“Sporadic” familial amyloidotic polyneuropathy in a German patient with B cell lymphocytic leukaemia

We report a 70 year old German man presenting with a three year history of progressive numbness and painful tingling and burning paraesthesiae in his hands, feet, and lower legs, which had worsened during recent months. He also reported unsteadiness of gait, fatigue, night sweats, loss of appetite, and a weight loss of 12 kg within one year. He denied bowel or bladder problems and alcohol ingestion, but admitted smoking (110 pack-years). His family history was negative for neurological diseases.

The family was originally from Gdansk (now Northern Poland). The patient's father and his four siblings all reached their 80s without developing neurological symptoms. The patient's mother died at the age of 64 of blood cancer, and her half brother died at the age of 78. Three of the patient's siblings died at the ages of 1, 17, and 33 (starvation, killed in the war, stomach cancer). Two further sisters, aged 64 and 69, their descendants, and the patient's own five sons and their children were healthy. Both of the patient's grandmothers died in their 80s, whereas the paternal grandfather died early of unknown cause, and the maternal grandfather drowned in his 30s.

Neurological examination revealed severe ataxia of gait and stance, atrophy of the small hand and foot muscles, and bilateral distal pareses (3–4/5 on the MRC scale), diminished tendon jerks, a glove and stocking distribution of hypoaesthesia for all sensory qualities up to the mid-thighs and elbows, and severe trophic skin disturbances of the lower legs and hands with oedema and ulcers, suggestive of autonomic neuropathy. No orthostatic hypotension was observed.

Quantitative sensory testing showed markedly increased or undetectable thermal thresholds for heat and cold sensation in both hands and feet. Dynamic (brush) and static (von Frey hair) mechanical stimuli were not detected. Electrodiagnostic studies revealed absent sensory nerve potentials in the right sural nerve, absent compound muscle action potentials (CMAP) of the right tibial nerve, and markedly reduced CMAP, moderately slowed conduction velocity, and no F waves in the right median nerve. An ECG showed atrial fibrillation. On transthoracic echocardiography there was concentric hypertrophy of the left ventricle, dilatation (51 mm) of the left atrium, no stenoses of the cardiac valves, and normal left ventricular function. The patient had no history of hypertension. Abdominal and thoracic computed tomography detected no tumour mass or lymph node enlargement.

Isoelectric focusing of the serum showed oligoclonal bands identified as IgG λ and κ on immunofixation. In the urine, no Bence-Jones proteinuria was detected, and creatine clearance was within normal limits. The blood leucocyte count was 7.1 x 10^9/µl, 40% of which were lymphocytes. Flow cytometric analysis of the peripheral blood showed that 38% of the lymphocytes were positive for CD19, CD5, CD23, and CD27. These cells showed normal CD20 expression and slight surface expression of λ light chains. A bone marrow biopsy showed multifocal 40% infiltration with

![Figure 1](http://jnnp.bmj.com/)

(A) Semithin section of sural nerve stained with methylene blue azure-two, showing massive loss of myelinated fibres and an amyloid plaque (arrow). (B) Paraffin section with Congo red staining showing birefringence in polarised light. (C) Cryosection reacted with antibodies to transthyretin (prealbumin Dako, 1:20 000), showing dense immunoreactivity of the plaque for transthyretin. (D) Cryosection reacted with polyclonal antibodies to human IgG (Dako, 1:1000) showing no immunoreaction on the amyloid plaque (arrows). (E) Protein analysis by hybrid isoelectric focusing under half denaturing conditions (left), and restriction fragment analysis after amplification of exon 2 of the transthyretin (TTR) gene and digestion with Nsi I for the identification of the ATTR(Val30Met) mutation (right). Lane 1 represents the patterns of the patient, lane 2 the patterns of a normal control individual, and lane 3 the patterns of a known FAP patient with normal TTR and the ATTR(Val30Met) mutation.
lymphoid B cells of low proliferative activity and no clear birefringence in Congo red staining. A diagnosis of smouldering B cell lymphocytic leukaemia (B-CLL) was made.

Sural nerve biopsy disclosed a dramatic loss of both myelinated and unmyelinated fibres without signs of regeneration (fig 1A). Surprisingly, several amyloid plaques were seen on Congo red staining (fig 1B). Immunohistochimistry showed unequivocal immunoreactivity for transthyretin (TTR) (fig 1C), while polyclonal antibodies to human IgG (fig 1D) stained negative. On skin biopsy of the left lower leg, there was total loss of epidermal nerve fibres. Protein and DNA analysis showed heterozygosity for normal TTR and the amyloidogenic mutation ATTR(Val30Met) (fig 1E) leading to the diagnosis of familial amyloidotic polyneuropathy (FAP).

This patient presents a chance association of B-CLL with “sporadic” FAP. Several cases of a B-CLL associated chronic sensorimotor neuropathy, either caused by neoplastic nerve pathy, either caused by neoplastic nerve involvement or as a paraneoplastic condition, have been described. The initial tentative diagnosis of CLL associated neuropathy was revised when amyloid plaques immunoreactive for TTR were found in the sural nerve biopsy and the ATTR(Val30Met) mutation was demonstrated.

In most cases FAP is caused by a point mutation in the TTR gene. About 80 different mutations of the TTR gene have been identified, the Val30Met mutation being by far the most common. In Europe, this mutation clusters in distinct areas of Portugal and Sweden. Smaller foci or single families/cases have been described in most other European countries. In Germany about half the known FAP patients are carriers of the ATTR(Val30Met) mutation. Age of onset and penetrance of ATTR(Val30Met) amyloidosis vary considerably. While Portuguese patients from the focus Povoa do Varzim/Vila do Conde develop the disease at a mean age of 51 years, the age of onset among Swedish patients is approximately 57 years. Penetrance is high and progression is rapid in Portugal, but penetrance is low and progression slow in Sweden. Additional genetic and environmental factors probably influence the wide range of both age at onset and severity of FAP.

Most FAP patients present with fibre length dependent sensorimotor and autonomic neuropathy. Cardiac involvement, as observed in our patient, is less common and seen in cases of severe polyneuropathy only. Renal involvement is much less prevalent in FAP than in AL amyloidosis, and macroglossia does not occur in FAP. Differentiation of amyloid in tissues by immunohistochimistry is essential for identifying the major amyloidogenic protein. Finally, the diagnosis of FAP must be based on molecular protein/DNA analysis.

