SHORT REPORT

Focal (segmental) dyshidrosis in syringomyelia

Kazumasa Sudo, Naoto Fujiki, Sachiko Tsuji, Minoru Ajiki, Takuya Higashi, Masaaki Niino, Seiji Kikuchi, Fumio Moriwaka, Kunio Tashiro

Abstract
The features or mechanisms of dyshidrosis have not been sufficiently clarified. Neither has the difference between hyperhidrosis and hypohidrosis. To clarify the features and mechanisms of dyshidrosis (hyperhidrosis and hypohidrosis) in syringomyelia, the clinical features focusing on hidrosis of 30 patients with syringomyelia and Chiari malformation located from a syringomyelia database were prospectively analysed. The patients were classified into three groups: eight patients (26.7%) had segmental hypohidrosis, 10 (33.3%) had segmental hyperhidrosis, and 12 (40.0%) had normohidrosis. We found that the Karnofsky functional status for the hyperhidrosis and normohidrosis groups were significantly higher than for the hypohidrosis group (p=0.0012), with no significant differences between the hyperhidrosis and normohidrosis groups.

The duration from the onset of syringomyelia to the current dyshidrosis was significantly longer in the hypohidrosis group than in the hyperhidrosis group (p=0.0027). A significant correlation was identified between the duration from the onset of syringomyelia to the time at study and the performance score (r=0.599, p=0.0003). The results substantiate previous hypotheses that in its early stage syringomyelia causes segmental hyperactivity of the sympathetic preganglionic neurons, and hyperactivity of these gradually subsides as tissue damage progresses. Focal hyperhidrosis may be regarded as a hallmark of a relatively intact spinal cord, as well as normohidrosis.

Keywords: syringomyelia; Chiari malformation; dyshidrosis; sympathetic preganglionic neuron

Methods

Patients and Methods

We have stored clinical data of a consecutive 34 patients (0.28%) with MRI confirmed syringomyelia and Chiari malformation among the 11 967 outpatients who visited our neurology clinic from April 1989 to November 1996. Three quarters of the patients came without referral, and a quarter came with referral. Our outpatient clinic is not only a primary but also a secondary and tertiary centre for diagnosis and treatment of all neurological disorders. The case records of each patient showed that there had been no referral bias to our clinic as a consequence of our interest in dyshidrosis in syringomyelia. The protocol includes items for the autonomic nervous system as well as other systems. The data were obtained prospectively, with the intention of avoiding any predetermination bias, according to a protocol for examining patients with syringomyelia, which we ourselves designed. At the time of registration for this study, we obtained informed consent from patients to enter their information into our study database. Four of the 34 patients were dropped from the study because they refused to give us permission to employ clinical information about themselves for any clinical study; this left 30 patients. Twelve of these patients were operated on for syringomyelia, and we completed entering their information at the time of the operation.

Protocol for Examining Dyshidrosis

We obtained detailed clinical information for each patient, including their previous experience of hidrosis. A structured protocol was used to examine the state of hidrosis: step 1 asking about the nature and distribution of the hidrosis and the effects of room temperature, exercise, clothing, psychological burdens, food, etc; step 2 examining the state of hidrosis by observation, manual examination, and drawing a metal spoon across the surface of the skin (spoon test) either after adequate physical exercise or when lying in a bed warmed in advance by electric blankets. When further investigation was necessary to clarify the nature and distribution of dyshidrosis, the following steps were performed: step 3 taking a thermograph in a room at a temperature of 21–28°C; step 4 a hidrosis examination (the iodine-starch method) at a room temperature of 45–50°C, or in a bed warmed in advance. Consequently we
performed thermography in 16 patients, and the iodine-starch method in nine patients. We assessed the performance status by Karnofsky performance score (K score); this ranges from 0 to 100, and the higher the score, the better the performance.\textsuperscript{13}

**CASE RECORDS**
(See also our previous case records for three patients with hyperhidrosis\textsuperscript{14}).

Patient 18 (hyperhidrosis; 37 year old woman) had a 7 month history of persistent hyperhidrosis and pain in the left upper quadrant of the body. There was no muscle weakness or atrophy. Thermography showed low temperature in the left upper quadrant, which was consistent with hyperhidrosis of the area (figure A). She underwent an operation (a syringosubarachnoid shunt) 7 months after onset, after which hyperhidrosis and pain subsided within a week, as indicated by thermography (figure B).

**STATISTICAL ANALYSIS**
We performed a statistical analysis of five factors (age at time of study, age of onset of symptoms, duration from onset of symptoms to time of study, K score, and duration of follow up period) for the three groups of patients (hyperhidrosis, normohidrosis, and hypohidrosis) by one way factorial analysis of variance (ANOVA) (Fisher’s PLSD method as a post hoc test), and for two factors (age of onset of current dyshidrosis and duration from onset of symptoms to current dyshidrosis) between the two groups of patients (hyperhidrosis and hypohidrosis) by non-paired \textit{t} test. We then obtained the Pearson’s correlation coefficient for duration from onset of symptoms to time of study, and K score for all 30 patients.

**Results**
Of the 30 patients, eight (26.7%) had hypohidrosis, 10 (33.3%) had segmental hyperhidrosis, and 12 (40%) had normohidrosis. In all patients, the distribution of dyshidrosis corresponded with the location of the syrinx and other neurological manifestations; the syrinx was located roughly in the region from the central canal to the unilateral (or sometimes bilateral with asymmetry) posterior angle of the spinal cord.

We have summarised the results of the statistical analyses in the table. Although we

![Thermograph of patient 18 before (A) and 11 days after (B) surgical decompression of syrinx (anterior views). Temperature asymmetry has resolved immediately after decompression of the syrinx.](http://jnnp.bmj.com/)

<table>
<thead>
<tr>
<th>Item</th>
<th>Hypohidrosis</th>
<th>Hyperhidrosis</th>
<th>Normohidrosis</th>
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<td>Number of patients</td>
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<td>10</td>
<td>12</td>
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<td>Mean (SD)</td>
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<td>5.50 (4.70)</td>
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*\textsuperscript{*}One way factorial ANOVA (Fisher’s PLSD method).
†Non-paired \textit{t} test.
§Statistically significant.
|| \textit{p} value for each pair of items: hyperhidrosis \textbullet hypohidrosis 0.1148; hypohidrosis \textbullet normohidrosis 0.0078; normohidrosis \textbullet hyperhidrosis 0.2194.
|| \textit{p} value for each pair of items: hyperhidrosis \textbullet hyperhidrosis 0.0007; hypohidrosis \textbullet normohidrosis; 0.7282; normohidrosis \textbullet hypohidrosis 0.0012.
ourselves were not able to confirm any change in the features ofhidrosis during the follow-up period, the clinical histories of five patients indicate that hidrosis decreased segmentally and diffusely over a long period. Duration from onset of symptoms to study was significantly longer in the hypohidrosis group than in the hyperhidrosis group (p=0.0027). There were no significant differences between hidrosis groups in the other factors. A significant correlation between the two items (duration from onset of symptoms to study, and K score) was recognised (r=−0.599, n=30, p=0.0003).

