Prolonged hemiplegic migraine associated with unilateral hyperperfusion on perfusion weighted magnetic resonance imaging

Hemiplegic migraine (HM) is an unusual subset of migraine with aura, in which headache is associated with unilateral motor deficits, thought to be attributable to an underlying calcium channelopathy.1 In some cases the neurological dysfunction may outlast the headache and persist for many days. In the initial stages, hemiplegic migraine may mimic cerebral infarction. Within the first few hours after stroke, both computed tomography and magnetic resonance imaging (MRI) are often normal. However, more information can be gained using diffusion (DWI) and perfusion weighted imaging (PWI), which are much more sensitive to acute events in cerebral ischaemia. A recently reported post-processing technique (factor analysis of dynamic studies FADS) can be applied to PWI to generate images representing arterial (“early”) and venous (“late”) contributions to signal intensity.2 This report outlines the findings arising from the application of multimodal MRI techniques to a patient with prolonged hemiplegic migraine.

Case report
A 21 year old woman, with a long history of familial HM, presented with a six hour history of headache, nausea, right sided weakness, and expressive dysphasia. Her maternal aunt had also suffered with the condition. Genetic testing for CACNA 1A had not been performed. In previous episodes, her symptoms had resolved within four hours, so a clinical diagnosis of migraine related stroke was made and she underwent urgent T2 weighted MRI and MR angiography with DWI and PWI. FADS was applied to the perfusion weighted images. These sequences revealed no large vessel obstruction and normal DWI, thus excluding infarction, but there was gross hyperperfusion of the left hemisphere on the early FADS images (fig 1A). The late FADS images, representing venous signal were unremarkable (data not shown).

Her headache persisted for the next 10 days. However, the right limb weakness improved over the next four days, but the dysphasia persisted. Repeat PWI on day four showed focal hyperperfusion of the inferior frontal lobe (fig 1B). A follow up scan at three months, at which time she was totally asymptomatic, showed complete resolution of these appearances (fig 1C).

Comment
This report demonstrates multimodal MRI findings in a case of HM and that by applying the techniques of DWI, PWI, and FADS, it was shown that hyperperfusion existed in the phase of neurological deficit thus excluding acute stroke.

There have been conflicting views regarding whether migraine is primarily attributable to vascular or neuronal dysfunction. One of the earliest models of its pathogenesis proposed that symptoms of migraine aura were related to hyperperfusion and ischaemia and that the subsequent headache was related to reactive hyperaemia. Initial studies of regional cerebral blood flow initially seemed to support this theory, demonstrating hyperperfusion in the aura phase and hyperperfusion in the headache phase. However, the observation by some authors that hyperperfusion may outlast the aura symptoms and extend into the headache phase makes a simple vascular pathogenesis less likely.

Our findings of normal DWI appearances associated with hyperperfusion in the context of neurological deficit and headache also argue against an ischaemic mechanism. The presence of hyperperfusion affecting the entire hemisphere and therefore not respecting anatomical boundaries is difficult to explain on a simple vascular model and may therefore be a secondary phenomenon resulting from underlying neuronal dysfunction. The concept of a primarily neuronal dysfunction in migraine has been drawn from parallels with the experimental phenomenon of “cortical spreading depression” (CSD) described by Leao.3 The rate of propagation of CSD is similar to Lashley’s estimate of the rate of progression of symptoms during the human migrainous visual aura.

Subsequent studies have shown that in migraine with and without aura there is a similar spreading hyperperfusion across the cerebral hemispheres. This has also been demonstrated in HM.4 However, hemispheric hyperperfusion during HM, correlating with contralateral hemiplegia has also been previously reported.4 On the balance of available evidence, it seems likely that in the early phase of migraine there is spreading cortical oligaemia and that this is linked to a neuronal dysfunction analogous to that reported in CSD. Oligaemia was not found in our patient although this may be because she was not scanned at the very onset of her attack.