Although FAP is a disease of autosomal dominant inheritance, a negative family history of polyneuropathy or amyloidosis does not rule out the disease, owing to incomplete penetrance or a new mutation. FAP should be considered in all cases of sporadic neuropathy with prominent autonomic symptoms, trophic ulcers, or weight loss, even in countries with a low incidence like Germany. Possibly the prevalence of FAP is underestimated in such countries because of incomplete diagnostic workup.

The recognition of FAP is important for two main reasons. First, treatment is possible by liver transplantation when performed early in the course of disease. Second, diagnosis of FAP in the propositus is essential for identifying relatives at risk for the disease and for providing adequate genetic counselling.

**References**


**Aneurysm of the extracranial internal carotid artery presenting as the syndrome of glossopharyngeal pain and syncope**

The syndrome of glossopharyngeal pain and/or syncope mimicking idiopathic glossopharyngeal neuralgia has been reported to be associated with a variety of intracranial or extracranial conditions, including mass lesions in the parapharyngeal space, the clon- gated styloid process, and multiple sclerosis. However, aneurysm of the cervical portion of the internal carotid artery (ICA) presenting as episodic glossopharyngeal pain and syncope has not been reported previously to the best of our knowledge. We report here the first such case that was successfully treated by surgical resection of the aneurysm.

A 66 year old woman with a two year history of paroxysmal attacks of pharyngeal pain with occasional syncope episodes was admitted to our hospital. She had been in good health until two years previously, when she first noticed pain in the region of the left
which was located near the skull base above the distal cervical portion of the left ICA (fig 2), space, compressing the parapharyngeal space. A computed tomography showed a round lesion with an unusual enhancement of the left parapharyngeal space (fig 2). Four vessel angiography showed a large aneurysm (3.9 x 3.0 cm) of the distal cervical portion of the left ICA (fig 2), which was located near the skull base above the bifurcation. There were no aneurysms elsewhere. A computed tomography scan of the neck showed no evidence of the elongated styloid process.

Treatment with phenytoin (300 mg a day) caused the paroxysmal pain to disappear completely within three days. Under general anaesthesia, the aneurysm was approached by a preternucleomasticoid cervicotomy with sacrifice of the mandible or transection of the digastic muscle. The cutaneous incision was extended along the posterior border of the mastoid process. The aneurysm was found 5 cm above the carotid bifurcation. The anatomical relation between the aneurysm and the glossopharyngeal nerve was not identified in the surgical field. The aneurysm was resected, with replacement with a saphenous vein graft. Surgical and pathological findings indicated a true aneurysm. After surgery, there were no neurological deficits except incomplete Horner’s syndrome on the left side. Postoperative angiography showed satisfactory reconstruction (fig 2). Phenytoin was not given after surgery. No episodes of pain or syncope recurred during the follow up period of six months after surgery.

Our case was characterised by episodic pain in the distribution of the glossopharyngeal nerve, sometimes associated with syncope, and a dramatic response to phenytoin. A huge aneurysm of the extradural ICA was found to cause the glossopharyngeal pain and syncope syndrome, which was confirmed by successful surgical resection. The syndrome of glossopharyngeal pain and/or syncope may be caused by a variety of conditions. In our case, the glossopharyngeal neuralgia had been considered to be unlikely because of the absence of a stabbing feeling, precipitating factors, or trigger zones. Also, there was no radiological evidence of mass lesions in the parapharyngeal space or the elongated styloid process.

The pathogenetic mechanism in our patient was considered to be similar to that involved in glossopharyngeal neuralgia and syncope. Sobol et al reported two cases of glossopharyngeal neuralgia-astystole syndrome associated with ipsilateral lesions of the parapharyngeal space, and postulated that parapharyngeal space lesions may induce neural irritation to the afferent pain fibres of the glossopharyngeal nerve and reflex within the nerve to produce the syndrome. The causes of aneurysm of the ICA are multiple and include atherosclerosis, dysplasia, trauma, and infectious lesions. The cause in our patient was not known despite the histological examination. Welling et al reported that 41 of 1118 aneurysms of the peripheral arteries arose from the extracranial carotid system. Only four of them were saccular aneurysms of the extracranial ICA. Other aneurysms of the extracranial ICA do not usually produce neurological symptoms, they may result in potentially serious problems, such as cerebrovascular events, as a consequence of thromboembolic phenomena or impairment of flow in the proximal carotid artery. Isolated cranial neuropathies can also occur as the result of direct nerve compression. In this case, the aneurysmal parapharyngeal mass produced episodic glossopharyngeal pain and syncope. The syncope with the family, aggressive supportive measures were withdrawn and the patient died. The transient ischaemic attacks persisted unabated during the follow up period of six months after surgery. Preoperative T2 weighted and magnetic resonance images revealed a small scattered subcortical signal changes, but no evidence of a previous cerebrovascular event. Cerebral angiography showed severe right supraclinoid internal carotid artery and proximal right M1 stenosis with contributing collateral supply from the middle cerebral artery from pial collaterals. The cervical carotid arteries were normal. Transcranial Doppler studies with carbon dioxide vasodilatation challenge showed flow limiting stenosis with compromised cerebrovascular reserve.

On the basis of these data and the refractory nature of the symptoms, we decided to proceed with a high flow revascularisation procedure. An autologous saphenous vein graft was inserted into a proximal M2 branch and the external cervical carotid artery in end to side fashion. During this time the patient’s systolic blood pressure was maintained between 160 and 180 mm Hg and the patient was heparinised. A temporary clip was placed across the graft, and the brain became massively swollen. A temporary clip was placed across the graft, and the brain became massively swollen. A temporary clip was placed across the graft, and the brain became massively swollen. A temporary clip was placed across the graft, and the brain became massively swollen. A temporary clip was placed across the graft, and the brain became massively swollen. A temporary clip was placed across the graft, and the brain became massively swollen. 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to support metabolic demands despite maximal oxygen extraction. Management of patients refractory to treatment with an- tialcalcet or anticoagulants, blood pressure augmentation, and blood volume expansion is difficult. There is a high risk of stroke, and several studies have argued strongly in favour of EC-IC bypass in these patients. Con- sequently, a decision was made in this case to carry out a high flow bypass from the external carotid artery to an M2 branch of the middle cerebral artery. The long nature of the lesion in the suprarinal carotid, extending into the proximal M1 segment, was judged not ame- nable to angioplasty. We failed to consider seriously the use of a low flow bypass graft.