Discussion

We performed a MEDLINE search for publications dealing with dyshidrosis in syringomyelia between January 1966 and June 1997, with a language limitation of English, German, and French. This search confirmed the scant accumulation of information regarding dyshidrosis in syringomyelia; we were able to locate only four cases accompanied by Chiari malformation (three of which we have already reported and are currently included in this study).

We previously speculated that hyperhidrosis is caused by stimulation of sympathetic preganglionic neurons (SPGNs) rather than interference to the inhibitory tract. This is equivalent to the hypothesis regarding body hypertrophy which we recently presented. Later, disinhibition of the inhibitory local interneurons (ILINs), which are located in the vicinity of SPGNs, was supposed to be the cause of segmental hyperactivity of the SPGNs. When, in the clinical course of syringomyelia, slowly progressive tissue damage around the syrinx reaches the lateral horn, it will segmentally affect the SPGNs or adjacent structures. This time our results have shown, from the viewpoint of sweating, that there evidently is a hyperactivity of the SPGNs as long as the disability is mild; however, as the disability progresses, the hyperactivity gradually decreases and is replaced by hypoactivity (table).

We have a choice of two possibilities for the mechanism responsible for the hyperactivity of the SPGNs so far; the first is that the SPGNs are stimulated directly by a minimal tissue damage; the second is damage to the ILINs (preceding the damage to the SPGNs)—we have recently acquired some knowledge of these ILINs. In either case, as the disease progresses, hyperactivity will shift to normoactivity and finally to hypoactivity because of progressive and irreversible damage to the SPGNs, consistent with the clinical history of five of our eight patients with hypohidrosis. By contrast, immediate resolution of hyperhidrosis after decompression of the syrinx in patient 18, whose disability was minimal, showed that the damage to the SPGNs was mild and tends to be reversible in patients with mild disability (figure). Before we reached the above hypothesis for the mechanism of hyperhidrosis, we had ruled out the possibility of interference to the inhibitory tract that connects the upper centre and the SPGNs as before because of the segmental distribution of hyperhidrosis and because of the locational relation among the syrinx, inhibitory tracts, and SPGNs.

Current results substantiate previous speculation about the mechanism of and relation between hyperhidrosis and hypohidrosis in syringomyelia. We now think that, in syringomyelia, focal hyperhidrosis can be regarded as a hallmark of a relatively intact—even though slightly damaged—spinal cord. We also think that, in syringomyelia, some part of normohidrosis is associated with a considerable amount of spinal cord damage. We propose that in diagnosing focal dyshidrosis, more attention should be given to the possibility of syringomyelia.

We are indebted to Drs Kazuto Hiroshi Abe (Department of Neurosurgery, Hokkaido University School of Medicine) for their help in providing us with clinical information regarding surgical treatment. This study was supported by Research Grant (SB-3) for Nervous and Mental Disorders, from the Japanese Ministry of Health and Welfare.

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doi: 10.1136/jnnp.67.1.106

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Letters to the Editor

Behavioural status during the intracarotid amobarbital procedure (Wada test): relevance for surgical management

Presurgical evaluation in many epilepsy programmes often includes the intracarotid amobarbital procedure (IAP). Sodium amytal is injected into the internal carotid artery to produce a temporary “pharmacological paralysis” of hemispheric function. Traditionally, the IAP has been employed in patients with refractory temporal lobe epilepsy being considered for anterior temporal lobectomy. In these cases it is used to determine cerebral dominance for language,1 to assess the risk of severe postsurgical amnesia and to predict postsurgical material specific memory changes.2 More recently, the use of the IAP has been extended to compliment EEG localisation and radiological data by lateralisng temporal lobe dysfunction.

The IAP has had a hitherto unrecognised role in patients with refractory frontal lobe epilepsy being considered for fronto lobectomy. Specifically, observation of behavioural function during the period of the ablation may provide useful information about the integrity of the contralateral frontal lobe. This is particularly relevant in those candidates with a history of cerebral trauma in whom damage to the bifrontal lobe is known or suspected. A review of the IAP studies performed on patients with temporal lobe epilepsy in our comprehensive epilepsy programme (1991–8) suggests that the emergence of frontal lobe behavioural features is common in patients in whom the astology leads to the suspicion of bifrontal compromise (for example, a history of traumatic head injury). By contrast, these features rarely occur in cases of non-traumatic astology, in which the integrity of frontal lobe systems is presumed. Although it remains an incidental finding in the context of determining the suitability of a candidate for anterior temporal lobectomy, this outcome may have potential implications for the selection of patients for frontolobectomy.

We report a case of frontal lobe epilepsy secondary to a traumatic head injury. Out of concern for untoward postoperative behavioural change, we employed the IAP in an attempt to predict the risk of a frontal lobe syndrome.

A 39 year old man had a 23 year history of severe refractory epilepsy. The seizures postdated a road traffic accident at the age of 12 years when he sustained a head injury with an ill defined period of loss of consciousness. Seizures commenced within months of that injury and, although initially well controlled, became refractory within a few years. The seizure types included staring spells, violent tonic-clonic seizures, and atonic drop attacks. He had complications from his epilepsy including a fractured jaw, two episodes of severe burning due to seizures while showering, multiple episodes of postictal confusion and probable postictal psychomotor, a lung abscess secondary to aspiration, and episodes of status epilepticus. Intracarital EEG recordings showed bilateral generalised spike and wave discharges at around 2 Hz-5 Hz with some mild increase in bilateral slow activity and no convincing evidence of electrographic focalisation. Video EEG monitoring showed apparent generalised seizures without any focal onset on scalp EEG. Brain MRI disclosed a well defined atrophic lesion involving the left hemisphere, a consideration likely to be post-traumatic in origin. Interictal FDG PET and HMIO SPECT disclosed hyperfusion in the left anterior frontal region commensurate with the abnormality shown on MRI. Although his electroclinical pattern was suggestive of symptomatic generalised epilepsy, because of the left frontal lesion, seizure onset from that region was considered likely.

On neuropsychological examination, his general cognitive function was normal. At a behavioural level, however, he presented as very peurile in manner with a very rigid, inflexible cognitive style. The neuropsychological opinion was of a mild fronto lobe syndrom consistent with the history of traumatic head injury. There was no current evidence of psychiatric disorder. Although having successfully passed his final year of secondary school (together with several courses of advanced education), he had remained unemployed due to his seizures. He was socially isolated and his interpersonal relationships were limited.

He had severe life threatening epilepsy with the surgical evaluation of the remaining avenue of treatment. However, as surgical management would involve resection of the left frontal lobe against a background of traumatic head injury and the possibility of more generalised frontal lobe dysfunction, a left hemispheric IAP was performed. Sodium amytal (125 mg) was administered via a slow hand injection. Of relevance, no crossflow into the contralateral anterior cerebro artery via the anterior communicating artery was present (as assessed by a separate injection of contrast medium). The injection was accompanied by a dense right hemiaglum and global aphasic arrest. Resolution of language was characterised by a dense perseveration of counting which could not be influenced by the examiner. Despite normal comprehension, he showed severely impaired capacity for motor regulation (go-no go paradigm), together with marked behavioural disinhibition (agitation, swelling, verbosity, childishness). Although seemingly aware of some aspects of his behaviour (apologising for swearing), he seemed unable to modify his responses. The overall impression was of a pronounced frontal lobe syndrome, suggesting that the right frontal lobe had incurred some damage secondary to the documented head trauma and that he must have been reliant on some left frontal contribution.