HM has been linked to mutations in the CACNA 1A gene, which encodes a P/Q type calcium channel.5 This channel is located on presynaptic membranes and is tightly coupled to neurotransmitter release. Conceivably, CACNA 1A mutations could cause neuronal membrane instability resulting in episodic loss of neural control of cerebrovascular tone and that, as neuronal membrane function recovers, neurogenic control of CBF is regained. It is of interest, in this respect, that the recovery of neurological function in our patient was closely mirrored by the restoration of normal cerebral perfusion.

In conclusion, we show that the use of multimodal MR in a case of acute hemiparesis in a patient with HM was effective in excluding cerebral infarction. FADS analysis demonstrated reversible focal hyperperfusion of the cerebral cortex correlated with the clinical distribution of neurological deficit. Recovery was mirrored by the restoration of a normal vascular pattern.
Slowly progressive Foix–Chavany–Marie syndrome associated with chronic herpes simplex encephalitis

Foix–Chavany–Marie syndrome (FCMS) is characterised clinically by automatic voluntary dissociation of orofacial motility. It is caused by bilateral anterior opercular lesions and its aetiology is heterogeneous. Clinically, most cases of FCMS can be divided into three categories—developmental, acute/subacute, and transient. The most common cause of the developmental form is congenital bilateral opercular dysplasia. The acute/subacute form is usually caused by infection in the CNS or cerebral blood flow study. The concentration of IgG (7.9 mg/dl) and the IgG index (1.89) in the CSF were increased, while the protein level in the CSF (30 mg/l) and the cell count (2/mm³) were normal. IgG antibody titres for herpes simplex virus (HSV), measured by enzyme linked immunosorbent assay (ELISA) in the serum (64.6) and CSF (64.6), were also raised. The serum to CSF ratio of the HSV IgG titre was decreased at 10.1, and the IgG index for HSV was increased at 3.28. IgM was negative. Polymerase chain reaction (PCR) methods did not reveal genomes for HSV 1 or 2 in the CSF.

An EEG showed generalised mild slowing without paroxysmal activity. Magnetic resonance imaging (MRI) on FLAIR sequences revealed bilateral linear high intensity lesions in the opercular area and severe atrophy of the operculum bilaterally. Diffuse atrophy of the frontaltemporal lobes was also observed.

(AWAS-R) was 80, with a verbal IQ of 85 and a performance IQ of 78. There was no similar disorder in her family members.

Treatment with acyclovir was begun but was suspended immediately because of a drug eruption. Treatment with intravenous vidarabine for 14 days was tried twice, and transient decreases of both IgG antibody titre and the IgG index for HSV in the CSF were observed on each occasion. There was no further deterioration in her neurological state after these treatments.

Comment

Neurological examination in our patient revealed automatic voluntary dissociation of orofacial motility in addition to a disturbance of movement of the pharynx and tongue. An MRI study showed involvement of the opercular androlandic regions bilaterally. This combination of clinical and neuroradiological features is typical of FCMS. However, our patient is unusual for two reasons. First, the clinical course of the FCMS was of adult onset and was slowly progressive; this type of deterioration has not been reported previously either in congenital dysplasia or in acquired acute/subacute CNS event such as stroke or infection. Although some cases with adult onset and a slowly progressive course have been reported, the aetiology of those cases remained obscure. Second, elevation of the IgG antibody titre and the IgG index for herpes simplex virus in the CSF showed the presence of chronic herpes simplex encephalitis. The temporal lobe is the favoured region for this. FCMS with an acute clinical course caused by herpes simplex encephalitis has been reported.1