Hyperperfusion following cerebral revascu- larisation is well recognised, particularly in the context of carotid endarterectomy. Its occurrence secondary to EC-IC bypass is not surprising. Intra- cerebral haemorrhages can complicate both superficial temporal artery to middle cerebral artery (STA-MCA) and saphe- nous vein EC-IC bypasses for carotid occlusive disease, but evidence for hyperperfusion as the underlying cause of these haemorrhages is not established. A dense perfusion blush on the intraoperative angiogram documented hyperperfusion following connection of the EC-IC bypass in this case (fig 1). In chronic ischaemic brain, hyperperfusion syn- drome is thought to arise as a result of disturbed cerebral autoregulation. The vasculature is maximally dilated and following restor- ation of flow vascular reactivity is impaired and unable to vasoconstrict appropriately, to protect the capillary bed against the increased perfusion pressure. Low signal oedematous changes and cerebral haemorrhage result, as was evidenced on postoperative computed tomography in this case.

Several factors led to the development of hyperperfusion syndrome in our case. Preoperatively we failed to recognise that altered microvascular permeability of the chronically hyperperfused brain may lower the safe threshold for ischaemia and hypertension.

Despite neuroprotective measures, temporary occlusion of the M2 branch for the bypass may have resulted in a serious degree of ischaemia, and our routine practice of moder- estly raising the patient's blood pressure during temporary clamping may have been detri- mental in this setting. Given the increased susceptibility of the chronically ischaemic brain—barrier to injury, the choice of a high flow bypass was in retrospect an error. Depending on the diameter of the graft, saphenous vein bypass grafts provide flows to 110 ml/min. By comparison, STA-MCA by- passes generate flows through the graft in the range of 10 to 60 ml/min (mean, 28 ml/min). Revascularisation is instituted to rescue tissue with blood flows of 20–25 ml/100 g/min from dropping to 10–15 ml/100 g/min leading to cell death. This incremental augmentation of blood flow can be achieved by a low flow STA- MCA bypass with a lower risk of complica- tions. Over time, adaptation will occur, allowing increased flow through the bypass graft to be tolerated by the brain. However, if an ischaemic brain is subjected acutely to these high flows, Patients with intracranial stenosis and compromised cerebrovascular reserve—high- lighted as a group most likely to benefit from EC-IC bypass—are at high risk for hyperper- fusion syndrome. Strict attention to judicious choice of bypass conduit, minimising ischae- mic time for the anastomosis, optimal neuro- protection, and meticulous control of blood pressure and intravenous fluids is mandatory to minimise complications of hyperperfusion syndrome and optimise the potential benefit of EC-IC bypass in these patients.

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References

A Japanese case of steroid responsive myopathy with deficient chondroitin sulphate

In 1998, Al-lozzi et al described a case of steroid responsive myopathy with deficient chondroitin sulphate C that had not been reported before. The patient developed diffuse bulbar and systemic weakness with respiratory fail- ure. While muscle biopsy showed only a mod- erate degree of type 2 atrophy with one small perimysial, perivascular mononuclear cell in- filtration, immunocytochemistry showed an absence of chondroitin sulphate C in the

dendomyosum. Prednisone treatment resulted in a marked increase in muscle strength. Here we report another case of this interesting and treatable muscle disorder.

Case history

A Japanese woman first developed neck mus- cle weakness, dysphagia, and weight loss at the age of 42 years. She was diagnosed as having anorexia nervosa at the age of 42, and was later treated with antidepressive drug treatment. Her symptoms worsened and after a few months she developed weakness in all of her limbs, sluggish speech, and diplopia, and began hav- ing difficulty with breathing. She presented in our outpatient clinic in 1993 at the age of 43.

Her personal and family histories were negative for neuromuscular disorders. On physical examination, she was very thin (height 162 cm, weight 32 kg), and her temperature was 38.1°C. Coarse crackles were heard in the right lower lung. Neurological examination revealed dysarthria, dysphagia, palatal paresis, limitation of extraocular movements in all directions, proximal muscle weakness of all four limbs, and generalised hyporeflexia. Her muscle tone, sensory per- ception, and autonomic system were normal, as was her cognitive function.

Laboratory tests showed signs of inflamma- tion (white blood count 9000/μl, C reactive protein 3.2 mg/dl), considered to be the result of mild aspiration pneumonia in the right lower lung on chest x ray. There was also hypoproteinaemia. Blood gas analysis re- vealed hypoxia, with a PaO2 of 8.05 kPa, a PaCO2 of 9.27 kPa, and a blood pH of 7.392. Other blood constituents were normal, including creatine kinase, aldolase, anticyclic red blood cell receptor antibody, antinuclear antibody, lactic acid, and pyruvic acid. Urinalysis, ECG, and cerebrospinal fluid examination were also normal, as was brain magnetic resonance imaging.

Electromyography (EMG) showed myo- genic discharges in both biceps brachii, the left rectus femoris, and in both sternocleido- mastoid muscles. Motor and sensory nerve velocities were normal in the median, ulnar, tibial, peroneal, and sural nerves. Repetitive stimulation tests of the facial and deltoid muscles gave normal results. A tension test was negative.

Because she was clinically diagnosed as having atypical oculopharyngeal myopathy with respiratory failure, a biopsy was per- formed on the right rectus femoris muscle. On histochemical examination, a moderate de- gree of type 2 atrophy was identified (fig 1A). Immunohistochemical investigation using antibodies to CD3, CD4, CD8, CD68, and CD22 (Dako Denmark, catalogue Nos 054, 105, 036, 044, and 093) failed to show the presence of infiltrating inflammatory cells (data not shown). At this time, the origin of the patient’s disorder remained undetermined.

The patient was given prednisone orally in a dose of 60 mg/day and her symptoms mark- edly improved. By day 7, the diplopia, dysphagia, and dyspnoea had resolved. After four months, she was discharged with no remain- ing neurological deficit. Her prednisone dosage was gradually reduced and eight years later, at the time of writing, she was taking a maintenance dose of 20 mg every other day and showed no neurological deterioration.

Because the clinical features of steroid responsive myopathy with deficient chondroitin sulphate C—first reported in 1998—were similar to those in our case, we carried out an immunohistochemical study using a mono- clonal antibody to chondroitin sulphate.
were markedly similar to those seen in the
cal examination, all other clinical features
movements, the EMG results and the absence
Apart from the limitation of her extraocular
responsiveness; and type 2 muscle fibre
lar movement limitation, and proximal mus-
Our patient showed the following clinical fea-
tions with the other reported case suggest that
A 31 year old patient was admitted because
This was certainly malnour-
ished as a result of severe bulbar involvement.
The other patient with steroid responsive
myopathy was similarly reported to have been
malnourished, for a period of 18 months. Thus
it is likely that the type 2 fibre atrophy shown in
both these patients was caused by malnu-
Chondroitin sulphates are major constitu-
ts of the extracellular matrix of skeletal
muscle and play an important role in binding
cytokines as well as in cellular adhesion,
differentiation, and signal transduction. Thus
their disruption in muscle is thought to be
involved in the pathogenesis of disease.
Al-Lozi et al suggested that myopathy might
be caused by a deficit in chondroitin sulphate
C developing as a result of immune mediated
mechanisms. In our case, there was dramatic
improvement with steroid treatment, further
supporting a role of the immune system in the
disease pathogenesis.
In conclusion, we presented a case of
steroid responsive myopathy with deficient
chondroitin sulphate. This condition should
be considered in cases of atypical oculopha-
ryngeal myopathy of unknown origin.