On the basis of the IAP findings, a selective cortical resection (as opposed to more extensive frontal lobe resection leading to the region of damage was advised. Intraoperative electrocortigraphy showed active focal epileptiform discharges maximal in the inferior frontal lobe in the electrodes closest to the lesion. A cortical resection was performed with frameless stereotaxy guidance excision of the frontal lesion. Histopathology on the resected tissue showed an old post-traumatic cyst involving the cortex and white matter. His postoperative course was unremarkable. When reviewed 3 months after surgery he was seizure free. His performance on neuropsychological evaluation remained commensurate with presurgical status. There were no novel subjective complaints. Mood, behaviour, and temperament remained stable.

Despite its undoubted value in many individual cases of temporal lobe epilepsy, the IAP has remained a controversial assessment instrument.1-3 Amid this controversy its potential usefulness in other patient groups seems to have been overlooked. A primary criticism of its use in temporal lobe epilepsy has been the question of irrigation and whether the medial temporal lobe is adequately “disabled” during the procedure. This particular limitation is not applicable in the patient with frontal lobe epilepsy, as the region of interest is clearly ablated via supply from the carotid arterial system. Caution must, however, be exercised with respect to possible crossflow into the superior cerebrobral artery via the anterior communicating artery. When such crossflow is present, the ability to assess validly the integrity of contralateral frontal lobe function will be confounded by virtue of a pharmacologically induced bilateral frontal lobe syndrome. As with the use in cases of temporal lobe epilepsy, only a restricted form of assessment is possible with the frontal lobe patient during the period of ablation. An attempt of assessing the potential outcomes of such crossflowing on issues of behavioural regulation would seem most useful.

It should be borne in mind that the degree of frontal lobe dysfunction induced by the IAP represents the worst confounding of the entire frontal lobe is included in the ablation. There are likely to be few surgical scenarios in which a comparable extensive resection of tissue is likely to be considered, and results must be interpreted in this context. This limitation notwithstanding, the IAP does seem to have a role in separating out those patients in whom more extensive frontal lobe resections could be considered, but opposed to those in whom a more conservative approach is warranted.

This case report forms only the basis for a novel hypothesis that clearly requires more rigorous scientific research before its clinical utility can be reliably established. Nonetheless, we think that it is worth drawing the attention of the epileptological community to the potential application of the IAP in the surgical management of extratemporal cases.

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Reversal of tetrabenazine induced depression by selective noradrenaline (norepinephrine) reuptake inhibition

Tetrabenazine (TBZ), a synthetic benzoquinolizine, was first introduced as a neuroleptic agent in 1960, and is now widely used in the treatment of hyperkinetic movement disorders such as chorea, tics, or tardive dyskinesia. The side effect profile is predominantly characterised by the triad of drowsiness/fatigue, parkinsonism, and depression; depression is found in about 15% of patients treated with TBZ.1 We here report on the rapid reversal of depressive symptoms in a patient treated with TBZ for orofacial dystonia by administering the new and highly selective noradrenaline (norepinephrine) reuptake inhibitor (SNRI) reboxetine.2

On admission, the 64 year old woman presented with perioral and lingual hyperkinetiasis as well as intermittent and involuntary movements of her lower jaw, which had lasted for about 2 years, causing her a considerable impairment in her daily life. No history of neuroleptic treatment or Parkinson's disease was evident. Her cranial CT and blood chemistry were normal. We diagnosed a segmental dystonia, which improved dramatically after a taper of a tetrabenazine medication (60 mg a day). This successful treatment response, however, was accompanied by a severe depressive syndrome, which was characterized by a mixed anxious-depressive mood, low self esteem, a complete loss of drive, and intermittent suicidal ideations. After switching from TBZ to tiapride, the patient recovered from depression, but her neurological status worsened significantly. The re-exposure to TBZ again ameliorated hyperkinetiasis, but provoked a depressive relapse. A comedication with reboxetine (6 mg/day), a new and selective noradrenaline reuptake inhibitor, finally led to a stable remission of the depressive symptoms within a week, without any worsening of the dystonic syndrome.

Tetrabenazine (TBZ) is known to act as a monoamine depleting and dopamine receptor blocking drug.3 In more detail, TBZ binds to and inhibits specifically the human vesicular monoamine transporter isoform 2 (hVMAT2). Whereas the indoleamine serotonergic system forms a similar affinity for both hVMAT1 and hVMAT2, catecholamines such as noradrenaline exhibit a threefold higher affinity for hVMAT2.4 As these specific transporters are responsible for packaging monoamine neurotransmitters into presynaptic secretory vesicles for release by exocytosis, the inhibition of hVMAT2 by compounds such as tetrabenazine thus results in consecutive noradrenaline depletion.5

Alterations of noradrenergic neurotransmission—that is, a neuronal noradrenaline depletion—can therefore be postulated to form one major origin of TBZ induced depression, in line with this assumption, brain-specific catecholaminergic activity enhancers (CAEs) such as phenylethylamine have been shown to antagonise TBZ induced depression-like behaviour in rats.6 Modulating this altered noradrenergic neurotransmission pattern by the administration of selective noradrenaline reuptake inhibitors such as reboxetine may thus provide a new, specific, and fast acting tool in the management of depression caused by TBZ and related (neuroleptic) compounds.

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2 Montgomery S. Specific and additional benefits of reboxetine may thus provide a new, specific, and fast acting tool in the management of depression caused by TBZ and related (neuroleptic) compounds.

Spinal sulcal artery syndrome due to spontaneous bilateral vertebral artery dissection

In young adults vertebral artery dissection (VAD) is an important cause of brain infarction.1,2 A known mechanism is microtrauma due to abrupt head movements for example, chiropractic manipulations. In addition a pathogenetic role of connective tissue diseases, cystic media necrosis, fibromuscular dysplasia, migraine, and inflammatory diseases has been postulated.3 In VAD initial neck pain is often reported which may be slight. Lesions caused by VAD are cerebellar or brainstem infarcts, unilateral or bilateral thalamic infarcts (top of the basilar syndrome), or infarctions in the posterior cerebral artery territory due to intra-arterial embolism or haemodynamic decompensation when collaterals are insufficient.4 Lesions of the spinal cord are rare because of its good collateral supply.5 We report on a patient with a syndrome of the spinal sulcal artery (incomplete Brown-Sèquard syndrome) caused by spontaneous bilateral VAD.

A 43 year old man with a history of arterial hypertension presented with left sided numbness sparing the face, which had evolved suddenly while he was walking. In addition, he reported on dull right sided neck pain irradiating into the occiput, which had been initiated by a head rotation while he was working at a computer 2 weeks before. The neck pain had spontaneously ceased 6 days later. Neurological examination disclosed dissociated sensation defect on the left with an indistinct level around C4 to C6. Below this level on the left he had a marked hypalgesia and nearly a loss of temperature sense. The right limbs were warmer than the left ones. In addition, we found mild right sided motor system deficits. Cranial nerve function was intact, despite a right sided hemiparesis and the different temperature sensation in the limbs resolved completely within 3 weeks.