Transient decreases in both IgG antibody titre and the IgG index for HSV after intravenous vidarabine were noted on both occasions the treatment was given. Although the correlation between increased IgG antibody for herpes simplex virus in the CSF and the chronic cerebral disturbance has not been verified, these observations support the idea that chronic herpes simplex encephalitis remained active in our patient and could have been responsible for her neurological impairment. The clinical features—including the slowly progressive clinical course, the negative results of PCR testing for HSV, and the normal protein level and the cell count in the CSF—suggest that herpes simplex encephalitis was not the direct cause of the damage in the affected region. It is possible that persistent HSV infection may induce inappropriate activation of the immune system, resulting in neurotoxicity because of cross reactivity. Our patient had both a partial defect of the corpus callosum and epilepsy. This combination is often observed in patients with congenital cerebral dysplasia. However, the onset of developmental FCMS is always in the early infant period and is associated with delayed psychomotor milestones or mental retardation.2 Thus the pathogenesis in our patient is very unlikely to be explained on the basis of simple congenital dysplasia. The association between a partial defect of the corpus callosum and epilepsy in FCMS could be explained by the presence of herpes simplex virus infection dating from the fetal period. Although a necropsy proven case of FCMS that was probably caused by chronic herpes simplex encephalitis has been reported before,3 the clinical course in that case was not slowly progressive. In fact there have been no previous reports of slowly progressive FCMS associated with chronic viral infection.

In conclusion, this is the first report of a case of FCMS associated with chronic herpes simplex encephalitis. Further similar cases would establish this as a variant type of FCMS.
Lesion responsible for WEMINO syndrome confirmed by magnetic resonance imaging

WEMINO (wall eyed monocular internuclear ophthalmoplegia) syndrome is a rare neurological impairment involving disconjugate ocular movements. Neuroradiological findings of the lesion responsible for WEMINO syndrome have not been reported to date. We report a case of the syndrome in which cerebral magnetic resonance imaging (MRI) clearly showed a tiny isolated lesion causing this impairment.

The patient was a 61 year old Japanese man who had been admitted to hospital for surgery for mitral regurgitation. He had a two year history of mitral incompetence, and mitral valve plasty was completed successfully on 21 September 2000. There were no postoperative problems.

On the afternoon of 27 September, one week after the operation, he suddenly experienced double vision, and was found to have left exotropia without blepharoptosis. On neurological examination, adduction of left eye was disturbed and it could not move beyond the midline of orbit, although full abduction was possible. Bilateral upward nystagmus was noted on forward gaze. Right ocular movement was not disturbed in any direction, but horizontal nystagmus appeared on rightward gaze. There was deficiency of left convergence. No ptosis occurred at any time.

His pupils showed isocoria and responded promptly to light. Vertical ocular movement was not disturbed in either eye (fig 1A). Other neurological findings were completely normal. His ocular symptoms were summarised as comprising a left internuclear ophthalmoplegia with ipsilateral exotropia; these findings have been termed WEMINO syndrome.

Cerebral computed tomography, undertaken immediately after onset, did not show any abnormalities.

We considered that he might have had a cerebral embolus caused by microthromboembolism following the heart surgery, but echocardiography did not show any obvious thrombus. We speculated that the responsible lesion was isolated in the area that included the medial longitudinal fasciculus. There have been few reports describing WEMINO syndrome, and up to this impairment.

MRI performed 20 hours after onset showed a tiny isolated lesion at the left paramedian pontine tegmentum just adjacent to the fourth ventricle on both fluid attenuated inversion recovery (FLAIR) imaging and diffusion weighted MRI (fig 1B). This corresponds to the anatomical area of the medial longitudinal fasciculus. The tiny lesion showed high signal intensity on FLAIR imaging and diffusion weighted MRI, and low signal intensity on T1 weighted MRI. These MRI findings are typical of an acute lesion resulting from cerebral infarction. Other parts of the brain showed no abnormalities. Cerebral magnetic resonance angiography showed neither stenosis nor occlusion of any of the major vessels.

The ocular impairment began to improve by the third day after onset. On the seventh day, the left exotropia on forward gaze had disappeared, and the left internuclear ophthalmoplegia had begun to improve. By the 13th day, eye position and ocular movement were completely normal, and on the 14th day the high signal intensity on FLAIR MRI had diminished.