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References
1 Al-Lozi MT, Hemelt VB, Pestonk A.
Steroid-responsive myopathy with deficient
chondroitin sulfate C in skeletal muscle
2 Tubbs RR, Sheibani K. Immunohistology of
lymphoproliferative disorders. Semin Diagn
3 Carpenter S. Light-microscopic pathology of
skeletal muscle. In: Walton J, Karpati G,
Hilton-Jones D, eds. Disorders of voluntary
muscle. New York: Churchill Livingstone,
1994;233–50
4 Hardinghorne TE, Fosang AJ. Proteoglycans:
many forms and many functions. FASEB J
1992;6:861–70.

Fulminant progression of
hyperammonaemic
encephalopathy after treatment
with valproate in a patient with
ureterosigmoidostomy

In the absence of liver disease, hyperammon-
aemia is often considered in the differ-
ential diagnosis of encephalopathy and, there-
fore, the diagnosis of hyperammonaemia
encephalopathy may be delayed. We report a
case of fulminant progression of hyperamno-
daemia encephalopathy after valproate treat-
ment in a patient with ureterosigmoidostomy.
A 31 year old patient was admitted because of
confusion and agitation. Ureterosigmoidos-
tomy for congenital bladder extrophy was per-
formed when he was 9 years old. Over the
past year, he was repeatedly hospitalised
with episodes of abnormal behaviour, which
were blamed on his abuse of various illegal
drugs. At this admission, he was disoriented,
with lapses into somnolence as well as agita-
tion. Apart from that, his general and
neurological status was unremarkable. C
reactive protein was 80.5 mg/l, leucocytes
16160/µl, and blood urea 12.6 mmol/l. Venous
ammonia concentration was mildly increased
(63 µmol/l). Arterial blood gas analysis showed
respiratory alkalosis. All other labora-
tory analyses including toxicological screen-
ing, microbiological test for encephalopathy,
and cranial computed tomography were
unremarkable. Plasma amino acids,
organic acids, and orotic acid in urine were
normal. After treatment with fluids and
amoxicillin with clavulanate for urinary infec-
tion, C reactive protein, leucocytes, blood urea,
and sodium concentrations normalised.
Soon after admission, he developed generalised
tonic-clonic seizures. Antiepileptic drugs
was introduced with 900 mg valproate intra-
venously followed by continuous infusion
(2000 mg/day). Because of repeated seizures,
phenytoin was added two days later (1000 mg
bolus followed by 1000 mg/day). Despite the
antiepileptic treatment, the patient developed
a status epilepticus and had to be intubated.
The seizures finally stopped after barbiturate
controlled (with thiopental (2×250 mg bolus
+10 000 mg/day)) was induced. Arterial blood
ammonia concentration was now massively
increased (2875 µmol/l). Emergency dialysis
was started, and paromomycin and lactulose
administered. Under dialysis, the blood
ammonia concentration decreased to
812 µmol/l. However, the patient developed
dilated, astatic pupils. Computed tomogra-
phy showed diffuse brain oedema. The patient
died a few hours later, five days after
admission. Total plasma carnitine (6 µmol/l,
normal range 33–77 µmol/l) and free carnit-
ine (3 µmol/l, normal range 25–54 µmol/l)
concentrations were decreased. Acylcarnitine
profile also showed decreased but no abnor-
mal individual acylcarnitine species. Repeated
analyses of amino acids in plasma and urine,
urinary organic acids, and orotic acid showed
no significant abnormalities. On postmortem
examination, the liver was normal. In both
kidneys, multiple abscesses were found. There
was massive cerebral oedema and cerebellar
hemorrhiation.

Ureterosigmoidostomy has been repeatedly
associated with episodic hyperammonaemic
encephalopathy. This condition, the urine
is excreted directly into the sigmoid colon
and then excreted during defecation. The
complications include recurrent pylonephri-
ts, faecal incontinence, intestinal malabsorp-
tion, and hypercholaemic acidosis. Hyper-
ammonaemia develops as a result of the
increased production of ammonia in the colon
from bacterial ureolysis and subsequent ab-
sorption of ammonia in the colon. The bowel
wall is much more permeable to ammonia
than the bladder mucosa, allowing rapid
absorption of the ammonia produced within
the sigmoid colon. This exceeds the liver’s
capacity to detoxify ammonia by the urea
cycle. In addition, a proportion of the reab-
ored ammonia enters the portal blood through
oesophageal and haemorrhoidal veins. Thus,
hyperammonaemic encephalopathy can de-
velop even if liver function is normal.

In the present patient, the diagnosis of
hyperammonaemic encephalopathy was not
established until the ammonia concentration
had risen greatly and the patient was already
in critical condition. Urea cycle disorders and
organic acidurias were excluded. The labo-
ratory analysis and postmortem examination
did not find any signs of hepatic dysfunction.
There were no signs of inborn systemic carnit-
ine deficiency. The ammonia concentration
increased massively after the introduction of
valproate. This can hardly be explained as a

Figure 1 (A) Muscle biopsy from our
patient showing a predominant type 2 fibre
atrophy [adenosine triphosphatase 10.4
staining, ×50]. (B) Immunohistochemical
staining of muscle obtained from our patient
and (C) from disease control subjects, using
a chondroitin sulphate specific antibody
[×60]. Chondroitin sulphate staining was
absent from the muscle of our patient.

