Cerebral metabolism during vegetative state and after recovery to consciousness

One way to approach the study of consciousness is to explore lesion 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 [18F]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 assessment 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 pronounced on 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) 1. The use of SPM to assess between subject (rather than within subject) variability is able 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 2 and with PET studies in postanoxic syndrome, in which the parieto-occipital cortex showed the most consistent impairment. 3 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. 4 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 motor neurones and consequent motor cell loss. 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.1 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. Ahn et al2 described a 1-year-old male infant with SMA who fulfilled at least one exclusion criterion. Studies involving hundreds of patients with SMA have disclosed a subset of patients who fulfil 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 10 month old male infant was born at term. From fetal movements were noted at 13 weeks of gestation. Chorionic villus sampling at 10 weeks of gestation disclosed normal chromosome karyotypes. 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 following. Tongue fasciculations were present. Other cranial nerves seemed intact. Deep tendon reflexes were absent. The patient was moved to the medical intensive care unit and observed for 24 hours. The ECG showed a P pulmonale, but no other significant abnormalities. 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 carbiodopa/levodopa (50 mg/200 mg tablets). A 76 year old patient had a pre-existing severe Parkinsonian syndrome, which had been treated for the past 1.5 years with 3×1 tablets of carbiodopa/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 30 minutes he was increasingly inadequate, with restlessness, and was experiencing visual hallucinations; he was restless, tossing and turning, and getting out of bed. He did not represent peak dose dyskinesia or other extrapyramidal clinical features. At 10.00 pm he showed bilaterally maximally dilated pupils. The muscle stretch reflexes were lively, 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 (carbiodopa/levodopa, 50 mg/200 mg) was found in the patient’s flat, 1 g of carbon was given by stomach tube after gastric lavage. With suspicion of right ventricular hypertro-
the peripheral conversion of levodopa into ecate is caused by kinesia has not previously been reported. It is absent light reaction, at the time of the maximum movement disorders of levodopa and metabolites is shown in the figure. Blood was taken for the measurement of levodopa and metabolites 2.5 hours after ingestion, and again after 9, 14.5, 34, and 132.5 hours. Using high performance liquid chromatography with electrochemical detection, we measured the plasma concentrations of levodopa, 3-o-methyldopa, dihydroxyphenylacetic acid, homovanillic acid, noradrenaline, adrenaline, and dopamine. The time course of the concentrations of levodopa and 3-o-methyldopa are shown in the figure. After 24 hours the patient was moved from the intensive care unit to a normal medical ward. At this point no neuropsychiatric signs of levodopa intoxication could be detected. Clinically, the most prominent symptoms of levodopa overdose are confusion, agitation, sleeplessness, and excessive motor activity. The initial levodopa conversion in our patient was 6673 ng/ml, the concentrations of DOPAC, homovanillic acid, noradrenaline, adrenaline, and dopamine were raised 2.5 hours after ingestion and rapidly returned to normal. A very noticeable feature of this case was the maximal bilateral mydriasis, with absent light reaction, at the time of the maximal intoxication with a 30-fold increase in plasma levodopa concentration. To our knowledge, there is no association of a levodopa intoxication with maximally dilated, light unresponsive pupils and without signs of dyskinesia has not previously been reported. It can be hypothesized that the effect is caused by the peripheral conversion of levodopa into noradrenaline, which stimulates α-adrenergic receptors in the dilator iridis. There is no indication from animal experiments of a specific activation of dopamine receptors. The arterial hypotension measured initially can also be attributed to the high systemic concentrations of noradrenaline, and the tachycardia to the raised concentrations of adrenaline and dopamine. As seen in the figure, the only indicator which can show a levodopa intoxication in the subacute stage is the concentration of 3-o-methyldopa. The metabolite 3-o-methyldopa results from the oxidation of levodopa, which explains the delayed peak of the 3-o-methyldopa concentration. The half-life of 3-o-methyldopa in plasma was calculated at 16.7 hours in this patient. On the other hand, the plasma half life of levodopa was 111 minutes; this is slightly longer than normal, and can be explained by assuming a rate limited metabolism of levodopa when the substrate concentration for the enzymes metabolising it is raised.

Distribution into muscles rather than 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 6673 ng/ml is about 30 times higher than the peak concentration 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 concentrations of 3-o-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 sulphuride was carried out in March 1997. Sulphuride 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 sulphuride 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 sulphuride, his antidepressant 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 unaware 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. Serial quantitative neurological examination scores are illustrated in figure 1.

