LETTERS

Multiple painful sensory mononeuropathies (MPSM), a novel pattern of sarcoid neuropathy

Sarcoidosis is a granulomatous disease with the potential to affect many different organ systems. Approximately 5% of patients with systemic sarcoidosis have neurological involvement. Peripheral neuropathy occurs in up to 20% of these patients and is usually asymptomatic. Neurophysiological findings are consistent with primary axonal polyneuropathy. We report an unusual case of neurosarcoidosis, presenting with multiple painful sensory mononeuropathies (MPSM) and progressing to a symmetric confluent sensory neuropathy.

Case report

A patient in her 4th decade of life presented with a history of multiple sensory deficits. She first developed acute onset pain and numbness of the right little finger, followed by a change in taste over the anterior two thirds of the tongue, without facial weakness. Two months later, the patient developed numbness in the palmar aspect of all fingers with dysesthesia, intermittent burning, and throbbing pain. Three months later, the pain spread to involve the dorsal aspect of the forearms. Seven months after the initial onset of symptoms, the patient developed a burning sensation in the distribution of the right sural nerve, and numbness in the right posterior leg and over the left side of the trunk. The patient denied muscle weakness, painful radicular symptoms, or systemic features.

Physical examination was remarkable for the absence of sweet taste sensation over the anterior two thirds of the tongue, without facial weakness. Two months later, the patient developed numbness in the palmar aspect of all fingers with dysesthesia, intermittent burning, and throbbing pain. Three months later, the pain spread to involve the dorsal aspect of the forearms. Seven months after the initial onset of symptoms, the patient developed a burning sensation in the distribution of the right sural nerve, and numbness in the right posterior leg and over the left side of the trunk. The patient denied muscle weakness, painful radicular symptoms, or systemic features.

Laboratory investigations included a polyclonal increase in IgGM component, with a low concentration band in the slow γ region. Serum immunofixation confirmed the presence of IgG. Serum antineutrophil antibodies were positive, with a homogeneous pattern (1/640), and the serum angiotensin converting enzyme (ACE) concentration was raised (69 U/litre; normal range, 8–52). Other laboratory investigations were normal or absent, including serum chemistry, complete blood count, erythrocyte sedimentation rate, serum vitamin B12 concentration, antinuclear antibodies, anti-SSA/SSB antibodies, rheumatoid factor, cryoglobulins, serum complement, and serology testing for Epstein-Barr virus, herpes simplex virus types 1 and 2, and human immunodeficiency virus types 1 and 2. Cerebrospinal fluid (CSF) examination revealed an increased concentration of protein (980 mg/litre; normal range, 150–450), with oligoclonal bands. The CSF cell count was normal, with lymphocytes 2%, monocytes 2%, and polymorphs 8%. The cell count was normal, with lymphocytes 2%, monocytes 2%, and polymorphs 8%. The cell count was normal, with lymphocytes 2%, monocytes 2%, and polymorphs 8%.

A chest computerised tomography scan demonstrated scattered centrilobular nodules, with thickening of the interlobular septa, and no hilar lymphadenopathy, which was consistent with lung sarcoidosis. Pulmonary function tests were normal. Abdominal fat pad aspiration biopsy was negative for amyloid. A right sural nerve biopsy revealed non-caseating granulomas admixed with chronic inflammatory cells in the epineurium (fig 1A, B). Immunohistochemistry of the lymphoid infiltrate was not possible because of technical difficulties. Sural nerve teased fibre preparations revealed myelin ovoids in numerous fascicles. Vasculitis was not seen. Biopsy of the right gastrocnemius muscle was normal. The patient was treated with prednisone, starting at 60 mg/day. At last follow up, 12 months after treatment onset, the patient continued to experience pain, but had not developed new neurological deficits. The patient was eventually lost to follow up.

Figure 1 (A, B) Haematoxylin and eosin stained section of the right sural nerve, at different magnifications, demonstrating a prominent collection of epineurial histiocytes admixed with chronic inflammatory cells in the epineurium; (A) original magnification, ×100; (B) original magnification, ×400. The arrow in (B) indicates a multinucleated giant cell.

Discussion

We report a case of sarcoid neuropathy presenting as MPSM and progressing to a symmetric confluent sensory polyneuropathy. This case was particularly challenging because the patient was not known to have sarcoidosis at presentation. The findings of a raised serum ACE concentration and lung computerised tomography imaging suggested a diagnosis of sarcoidosis. This was confirmed by demonstrating non-caseating granulomas in the epineurium of the right sural nerve. Although previous cases of pure sensory polyneuropathy have been reported, they were distinct from our case in that the patients were already diagnosed with systemic sarcoidosis, or the symptom of pain was unreported. To our knowledge, our case is the first description of systemic sarcoidosis presenting as MPSM.