Tibial nerve somatosensory evoked potentials (SSEPs) had regular N22 and P40 latencies and amplitudes. Central motor conduction time (CMCT) and transcranial magnetic stimulation was prolonged to the right abductor digiti minimi (9.2 ms) and tibialis anterior (23.1 ms). The CMCT to the left target muscles was normal. Duplex sonography showed increased flow velocity on the level of the cervical vertebrae 3 to 5 with a maximum of 214 cm/s in the right and 197 cm/s in the left vertebral artery. Colour mode showed irregular narrowings of the lumen indicating dissections.

Cervical MRI showed a spinal cord infarction at the level C2 (figure). The circumference and dorsal part of the cord were not affected. In digital subtraction angiography (DSA) both vertebral arteries had string signs in the V1 and V2 segments with collateral flow to the distal V2–4 segments via the throcervical trunk (cervical ascendent artery) and the costovertebral trunk also. The anterior spinal artery was incompletely contrasted by unilateral spinal branchings of the right vertebral artery. They originated at the level of dissection. The intradural origins of the anterior spinal artery (A5 and A7) could be seen distinctly. The vertebral arteries (V4 segment) were not visible.

Bilateral spontaneous VAD is not rare, but often missed. In most cases, microtrauma preceding the dissection can be recalled by the patients. Due to the mild mechanical impact, the action of predisposing factors might be postulated. Among these may be changing in type III collagen, migraine, fibromuscular dysplasia, infections in the near past, and inflammatory vasculopathy.6 Magnetic resonance imaging with typical semilunar mural haematoma and in addition magnetic resonance angiography (MRA) with complementary documentation of an irregular or tapering occlusion have a high sensitivity and specificity in cases of internal carotid artery dissection.7 By contrast, mural haematomas of the VA especially in the V1 and the V3 segments are often not detectable by MRI. In cases of unclear non-invasive findings, DSA is still the method of choice.8

In addition to consecutive brain infarctions, cervical spinal cord infarctions and nerve root compression syndromes may occur in cases of unilateral or bilateral VAD. Probably as a result of the pial collateral network and the dual posterior spinal artery, spi...
Cerebral cavernous malformations are vascular malformations mostly located in the CNS. Their frequency is estimated close to 0.5% in the general population. Cerebral cavernous malformations occur as a sporadic or hereditary condition. From the Hispanic-American population, familial forms were reported with a high frequency. CCM1, a hitherto unidentified gene mapping on chromosome 7 was shown to be involved in all families with cerebral cavernous malformations of Hispanic-American descent with a strong founder effect. Around 50% of non-Hispanic-American families showed linkage to CCM1 but no common haplotype was found. A recent study showed linkage of cerebral cavernous malformations to two additional loci. No Spanish family with cerebral cavernous malformations has been analyzed so far.

We report herein a genetic linkage analysis conducted on nine Spanish families with cerebral cavernous malformations. All procedures were approved by an ethics committee. The families were unrelated and originated from different regions of Spain (south west (CVE2, 3, 4, 10, 17, 25), central (CVE24), south east (CVE28), and north east (CVE29). Seventy seven subjects including 55 potentially informative meioses and 12 spouses gave their informed consent. They were examined by a board certified neurologist, underwent cerebral MRI, and blood samples were taken. Magnetic resonance imaging was used to establish status for linkage analysis. Thirty four members had MRI diagnosis of cavernomas and were considered as affected. Among them, 14 experienced neurological symptoms (cerebral haemorrhage n=6, seizures n=8). Nineteen members with normal cerebral MRI were considered as healthy. Twelve members without MRI investigation had an unknown status. Analysis of pedigrees was consistent with an American haplotype.

(A) Pedigrees of the nine families with cerebral cavernous malformations. Blach symbols=asymptomatic patients with cavernous angiomas on MRI; half filled symbols=asymptomatic members with cavernous angiomas on MRI; empty symbols=asymptomatic members with normal MRI; question mark=members with unknown status. (B) Comparison of the Hispano-American CCM1 haplotype and the haplotypes segregating with the disease phenotype within Spanish families. Polyomorph markers are shown on the left. Numbers indicate the sizes in base pairs. Primers used to amplify D7S2409 were di

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<td>D7S669</td>
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cerebral cavernous malformations, this haplotype is most likely not predominant in Spain, and the strong founder effect seen in all published Hispano-American families with cerebral cavernous malformations might be specific for this population.

HJ is supported by the Schweizerische Stiftung für medizinisch-biologische Studien (Switzerland), SL, by the Fonds de Recherche en Santé (Canada), PT, by the Centre des Enseignements de Neurologie et ZENÉCA pharmaceutical group. The work was founded by INSERM, Ministère de l’Enseignement Supérieur et de la Recherche, CSC, and the Fondo de Investigacion de la Seguridad Social (Fiss: 9004/07).

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Hydrocephalus caused by metastatic brain lesions: treatment by third ventriculostomy

Metastasis to the brain occurs in 20%–40% of cancer patients.1 About 20% of these metastases are located in the posterior fossa, cerebellum, and brainstem. Metastatic disease to pterional ventricular brain tissue can obstruct the cerebral spinal fluid (CSF) produced in the ventricles to the subarachnoid space where it is normally absorbed by arachnoid granulations. This typically causes an obstructive or non-communication hydrocephalus. This can be treated by placing a pressure regulating valve and into the atrium or peritoneal or pleural cavity. However, tumours in contact with CSF space can even the flow of CSF inside the brain. Although third ventriculostomy has a low operative morbidity and high probability of success, because of the low CSF space surrounding the brain, it is only commonly used on patients with aqueductal stenosis and the pediatric population. To avoid placing shunts in patients with inoperable metastatic brain tumours who typically have only a few months to live, we have seen that patients third ventriculostomy as a palliative procedure.

We performed third ventriculostomy on seven patients with hydrocephalus due to metastatic tumours of the posterior fossa or thalamus. They typically presented with symptoms of acute hydrocephalus in addition to any local mass effect of the tumour. Postoperatively, five patients were relieved of hydrocephalic symptoms and follow up brain imaging studies disclosed decreased ventricular size. Three patients had a median hospital time of 6.5 days and median survival of 5 weeks after the operation. The third ventriculostomy was performed after the palliative procedure. One patient (case 7) showed no change in the size of his ventricles compared with the scan obtained on the day of admission. The patient’s family requested comfort care only and the patient died 2 days later. In the second case (case 6) the patient had improvement in his neurological examination and ventricles size by CT scan immediately after the operation, but had recurrent symptoms of hydrocephalus 11 days later. After placement of a ventriculoperitoneal shunt, his examination returned to baseline.

Every patient except the person described in case 4 received brain radiotherapy after the palliative procedure. One patient (case 3) underwent a course of radiotherapy treatment prior to the operation. Another (case 5) had radiation to her orbit in the distant past once enucleation for retinoblastoma. Even though previous radiotherapy may be considered a contraindication for third ventriculostomy by some authors, it did not seem to affect the success of third ventriculostomy in our patients. Carcinomatous meningioma which could have caused a continuous communicating hydrocephalus was not grossly evident on examination, on any of the brain imagings, or during endoscopy. However, tumours in contact with CSF space can also cause a communication by raising CSF protein which can obstruct distal CSF space and arachnoid granulations.