In the absence of a cure for Huntington's disease, it is very important that any interventions considered enhance the quality of life of the patient and improve overall functioning. It may not always be in the best interests of the patient to use drug treatments for the movement disorder. In those patients who have severe movements, however, a trial of treatment may be appropriate and continued if a clear benefit has been achieved. Neurological monitoring and the patient's own perception of the effect of the drug must be taken into account.

The mechanism by which olanzapine may have beneficial effects is unclear. Olanzapine has been shown to have high affinity for a large number of receptors including D1, D2, D4, 5HT2A, 5HT2C, 5 HT3, a1-adrenergic, histamine H1, and 5 muscarinic receptors. This binding profile is similar to clozapine, another atypical antipsychotic drug, but substantially different to the conventional antipsychotic haloperidol.1 Preferential loss of D2 projection neurons which are involved in a feedback loop normally active in the suppression of involuntary movements is thought to be the pathological basis of chorea in patients with Huntington's disease. The D2 antagonist properties of olanzapine may explain its possible benefits in the improvement of chorea. However, the effect at other receptors such as D4 may also be important, as D4 receptor density has been shown to be raised in Huntington's disease, therefore the D4/D2 ratio of activity may also be relevant. Differences in binding profile across a range of receptors may explain clinical differences in outcome when comparing different antipsychotic drugs.

This case report indicates that olanzapine may be a useful addition to the treatments for movement disorder, for some patients, and controlled trials of its use in Huntington's disease would be welcome.

**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# po/H and Y on/off</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>2/5</td>
<td>57/NP§</td>
<td>R</td>
<td>Slight facial paresis, swallowing problems, drooling</td>
<td>Trzytoprol, mezamopex, alprazolam, apomorphine</td>
</tr>
<tr>
<td>2</td>
<td>43</td>
<td>F</td>
<td>7</td>
<td>2/2.5</td>
<td>22/7</td>
<td>L</td>
<td>Slight dysarthria</td>
<td>Trihexifendyl</td>
</tr>
<tr>
<td>3</td>
<td>45</td>
<td>M</td>
<td>15</td>
<td>2/1.5</td>
<td>55/15</td>
<td>L</td>
<td>Facial paresis</td>
<td>Pergolide, 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>Slight dysarthria</td>
<td>Selegeline, biperiden</td>
</tr>
<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>
<td>Facial paresis, hypophonia</td>
<td>Pergolide, selegeline</td>
</tr>
<tr>
<td>6</td>
<td>55</td>
<td>M</td>
<td>13</td>
<td>2.5/3</td>
<td>48/27</td>
<td>L</td>
<td>Facial paresis, aphasia</td>
<td>Selegeline, biperiden</td>
</tr>
<tr>
<td>7</td>
<td>61</td>
<td>F</td>
<td>15</td>
<td>2.5/4</td>
<td>55/NO</td>
<td>R</td>
<td></td>
<td>Clozapine, temazepam, cisispine</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 antiparkinson medication; SNP=not performed.

**Letters, Correspondence, Book reviews, Correction**


**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.3,4 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.5 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 line, 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 having levodopa. In four patients the hiccups appeared 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 hiccups. The pallidotomies improved parkinsonism in the “off” state (table), contralateral dyskinesias, and pain accompanying Parkinson’s disease. Six patients had transient adverse events: four patients had transient facial paresis postoperatively and two had 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.

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 an infarct.

We never encountered hiccups in 150 other stereotactic procedures for Parkinson’s disease, such as thalamotomies or deep brain stimulation electrode implantation in the thalamus and therefore it is unlikely that medication or positive contrast medium ventriculography with Iohexol evoked the hiccups. A possible cause for the transient hiccups 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 hiccups as an adverse event after functional stereotactic surgical interventions, nor after lesions of other aetiology involving the striatum. 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. 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.

In two previous studies4 5 we have shown that stroke patients with emotionalism have more symptoms of psychological disorder than do patients without emotionalism. In the present study, we explored further the psychological characteristics of stroke patients with 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, passive, or avoidant 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 committees.