Sensomotor and pure motor polyneuropathies have been reported in systemic sarcoidosis. The relative frequency of different subtypes of sarcoid neuropathies is uncertain. In a detailed clinical description of 10 cases of chronic sensory polyneuropathy, peripheral neuropathy was the most common form of non-cranial neuropathy. Other patterns included small fibre neuropathy, acute ascending paralysis similar to Guillain-Barré syndrome, polyradiculopathy, and lumbo-sacralplexopathy.

A potential mechanism of nerve damage in sarcoid neuropathy includes the local effects of tissue inflammation through release of noxious secretory products by activated inflammatory cells. Alternatively, ischaemia induced by necrotising vasculitis and direct mechanical compression of nerve fibres may lead to primary axonal degeneration, as supported by pathological findings of non-caseating granulomas in the epineurium and perineurium with periangiitis, periangiitis, perineuritis, and axonal loss. Furthermore, most neurophysiological findings were consistent with an axonal form of nerve injury.

In our case, the neuropathological and pathological findings were consistent with primary axonal degeneration. We hypothesise that peripheral nerve injury may have resulted from mechanical compression of nerve fibres, because there was no evidence of vasculitis in our case. Moreover, the effects of local tissue inflammation could not be ruled out in this case.

Acknowledgements

The authors acknowledge Dr T Hedley-Whyte for assistance with the figure.

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doi: 10.1136/jnnp.2003.028314

References

Non-herpetic limbic encephalitis associated with relapsing polychondritis

Relapsing polychondritis is a generalised disorder characterised by recurrent inflammation of cartilaginous structures throughout the body, without recognised collagen disease or infectious disorders. Central nervous system involvement is rarely reported in this disorder. We describe the cases of two patients with relapsing polychondritis who presented with severe memory impairment and psychiatric features such as euphoria and hyperactive behaviours, leading to a diagnosis of non-herpetic limbic encephalitis.

Limbic encephalitis is caused by the herpes simplex virus (HSV) or by heterogeneous non-herpetic disorders (non-herpetic viruses, Hashimoto’s encephalopathy, central nervous system lupus, gliomatosis cerebri, intravascular malignant lymphomatosis, and paraneoplastic conditions). Clinical characteristics include cognitive dysfunction, severe memory impairment, seizures, depression, anxiety, and hallucinations. Magnetic resonance imaging (MRI) studies reveal selective unilateral or bilateral involvement of the limbic system, particularly the medial temporal lobe regions.

Our first patient was a 45 year old man referred to us because of subacute progressive mental confusion, euphoria, hyperactive behaviour, disorientation, and forgetfulness of recent episodes. He had a history of right sided conjunctivitis successfully treated with steroid and antibiotic ointment, shoulder stiffness, headache, low grade fever, and recent weight loss (6 kg).

On admission, the patient was disoriented, with an inappropriately jocular affect, disjointed speech, confabulation, attention deficits, and memory impairment including anterograde and 1 year retrograde amnesia. His Mini-Mental Status Examination (MMSE) score was 11 (of a possible 30). He had no pyramidal or extrapyramidal disturbances or cerebellar ataxia. T2 weighted MRI showed bilateral, small, disseminated high intensity signals with vague margins in the medial temporal lobe, hippocampus, and insular cortex (fig 1A).

Laboratory studies showed white blood cell count 14.8×10^9/l (normal 3.9–9.3×10^9/l), platelet count 363×10^9/l (normal 3.9–9.3×10^9/l), -thromboglobulin (F-TG) 94 µg/l (normal <50 µg/l), platelet factor 4 (PF-4) 30 ng/ml (normal <20 ng/ml), erythrocyte sedimentation rate (ESR) 42 mm/h, C reactive protein (CRP) 29 mg/l, ferritin 668 g/l (normal <465 g/ml), rheumatoid factor 145 IU/ml (normal <20), and antinuclear antibodies (ANA) 1:40. Serum tests were negative for myeloperoxidase antibody, anti-neutrophil cytoplasmic antibodies, anti-nuclear antibodies (anti-SSA/SSB), and anti-RNP. Thyroid function and vitamin B12 and B12 levels were normal. Thirty days after presentation, subarachnoid haemorrhage was detected.

Cerebrospinal fluid (CSF) was sterile, with a protein concentration of 86 mg/dl, glucose, 3.0 mmol/l (serum glucose, 5.5 mmol/l); white cells, 8×10^9/l (94% lymphocytes); and IgG/albumin index, 1.02.

Despite intravenous acyclovir, his cognitive function deteriorated, and his MMSE score decreased to 4. He developed right conjunctivitis, left wrist pain, and bilateral auricular swelling. Brain biopsy showed marked gliosis with scattered gigantoastocytes, perivascular cuffing, and destruction of the vascular wall (fig 1B). After high dose intravenous methylprednisone, then 40 mg oral prednisone per day, his psychiatric and cognitive functions improved dramatically and the joint pain and auricular swelling disappeared. Mild impairment of recent memory and orientation remained. MRI performed 1 month later revealed bilateral cortical atrophy in the temporal lobes with dilated temporal horns.