There are various syndromes that involve disconjugate ocular movement and eye position simultaneously. WEMINO syndrome consists of symptoms similar to internuclear ophthalmoplegia with ipsilateral exotropia.

now no lesions in the central nervous system have been identified as a cause of the syndrome. Johnston and Sharpe reported that the neuropathological findings in one case of WEMINO syndrome were confined to a lesion of the pontine tegmentum, sparing the oculomotor nuclei. As the exotropia in our WEMINO patient disappeared within a short space of time, the symptom could be regarded as an acute phase phenomenon accompanying injury to the medial longitudinal fasciculus. Thus exotropia in patients with WEMINO syndrome might not be confirmed at an appropriate stage, as in PPE and NPPE patients.1–3

Cerebral MRI in our patient showed a tiny isolated lesion corresponding to the medial longitudinal fasciculus in the pontine tegmentum. This report is the first in which MRI has shown that WEMINO syndrome can arise from damage confined to the area of the medial longitudinal fasciculus.

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References

A relapsing-remitting type of ocular myasthenia gravis without typical muscle fatiguability

Myasthenia gravis (MG) is an autoimmune disorder causing postsynaptic impairment of neuromuscular transmission.1–3 Ocular, bulbar, or proximal limb muscles are most frequently affected, and weakness worsens during exercise. Recently, variants of MG have been described that deviate notably from the typical clinical presentation of MG, including “MG of respiratory muscles” and a “distal type.”4

The neurological department of the Innsbruck University Hospital serves as a single referral centre for all cases of MG in the state of Tyrol. Over the past 20 years we have been prospectively following 84 patients with MG, corresponding to a prevalence rate of 116 per million.

Our patient series includes five men and women with an unusual relapsing-remitting variant of ocular MG that lacks muscle fatiguability and most typical laboratory features of neuromuscular junction disorders and, thus, may evade correct diagnosis. All these patients reported acute or subacute onset (overnight in three cases) of non-fluctuating diplopia with gradual spontaneous remission over a 2–20 week period. Further episodes (one to six) — none of which was provoked by infection, immunisation, or medication — emerged at intervals of 1–80 months. The pattern of ocular muscles involved varied from episode to episode. Ptosis was usually mild or absent. Extensive laboratory investigations involving blood analysis (erythrocyte sedimentation rate, antinuclear, anticytacetylcholine receptor, and antistriated muscle antibodies, circulating immune complexes, routine blood tests, thyroid hormones, etc), analysis of cerebrospinal fluid (three patients), an edrophonium (Tensilon Roche Laboratories, Nütley, New Jersey, USA) test, electrophysiological examinations, magnetic resonance imaging of orbita, sinus cavernosus, and cerebrum and computed tomography of the chest were all unremarkable or negative. Oral pyridostigmine (180 mg daily) was tried in one patient over a period of two weeks but it had no clinical effect. Table 1 summarises the main clinical and laboratory characteristics of the patients. Because of the unusual clinical presentation, especially the absence of muscle fatiguability — the clinical hallmark of MG — and the normal results of standard laboratory procedures (tension test, repetitive nerve stimulation, and measurement of acetylcholine receptor antibodies), MG was not diagnosed in any of the patients initially. All were presumed to suffer from recurrent cranial nerve palsy or midbrain lesions (table 1). Later in the course of disease the correct diagnosis was established by single fibre electromyography of the right extensor indicis muscle (pathological jitter) and the observation of a few episodes of typical ocular MG. All patients responded exceptionally to a medium dose of prednisone and remained asymptomatic under a low maintenance dose (4–8 mg) but relapsed weeks to months after further tapering or discontinuation of corticosteroids (four of the five patients). None developed generalized MG during follow up.

Except for a few anecdotal case reports, this unusual presentation of MG has not yet been addressed in the literature or mentioned in standard neuromuscular textbooks.1–3 Our five patients represent 10% of all subjects with ocular MG seen in the single referral centre for the state of Tyrol, suggesting a significant minimal prevalence of this type of disease. Single fibre electromyography is necessary to establish an early diagnosis and, thus, should be an obligatory component in the diagnostic investigation of patients with diplopia or piosis of unknown origin, even in the absence of muscle fatiguability.

