLIAN HALL


This is the second time that I have been asked to review a book on this topic. The first time I approached the task with some scepticism were neurological diseases in women really so different from those in men that they warranted their own text book? But I rapidly became a convert to the cause, being reminded that there are issues specific to females that influence both disease, investigation, and treatment (pregnancy, breast feeding, menopause, to name the most obvious) and that not all neurological diseases attack the sexes equally. There are also wider socio-economic and legal issues that play a part in the complete disease picture which many of us neglect too often but which this book is careful to address (see below). Leaving content aside for a moment, this is a beautifully presented book; clearly headed and with wide use of well constructed tables. It encourages one to read on. It seems up to date and well referenced.

The contributors (40 in total) are exclusively American, and east coast American at that with only occasional forays westward. The text is divided into three sections. The first, entitled General Disease in Women includes an anatomical chapter considering the sex differences of regional brain structure and function. More novel for this type of text, it contains two thoughtful chapters considering women’s health within the context of their lifestyles and women’s health and its relation with the law. This chapter considers issues such as coercive approaches to preventing foetal harm, those relating to informed consent to medical treatment, and difficult choices with neurological implications. The law and the case examples are exclusively American but the issues are universal.

The opening section leaves no doubt that this is a book that has taken female issues extremely seriously.

The second section looks at neurological diseases as they affect females at different life stages, from birth through menarche, pregnancy, and menopause, to the elderly woman. As well as considering genetic diseases that strike at a particular age, these chapters consider the influence of changing physiology and hormonal balance on neurological disease. The third section is the most conventional. Each chapter considers a neurological disease representing these diseases with emphasis on their effect on women and there is, by necessity, some overlap between this and the previous section. As a non-American, I would feel more comfortable to believe that the high number of female patients with peripheral nerve injuries secondary to physical beatings, knife wounds, or gunshot wounds reflected the country of origin of this book.

If pushed to criticise, the indexing could be more complete and certain conditions considered in more detail, in particular, paraneoplastic conditions associated with breast and gynaecological malignancies. However, that aside, I think this a rather special book and not only a good addition to any neurological library but a useful purchase for anyone interested in female medical issues.

GILLIAN HALL

The reader may be interested in the following:


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**CORRECTION**


During the editorial process the descriptions of the histograms in figure 4 (p 614) were wrongly ascribed. The corrected figure is reproduced below.

![Figure 4 Correlation of clinical response](http://jnnp.bmj.com/content/bmj/journals/10.1136/jnnp.76.8.612)

**Figure 4 Correlation of clinical response**

(grade 0 or 1 response indicates non-responders, grade 2 response indicates reduced response, and grade 3 or 4 are responders) with response to test injections.)
Cerebral metabolism during vegetative state and after recovery to consciousness

STEVEN LAUREYS, CHRISTIAN LEMAIRE, PIERRE MAQUET, CHRISTOPHE PHILLIPS and GEORGE FRANCK

J Neurol Neurosurg Psychiatry 1999 67: 121-122
doi: 10.1136/jnnp.67.1.121

Updated information and services can be found at:
http://jnnp.bmj.com/content/67/1/121

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