Our second patient was a 62 year old man who presented with sudden memory impairment, confusion, and euphoria, with a history of ankle and wrist pain. On examination, he had mild hearing loss and bilateral auricular swelling. Although appearing alert and happy, he had amnesic episodes, was disoriented, and had impairment of memory storage and calculation (MMSE score 4). He followed simple commands, but filled in memory gaps with inaccurate and implausible information. All other neurological findings were unremarkable.

Laboratory examination showed ESR 20 mm/h, CRP 12 mg/l, IgE 1570 IU/l, fibrinogen 5.51 g/l, and ferritin 448 µg/l. Thyroid function and serum vitamin B12 and B12 levels were normal. Results were negative for all bacterial, mycobacterial, fungal, and viral stains and cultures, and for specific antibody tests. Whole body computed tomography and gallium scintigrams to search for neoplasms in the lungs, thymus, and testis were negative. CSF examination showed increased white cell count 2.4×10^6/l (83% lymphocytes), protein 46 g/l, glucose 4.27 mmol/l (serum glucose 5.94 mmol/l), and IgG/albumin index 1.56 (normal <0.6). Flair (fluid attenuated inversion recovery) images and T2 weighted MRI revealed bilateral, sparse, high intensity patches in the mediotemporal lobe, including the insula, hippocampus, and amygdala, and abnormal signals in the deep white matter. Auricular biopsy showed active chondritis. Brain biopsy demonstrated prominent perivascular cuffing around the meningeal and intracerebral vessels with increased vascular wall thickness.

After methylprednisone pulse therapy and then 40 mg per day of prednisone orally, the auricular swelling lessened and the psychiatric problems improved enough for the patient to communicate verbally. However, after 2 months, recent memory storage and orientation were still impaired and MRI showed bilateral cortical atrophy within the frontotemporal lobes.

Both patients had auricular chondritis, ocular inflammation, and non-erosive polyarthritis, thus meeting the criteria for a diagnosis of relapsing polychondritis. In addition, the clinical manifestations, radiological findings, and absence of HSV infections indicated non-herpetic limbic encephalitis. Despite intensive investigation, no evidence of a neoplasm or a known autoimmune disease was found.

Several previous case reports of relapsing polychondritis include confusion, disorientation, and psychiatric symptoms with or without neurological abnormalities, suggesting that limbic system involvement might be more common in this disorder than is generally thought. Histopathological evidence is limited. Although extensive cerebral and systemic vasculitis has been demonstrated on autopsy, an inflammatory cell component has been demonstrated.

In our patients, simultaneous brain and auricular biopsies showed active inflammation with chondritis and meningoencephalitis. The inflammatory cell components consistent with meningoencephalitis were predominantly T cells. Although our observations of perivascular cuffing with increased thickness and partial destruction of the vascular wall were consistent with vasculitis, histopathological features were not specific for vasculitis.

Our patients responded dramatically to early treatment with high dose intravenous corticosteroids followed by an oral corticosteroid, although mild amnesia with confabulation remained in both cases. The atrophy of the medial temporal lobe and dilatation of the temporal horns of the lateral ventricle seen on MRI after treatment indicated irreversible ischaemic damage. Although we cannot exclude the possibility that the brain atrophy in the medial temporal regions resulted from the corticosteroid therapy, bilaterally reduced blood flow was seen on SPECT images of the temporal lobes (data not shown), suggesting that the atrophy was not caused by corticosteroid treatment.
Although relapsing polychondritis is a rare disorder, it should be considered in the differential diagnosis of neurological complications such as limbic encephalitis, and it is worth noting that steroid therapy may be beneficial.

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doi: 10.1136/jnnp.2003.035170

Competing interests: none declared

References

Diffusion tensor MRI of the cervical cord in a patient with syringomyelia and multiple sclerosis

Diffusion tensor magnetic resonance imaging (DT-MRI) is a powerful technique which provides quantitative information about structural and orientational features of the central nervous system. Development of DT-MRI technology for identification for individual fibre tracts is important; this will allow detailed assessment of the damage to the intrinsic nerve tract, which could be helpful in understanding how tissue damage causes clinical deficits in various neurological conditions. In this context, the assessment of cord damage with DT-MRI is particularly appealing. The cord contains uniformly orientated fibres, thus obviating some caveats of anisotropy measures in the brain—for example, those related to the presence of crossing fibres on a voxel scale. Unfortunately, because of the small size of the cord and its sensitivity to artefacts related to the cerebrospinal fluid, cardiac and respiratory motions, spinal cord DT-MRI presents some technical difficulties and has been used in only very small and preliminary studies.