Our success rate of about 70% (five of seven) for third ventriculostomy in pterional metastatic disease is consistent with the results obtained with third ventriculostomy for adult patients with secondary hydrocephalus. This is comparable with the alternative shunting with an implanted catheter which has a first year revision rate as high as 70%.
Neuronal activity alters local blood flow in brain tumour adjacent to the activating cortex

Characteristics of blood flow in brain tumours have been studied extensively; these studies are important for diagnosis of malignancy and therapy monitoring. Our study is the first to consider how activity dependent changes of regional cerebral blood flow (rCBF) alter tumour blood flow in the brain tumour adjacent to the activating cortex.

Such an interaction between cortical blood flow and tumour blood flow may be of value for evaluating mechanisms of neurological symptoms associated with brain tumours.

Neuronal activation causes an increase of regional cerebral blood flow (rCBF) in the activating cortical area. Near infrared spectroscopy (NIRS) demonstrates the increase in rCBF during neuronal activity as increases in oxygenated haemoglobin (oxy-Hb) and total haemoglobin (total-Hb) with a decrease in deoxyhaemoglobin (deoxy-Hb). NIRS is an optical method to measure concentration changes of oxy-Hb, deoxy-Hb, and total-Hb in cerebral vessels by means of the characteristic absorption spectra of haemoglobin in the near infrared range. In the present study, we measured changes of oxygenation and haemodynamics in the brain tumour adjacent to the activating cortex by means of NIRS. We found transient decreases in oxy-Hb and total-Hb in the tumour during neuronal activation, suggesting that the local blood flow of the tumour was decreased by a transient increase of rCBF induced by neuronal activation.

The patient was a 35 year old right handed man who presented with complaints of headache and dizziness. A neurological examination showed no abnormalities and a decline in language functions. A postcontrast CT showed a well defined large enhancing tumour (4×5 cm) compressing the left frontal lobe. Computed tomographic angiography showed that the branches of the left middle cerebral artery supplied the tumour (figure A). The patient underwent a left frontal craniotomy for removal of the tumour; the pathological diagnosis was meningioma. The NIRS measurement was performed before the operation.

We measured haemodynamic changes in the brain tumour during neuronal activation in the left frontal lobe induced by cognitive changes of regional cerebral blood flow and tumour blood flow were evaluated by NIRS in a healthy volunteer (figure B).
that a stealling of blood flow is one of the mechanisms. The present report supports this hypothesis.

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Migraine aura masquerading as Balint’s syndrome

Migraine is a common neurological disorder with a prevalence of 0.5% to 2% in the general population.1 In one forth of total migraineurs, headache is preceded by an aura.2 We describe a patient with recurrent episodes of migraine in whom headache was preceded by a constellation of visual symptomatic which constituted salient component of Balint’s syndrome. This syndrome, consisting of a triad of simultanopia, optic ataxia, and oculomotor apraxia, is seen with bilateral lesions of occipitoparietal cortices affecting connections between visual cortical regions and the frontal eye field.3

A 29 year old female teacher presented with an 8 year history of paroxysmal alternating hemianopic and throbbing headache which was often associated with nausea, photophobia, and occasionally vomiting. Headache used to last for about 4 to 18 hours and would respond to either ergot drugs or sumatriptan, especially if taken during the aura phase of the episode. Occasionally these visual symptoms were not followed by headache. The patient would not lose contact with the environment during or after the visual symptoms. Her mother and two younger sisters were also having paroxysmal episodes of common migraine.

Her general physical and neurological examination in between the episodes was unremarkable. Neurological examination during the aura symptoms disclosed that she was unable to see simultaneously all the objects in the visual field (simultanopia). She did omit several words while reading a paragraph. However, she could comprehend and read each and every word individually. On being shown a complex picture comprising multiple subunits she was not able to comprehend and perceive the entire picture but always able to perceive and comprehend all of the picture individually (seeing in piecemeal). These aforementioned features were consistent with simultanopia. Besides simultanopia, she had optic ataxia as evidenced by her inability to coordinate hand-eye movements. Optic ataxia was tested as follows: each eye was tested separately and the hand ipsilateral to the eye being tested was used. The target stimulus was a 5 mm long pin with a width of 2 mm placed at preselected locations. The patient was asked to touch this pin with her index finger without shifting her gaze from the fixation point. The patient had difficulty in performing this test but had no problem in reaching out to her own body parts or an auditory stimulus with her eyes closed. These features were consistent with optic ataxia. Moreover, gaze apraxia was evident by her inability to look at an object on command. However, she could do it spontaneously. In addition, she had impaired smooth pursuit and voluntary saccades in all directions. Reflex eye movements were normal. Visual acuity during the episode was 6/6 bilaterally. Visual fields were normal during the episode as demonstrated by the confrontation method. Ophthalmological examination, including perimetry performed during a symptom free period, was normal. There was no clinical evidence of Gerstmann syndrome, prosopagnosia, object agnosia, or colour agnosia. Her cranial CT and magnetic resonance angiography were unremarkable. Electroencephalography was also non-contributory. The frequency of visual aura symptoms and headache decreased considerably after the patient was started on flunarizine at a daily dosage of 10 mg at bed time. The visual impulses, after being recorded from the primary visual cortex (Brodmann area 17), are interpreted and integrated in visual association areas 18 and 19. Brodmann area 19, in turn, is connected with the angular gyrus and frontal eye field that relays visual information fibres. Any lesion in the visual association areas or their connections would result in impaired integration of visual impulses despite normal visual acuity. The visual symptom complex in this case possibly represents an aura of migraine. The pathogenesis of migraine aura has been a debatable issue.4 In this case it is suggested that the pathophysiological process of migraine aura results in a disconnection syndrome by the occipitoparietal cortex, the source of two groups of information fibres. Any lesion in the visual association areas or their connections would result in impaired integration of visual impulses despite normal visual acuity.

The visual symptom complex in this case possibly represents an aura of migraine. The pathogenesis of migraine aura has been a debatable issue.5 In this case it is suggested that the pathophysiological process of migraine aura results in a disconnection syndrome by...
invoking visual association areas and their association pathways, optic ataxia, gaze apraxia, and simultagnosia seem to represent a dissociation of visual information from the frontal eye field and dorsal parietal regions.

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ing, walking, and continent but with some persistent emotional liability and mild memory impairment. A follow up MRI examination 5 weeks after discharge showed further improvement, apart from minor abnormalities in the basal ganglia, and generalised increase in ventricular size, consistent with residual cerebral atrophy.

Rabies is caused by an RNA virus, a member of the Rhabdoviridae family, it infects mammals and can be transmitted to humans by contact, generally from an animal excreting the virus in the saliva. Rabies manifests as an acute encephalomyelitis, the development of which is almost invariably fatal. The distinction between rabies and postvaccine encephalitis is difficult and may be helped by antigen detection via a skin biopsy; however, this technique is not available in Vietnam.1 Paralytic rabies could not be excluded in this patient and hence steroids were not used initially. Steroids have been reported to increase mortality in experimental animals with rabies, and it has been suggested that they may abrogate the immune response to the postexposure vaccine, thus precipitating uncontrollable rabies.5

There are three types of postexposure vaccine in use worldwide. The Simple type (STV) is obtained from inactivated virus prepared on adult animal nerve tissue; it is inexpensive and relatively easy to produce. In India 3 million people receive postexposure courses of STV (phenolised sheep brain) antirabies vaccine each year.1 These produce neurological reactions, including postvaccination encephalomyelitis, in up to 1 in 200 courses, with a 3% mortality.1 Clinical forms include a reversible mononeuritis multiplex, and meningoencephalitic and encephalomyelitic reactions. Myelin basic protein and related neural proteins from the nervous tissue of the animal on which the virus was cultivated stimulate an autoimmune reaction in the human nervous system.