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References

Table 1 Clinical and laboratory characteristics of five patients with an unusual variant of ocular myasthenia gravis

<table>
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<th>Patient</th>
<th>Clinical features</th>
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<tr>
<td></td>
<td>Age at onset (years)</td>
<td>Sex</td>
<td>Prominent oculomotor palsy</td>
<td>Muscle fatiguability (at disease onset)</td>
<td>Subacute disease manifestation</td>
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<th>Generalisation</th>
<th>Concomitant diseases</th>
<th>Diagnostic findings at disease onset</th>
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<th>Diagnosis initially proposed</th>
<th>Midbrain lesion</th>
<th>Incomplete external oculomotor nerve paresis</th>
<th>Bilateral external oculomotor nerve paresis</th>
<th>Abducens nerve paresis</th>
<th>Tolosa-Hunt syndrome</th>
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*Episodes without corticosteroid therapy only. -, Absent or negative; AChR, acetylcholine receptor; F, female; M, male; MRI, magnetic resonance image.
Acute dopaminergic challenge tests to assess postural/kinetic tremor of different origin: a case report

In Parkinson's disease, a postural/kinetic tremor may occur in association with the classical resting tremor. According to the consensus statement of the Movement Disorder Society on tremor, this association is classified as type I (classical parkinsonian tremor) if the frequency difference between the frequencies of postural/kinetic tremor and resting tremor is less than 1.5 Hz; and as type II if this difference is more than 1.5 Hz. In type I tremor, resting tremor and postural tremor share common pharmacological properties responding to levodopa. Type II tremor (that is, a predominant postural/kinetic tremor associated with a resting tremor of a lower frequency) is considered to be a combination of essential tremor and parkinsonian tremor, and is reported in between 3% and 24% of the patients diagnosed as having Parkinson's disease. Though postural/kinetic tremor and resting tremor may show some overlap in their electrophysiological properties in Parkinson's disease, the postural/kinetic component does not respond to levodopa. Nevertheless, clinical criteria may be insufficient to differentiate between Parkinson's disease and essential tremor.

We report a case of a 70 year old patient affected by essential tremor and Parkinson's disease, in whom acute dopaminergic challenge tests allowed us to differentiate between the two components of severe bilateral arm tremor.

Acute dopaminergic challenge tests, which are currently accepted as a diagnostic tool in Parkinson's disease, may be helpful in various clinical settings—for example, postural/kinetic tremor of mixed origin—by identifying the parkinsonian component and predicting the responsiveness of the tremor to dopaminergic treatment.

A 70 year old right handed woman was referred to us because of disabling postural/kinetic tremor of her left arm. At age 61, the patient had developed a postural/kinetic right handed tremor. Two years later, she had also developed resting tremor in the same limb. The resting tremor and the postural/kinetic tremor worsened progressively, with significant impairment of her daily activities and social life. Two months before our first evaluation, she had started to notice a postural/kinetic tremor of her left upper arm.

On neurological evaluation, she had mild asymmetrical parkinsonism with a bilateral resting tremor, a postural/kinetic tremor of the upper limbs, and a moderate voice tremor. The UPDRS motor score (items 18–31) and writing (writing a phrase and drawing a spiral) (fig 1, panels B and C).

The levodopa/apomorphine test mainly improved akinesia and rigidity, the right sided postural/kinetic tremor and resting tremor being improved by only 33%. The left sided resting tremor and postural/kinetic tremor did not change significantly. A progressive improvement in the tremor was observed with increasing doses of apomorphine, with total disappearance of the right sided resting tremor at a dose of 6 mg, and of the left sided resting tremor at 1.5 mg. The right postural component was reduced by 60% by 1.5 mg of apomorphine and disappeared at the 6 mg dose, while a mild kinetic tremor persisted unchanged. The left sided postural/kinetic tremor did not change.