Against this background, we carried out DT-MRI of the cervical cord in a 62 year old man with syringomyelia and primary progressive multiple sclerosis. In 1989, he had complained of bilateral arm weakness and sensory loss and cervical syringomyelia was diagnosed. In 1995, he complained of progressive gait disturbances, followed by subacute onset of bilateral visual loss. Primary progressive MS was diagnosed based upon brain MRI and cerebrospinal fluid findings. Although he now requires bilateral assistance for walking, following surgical intervention the upper limb signs and symptoms related to syringomyelia did not worsen over the past five years.

We acquired sensitivity encoding (SENSE) single shot echo planar imaging (EPI) sequence of the cervical cord and the brainstem of the patient. This sequence collected 16 images per section, including two images with no diffusion weighting (b=0 s/mm²) and 14 images with the same b factor of 900 s/mm² but with gradients applied in different directions. The diffusion unweighted images were needed to compute the DT, and the gradient orientation was chosen according to the algorithm proposed by Jones et al., designed to optimise DT-MRI acquisition. The measurement was repeated four times to improve the signal to noise ratio. Three saturation bands were used, positioned in the anterior part of the neck and transversely at the edges of the field of view in the vertical direction. From the SENSE single shot EPI images, a colour encoded sagittal image was obtained. The blue colour indicates preferential fibre direction along the z axis, the green colour preferential water molecular motion along the x axis, and the red colour preferential water molecular motion along the y axis. A sagittal T2-weighted sequence of the cervical cord was also acquired.

The sagittal T2-weighted image (fig 1A) shows a syrinx extending for the whole length of the cervical cord. The colour encoded SENSE single shot EPI image (fig 1B) demonstrates the presence of preserved white matter fibre tracts around and beyond the syrinx. This latter finding is consistent with the relatively preserved motor and sensory functions of the patient, despite the extensive cervical syrinx visible on the T2-weighted image.

In this patient, the preserved tissue geometry of the cervical cord around the syrinx underpins the potential of DT-MRI to provide a more complete picture of cord damage in different neurological disorders. Compared with conventional MRI, it enabled us to obtain quantitative information of the pathological characteristics of the tissue beyond the abnormalities visible on MRI. This shows promise in overcoming the well known discrepancy between aspects of conventional MRI and the clinical findings, reported in numerous neurological conditions. Moreover, clinical application of cord DT-MRI tractography may have prognostic value with regard to functional recovery after acute inflammatory or demyelinating pathologies, as it may enable us to investigate the residual integrity of clinically important pathways.

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doi: 10.1136/jnnp.2004.042069

Competing interests: none declared

References
Ipsilateral axial lateropulsion as an initial symptom of vertebral artery occlusion

Case reports
A 58 year old man noticed an unsteady gait when he woke up. He was unable to keep standing and fell several times to the left. On the next day, he visited our clinic. He denied vertigo, diplopia, hiccup, dysphagia, speech disturbance, numbness, and muscle weakness. On admission, ocular movements were normal in all directions. Spontaneous or gaze evoked nystagmus was undetectable with or without Frenzel’s glasses. He had no skew deviation, ocular lateropulsion, saccadic pursuit, ocular dysmetria, or Horner’s syndrome. Elevation of the soft palate was intact on phonation. There was no nasal voice, hoarseness, or dysarthria. The tongue did not deviate on protrusion. Other cranial nerve functions were intact. He had no weakness. Coordination of the extremities was intact. He was unable to keep standing without assistance due to marked lateropulsion to the left. Deep tendon reflexes were normal. He had no pathological reflexes. Facial sensation was intact and was light touch and pinprick sense in the trunk and upper limbs. Position sense was intact in the lower limbs. Magnetic resonance imaging (MRI) showed an acute infarct in the left lateral medulla (fig 1A) and a flow signal abnormality in the left VA. Magnetic resonance angiography (MRA) confirmed an occlusion of the left VA (fig 1B). The patient was treated with intravenous argatroban, a direct thrombin inhibitor, on day 6. He had no Horner’s syndrome, skew deviation, or ocular lateropulsion. He had no pathological reflexes. Facial sensation was intact and was light touch and pinprick sense in the trunk and upper limbs. Position sense was intact in the lower limbs.

Figure 1 Diffusion weighted axial MRI (A) shows an acute infarct in the left lateral medulla (arrow). MRA (B) shows an occlusion in the distal portion of the left vertebral artery (arrowhead).

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doi: 10.1136/jnnp.2003.035246

References

Epilepsy in one family with parietal foramina: an incidental finding?