Tolerance has been improved by the development of the sucking mouse brain vaccine (SMBV).3 The attenuated virus is cultured on immature mouse brain tissue, which contains little myelin, thus reducing the risk of complications. SMBV is expensive (US$1.5 per treatment course) and easily manufactured locally; it is the most widely used postexposure vaccine in Vietnam. Rare neurological reactions do occur with SMBV, Complications of the CNS have been reported to occur after vaccination with an incidence of 1:27000 treated people, with a 22% mortality4 The mortality was particularly high (90%) if there was extensive CNS involvement. The third type of vaccine available is the human diploid cell culture vaccine (HDCV), which is both safe and efficacious. However, the recommended regimen is not affordable in most developing countries.

When we approached the Rabies Laboratory, Ministry of Agriculture and Fisheries, United Kingdom for advice in this case their comment was “why do you use the SMBV, can’t you use another vaccine”. Worldwide about 10 million people each year receive rabies vaccine after exposure; at the Centre for Tropical Diseases we treat 3000 people with dog bites annually. The cost of an HDCV in Vietnam, administered in its present regimen (1ml given for 5 days on days 0, 3, 7, 14, and 28 with an optional booster on day 90) is US$ 125, making the use of this vaccine unaffordable.

This is the first report to show the demyelinating CNS lesions on MRI, and their resolution after steroid therapy. It is relatively rare for patients to survive if they develop severe CNS effects after postexposure rabies vaccination. Although the incidence of reactions to SMBV is very much lower than STV, this report confirms that it does still occur. Both SMBV and STV are widely used throughout the developing world, and would be the vaccine administered to travellers exposed to animal bites in such countries. This case stresses the need for high dose steroids in postexposure vaccine encephalitis and the urgent need for the development and deployment of a safe, and critically, affordable postvaccinations exposure vaccine regimen.

The economic low dose multistate intradermal regimen using the HDCV provides an example of how this goal may be achieved although it is not yet widely accepted. Such a vaccine regimen (0.1 ml HDCV given at multistate injections on days 0, 7, 28, and 90) could be made affordable, and offers excellent protection without the risks of postexposure immune mediated encephalitis.1

Brain MRI in May 1997. (A) T2 weighted image showing multiple areas of high signal in the cerebral white matter. Bilateral subcortical and periventricular lesions are seen. (B) Brain MRI in July 1997, T2 weighted image shows resolution of the white matter lesions.
Khat chewing associated with leukoencephalopathy in the United Kingdom.

The leaves of the tree Catha edulis, or khat (also qat and kat) are chewed by a large proportion of the adult population of the Yemen, and throughout Saharan and sub-Saharan Africa. The leaves are also chewed by members of the Yemeni and Somali community in the United Kingdom. The psychoactive constituents of khat are cathin (d-norisoephedrine), cathidine, and cathinone (an indwelling catheter). There is marked cortical atrophy. Brain biopsy (via percutaneous gastrostomy) was started. A second MRI (figure) 3 months after onset of symptoms showed the presence of a continuing diffuse exudative abnormality in the deep white matter of both cerebral hemispheres with marked cortical atrophy. Brain biopsy (via frontal craniotomy) was performed 3 months after onset of his illness. There was no evidence of acute inflammation, vasculitis, or infarction.

While undergoing rehabilitation there has been slow improvement in his cognitive and neurological status, with startle response. Neuropathy associated with cold agglutinins has been described, but its pathomechanism are unclear. Here, we report a case in which khat chewing has been associated with a severe and disabling neurological illness.

A 56-year-old man living in the United Kingdom for the past 18 years was admitted to a psychiatric hospital with a 5-week history of progressive confusion and agitation. His family reported that he had been chewing khat, in their opinion to excess, every day during that time but had stopped 2 days before admission. There was one previous admission to hospital 9 months previously with khat induced psychosis, from which he recovered without complications within 24 hours. On this occasion, shortly after admission, his conscious level deteriorated abruptly and he was referred for neurological opinion. He was apyrexial and a neurological examination was normal. He opened his eyes spontaneously but there was no verbal response and he did not obey commands. He withdrew all four limbs to pain. Upper and lower limbs were held in flexion with markedly increased tone. Reflexes were brisk but equal. The right plantar was extensor. There were bilateral palmar and grasp reflexes.

Full blood count, urea and electrolytes, glucose, liver function tests, thyroid function test, viral serology, and malaria screen all gave normal results. Tests for HIV antibody, serum angiotensin converting enzyme, white cell enzymes, and serum and urinary porphyrias were negative. Erythrocyte sedimentation rate on admission was 58 mm/h.

Examination of the CSF showed normal opening pressure (10 cm H2O, 27 g/l, glucose 4.3 mmol/l (blood glucose 6.1 mmol/l)), and no cells. His initial EEG was abnormal with diffuse slow waves indicative of widespread cerebral dysrhythmia. A chest radiograph and ultrasound examination of the abdomen were normal. Cranial MRI 3 months after onset of symptoms showed diffuse signal abnormality in the deep white matter of both cerebral hemispheres. Fourteen days after admission he was witnessed to have a single brief adverse seizure with eye and head deviation to the right.

The patient was admitted to a rehabilitation unit. His mini mental state examination score and Barthel scores were zero. Feeding by percutaneous gastrostomy was started. A trial of intravenous methylprednisolone (1 g on 3 consecutive days) gave no benefit. Repeated EEGs (on four occasions) showed diffuse slow waves only. A second MRI (figure) 3 months after onset of symptoms showed the presence of a continuing diffuse exudative abnormality in the deep white matter of both cerebral hemispheres with marked cortical atrophy. Brain biopsy (via frontotempal craniotomy) was performed 3 months after onset of his illness. There was no evidence of acute inflammation, vasculitis, or infarction.

The likely precipitant of this man's illness seems to be his use of khat. A drug screen on admission was negative, and his family denied misuse of other drugs. It remains possible that the sample of khat chewed by this man was contaminated. We are unaware of any previous reports of khat misuse with severe neurological deterioration; previous cases may not have been investigated or reported. In reporting this case our intention is to alert others to a possible complication of the misuse of this drug. Evidence of other cases would provide a powerful argument for the restriction of import and sale of khat.

Cold agglutinins are cold reactive autoantibodies that have haemolytic effects on red blood cells mediated via complement fixation. Neurupharyngeal mononeuropathy multiplex in a patient with cold agglutinins, who responded very well to plasmapheresis. A 72 year old man was admitted with a 1 month history of progressing dysaesthesia and weakness of the limbs. He had no anaemia, jaundice, hepatosplenomegaly, or other systemic complications. Cranial nerves and the cerebellum were not involved. There was severe weakness and atrophy of bilateral thenar, interossei, and plantar muscles with severe dysaesthesia of both palms and plantaris. Pin prick and light touch were reduced as well as position and vibratory sensation in both hands and feet. Deep tendon reflexes were hyporeactive. Babinski's sign was negative.