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consequence of ureterosigmoidostomy: alone ammonia concentrations as high as these have never been observed in patients with hyperammonaemia following ureterosigmoidostomy. The patient had been treated a few weeks before for ursoscapic following constipation, which theoretically can lead to very high ammonia concentrations. However, during the final episode, he was not constipated. Therefore, in our patient, pre-existing episodic hyperammonaemia with encephalopathy and seizures was obviously severely aggravated by valproate induced hyperammonaemia and depletion of carnitine. Patients with valproate induced encephalopathy have been repeatedly described, the pathophysiology of which seems to be heterogeneous. In some patients, previously subclinical urea cycle defects have become manifest after treatment with valproate. However, these disorders could be ruled out in our patient. Hyperammonaemia is a frequent side effect of valproate treatment and is often asymptomatic. It seems to occur more frequently in children but is also common in adults, particularly in the presence of other antiepileptic drugs, as was the case in our patient. The exact mechanism of valproate induced hyperammonaemia is unknown but it may appear independently of hepatotoxicity. Valproate has repeatedly been shown to reduce serum and liver carnitine concentrations, both with and without being associated with hyperammonaemia. While most of these patients were children, some cases in adults have been described. Valproate may reduce carnitine concentrations by forming an ester with carnitine, which is coexcreted with organic acids into the urine, or by altering renal reabsorption of acylcarnitine and free carnitine. In conclusion, our case shows that valproate may greatly aggravate pre-existing, mild hyperammonaemia. We suggest that valproate should be avoided in patients with even slight hyperammonaemia and normal liver function. Equally, we advise the close monitoring of ammonia and carnitine concentrations in patients with ureterosigmoidostomy, such as the one described here, if valproate cannot be avoided.

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References

Palatal tremor and cognitive decline in neuroferritinopathy

Neuroferritinopathy is a recently described autosomal dominant disorder associated with iron accumulation, particularly in the basal ganglia. All patients found to date have a single adenine insertion between nucleotides 460 and 461 of the ferritin light chain gene. This results in a frame shift and is predicted to cause structural alteration of the polypeptide carboxy terminus. Magnetic resonance imaging of the brain shows iron accumulation and this has been confirmed pathologically with the detection of numerous iron positive inclusions particularly in the globus pallidus. In spite of this, serum ferritin levels are found to be normally low or at the lower end of the normal range. Patients tend to present in mid-life with a movement disorder, characterised by chorea, dystonia, and rigidity. In contrast with Hallervorden-Spatz syndrome, which is also associated with accumulation of brain iron, visual and cognitive function is preserved. Here, we report a patient with genetically proven neuroferritinopathy in which the clinical features included cognitive decline, decrease in social activity, and palatal tremor. These features extend the phenotype of this condition from those previously reported. The patient was a 49 year old man who developed lingual and oral dyskinetic movements and a slurring dysarthria at the age of 37. Initially, the movement disorder was partially controlled with high dose anticholinergic but then progressed to involve his limbs. Over the next 10 years, he developed dysphagia, unsteadiness, and cognitive decline, particularly of frontal lobe function. His father, paternal uncle, and paternal grandmother had all developed a movement disorder in middle age. A diagnosis of Huntington’s disease was made at that time and was assumed in the patient until disproved by a negative genetic test result. The family continued to seek diagnostic clarification to enable life planning for the patient’s children.

On examination, he was alert and oriented. He scored 7/10 on a mini mental state examination. Detailed cognitive testing showed particular impairment of non-verbal abstract reasoning, with some word retrieval difficulties. He tended to perseverate, and his cognitive estimates were poor. He exhibited pout, palinomental, and grasp reflexes. He manifested appreciable oral, lingual, and facial dyskinesias. Eye movements were abnormal, with saccadic intrusion into pursuit and use of head thrust to initiate saccades. He had apraxia of eyelid opening. There was no evidence of a pigmented retinopathy or Kayser-Fleischer rings, and the optic discs were normal. There was a palatal tremor at a frequency of 1 Hz. Examination of the limbs showed pronounced choreiform movements and dystonic posturing. There was no evidence of a peripheral neuropathy or myoclonus.

The following blood tests were normal or negative; full blood count and film, copper studies, creatine kinase levels, ferritin levels (60 µg/l, normal range 25–350 µg/l), liver function tests, and genetic tests for Huntington’s disease (HD), dentatorubral pallidoluysian atrophy, and spinocerebellar ataxia 1–3, 6, and 7. Nerve conduction studies were normal. A muscle biopsy was normal. Cerebrospinal fluid analysis was normal, with no evidence of xanthochromia. Magnetic resonance imaging of the brain (fig 1) showed considerable hyperintensity, with a band of surrounding hypointensity on T2 weighting involving the putamen, pallidum, thalamus, substantia nigra, and dentate nucleus. The cerebral cortex was atrophic. A computed tomography scan showed no evidence of cerebral calcification.

Mindful of the clinical features, ferritin deposits, dominant inheritance, and family origin reported in neuroferritinopathy, further genetic testing confirmed the presence of the same A insertion at position 460-461 of the ferritin light chain gene. Investigation of genotypes at six polymorphic microsatellite markers close to the gene on chromosome 19 showed sharing of one allele at each marker. Thus, it is likely that the patient potentially shares the disease associated haplotype with all affected individuals of the originally described families and is another example of inheritance of an initial founder event. Additional evidence comes from the north-west geographical origin of his family.

The differential diagnosis in this case initially included HD, neuroacanthocytosis, and Wilson’s disease, but these conditions were excluded by appropriate investigations. Atypical Hallervorden-Spatz syndrome was also considered, particularly in the light of the appearances on brain imaging, but this condition is recessively inherited and associated with a defective pantothenate kinase gene.

Figure 1 Magnetic resonance image of the brain showing hyperintensity with surrounding hypointensity on T2 weighting affecting the putamen, pallidum, and thalamus.
(PANK2). Interestingly, our patient had significant cognitive impairment and palatal tremor in addition to the movement disorders so far described in patients with neuroferritinopathy. In other neurodegenerative disorders, particularly HD, the causative proteins may be involved in iron metabolism. Thus, cognitive impairment may be predicted to occur in neuroferritinopathy, especially in the presence of a pre-existing hyperkinetic movement disorder.

The development of palatal tremor in our patient deserves further explanation. Palatal tremor (previously known as palatal myoclonus) may be classified as essential or symptomatic. It is thought that palatal tremor arises because of functional disruption in "Mollaret's triangle", which consists of the inferior olivary nucleus, red and dentate nuclei. The symptomatic form is usually associated with hypertrophy of the inferior olivary nucleus and may arise from vascular lesions, particularly in the cerebellum. Further evidence for this hypothesis comes from a positron emission tomography study, which showed hypermetabolism in the inferior olivary nucleus. Most patients also have cerebellar ataxia. However, palatal tremor may also occur in other conditions including multiple system atrophy, progressive supranuclear palsy, and Alexander's disease. As in our case, symptomatic palatal tremor is not usually associated with ear clicking. Presumably, in our patient, iron deposition in the dentate and cerebellar nuclei was responsible for disruption of rubral and olivary pathways.