A diagnosis of essential tremor and Parkinson's disease was made, and antiparkinsonian treatment with levodopa/benserazide 100/25 mg three times daily and pergolide 0.25 mg three times daily was started. On this treatment, the resting tremor improved on the right side and disappeared on the left. In contrast, the postural/kinetic tremor persisted unchanged on the left, though it clearly improved on the right, allowing the patient to perform most of her daily activities. A therapeutic trial with primidone (Mysoline) was started, and this resulted in substantial improvement in the left sided tremor and a further positive effect on the right sided residual postural/kinetic tremor (fig 1, panel D).

Our patient presented with a combination of essential tremor and Parkinson's disease, with a differential response of the tremors to acute dopaminergic challenge tests. The opposite lateral predominance of the tremors (right for Parkinson's disease and left for essential tremor) allowed us to differentiate the pharmacological response of the two tremors more easily: the resting tremor responded to apomorphine, disappearing at the highest dose on the right side and at lower doses on the left side, while the postural/kinetic tremor showed a different response on the two sides, nearly disappearing on the right (except for a mild kinetic tremor), while persisting almost unchanged in both its postural and kinetic components on the left. The dopaminergic tests clearly indicated the presence of a postural/kinetic tremor which did not respond to dopaminergic stimulation and which was diagnosed as essential tremor. In accordance with the results of the acute challenge tests, chronic treatment with dopamine agonists and levodopa significantly improved the parkinsonian tremor (both the resting and the postural component) on the right side, while the left sided postural/kinetic tremor responded selectively to primidone.

The different pharmacological response of essential tremor and parkinsonian tremor confirms that they are separate pathophysiological entities, often difficult to distinguish on a clinical basis. The mainstays of treatment for essential tremor include β adrenergic blocking drugs and primidone. The response of parkinsonian tremor to antiparkinsonian treatment is variable. Both the resting tremor and the postural tremor, which share similar electrophysiological properties (as in type I tremor) seem to respond to antiparkinsonian treatment (L-dopa or dopamine agonists)—providing an adequate dosage is given—but not to primidone or β blockers. When both types of tremor (essential tremor and parkinsonian tremor) coexist, combined treatment is necessary, in line with their different pathophysiology.

Dopaminergic acute challenge tests are a well accepted diagnostic tool for diagnosis and evaluation of dopaminergic responsiveness in Parkinson's disease, including parkinsonian tremor. Our observations show that in particular clinical settings, such as when both essential tremor and parkinsonian tremor are suspected, acute dopaminergic challenge tests may differentiate these two entities and define the best treatment strategies.
was treated successfully with metoprolol, but his medical history was otherwise unremarkable—specifically, there was no history of gastrointestinal problems. There was no family history of neurological illness.

On examination, cranial nerves were normal, with no ophthalmoplegia or facial weakness. There was symmetrical weakness of proximal and distal muscles in all four limbs, which was most pronounced distally, especially affecting ankle dorsiflexion (graded 3/5), giving rise to a pronounced foot-drop gait. The small hand muscles were wasted but no fasciculations were seen. All deep tendon reflexes were brisk but symmetrical and the toes downgoing.

Preliminary investigation found that the full blood count, erythrocyte sedimentation rate, renal, liver, and thyroid function, serum glucose and calcium, creatine kinase, vitamin

Distal myopathy with tubular aggregates: a new phenotype associated with multiple deletions in mitochondrial DNA?

Multiple deletions of mitochondrial DNA (mtDNA) are recognised in association with a number of clinical phenotypes, including chronic progressive external ophthalmoplegia (CPEO) and myoneurogastrointestinal encephalopathy (MNGIE). The abnormality may be sporadic or inherited in a recessive or autosomal dominant fashion and is generally considered to be secondary to an abnormality of nuclear DNA.