Parietal foramina (PFM) are defects of the human skull vault, characterised by symmetrical, oval defects in the parietal bone situated on each side of the sagittal suture and separated from each other by a narrow bridge of bone. Size decreases with age and an intrafamilial variability is seen (OMIM 168500). It is thought to be a normal variant of skull development and, consequently, a benign entity.1 Currently, loss of function and mutations in two genes encoding homeobox containing transcription factors, MSX2 and ALX4, have been detected in patients with PFM.1,2 Parietal foramina is classified as type I, caused by MSX2 mutation, and type II, which is caused by ALX4 mutations.

Herein, we report a family with PFM type II in which two members had epilepsy and discuss the importance of neuroimaging techniques to determine its possible cause. In addition, we study the variations of clinical expression, with regard to the severity of the epilepsy, in different generations.

Discussion
Isolated axial lateropulsion occurs with ischemic lesions in the inferior portion of the cerebellum and tonsil and with a demyelinating lesion of the superior and inferior cerebellar peduncles.2 Lee et al. reported a patient with lateral medullary infarction who showed a gaze evoked horizontal nystagmus as well as axial lateropulsion.3 Thus, the critical structure for lateropulsion remains to be elucidated.

The patients described here did have pain and thermal sensory impairment in the contralateral lower limb, which is attributed to a lesion in the ventrolateral part of the spinothalamic tract. A very small lesion located superficially in the lateral medulla causes an atypical spinothalamic sensory deficit, which in some cases appears a few days after the onset of other symptoms.4 In the present cases, however, it is likely that the pain and thermal sensory deficit was present initially but was not noticed. An occlusion of the VA may have caused ischemia in the inferior part of the short circumferential medullary artery directly arising from the distal VA. Structures located dorsal to the spinothalamic tract, including the spinal trigeminal tract and nucleus, and the ambiguus and vestibular nuclei were probably spared, because these patients did not have facial sensory impairment, pharyngeal or laryngeal palsy, or nystagmus. Conversely, it is highly likely that the vestibulospinal tract was involved, because it is located just ventromedial to the spinothalamic tract in the medulla. The vestibulospinal tract is considered to play an important role in the regulation of posture by exerting strong excitatory influences on extensor muscles and inhibitory influences on flexor muscles.5 Thus, interruption of the vestibulospinal tract decreases extensor muscle tone of the trunk and lower limb on the side of the lesion, which is likely to cause ipsilateral axial lateropulsion. The anterior spinocerebellar tract was likely to be involved, because it is located just dorsolateral to the spinothalamic tract in the medulla. It is possible that axial lateropulsion is associated with a lesion of the spinocerebellar tract.

In the case reported by Bertholon et al., axial lateropulsion may have been caused by ipsilateral lesions of the anterior and posterior spinocerebellar tracts, which are incorporated in the superior and inferior cerebellar peduncles. Given that the vestibulospinal and spinocerebellar tracts have no projections to the ocular motor system, it is natural that these two patients did not have nystagmus or oculomotor disorders. The present findings raise the possibility that the lateral medullary infarction in the Wallenberg syndrome is attributable to lesions of the vestibulospinal and spinocerebellar tracts as well as central vestibular pathways.
The first patient, a boy, was referred at the age of 3 months because of a large bone defect (PFM) identified on physical examination. The mother (22 years old), aunt (25 years old), and grandfather (55 years old) also had PFM, but smaller than the child’s, showing an age related size variation. Molecular analysis, reported elsewhere, showed that this family had an ALX4 mutation (PFM type II). History, neurological examination, and neuroimaging evaluations were obtained from three relatives. The aunt refused further analysis. Electroclinical investigation consisted of a detailed clinical history, review of charts, and video electroencephalogram (V-EEG) monitoring. Neuroimaging evaluation consisted of helical computed tomography scans of the head (with post-processing three dimensional views of the cranial vault), 1.5T magnetic resonance imaging (MRI) at three orthogonal planes with conventional SE (before and after intravenous paramagnetic contrast), and magnetic resonance venography.

At the age of 4 years, the patient was referred to our laboratory for elucidation of paroxysmal events, described as brief periods of “blindness”. He was born at term, by cesarean section after an uneventful pregnancy. During follow up, physical and neurological examinations revealed normal neurological development and physical growth. Seizure semiology was highly suggestive of an occipital origin; seizures were characterised by visual phenomena (blackouts), progressing to loss of contact and forced eye and head deviation to the left, followed by vomiting and headache. Onset occurred during infancy, at 8 months, and up to the latest evaluation, a total of six seizures had occurred. Carbamazepine was replaced by valproate in an attempt to improve seizure control.

The mother had a history of epilepsy with the same characteristics as those seen in the child, although the seizures were shorter. Onset occurred later, during puberty, at 15 years. She had four stereotyped seizures, controlled with phenobarbital (50 mg/day), which was taken for two years. Her past and current medical history was normal, including neurological examination.