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; 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. 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>GHQ-12*</th>
<th>Recovery locus of control scale</th>
</tr>
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<tr>
<td>MASS = Mental adjustment to stroke scale.</td>
<td></td>
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<tr>
<td>Impact of events scale intrusion subscale**</td>
<td></td>
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<tr>
<td>Impact of events scale avoidance subscale*</td>
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<tr>
<td>MASS Fighting subscale</td>
<td></td>
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<tr>
<td>MASS Anxious preoccupation subscale*</td>
<td></td>
</tr>
<tr>
<td>MASS Fatality subscale*</td>
<td></td>
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<tr>
<td>MASS Avoidance subscale</td>
<td></td>
</tr>
<tr>
<td>MASS Helplessness/hopelessness subscale**</td>
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</table>

Mass = Mental adjustment to stroke scale. *p<0.05; **p<0.01, t-tests.

<table>
<thead>
<tr>
<th></th>
<th>No emotionalism</th>
<th>Emotionalism</th>
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<tr>
<td>(n=15)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
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<tr>
<td>GHQ-12*</td>
<td>3.2 (2.4)</td>
<td>5.3 (3.5)</td>
</tr>
<tr>
<td>Recovery locus of control scale</td>
<td>33.2 (3.3)</td>
<td>34.6 (17.7)</td>
</tr>
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<td>2.9 (4.6)</td>
<td>9.2 (6.6)</td>
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<tr>
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<td>4.7 (4.6)</td>
<td>9.9 (6.1)</td>
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<td>49.1 (4.2)</td>
<td>48.3 (4.2)</td>
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<tr>
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<td>22.2 (2.8)</td>
<td>25.2 (4.0)</td>
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<tr>
<td>MASS Fatality subscale*</td>
<td>20.0 (1.9)</td>
<td>21.3 (2.2)</td>
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<tr>
<td>MASS Avoidance subscale</td>
<td>1.7 (0.8)</td>
<td>1.9 (0.8)</td>
</tr>
<tr>
<td>MASS Helplessness/hopelessness subscale**</td>
<td>10.9 (2.5)</td>
<td>14.1 (3.5)</td>
</tr>
</tbody>
</table>

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. This study was completed as part of work for the degree of D Clin Psych at Leeds University (SE).

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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. 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 onconecrosis 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. ISAAC E SILVERMAN
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Tetradoxin intoxication in a uraemic patient

Tetradoxin intoxication results from ingesting 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-
ably 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 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 *Yongeichthys nebula*), tetrodotoxin was demonstrated by thin layer chromatography, high performance 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 MU = 1/2 of the TCR strain method).

Tetrodotoxin exerts its effect through binding with and blocking the voltage dependent sodium channel.4 The voltage clamp experiments showed that tetrodotoxin diminished the sodium inward current responsible for the depolarization of excitation 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 permanently damaged and its function recovers when the bound toxin is released. In uraeemia, ion conductance through the sodium channel is also impaired. Sodium permeability through excitatory membranes is reduced and small inward sodium current and reduced action potential amplitudes are noted in experimental uraemic neuropathy.5 By contrast with the effects of tetrodotoxin, uraeemia 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 conditions occur.6 The synergistic effect of uraemia and tetrodotoxin is obvious in this incident in which the patient and her husband ingested roughly an equal amount of toxin (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 weight7 (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, prominent 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 haemodialysis7—Dehydration and 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. It has a low molecular weight (C11H17N3O8), is water soluble, 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 assisted 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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4 Tam L. Toxicological studies on tetrodotoxin in Japan. Tohoku-Jihin (Tokyo) 1945:103.

Relation between critical illness polyneuropathy and axonal Guillain-Barré syndrome

The clinical entity critical illness polyneuropathy occurs almost exclusively in patients in critical care units and has been characterised as a complication of sepsis and multiple organ failure.1 Critical illness polyneuropathy 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. The CSF was only absent, indicative of a predominantly demyelinating process. Knowledge of this type of polyneuropathy is of help in making the correct diagnosis and selecting suitable treatment 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 al4 have made an important 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 al4 reported, it is difficult to distinguish 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 impairment.