Ferritin is an iron storage protein and alteration in structure of the carboxy terminal could lead to the release of free iron and excessive oxidative stress. In other conditions, such as haemochromatosis, the use of iron chelators has been advocated as a potentially useful treatment. Results, in the main, have been disappointing. Whether free radical scavengers, such as idebenone, have useful therapeutic value in neuroferritinopathy remains to be seen.

Neuroferritinopathy should be considered in all patients with a hyperkinetic movement disorder, imaging evidence of iron deposition within the brain, and an autosomal dominant family history.

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Cocaine induced hypokalemic periodic paralysis

The use of cocaine has been associated with a number of peripheral, central, and neurological complications. This is the second reported case of a patient who suffered three distinct episodes of paralysis after engaging in a cocaine binge.

Case report

A 33 year old male horse breeder with no significant medical history was evaluated at the Texas Tech Health Sciences Center after the abrupt onset of ascending generalised weakness. He reported not being able to walk or lift his arms or legs, much less climb up or get down the stairs of his home. He reported no bowel or bladder dysfunction, loss of sensation, headache, nausea, or vomiting. The patient did report mild chest pain at the time.

Ten days before his initial evaluation he had suffered a very similar episode but had not sought medical attention. At the time of his evaluation the patient stated that he would be better in 24–48 hours. A very similar event had occurred five years earlier, for which he was seen in an urgent care facility and discharged home; symptoms resolved after two to three days. Records of this first episode were not available, although he reported that potassium supplements were provided at that time.

Physical examination found an unfortun- able appearing, slightly dishevelled, unshaven man. Physical examination found an awake, alert, and oriented person. Speech and language were normal. Cranial nerves were intact. Motor examination found normal bulk with a reduction in tone. Strength was 5/5 in all major muscle groups with a very mild left upper limb predominance. Neck extensors and flexors were 5/5. Bulbar muscles were spared. No myodegeneration, myotonia, fasciculations, or other abnormalities were noted. The sensory examination was normal and reflexes were symmetric with no Babinski signs. A complete blood count and comprehensive metabolic panel, including thyroid studies, complete blood count, blood alco- hol concentration, and erythrocytosis rate, were performed. Cardiac enzymes were normal. Neuroimaging of the brain and spinal cord were normal. Forced vital capacity and negative inspiratory fraction were normal. Laboratory investigations showed a blood glucose concentration of 6.6 mmol/l, sodium 141 mmol/l, calcium 2.27 mmol/l, and creat- inine kinase (CK) 395 IU/l. Acetylcholine recep- tor antibodies were drawn at the time of admission and subsequently shown to be in the normal range. Two laboratory investigations were of particular interest. The patient's potassium concentration was 1.9 mmol/l and urine toxicology screen found the presence of cocaine, cannabinoids, and benzodiazepines.

The patient had initially denied any illicit drug use but later admitted to having engaged in a cocaine binge the previous night and before the previous two episodes of weakness. There was no family history of periodic paralysis or other neuromuscular disorders. Supplemental potassium was provided and the patient's strength gradually improved with rising concentrations of serum potassium.

CPT code 88294: Neuron-conduction studies and electro- myography were normal at 48 hours after the onset of symptoms. He was discharged home to an outpatient substance abuse program three days later with almost complete resolu- tion of symptoms. At the time of discharge, the serum potassium concentration was 4.5 mmol/l and the CK concentration declined to 133 IU/l.

It is not clear why the use of cocaine led to such severe generalised weakness and hypokalemic paralysis in this patient. Nalluri et al reported a similar case and suggested that the hypokalemic paralysis was caused by an intracellular shift of potassium secondary to the adrenergic effects of cocaine; a hyperadrenergic cause of periodic paralysis in patients suffering from thyrotoxicosis has also been postulated. In their report, as in this case, the patient responded quickly to potassium supplemen- tation. An alternative mechanism may have been cocaine's potential effects on potassium channels. The increased CK and serum glucose concentrations were felt to be the result of cocaine's effects.

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References


Sulcal abnormalities on brain magnetic resonance imaging in the Guillain–Barré syndrome

The Guillain–Barré syndrome is an immunologically mediated condition affecting the peripheral nervous system. There is evidence that Guillain–Barré syndrome, Miller–Fisher syndrome, and Bickerstaff brain stem encephalitis form a closely related spectrum of disorders. Magnetic resonance imaging (MRI) abnormalities were described in these conditions have been well described, but intracranial findings are infrequent. We report resolution of sulcal changes on serial MRI of the brain concomitant with clinical recovery in a typical case of Guillain–Barré syndrome.

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An 81 year old man had a one week history of progressive lower limb weakness and numbness associated with pain radiating down his right leg. There was no preceding history of infection or trauma. He had no significant past medical history.

On examination, he was alert and rational. There was no slurring of speech or paresis of the extraocular muscles. Cranial nerve and visual field examination was unremarkable and the neck was supple. He had mild proximal symmetrical upper limb weakness (MRC grade 4+5) and bilateral lower limb weakness (MRC grade 3/5). He had difficulty in walking unaided and in tandem walking. Sensory loss to touch was elicited in the distal lower extremities in stocking distribution. Reflexes in all four limbs were absent. The clinical features were consistent with the Guillain–Barré syndrome.

The patient was initially referred to an orthopaedic surgeon for possible lumbosacral spondylotic disease. Unenhanced MRI scans of the lumbar and thoracic spine showed mild degenerative changes and excluded intrinsic cord abnormalities or external compression. Subsequent enhanced cervical spine MRI scans were also negative. He was then referred for a neurological opinion.

Nerve conduction studies revealed significantly prolonged distal motor latency (median motor distal latency 6.7 to 9.8 ms; posterior tibial distal latency 7.7 to 9.4 ms) and reduced conduction velocities in the median (40.3 m/s), ulnar (39.6 m/s), and tibial nerves (35.7 m/s). F responses were prolonged (> 37 ms) or absent in all four limbs. Cerebrospinal fluid examination showed obliteration of the normally dark CSF containing sulci (compare with frontal sulci) and subtle enhancement (indicated by arrows).

In the related Miller–Fisher syndrome, MRI changes have been documented in the cranial nerves, spinocerebellar tracts, and pons. We postulate that our MRI findings represent a focal manifestation of a wider immunologically mediated reaction within the subarachnoid cerebrospinal fluid bathed space. This focal sulcal reaction probably represents a local concentration of proteinaceous fluid and correlates well with the CSF findings of high protein levels but an absence of cells. These MRI changes resolved with immunoglobulin treatment and clinical recovery. While MRI changes have been reported in the subcortical regions in demyelinating neuropathies, most probably from focal demyelination, sulcal changes have not been described. Serial MRI studies are a sensitive technique for documenting cerebral cortical abnormalities in this condition, even in the asymptomatic setting as demonstrated here.