Tubular aggregates (TA) are histological bodies consisting of densely packed, double walled tubules 50–70 nm in diameter, originating from the lateral sacs of the sarcoplasmic reticulum. Their functional significance remains controversial: in a small group of progressive myopathies, TA form the dominant or even the sole structural abnormality, but more commonly they appear as an accessory histopathological feature in a wide variety of neuromuscular disorders, both inherited and acquired. The strongest association appears to be with periodic paralysis and myotonics disorders, but the finding is by no means consistent, and TA are never more than a minor element of the overall myopathology.

To the best of our knowledge, an isolated late onset distal myopathy has never been described in association with multiple mtDNA deletions, and high densities of TA have not previously been described in association with mitochondrial myopathy. The present case therefore illustrates two original clinicopathological observations and may be a novel clinical phenotype.

A 73 year old man presented with a history of diffuse muscular pain and progressive gait disturbance over two years. The pain, which preceded the gait disturbance, affected his lower back, buttocks, and upper thighs, was maximal when he was supine, and was not exercise induced. He later noticed that his walking was becoming slower, and then he developed a tendency to drag his feet and trip over. Subsequently, arm elevation and fine finger movements became mildly affected. There were no symptoms of bulbar or sphincter dysfunction. Over the previous five years he had begun to suffer from mild angina and...
B12 and red cell folate, immunoglobulins and electrophoresis, prostate specific antigen, an autoimmune screen, antineuronal antibodies, and antibodies against voltage gated calcium and potassium channels were all normal or negative. A chest radiograph and echocardiogram were normal. Magnetic resonance imaging of the brain, spinal cord, lumbar roots, and plexus was normal. Cerebrospinal fluid examination showed an increased protein concentration (0.97 g/l; range 0.15–0.45) but other constituents were normal and oligoclonal bands absent. Routine sensory and motor nerve conduc-
tion studies of the upper and lower limbs did not show any abnormal evidence for a peripheral neuropathy. All F latencies were within normal limits. Repetitive stimulation of the right median nerve showed no significant amplitude decrement. Electromyographic sampling of distal lower limb muscles showed an excess of low amplitude polyphasic units of brief duration and a full interference pattern (<1 mV) during a weak contraction. The same was noted in an upper limb forearm muscle. Other muscles sampled also showed similar though less pronounced changes suggesting a patchy but diffuse myop-
athy.

A therapeutic trial of corticosteroids (pred-
nisolone 60 mg/day) resulted in a significant reduction in pain but no change in the weak-
ness and walking difficulties. Pain returned when the prednisolone was withdrawn after two months. Some months later a left vastus lateralis muscle biopsy was performed and showed changes of mitochondrial pathology (1% ragged red and 8% cytochrome oxidase negative fibres) together with the mutations of neutral lipid and TA in 12% of fibres (fig 1A–D). Muscle respiratory chain analysis was consistent with a reduction in complex IV activity. Serum lactate concentration was increased at 3.12 mmol/l (range 0.5–1.65), with a lactate to pyruvate ratio of 29 (range 10–20). mtDNA analysis by Southern blotting was positive for multiple deletions (fig 1E).

Mitochondrial myopathy is characterised by the presence on muscle biopsy of ragged red fibres and abnormal mitochondria with paracrystalline inclusions. The cardinal clini-
cal features consist of proximal muscle weak-
ness and exercise intolerance, which may be ac-
companied by a variable degree of resting or exercise induced lactic acidosis. Neither pain nor distal weakness is a typical feature.

From a genetic perspective, the disorder may be related to a single mtDNA deletion, a point mutation, or multiple mtDNA deletions probably secondary to defects in nuclear genes critical to intergenic communication.1 This last group has shown great clinical hetero-
genecity: to date, the phenotypes described are an autosomal dominant form of (CPEO), disorders of neuromuscular function and intestinal motility (MNGE) associated with muscle weakness and exercise intolerance, which may be accompanied by a variable degree of resting or exercise induced lactic acidosis. Neither pain nor distal weakness is a typical feature.

Our patient’s clinical presentation was characterised by late onset, slowly progressive myalgia without exercise induced cramps and a predominantly distal pattern of muscle weakness in the absence of gastrointestinal disturbance, cardiomyopathy, or disturbances of eye movement. In the presence of multiple mtDNA deletions, such a combination of clinical findings constitutes a novel pheno-
type.