The first step by Bolton et al4 in determining 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 differences between the two types of polyneuropathies. Patients with Guillain-Barré syndrome had greater slowing of the speed of impulse conduction, and, in the initial stages, abnormal spontaneous activity in the muscle was absent, indicative of a predominantly demyelinating polyneuropathy. The CSF was notably 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.8 Zochodne et al4 (excluding 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 Guillain-Barré syndrome with acute flaccid paralysis without regard for the underlying physiology or pathology. Classic pathological studies of Guillain-Barré syndrome, however, have identified prominent demyelination and inflammatory infiltrates in the spinal roots and nerves. Guillain-Barré syndrome often has been considered to be synonymous with the pathological designation of acute inflammatory demyelinating polyneuropathy, and clinical and morphological similarities consistent with demyelination have been taken as supportive evidence for the diagnosis of Guillain-Barré syndrome. Feasby et al4 (with Bolton) therefore called attention to patients who were clinically considered as having Guillain-Barré syndrome, but who were characterised electrophysiologically 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 demyelination. Such patients often had severe paralysis and made a slow recovery presumably reflecting the need to regenerate axons rather than remyelination. Pathological findings are consistent with axonal degeneration without demyelination. Feasby et al4 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 al4 then confirmed the existence of the acute motor-sensory axonal neuropathy (AMSAN) pattern of Guillain-Barré syndrome described by Feasby et al.4

It is caused by the gram-negative bacteria *Corynebacterium jejunum*, a leading cause of...
of acute diarrhoea, commonly precedes the development of Guillain-Barré syndrome. There is a close association between axonal Guillain-Barré syndrome and antecedent C jejuni infection. The antecedent infectious symptom was diarrhoea in three of five patients with antecedent Guillain-Barré syndrome described by Feasby et al. Observations by Griffin et al confirmed that AMSAN 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 lipopolysaccharides 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, Hagenese 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 was complicated by an acute 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 AMSAN. 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.

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Table

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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 H 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 alsoneeds 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 thoughts and 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 precede 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 \(^4\) 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 they have the function of the part of the brain that normally works to make us think that we have conscious freedom of will. They develop the experience, therefore, of becoming mere remote spectators to the actions of their bodies.

Defenders of human “free will” argue what happens before the brain itself decides to act is still unknown, and there may be a role for our own autonomy there. But even these free will guardians concede the neurological research indicates that whatever happens before the brain is roused, must occur below our conscious awareness.

Yet in alien hand syndrome the patient thinks that the hand has hostile motivations; it is invariably the case that the patient not only thinks that the limb is “not self” but finds that the limb behaves towards the self in a destructive and aggressive manner. This could be explained by the hypothesis that if we lose our conscious sense of voluntary control over our bodies, our minds have to come up with an explanation for the location of action of our movements. We decide that if ourselves are not in control, then someone or something else must be; therefore, we no longer have a sense of the limb belonging to us.

Because to lose control over our bodies is one of the most terrifying experiences, our attempt to explain this finding occurs in the context of fear. It may be that our apprehension leads us to misinterpret innocent reflexive acts of our hands, such as scratching or rubbing, as malevolently inspired. Plus it could be that our interpretation of spurious possession in turn inspires us to believe only this is our conscious awareness. It may therefore be that we need to believe in our own free will and personal control over our bodies, because if we did not have the experience of our bodies acting as if we merely came along for the ride, too frightening. Also, we may no longer believe that our bodies or its relevant parts belong to us. All neurologists who have reported alien hand syndrome remark on how psychologically disturbing the symptom is for the patient. Psychiatrists would be interested in the parallels between alien hand syndrome and the split personality phenomenon. So the fact that in every case, plus the fact that the two diseases may share corpus callosum pathology,\(^5\) could go some 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 imputes negative intent to the alien limb might not be an incidental finding, but a core aspect of the disorder.

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 “sensory 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 their pattern of sensory activation that accompanies our own limb movements. When this pattern never reaches specific cortical regions, then the limb is not perceived as self; called “amorphosis” by Denny-Brown and Banker.

Sensitization 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 “motor” 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 whose 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 also affected 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. In a recent study by Heilman’s group entitled “Vasomotor reactivity is exhausted in transient ischaemic attacks with limb shaking”, patients with alien hand syndrome and related intermanual conflict were irritated by but not terrified by their opposing limbs simultaneously.

These patients rarely deny that the affected limb belongs to them. Instead, they understand it in terms of their “another 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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Bauamgarter and Bauamgarter 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. Patients with attacks of transient ischaemic attacks of the limbs have no EEG evidence of epileptic activity, and inhibitory movements do not stop after administration of anticonvulsant therapy. 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 for the homolateral hemisphere were presented. This is in accordance with the finding that the inhibitory movements as well as the sensorimotor deficits of Kaplan’s patient were not related to paraesthesia.

The pathogenesis of TIAs may be due to disintegration of subcortical control mechanisms as a result of ischaemia.

