Hashimoto's thyroiditis, in most of whom cerebellar atrophy was shown on magnetic resonance imaging. One of their reported cases was treated by intravenous immunoglobulin IgG, and ataxia partially improved.⁵ Although responsiveness to intravenous immunoglobulin suggested autoimmune mechanisms in the pathogenesis of ataxia in this patient, it remains uncertain whether or not ataxia and cerebellar atrophy were aetiologically associated with Hashimoto's thyroiditis. By contrast, our patient with progressive ataxia had a positive serological diagnostic marker, anti-NAE antibodies and showed an excellent response to steroid treatment, leading to a diagnosis of Hashimoto's encephalopathy.

In conclusion, this report suggests that a diagnosis of Hashimoto's encephalopathy is warranted in patients with progressive pure ataxia and anti-NAE antibodies are a useful serological marker of diagnosis. Moreover, Hashimoto's encephalopathy should be included in a differential diagnosis of a treatable ataxia.

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Third-nerve palsy heralding dissecting aneurysm of posterior cerebral artery: digital subtraction angiography and magnetic resonance appearance

Dissections of intracranial arteries are rare and occur most commonly in the vertebrobasilar system.¹ Isolated dissecting aneurysms of the

posterior cerebral artery (PCA) are very uncommon. We report a case of subarachnoid haemorrhage (SAH) heralded by a 3-month history of diplopia due to dissection of the right PCA documented with digital subtraction angiography (DSA), magnetic resonance imaging (MRI) and angiography (MRA). The patient was treated conservatively, with a good outcome.

Case report

A 58-year-old male farm worker was found unconscious in the countryside and admitted to hospital. His medical history was unremarkable except for treated arterial hypertension and diplopia for 3 months. On admission, he had a Glasgow Coma Scale (GCS) score of 14 and a complete right third-nerve palsy. Vision and corneal reflexes were normal. A computed tomography scan showed diffuse SAH and intraventricular haemorrhage with hydrocephalus (fig 1A). Soon after arrival, he became less responsive and underwent temporary external ventricular drainage. DSA disclosed a fusiform dilatation of the P1–P2 segment of the right PCA with a focal “blister”, suggesting a dissecting aneurysm (fig 1B).

Twenty days later, his GCS score was 15. MRI showed an area of hyperintensity in fluid-attenuated inversion recovery images in the right portion of the ambiens cistern and isohyperintensity in T1-weighted images and in axial source images of 3D time-of-flight MRA consistent with intramural haematoma in the subacute phase (fig 1C, D). The haematoma surrounded the P1–P2 segment of the PCA. We found no evidence of ischaemic brain lesions.

The patient was transferred to a rehabilitation centre.

Four months later, the patient returned to his normal activities. Neurological examination showed partial third-nerve palsy with ptosis, impaired adduction and a right mydriatic pupil with no reaction to light. A follow-up DSA showed a reduction of the right PCA fusiform dilatation, with disappearance of the focal blister (fig 1E). MRI and MRA showed a decrease in size of the intramural haematoma (fig 1F).

Discussion

We found a description of 26 cases with isolated PCA dissection in the English literature. The clinical presentation is usually with ischaemic symptoms in the PCA territory (17 patients) whereas SAH was described in 9 patients.^{1–3}

Our case has some peculiarities, which include the clinical presentation, the findings on diagnostic imaging and the clinical evolution.

In patients with PCA dissection, third-nerve palsy was reported in one, which was related to ischaemic lesion in the mid-brain.¹ In our patient, diplopia appeared 3 months before admission and was probably due to progressive enlargement of intramural haematoma with compression of the third-nerve trunk before rupture in the subarachnoid space.

The aetiology of PCA dissection and more generally of intracranial dissections remains obscure, although it has been associated with trauma and sport-related activities, cervical manipulations, arteritis, atherosclerosis, fibromuscular dysplasia, surgery, delivery,

Figure 1 Computed tomography scan at admission showing extensive subarachnoid haemorrhage (SAH) (A). Digital subtraction angiography (DSA; anteroposterior projection) showing a fusiform ectasia of the P1–P2 segment of the right posterior cerebral artery (PCA) with a focal “blister” (arrow) (B). Twenty days later, axial fluid-attenuated inversion recovery magnetic resonance (FLAIR MR) image (C) and axial T1-weighted source image of three-dimensional time-of-flight magnetic resonance angiography (3D TOF MRA) (D) show an area of abnormal signal intensity in the right portion of the ambiens cistern surrounding the P1–P2 segment of the right PCA, consistent with intramural haematoma in the subacute phase. DSA (E) and source image of 3D TOF MRA (F) 4 months after SAH showing a near normalisation of the right PCA calibre without focal blister (E) and a decrease in the size of the intramural haematoma (F).

hypertension and connective tissue disease.^{2,3} No definite risk factors were identified in our patient, except for mild hypertension controlled with drugs.