Laboratory investigation showed a raised erythrocyte sedimentation rate: 52 mm/hour (normal <10) and serum C reactive protein: 1.8 mg/dl (normal; < 0.5). Blood cell counts were within normal limits. The following were normal or negative: IgG, IgA, IgE, IgM, and serum and urinary porphyrias were negative. Erythrocyte sedimentation rate on admission was 58 mm/h.

Examination of the CSF showed normal opening pressure (10 cm H2O, 27 g/l, glucose 4.3 mmol/l (blood glucose 6.1 mmol/l)), and no cells. His initial EEG was abnormal with diffuse slow waves indicative of widespread cerebral dysrhythmia. A chest radiograph and ultrasound examination of the abdomen were normal. Cranial MRI 3 months after onset of symptoms showed diffuse signal abnormality in the deep white matter of both cerebral hemispheres. There is marked cortical atrophy.

Cranial MRI 3 months after onset of symptoms showing diffuse signal abnormality in the deep white matter of both cerebral hemispheres. There is also marked cortical atrophy.
M-protein, direct and indirect Coombs tests, cryoglobulin, antibodies to mycoplasma, myelin associated glycoprotein, gangliosides (GM1, GD1b, asialo-GM1, GT1b, GQ1b, Gal-C), P-ANCA, and C-ANCA. The CSF was normal. Titre of cold agglutinins was detectable at 1:128 at 4°C (normal <1:256). The patient’s serum agglutinated adult group O-red blood cells, but not O-red blood cells or human cord red blood cells, signifying cold agglutinins with I specificity. Immunelectrophoresis of the eluate confirmed IgM composition.

The initial nerve conduction study showed severe diminution or absence of compound nerve action potentials (CNAPs). Some vessels had focal necrosis of vasa nervorum (figure A). Teased fibre analysis showed that 90% of the myelinated fibres were markedly decreased (diameter<5 µm: 150±4/mm, diameter >5 µm:708±9/mm, total: 2212±2/mm)(figure B). Teased fibre analysis showed that 90% of the fibres were undergoing axonal degeneration. Oral prednisolone (30–50 mg/day) for 4 weeks reduced the erythrocyte sedimentation rate and C reactive protein, but not the serum titre of cold agglutinins; neither was there any improvement of symptoms. He received masive dose intravenous corticosteroid therapy. This moderately improved the muscle strength and sensory disturbance. Follow up nerve conduction studies (71 days after the initial study) suggested conduction block of the right median nerve on the forearm (CMAP, duration at the wrist: 2.76 mV, 8.4 ms; CMAP, duration at the elbow: 1.87 mV, 8.8 ms), whereas CMAP could not be elicited in the initial study. We adapted the following criteria to define conduction block: <15% change in duration and >20% fall in negative peak amplitude between proximal and distal sites by percutaneous supramaximal stimulation of motor nerves. As the conduction block might delay smooth recovery of symptoms, Double filtration plasmapheresis was performed four times. After the second plasmapheresis, dysaesthesia and muscle strength improved remarkably. The titre of cold agglutinins was reduced to 1:64. The motor nerve conduction velocity (MCV) of the right median nerve like wise improved (pretreatment: 40.0 m/s, post treatment: 57.0 m/s). Double filtration plasmapheresis was followed by oral azathioprine (50 mg/day) with tapering of steroid. He was discharged on prednisolone (20 mg/day). In the subsequent 4 years, he has had mild exacerbation of dysaesthesia that responded to intermittent steroid therapy.

Characteristic features of the present case are as follows: (1) subacute onset of mononeuropathy multiplex; (2) necrotising vasculitis with macrophage containing myelin debris fibres; (3) probable conduction block in the median nerve; (4) increased concentrations of serum titres of cold agglutinins; and (5) marked response to plasmapheresis. Extensive investigations for other causes of neuropathy was negative except for an increased serum concentration of cold agglutinins, which strongly suggests that cold agglutinins may play an important part in the induction of neuropathy in this case. Six patients with neuropathy associated with cold agglutinins have been reported including our patient. Cold agglutinins are cold reactive autoantibodies that react with the antigenic determinant termed I/i or Pr present on glycoproteins and glycolipids in erythrocyte membranes. Arai et al reported a case of polyneuropathy and IgM M proteinemia with cold agglutinins. This is the first demonstration of vasculitic neuropathy with cold agglutinins. The mechanisms similar to those in cryoglobulinaemic neuropathy have been postulated in the other cases. However, necrotising vasculitis has never been reported in neuropathy with cold agglutinins. This is the first demonstration of vasculitic neuropathy with cold agglutinins. Although the mechanism for neuropathy with cold agglutinins is unknown, mechanisms similar to those in cryoglobulinaemic neuropathy have been postulated. The hypothesis are (1) immunologically mediated demyelination; (2) ischaemic injury secondary to slugging or aggregation of red blood cells in the vasa nervorum; and (3) an associated vasculitis. In the present case, we have confirmed the necrotising vasculitis and probable conduction block. Pathophysiological explanations for association of vasculitis and conduction block may be as follows. Firstly, conduction block may occur as a consequence of nerve ischaemia due to small vessel occlusion. There have been reports of conduction block occurring in vasculitic neuropathy which support this possibility. Secondly, humoral factors including cold agglutinins may induce immune mediated demyelination in the peripheral nervous system. Taken together, neuropathy with cold agglutinins may involve immunologically mediated demyelination, microcirculation occlusion, and vasa nervorum vasculitis. The diversity of pathomechanisms may come from the difference target antigens recognised by cold agglutinins. Plasmapheresis proved effective in all cases. These findings strongly suggest that humoral factors including cold agglutinins may play an important part in the induction of neuropathy with cold agglutinins. We recommend plasmapheresis as first choice treatment for neuropathy associated with cold agglutinins.

We thank Dr Gerard Salazar for critical reading of the manuscript, Ms M Teshima and N Hirata for their technical assistance, Dr S Kusunoki (Department of Neurology, Institute for Brain research, University of Tokyo) for analyses of antibodies to gangliosides, and Mr H Moro (Division of Blood Transfusion Medicine, University of Kagoshima) for characterization of cold agglutinins.

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The cholinergic hypothesis of Alzheimer's disease: a review of progress

I read with interest the review of Francis et al regarding the progress of the cholinergic hypothesis of Alzheimer's disease. They mentioned that donepezil produced improvement or no deterioration in more than 80% of patients, and that such responses should be viewed positively considering the progressive, degenerative nature of the disease. Various donepezil manufacturer's medical representatives presenting data from a clinical study also commonly use this statement. However, this only partially reveals the truth. In fact, the same study produced improvement or no deterioration in 59% patients on placebo. I think that the beneficial effect of donepezil in particular clinical trials should always be critically reviewed in comparison with placebo. In addition, as both 24 week placebo controlled donepezil trials performed so far excluded patients with behavioural disturbances, my impression is that the positive effect of donepezil on the symptoms of behavioural disturbances still remains controversial. In fact there are reports that donepezil might induce behavioural disturbances in patients with Alzheimer’s disease.  