Electroencephalographic tracings showed frequent, sharp waves over the left posterior quadrant in the child (fig 1A). Although V-EEG was done, we did not register his seizures because of their sporadic nature. The mother had a normal current EEG, but previous EEG reports described the same abnormality as in her child.

The grandfather had no current neurological or cognitive defects. He denied a history of seizures, syncope, migraine, or other paroxysmal events. His EEG was normal.

Neuroimaging investigation with 1.5T MRI showed a malformation of occipital infolding, suggestive of a polymicrogyric cortex over the posterior regions in all three patients, although this was more prominent in the child (fig 1B).

This family had the classic phenotype for PFM, in this case type II (ALX4 mutation), including age related expression with regard to the size of the foramina. In contrast to the current idea that PFM is not associated with neurological disorders, the child and his mother had epilepsy with occipital lobe seizures. Reviewing previous studies, Kyte described one patient with identical epilepsy and EEG features as seen in our patients, including the age related improvement. An important issue in this family, not previously reported, is the earlier onset and higher frequency of events in the child. Analysis of this family showed an infrafamilial variabil-

Figure 1 The 4 year old boy. (A) Electroencephalogram, during sleep, shows low amplitude sharp waves over posterior regions, more prominent on the left parietal region. (B) Axial plane magnetic resonance imaging without contrast enhancement (T1) shows an unusual pattern of cortical gyration with polymicrogyria over bilateral occipital regions.

References
Baroreflex failure secondary to paraneoplastic encephalomyelitis in a 17 year old woman with neuroblastoma

Baroreflex failure is a rare cause of postural hypotension but should be considered in any patient with a diffuse central nervous system disease involving the brainstem. Paraneoplastic encephalomyelitis (PEM) is such a disease and, although rare, is becoming more frequently diagnosed because of improved imaging and specific antibody testing. We present the first case of baroreflex failure secondary to PEM. In January 2002, a 17 year old woman presented with a 3 week history of pain in the right shoulder which spread down the forearm to the radial border of her hand. She had also become anorexic and lost 18 kg over 3 months. A mild resting tachycardia was noted but there were no objective neurological signs, and routine blood tests, including inflammatory markers, were normal. In March, both pupils became dilated, non-reactive to light or near stimuli, and myotic (that is, Holmes-Adie pupils). Limb reflexes were decreased and nerve conduction studies demonstrated a mild motor-sensory polyneuropathy. The aetiology of her anorexia was thought to be psychological and over the next 3 months she was treated with sedatives, antidepressants, and motility agents. She regained 12 kg but her neurological abnormalities persisted, and she developed psychomotor retardation and symptomatic postural hypotension. In July she underwent tilt testing and autonomic studies.

The patient was positioned horizontally on the tilt table and continuous blood pressure (BP) was monitored using digital plethysmography, stroke volume was derived from the arterial pulse wave, heart rate (HR) from the ECG, and muscle sympathetic nerve activity (MSNA) from the right peroneal nerve using the microneurographic technique. All measurements were averaged over 1 min intervals. Recordings were made during “ice to face” stimulation and 60° head up tilt (fig 1). The results, with normal values from our laboratory in brackets, were as follows: resting horizontal, mean BP was 102 mm Hg (mean (SE): 111 (3) mm Hg), HR 110 bpm (75 (4) bpm), and MSNA 84 bursts/min (31 (4) bursts/min). After 2 min of 60° head up tilt, mean BP was 46 mm Hg (111 (5) mm Hg), HR 125 bpm (81 (3) bpm), and MSNA 64 bursts/min (44 (5) bursts/min), and cardiac output was decreased by 50% (normal response is a 20% decrease from 3.2 (2) to 2.5 (0.3) l/min/m²). Resting horizontal, venous noradrenaline was in the high normal range at 3100 (4700-3800 pmol/l) and during tilt, arginine vasopressin (AVP) levels increased from 6.1 to 7.3 pmol/l, much less than expected for the degree of hypotension. During ice to face stimulation, mean BP, HR, and MSNA increased to 114 mm Hg, 118 bpm, and 120 bursts/min, respectively.

Magnetic resonance scanning of the brain and spine were normal. Screening for common causes of neuropathy was negative. A radionuclide study demonstrated delayed gastric emptying. Paraneoplastic autoantibody testing was positive for immunofluorescent anti-neuronal nuclear antibody type 1 (ANNA-1, also known as “anti-Hu” titre 1:30 720), confirmed by western blot against native neuronal antigen. In October 2002 a mass was found in her right neck and biopsy demonstrated a neuroblastoma. Further bone scanning and bone marrow biopsies demonstrated no evidence of metastatic disease. She was treated with chemotherapy followed by surgery and local radiotherapy. Repeat scanning demonstrated complete remission. Her gastrointestinal symptoms improved, and the postural hypotension, pupillary signs, and psychomotor retardation remained stable.