The pattern of abnormality on his muscle biopsy was also of interest: the density of TA seen in was in keeping with a diagnosis of “myopathy with TA,” yet the finding was clearly accompanied by a second pathological process (mitochondrial myopathy). Although multiple mtDNA mutations are sometimes seen in inclusion body myositis (a condition that shares many of the clinical features of the present case and may be missed histologi-
cal), it is difficult to provide an independent explanation for TA (the known drug associa-
tions do not include prednisolone or metpro-
lol), suggesting that the two pathologies may be in some way linked. Animal models have suggested that structural changes in the sarcolemmal reticulum in affected muscle may be the end product of a range of functional abnormalities, including genetic anomalies, hormonal influences, and intra-
cellular calcium ion regulation.7 The role of ATP in controlling the calcium release channel of sarcolemmal reticulum and the importance of mitochondrial calcium signalling may suggest a link between the two patholo-
gies.

This case adds to the growing list of clinical phenotypes associated with multiple mtDNA deletions. Moreover, the clinical features cannot easily be accommodated into any of the currently recognised syndromes of mitochondrial or TA myopathy, suggesting that the classifi-
cation of these conditions is incomplete. Finally, although the co-occurrence of two extremely rare conditions may be random, it seems more likely that the coincidence of TA with mitochondrial dysfunction provides a clue to the functional significance of these poorly understood histological bodies.

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References
50 mg once daily. In retrospect, her husband noted first unusual arguments and a short temper while she was taking 100 mg/day topiramate for about two weeks. First psychotic symptoms were noted when the topiramate dose was adjusted to 200 mg/day three weeks before admission (blood concentration 8 µg/ml).

We discontinued antiepileptic treatment with topiramate immediately after admission and treated her extreme manic symptoms with haloperidol (up to 40 mg/day) and intravenous diazepam (20 mg/day). After four days haloperidol was replaced with olanzapine (20 mg/day, blood concentration 0.02 µg/ml) and after 21 days with risperidone (6 mg/day). Tiagabin (40 mg/day) and clobazam (20 mg/day) were finally used for antiepileptic cover. Extreme manic symptoms abated within one day after neuroleptic treatment and discontinuation of topiramate. Other indices of psychotic symptoms, however, were alleviated rather slowly: the YMRS score was 8 after one month and 2 after two months. Interestingly, concomitantly with aggravation of manic symptoms, seizures were declining and stopped nearly completely with add on treatment of 200 mg/day topiramate.

Topiramate is a novel AED, which is almost exclusively used as an add on. It acts by a state-dependent blockade of sodium channels, potentiation of γ-aminobutyric acid mediated neurotransmission, and antagonism of glutamate by blocking α-amino-3-hydroxy-5-methyl-4-isoxazole propionic acid receptors. Although in clinical trials the incidence of psychosis with topiramate treatment was not significantly different from placebo, concerns remain about its use, particularly in predisposed patients. Reports of paranoid delusions, auditory hallucinations, and cognitive impairment with topiramate treatment are scanty. While previous accounts have suggested that these adverse effects may occur mainly in patients with pre-existing psychiatric conditions, our report illustrates a rare case of an actual manic episode in a patient without respective psychiatric history. Although she had been receiving tiagabine for a long time, the close temporal relation of the introduction of topiramate and the onset of manic symptoms, as well as their disappearance after termination of topiramate treatment, indicates an adverse effect of topiramate (although an interaction can, of course, not be excluded).

This case is illustrative of a potentially severe side effect of topiramate: A careful determination of psychiatric history and neuropsychiatric assessment may be useful in identifying patients who are particularly prone to this side effect. Prescribing physicians need to recognise and treat affective and psychotic symptoms appropriately. Although topiramate and other novel AEDs have been used to treat mood disorders, their range and frequency of adverse effects will ultimately limit clinical use.

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