Therefore, I would be extremely cautious about prescribing donepezil to patients with Alzheimer’s disease accompanied by behavioural disturbances. Finally, donepezil was never investigated in a 36 week randomised double blind study as was mentioned in the review. The authors are probably referring to the randomised 24 week double blind placebo controlled trial with an additional 6 week single blinded placebo phase.

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The authors reply:
We thank Professor Babic for the letter, which raises several interesting points. We agree that it may be more helpful to put the results attributed to treatment with donepezil in the context of the placebo response. In general, looking at this as a class effect in relation to several compounds, the picture emerging is that about twice as many people obtain a response to active treatment as to that with placebo. The high placebo response is a common factor in most studies in this field and is worthy of some explanation in its own right. Although it seems that these studies compare drug treatment with that of a placebo (one treatment against no treatment!), the reality is that it is a comparison of patients receiving two treatments against other patients who are receiving one form of treatment. The additional treatment regime is, of course, the care and attention that they receive by being part of the clinical study, which often seems to have an impact, not just on the patient but also on their main carer or carers.

As far as behavioural disturbances are concerned, however, our review was making the point that evidence from both clinical trials to suggest that cholinomimetics as a whole may have a beneficial effect on some non-cognitive behavioural symptoms. This has now been reported for at least two cholinesterase inhibitors, and two muscarinic agonists. In particular, a clear link is emerging between psychotic symptoms and cholinergic dysfunction. Thus, Bodick et al have shown that the M1/M4 agonist xanomeline causes a dose-dependent reduction in hallucinations, agitation, and delusions in a 6 month randomised double blind placebo controlled, parallel group trial. In addition, Cummings and Kaufer have shown that the cholinesterase inhibitor, metrifonate, was also shown to reduce the number of hallucinations in a 26 week randomised, double blind, placebo controlled safety and efficacy study in patients with Alzheimer's disease. Further support for a link between acetylcholine and psychosis derives from postmortem data showing that the activity of choline acetyltransferase in the temporal cortex of patients with Lewy body dementia was lower in those patients with hallucinations than in patients without this feature. Finally, in animals the partial M2/M3 agonist (5R,6R)-6-(3-propylthio-1,2,5-thiadiazol-4-yl)-1-azabicyclo[3.2.1]octane has shown a preclinical profile suggestive of antipsychotic efficacy and that the psychomimetic NMDA receptor antagonist ketamine (when administered at subanaesthetic doses) reduced brain concentrations of acetylcholine.
This is certainly a book for the specialist and not at all (as the preface suggests) for the family practitioner. There are good reviews of nerve structure, causation, and treatment of painful neuropathies and focal neuropathies. The comprehensive survey of the Diabetes Control and Complications Trial (DCCT) shows in detail the only treatment which is likely to alter surgical practice radically over the coming decade and equipment that seemed at the cutting edge of technology only a few years ago, such as the mechanical arm, has already passed into near obsolescence at a bewildering rate. This volume provides an excellent account of the developments which have occurred in neuronavigation, and a thought provoking insight into the wider applications of equipment of which many of us use only a fraction of the potential capability. The title of the book should perhaps have included the word cranial, as there is almost no discussion of the impact that this technology has had in surgery of the spine. This aside it is an excellent book although, like the technology it chronicles, one which is likely to date quite rapidly.

ROBERT MACFARLANE


The title and back cover of the latest addition to Neurology Lite texts contains the usual proclamations. “Concise, key topics, revision aid, essential, review”... the well trailed soundbites demanded by the consumer in the increasingly competitive market of “read less - learn more” books. This book, however, is unusual and distinct. Unlike many rivals it is not an A5 facsimile of a superior parent A3 reference tome. Brevity, so essential to the success of an overview work, has sacrificed neither clarity nor clinical relevance. The strength of Key Topics in Neurology owes much to the author’s ability to negotiate skilfully the compromises necessary for a successful distillation of a large and complex field. He has not shied from wholesale culling of neurological ballast. The allied ability to distinguish and highlight the salient and relevant from the obscure and historical allows this small book to be surprisingly thorough in its coverage and topicality. There is sufficient up to date information on most areas of neurology such that this book would be useful for specialist registrarists albeit without the detail or embellishment they seek. In terms of the aims of this book such observations must be regarded as complimentary.

My limited criticisms relate to details of layout and presentation. I found the exclusive alphabetical arrangement of chapters mildly disorientating in that, for example, History taking in Neurology is to be found at p 131. Similarly, the absence of diagrams and tables is an unexpected omission as I would imagine that this would have complemented the overall style of the book. These are minor gripes that this would have complemented the overview, but unhelpful in an area of the text that is difficult to find. The huge subject of many of its reviews and their comprehensiveness of some of its reviews and their assembly of the appropriate literature.

PETER WATKINS


The quest for a means of accurate localisation of structures during neurosurgery has taxed the minds of clinicians from early in the history of the specialty, starting with Zernov’s encephalometer more than a century ago. Just as the solution to the mariners’ problem of determining longitude from which it partly takes its name, neuronavigation (“the surgeon’s sextant”) has relied on the advent of new technologies to provide solutions to an age old puzzle.

Advances In Neuronavigation begins by tracing the history of stereotaxis from a Cartesian coordinate system devised by Horsley at the beginning of this century, through ventriculography, stereotactic brain atlases, and CT/MR frame based stereotaxis. The final part of the first section discusses the roots of image guided frameless stereotaxis through the integration of high speed graphics computers, informatics, biotechnology, and robotics.

The remainder of the text is divided into four sections. The first concerns the creation of maps from CT, MRI, MRA, PET, and various types of functional imaging. The following section discusses clinical applications of stereotaxis, beginning with different authors’ experiences of their own favoured frames, the biopsy of difficult lesions such as those in the brainstem or posterior fossa, and finally experience with different image guidance systems and their integration with the operating microscope and endoscope. There then follows a series of chapters devoted to radiosurgery, and to image guidance in epilepsy and functional surgery. The final section is entitled Frontiers In Neurosurgical Navigation and considers, among other topics, intraoperative MRI, telepresence in neurosurgery, and robotics.

The incorporation of new technology is likely to alter surgical practice radically over the coming decade and equipment that seemed at the cutting edge of technology only a few years ago, such as the mechanical arm, has already passed into near obsolescence at a bewildering rate. This volume provides an excellent account of the developments which have occurred in neuronavigation, and a thought provoking insight into the wider applications of equipment of which many of us use only a fraction of the potential capability. The title of the book should perhaps have included the word cranial, as there is almost no discussion of the impact that this technology has had in surgery of the spine. This aside it is an excellent book although, like the technology it chronicles, one which is likely to date quite rapidly.

K Sudo, N Fujiki, S Tsuji, M Ajiki, T Higashi, M Niino, S Kikuchi, F Moriwaka, K Tashiro. Focal (segmental) dyshidrosis in syringomyelia. J Neurol Neurosurg Psychiatry 1999;67:106-8. During the editorial process the footnote to table 1(p 107) was wrongly transcribed. The last line—¶p value for each pair of items: hyperhydrosis v normohydrosis 0.0007; hypohydrosis v normohydrosis 0.7282; normohydrosis v hypohydrosis 0.0012 should read—¶p value for each pair of items: hyperhydrosis v hypohydrosis 0.0007; hypohydrosis v normohydrosis 0.7282; normohydrosis v hypohydrosis 0.0012.

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