In retrospect, all the clinical findings are consistent with PEM, consisting of: (a) limbic encephalitis causing psychomotor retardation, (b) sensory neuropathy affecting the limbs, (c) autonomic dysfunction including Holmes-Adie pupils and impaired baroreflex modulation of heart rate and vasoconstriction, and (d) enteric neuropathy causing gastrointestinal dysfunction.5 As we have demonstrated, the diagnosis may be difficult. This is primarily because paraneoplastic syndromes are rare (the incidence is less than 0.1% in cancer patients), neurological symptoms usually predate the discovery of the tumour, and the antibody tests are not widely available.3 Psychomotor retardation and anorexia were initially thought to be secondary to a psychological disorder, despite the neurological findings and the demonstration of delayed gastric emptying. The tilt test results indicated a polyneuropathy as the primary cause of the patient’s symptoms. Following exclusion of common neuropathic aetiologies, the diagnosis of PEM was made following the finding of high titre ANNA-1 antibody and the neuroblastoma.

The antibody recognises a family of RNA binding proteins (35–40 kDa) in neurones and certain tumours including small cell lung carcinoma and neuroblastoma which share a common ectodermal origin.6 The nuclear antigens are expressed by all small cell lung carcinomas and most neuroblastomas although the antibody is not usually present.

**Figure 1** (A) Recordings from the patient during the application of ice to the face (the diving reflex) showing a normal increase in blood pressure (BP), heart rate (HR), and muscle sympathetic nerve activity (MSNA), while cardiac output (CO) is maintained. However during head up tilt, there is an inappropriate fall in BP with no increase in MSNA. The fall in CO is exaggerated. (B) Recordings from a normal patient of similar age show similar responses to ice, but during tilt, BP is maintained, MSNA increases, and CO decay is less.
Acquired ocular motor apraxia from bilateral frontoparietal infarcts associated with Takayasu arteritis

The relatively rare syndrome of acquired ocular motor apraxia is characterised by difficulty in initiating saccades to command and to visual targets, usually in all directions.1

Case report

Our patient was a 52 year old handed and non-literate man. He was admitted to a local hospital with the complaint of acute and persistent thoracic and epigastric pain radiating to his back. Five days later he developed acute loss of consciousness and was sent to our hospital.

Blood pressure was 170/100 mm Hg from the right arm and 160/100 mm Hg from the left, the right femoral artery was pulseless, and the epigastrium was painful on palpation. He was stuporose, disorientated, and his cooperation was limited to simple commands only. He had bilateral ptosis with his eyes fixed in the primary position. Convergence was absent. However, an oculocephalic reflex could be elicited in both horizontal and vertical directions. His left nasolabial sulcus was somewhat reduced. He had paresis of both his arms and his left leg, while the motor strength in his right leg was almost completely normal. Hoffmann and Babinski signs were positive on the left side, with hyperreflexia. The tendon reflexes were normal on the right side and no pathological reflexes were elicited. He had urinary incontinence.

On the third day of admission he appeared aphaetic. Although his thinking was slowed, and his affect was flattened, he could answer simple questions and obey simple commands. He still had difficulty in understanding complex orders. His postis had resolved but the hypertonia in the left upper extremity was more pronounced. His eyes were still fixed in the primary position.

In the following few days, when he was no longer stuporous, he was observed to execute spontaneous eye movements in all directions without associated head movements, but he was unable to carry out any eye movements when he was instructed to gaze at an object. He was also unable to execute pursuit movements, and there was no optokinetic nystagmus response. On bedside examination, optokinetic nystagmus was tested by rotating a drum vertically and horizontally before his eyes. Foveal smooth pursuit was tested by asking the patient to follow the movement of a target light produced by a light source. Examination of the visual fields with confrontation was normal. He also had no visual extinction. Two weeks after admission, the patient was transferred to a rehabilitation centre, showing full cooperation and orientation and with his eye movements partly recovered. He had no anosognosia or right–left disorientation. His muscle strength had only mildly improved and he had severe hypertonity in his parietic extremities, with clonus of the left leg. A month later he was discharged from the rehabilitation centre without any eye movement abnormality. The oculocephalic reflexes were spared throughout the course of the illness.