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References

Muscle tissue oxygenation as a functional tool in the follow up of dermatomyositis

Near-infrared spectroscopy (NIRS) is a direct, non-invasive optical method for measuring local oxygenation and haemodynamics in muscle tissue. Although measurement of local oxygenation by NIRS has been used for the diagnosis of metabolic myopathies, the technique has not previously been applied to inflammatory myopathies. Dermatomyositis is a muscle disorder characterised by complement mediated capillary necrosis, resulting in ischaemia and hypoperfusion. We have now employed NIRS to study the effect of corticosteroid treatment on haemodynamics in muscle tissue in dermatomyositis.

The pathological features of dermatomyositis are characterised by a decreased number of capillaries per muscle fibre and necrosis of single muscle fibres or clusters of fibres at the periphery of the fasciculi. Muscle fibre regeneration and an increased number of capillaries have been shown in dermatomyositis after intravenous immune globulin treatment, but corticosteroids are still considered to be the first line of therapy. In the clinical setting, the effect of treatment is assessed by muscle strength and creatine kinase (CK) levels. Direct measurement of capillary and muscle fibre status can only be done by repeated muscle biopsies. However, apart from the fact that muscle biopsies are invasive, they are also a static representation of muscle tissue at a fixed time point and at a particular location (selection bias).

This is the first time that NIRS, a non-invasive optical method for the measurement of oxygenation and haemodynamics in muscle tissue, has been used to study the effect of treatment in a patient fulfilling the clinical and histological criteria of definite dermatomyositis. A young woman from Aruba, aged 24 years, presented with subacute erythema of the facial skin and severe proximal muscle weakness (arm muscles: mean Medical Research Council (MRC) grade 3; leg muscles: MRC grade 2). Serum CK levels were slightly increased (220 IU/L). Five weeks after the onset of symptoms, treatment with corticosteroids was started in our department at a dose of 60 mg/day (for six weeks), the dose being subsequently tapered. CK levels decreased and muscle strength increased (arm muscles: MRC grade 4; leg muscles: MRC grade 3) in week 12.

Tissue oxygenation was measured by NIRS immediately before treatment was begun and again after three and seven weeks of treatment. NIRS is based on the relative tissue transparency to light in the near-infrared region, and on the oxygen dependent absorption changes of haemoglobin and myoglobin. Using a modification of the Lambert–Beer law, in which physical path length is incorporated to account for light scattering, it is possible to calculate quantitative values for oxygen consumption and blood flow in skeletal muscle. NIRS is non-invasive and measures oxygenation directly in the muscle. Moreover, it is relatively inexpensive, easy to apply, and applicable at the bedside.

In this study, NIRS measurements were obtained using a continuous wave near-infrared spectrophotometer (Oxycon, Bioengineering Department, University of...
of Nijmegen, Netherlands). Using this spectrophotometer, which generates light at 950, 850, and 770 nm, it is possible to differentiate between oxyhaemoglobin/myoglobin (O₂Hb/O₂Mb) and deoxyhaemoglobin/myoglobin (HbHb/HbMb). The optical fibres were placed on top of the flexor digitorum superficialis muscle in the same location for all the measurements. Data were sampled at 10 Hz.

Quantitative NIRS values for oxygen consumption (mVO₂) were calculated by evaluating the rate of decrease in [O₂Hb] during arterial occlusion, as previously described. 7 Reoxygenation rate ([ΔO₂Hb]) was determined as the rate of initial increase in O₂Hb measured over three seconds immediately after cessation of arterial occlusion. Both mVO₂ and [ΔO₂Hb] were calculated at rest and following rhythmic isometric handgrip exercise at various work intensities. Each exercise session consisted of one minute of exercise at a contraction rate of 30/min (50% duty cycle), immediately followed by 45 seconds of arterial occlusion for the calculation of mVO₂ and [ΔO₂Hb]. Whereas mVO₂ is a measure of mitochondrial function at a certain work intensity and is dependent on the vascular capacity of oxygen delivery, [ΔO₂Hb] reflects the initial recovery rate at which deoxygenated haemoglobin/myoglobin are resaturated. 1 It is therefore directly related to microvascular function. All measurements were performed at the same absolute work intensities.

Figure 1 shows the effect of corticosteroid treatment on mVO₂ and with relative ease by NIRS, in the patient with severe dermatomyositis. Before treatment was begun, resting mVO₂ was slightly higher than in healthy controls (0.19 ± 0.14 ml O₂/min/100 g, respectively). However, mVO₂ during exercise was about 60% lower than in the controls over the whole range of exercise intensities (fig 1A). After three weeks of treatment, mVO₂ had already markedly increased. After seven weeks, mVO₂ had increased even further and was now only 25% below that of the controls, and within the normal range at several work intensities. Serum CK levels were normalised, while muscle strength had increased. [ΔO₂Hb] (fig 1B) showed similar results, with slow recovery rates before treatment was begun and an increase over all work intensities at the three week and seven week examinations. [ΔO₂Hb] after seven weeks of treatment exceeded the normal mean value.

As NIRS measures local oxygenation and haemodynamics within the muscle, it can give direct insight into the working microvascular system. [ΔO₂Hb] increased during treatment, indicating an increase in capillary function. As a result of the increased capillary function and a possible regeneration of muscle fibres, muscular oxygen availability increased, enhancing oxidative capacity—as reflected by the increase in local muscle oxygen consumption.

Although a muscle biopsy will remain indispensable for the diagnosis of dermatomyositis, NIRS is an interesting and non-invasive tool for monitoring the effect of treatment non-invasively and with relative ease. While both serum CK levels and muscle strength are indirect measures, and muscle biopsies provide only a static fingerprint of the muscle, NIRS measures local microvascular and mitochondrial function directly in the intact and working physiological setting.