In our opinion, it is not clear whether the asterixis-like movement of the outstretched right arm of Kaplan’s patient are due to epileptic seizures, because unilateral asterixis of the outstretched arm has been reported with contralateral vascular lesions affecting almost all cerebral structures involved in the homolateral hemisphere. All cerebral structures involved in the homolateral hemisphere are involved in the homolateral hemisphere. All cerebral structures involved in the homolateral hemisphere are involved in the homolateral hemisphere.


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 second year 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 lesion”. The “grey case” section, for instance, includes questions on multiple sclerosis, cluster headache, and HSV encephalitis, while broadening the topics to include postinfective demyelination, chronic hemi-craniation, and acute haemorrhagic encephalomyelitis. 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 characteristic EEG of Creutzfeldt-Jakob disease? I sure hope not. Finally, the slide tests are disappointing. If anything, neurology lends itself best to this section of the written examination but it is let down by the poor quality of some of the images in this book. This is especially unfortunate, as other images in the same section are remarkably impressive. The Sturge-Weber skull radiograph and central pontine myelinolysis MRI are beautiful. In Sturge-Weber skull radiograph and central pontine myelinolysis MRI are beautiful. The place of such a book within a neurologist’s library has to be questioned. There are a plethora of high quality textbooks devoted to all aspects of multiple sclerosis, all well illustrated and most in colour. They provide in depth analysis of all aspects of the disease and although their illustrations tend to be smaller this is where I would choose to spend my money. It may be that the circulation of this book will be higher than expected as it is likely to be a popular choice for some pharmaceutical companies.

NEIL ROBERTSON


This monograph is the latest to be produced by the American Association of Neurological Surgeons as part of its Neurosurgical Topics series. It begins by tracing the history of calvarial reconstruction from ancient times. There follows a discussion of the different autologous donor sites and synthetic materials currently used. The operation of calvarial and facial defects. The merits, disadvantages, and contraindications of each are considered. Dural substitutes are then dealt with in similar fashion. Specific problems, such as scalp reconstruction of comminuted frontal sinuses fractures, and reconstruction of the anterior skull base are the subject of separate chapters. The final part of the book is devoted to craniomaxnistry. 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 multisuture 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 bewildering variety of autologous, synthetic, and xenograft materials which are available when vascularised pericranial tissue is not an option. Craniomaxnistry is a topic which is covered very well in standard paediatric neurosurgical 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


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 Cruveilhier’s plates to histopathological specimens and also a heavy leaning to imaging particularly magnetic resonance scanning, as might be expected. There is no doubting the aesthetic impact of this short book. In addition, the fact that these illustrations emanate from a well established figure in the multiple sclerosis world and are likely to be a representative set of personal teaching slides from a successful academic career all vouch for the provenance and informative nature of the atlas. However the place of such a book within a neurologist’s library has to be questioned. There are a plethora of high quality textbooks devoted to all aspects of multiple sclerosis, all well illustrated and most in colour. They provide in depth analysis of all aspects of the disease and although their illustrations tend to be smaller this is where I would choose to spend my money. It may be that the circulation of this book will be higher than expected as it is likely to be a popular choice for some pharmaceutical companies.

NEIL ROBERTSON


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 for converting following analysis of the amplitude rather than the frequency of the reflected ultrasound beam. In addition, echoncontrast agents are now available which can increase the signal to noise ratio and thus help detection of 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 46 areas which may be less immediately suitable for ultrasound study. For example, the findings in head trauma, tumours, psychiatric disorders, and movement disorders are the subject of separate chapters. Although I have no problem with enthusiasm for this technique a little pragmatism would not go amiss. A more balanced discussion of the limitations as well as potentialities of the technique could have been applied.

As with any book with multiple authors there is some variation in style and overlap, particularly in the introductions and conclusions of the chapters. Nevertheless, it is a comprehensive current review of transcranial colour coded sonography. Although the reader must decide exactly how this technique fits into clinical practice the book will certainly stimulate some ideas.

PETER MARTIN


This is volume 4 of a series entitled Neurological Disease and Therapy, series editor W J C Koller. This volume is edited by an American surgeon and two British neurophysiologists. Most of the 45 contributors are American or British, almost half of whom, including Dr Cole, are from Southampton. The book begins with a pathophysiological
introduction setting the scene for the five main disease sections covering developmental/genetic 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 therapy in 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 surgeons, especially to 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, being 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 socioeconomic 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 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 Issues 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. This 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:


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 (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.
Sensory alien hand syndrome

R PERSAUD

J Neurol Neurosurg Psychiatry 1999 67: 130-131
doi: 10.1136/jnnp.67.1.130

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