Blood studies showed a leucocytosis (14 600 WBC/mm\(^3\)) and an inflammatory reaction (erythrocyte sedimentation rate 124 mm/h, C reactive protein 110 mg/l). Cranial computed tomography (CT) showed hypodense lesions of cortical grey matter at the level of both cerebral convexities. Cranial magnetic resonance imaging (MRI) showed subacute infarcts involving the cortical grey matter of both frontal and parietal border zones bilaterally. The frontal eye field (FEF, at the intersection of the precentral sulcus) and the superior frontal gyrus (SF, at the intersection of the superior frontal gyrus) were spared (fig 1A). Coronal section through the parietal lobe revealed that the intraparietal sulcus (PEF) was involved bilaterally (fig 1A), whereas both supplementary motor areas (SMA) and the parietal eye field (PEF, in the posterior part of the intraparietal sulcus) were involved bilaterally (fig 1A), whereas both supplementary motor areas (SMA) and the parietal eye field (PEF, in the posterior part of the intraparietal sulcus) were involved bilaterally (fig 1A), whereas both supplementary motor areas (SMA) and the parietal eye field (PEF, in the posterior part of the intraparietal sulcus) were involved bilaterally (fig 1A), whereas both supplementary motor areas (SMA) and the parietal eye field (PEF, in the posterior part of the intraparietal sulcus) were involved bilaterally (fig 1A), whereas both supplementary motor areas (SMA) and the parietal eye field (PEF, in the posterior part of the intraparietal sulcus) were involved bilaterally (fig 1A), whereas both supplementary motor areas (SMA) and the parietal eye field (PEF, in the posterior part of the intraparietal sulcus) were involved bilaterally (fig 1A), whereas both supplementary motor areas (SMA) and the parietal eye field (PEF, in the posterior part of the intraparietal sulcus) were involved bilaterally (fig 1A).

Comment

The case is a good example of “acquired” ocular motor apraxia. It appears that both frontal and parietal eye fields of the patient were affected by ischaemia. We concluded that ischaemia in the border zone areas of both hemispheres was the result of sudden haemodynamic insufficiency during the acute phase of the aorta.

Saccadic eye movements can be divided into three types: reflexive, intentional, and spontaneous saccades. Reflexive saccades are triggered by the sudden appearance of an external visual stimulus, whereas intentional and spontaneous saccades are internally triggered. Three cortical areas may trigger saccades—the frontal eye field (FEF), the supplementary eye field (SEF), and the parietal eye field (PEF). The SIF is involved mainly in intentional visual exploration (intentional saccades), the PEF mainly in reflexive visual exploration (reflexive saccades), and the SEF mainly in the preparation of motor programmes. SEF also appear to control spontaneous saccades.

Only bilateral lesions affecting these areas result in visible saccade disturbances on bedside examination. Saccadic eye movement disorders resulting from unilateral lesions of these areas can only be revealed by electro-oculographic recordings. Acquired ocular motor apraxia is usually caused by...
bihemispheric infarcts. Our patient could not be evaluated for any apraxia of his extremities or for optic ataxia because of the degree of paresis in both his arms. He might also have had an optical ataxia during the period when he had anosognosia and right–left disorientation. The development of a substantial degree of paresis with hypertonia in the first days of the ischaemic insult, and the continuation of these symptoms after ocular motor apraxia had resolved, may suggest that the anterior border zone areas were affected to a greater degree than the posterior border zone areas.

For this reason the functions of both the FEFs might have been undertaken by the PEFs. It seems likely that this role could be assumed by other areas, such as the posterior areas, as an adaptive response after injury. Bilateral damage to the PEFs may result in severe impairment of pursuit movements. The posterior cingulate cortex (PCC)—which is known to show neuronal activity during pursuit movements—was spared in our patient. However, the medial superior temporal lobe (MST), located close to the intraparietal sulcus, was possibly damaged. This area is known to be implicated in pursuit eye movements from single cell recording studies in the monkey.

We observed in our patient that ocular apraxia and pursuit movements of the eyes began to resolve simultaneously. This observation may suggest that recovery in the PEFs might have occurred first and have compensated for the FEFs. Recovery of spontaneous saccades in the first few days of ischaemia might indicate that the SEFs, which are assumed to be responsible for these eye movements, were not seriously damaged.

Figure 1 (A) Axial contrast enhanced T1 weighted magnetic resonance scan showing gyriform cortical enhancement caused by laminar cortical necrosis following a hypoxic ischaemic episode. Neural parenchyma of both the precentral area (frontal lobe, open arrow) and the postcentral area (parietal lobe, thick arrow) was involved. The thin arrow indicates the central sulcus. FEF, frontal eye field; SFG, superior frontal gyrus. (B) Contrast enhanced coronal section through the parietal lobe. The intraparietal sulcus (PEF, open arrows) was involved as well as the medial part of the parietal lobe (thin arrows), while posterior cingulate cortex was spared. (C) Contrast enhanced magnetic resonance angiography showing irregularity of the vessel wall beginning from the aortic arch and extending to the abdominal aorta.
Non-herpetic limbic encephalitis associated with relapsing polychondritis

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*J Neurol Neurosurg Psychiatry* 2004 75: 1646-1647
doi: 10.1136/jnnp.2003.035170

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