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References

Propofol in myoclonus status epilepticus in comatose patients following cardiac resuscitation

Myoclonus status epilepticus has been identified as a poor prognostic sign in comatose patients following cardiopulmonary resuscitation. 1 These vigorous generalised jerks are considered to be the penultimate phenomenon in a severely damaged brain that is difficult to manage and that may cause difficulty in ventilating the patient. Antiepileptic drugs such as phenoxytost or benzodiazepines have not been very successful. When the jerks are particularly severe, neuromuscular junction blockers have been recommended. 1

A 77 year old patient with a prior history of rheumatoid arthritis was resuscitated at home after sudden collapse. The emergency medical service found no pulse. He was debrillitrated, and after resuscitation of approximately 70 minutes, pulse and blood pressure returned. In the coronary care unit, he had generalised myoclonus in the face, limbs, and abdomen muscles and the movements were particularly sensitive to touch. His Glasgow coma score was 3 and brainstem reflexes were intact. These rhythmic jerks interfered with mechanical ventilation and caused repetitive bucking of the ventilator. He was treated with fosphenytoin (phenytoin equivalents 20 mg/kg), which subsequently reduced his blood pressure to 80 mm Hg but which quickly returned to a normal level. He was placed on a propofol infusion titrated to a maximal dose of 65 µg/kg/min, and myoclonus disappeared. After treatment for three hours, propofol was discontinued. An electroencephalogram showed a burst suppression pattern. Myoclonic jerks returned and, in addition, constant blinking was noted. The patient did not awaken after discontinuation of propofol on the second day.

A 19 year old boy was found hypothermic (core temperature of 31°C) in the field after a car rollover. He was resuscitated for 30 minutes before heart rate returned. On admission, his Glasgow coma score was 3. Notable signs were constant facial jerking, biting on the endotracheal tube, and sound sensitive myoclonus jerks in all limbs. Propofol in a dose of 35 µg/kg/min significantly muted myoclonus, although occasional myoclonic jerk was noted in both legs. An electroencephalogram showed a burst suppression pattern. Computed tomography showed poor white-grey matter differentiation, indicating early brain oedema. Care was withdrawn after the patient did not recover from coma after discontinuation of propofol.

Control of generalised myoclonus status epilepticus has been difficult and frustrating. I noted that the use of propofol in a fairly low dose muted myoclonus considerably. The typical dose in the intensive care unit is 5 µg/kg/min, which can then be titrated to 50–
Chronic asymptomatic progressive external ophthalmoplegia with right facial weakness: a unique presentation of mitochondrial myopathy

Because of genetic heteroplasmy, the clinical manifestations of mitochondrial disorders are quite varied. We report an unusual presentation in a patient with asymmetric ophthalmoplegia and unilateral myopathic facial weakness caused by a deletion in mitochondrial DNA.

Case history
The patient, a 42 year old white woman, was evaluated in our neurology clinic for double vision and right sided facial weakness in early 2000. She first noticed these symptoms in 1994. At that time, she had isolated weakness of adduction of the right eye and she was felt to have a right internuclear ophthalmoplegia. A demyelinating process was considered initially, but magnetic resonance imaging revealed no structural lesion. The diagnosis was uncertain. With no structural lesion to support such a diagnosis, the diplopia remained unchanged and an insidious facial weakness developed.

During the course of her illness she had extensive investigations, including normal cerebrospinal fluid, antinuclear antibodies, erythrocyte sedimentation rate, serum protein electrophoresis, and thyroid profile. Rapid plasma reagin and Lyme titre were negative. She received several courses of high dose steroids without any improvement.

There had been no substantial change in her general physical condition since 1994. Her past medical history was otherwise unremarkable. She is a computer operator and is quite active in sports. She has smoked moderately for 30 years. She has no family history of any neurological disorders. There was no diurnal variation of her symptoms and no complaint of dysphonia, dysarthria, or limb weakness.

Neurological examination revealed a pupillary sparing ophthalmoplegia without ptosis. Specifically she had bilateral exotropia on primary gaze, with total paralysis of adduction of the right eye and mild weakness of abduction of the left eye. She also had mild paresis of infraction of the right eye. Nystagmus was absent in both horizontal and vertical gaze. She had an infranuclear right facial weakness involving both the orbicularis oculi and the orbicularis oris, without lid synkinesis. The strength in the left facial muscles was normal. Ophthalmoscopy showed no spasticity of the optic disc. The remainder of her neurological examination was unremarkable. In summary, this patient had a chronic asymmetrical pupil and lid sparing ophthalmoplegia with binocular diplopia and right facial weakness.

The patient had several normal MRI scans. Previous attempts at treatment with high dose steroids were unsuccessful and the diagnosis was uncertain. With no structural lesion to explain her clinical condition, we suspected muscular or neuromuscular pathology. An unusual presentation of oculopharyngeal dys trophy, ocular myopathies, myasthenia gravis, and mitochondrial myopathies were in the differential diagnoses for this progressive ophthalmoplegia. However, we did not have an explanation for her right facial weakness, which we suspected represented a neuromuscular process. Further investigations showed normal serum lactate and pyruvate.

The blink reflex was normal, excluding the possibility of a cranial neuropathy. Electromyography of the right orbicularis oculi and orbicularis oris showed myopathic features; on the left side it was normal. This suggested an asymmetric facial myopathy. There was no decremental response of the compound muscle action potential, excluding a possible neuromuscular transmission defect. Muscle biopsy from the right quadriceps muscle showed ragged red fibres. Cytochrome C oxidase stains revealed an absence of staining in many fibres, which showed hyperreactivity on succinic dehydrogenase staining. Electron-microscopic examination of muscle tissue showed an increase in the number and size of the mitochondria, especially in subsarcolemmal locations—many of these contained abnormal cristae and paracrystalline inclusions. These findings were diagnostic of mitochondrial myopathy.

Discussion
Our patient represents a variant of sporadic progressive external ophthalmoplegia with the mDNA mutation typical of Kearns–Sayre–Daroff syndrome. We were able to find one previous report of this syndrome with a similar clinical presentation. It was a unique problem because of its atypical clinical features, which presented a challenging diagnosis. This case shows the heterogeneity of the clinical manifestations, course, and tissue involvement in mitochondrial disorders. The blink reflex is normal and symmetrical, thus suggesting a non-neuropathic facial weakness, which was confirmed by electromyography. The presentation of this disorder in our patient shows how supranuclear, brainstem, neuromuscular, or morphologic abnormalities may be encountered in patients with mitochondrial disorders, either in isolation or in combination. Mitochondriopathies should be included in the differential diagnosis of progressive asymmetric facial palsies, while asymmetrical myopathic facial weakness should be included in the differential diagnosis of infranuclear facial palsies. Our patient’s genetic study identified a deletion of mitochondrial DNA in a region that encodes different subunits of the respiratory chain complex. Given the clinical manifestations observed, it is clear that the patient has a significant degree of tissue heteroplasmy.

We would like to emphasise the diagnostic value of the muscle biopsy in cases with atypical clinical presentation and normal serum lactate levels. Genetic testing in blood may become the initial test of choice, with muscle biopsy as an alternative diagnostic aid.

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References