The pathological hallmark of arterial dissection is represented by a separation of layers of the vessel wall usually caused by an intimal tear that connects the arterial lumen with the wall of the artery, forming an intramural haematoma. SAHs are not rare in intracranial artery dissections because they lack an external elastic membrane and have a thinner adventitia and fewer elastic fibres in the media as compared with extracranial vertebral and carotid arteries.^{2,3}

Diagnosis of intracranial artery dissection relies on DSA, but MRI and MRA have found a role in establishing the initial diagnosis and in the follow-up.^{1,2,4} DSA signs of arterial dissections include irregular narrowing ("pearl and string sign"), fusiform aneurysm ("pseudoaneurysm" or dissecting aneurysm) and venous mural pooling of contrast medium, although the only pathognomonic DSA finding is the identification of a double lumen—that is, the passage of the contrast medium into a true and false lumen.^{2,3}

MRI is an ideal complement to DSA, as it can directly enable assessment of the vessel wall and demonstration of the intramural haematoma. The intramural haematoma typically has a crescent shape showing hyperintensity to isointensity in T1-weighted image and hyperintensity in proton density and T2-weighted images in the subacute stage.

The variability of MRI appearance of intramural haematoma reflects differences in the techniques used (spatial resolution, pulse sequence) and the time interval between haemorrhage and examination.⁴ A combination of DSA, MRI and MRA findings strongly supported the diagnosis in our case.

Arterial dissection is a dynamic disease and this justifies the clinical and neuroradiological follow-up of patients.⁴ The healing process at the site of mural haematoma is responsible for the change in vessel silhouette with time and can result in a complete or partial recovery of the vessel lumen. Sometimes, however, dissection evolves in vessel occlusion or formation of pseudoaneurysm.

The natural history and optimal treatment of PCA dissecting aneurysms are not established, but our and other cases¹⁻³ suggest a more benign outcome as compared with dissections of the vertebrobasilar arteries. A favourable outcome was common in patients with ischaemia treated conservatively or with anticoagulation. Among nine patients with SAH, four were treated with surgical or endovascular "trapping" with parent artery occlusion to prevent re-bleeding and five with a conservative management.^{2,3,5} We decided to treat our patient conservatively because of the poor clinical conditions at admission and in view of the rich vascular supply to the brain stem that originates from P1 segment which makes occlusion of the parent artery at this level risky.⁵

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Early mitoxantrone-induced cardiotoxicity in secondary progressive multiple sclerosis

Mitoxantrone is an anthracenedione antineoplastic agent approved as an escalating immunotherapy for multiple sclerosis. Owing to structural similarity with other anthracyclines, cardiotoxicity is a severe side effect of mitoxantrone. Cardiotoxicity from anthracycline is considered to be dose dependent and irreversible and to result in the reduction of left ventricular ejection fraction (LVEF) and congestive heart failure.¹ The risk of mitoxantrone-induced cardiotoxicity in patients with multiple sclerosis increases with cumulative doses >100 mg/m² body surface area (BSA).^{2,3} However, the effect of mitoxantrone on cardiac function in the early phase of treatment with cumulative doses <100 mg/m² BSA is unclear, and data on cardiac function regularly monitored from the beginning of treatment are rare.

From a total number of 18 patients with secondary progressive multiple sclerosis who were prospectively assessed at our institution during the past 2 years, we report on four patients with a temporary and considerable decrease in LVEF, and with additional echocardiographic findings of diastolic dysfunction after only one or two doses of mitoxantrone.

Monitoring of cardiac function and treatment procedures

All patients receiving mitoxantrone in our clinic undergo assessment of cardiac function according to the following protocol: from the beginning of treatment, transthoracic echocardiography is performed every 3 months before each infusion. Examinations are, whenever possible (i.e. in about 90% of cases) carried out by our cardiologists, who perform at least 600 echocardiograms per year. The quantitation of LVEF is based on Simpson's rule, as

described elsewhere.⁴ Further, left ventricular diastolic function is evaluated from the following parameters: ratio E (peak early filling velocity)/A (peak atrial velocity), isovolumetric relaxation time (IVRT) and E wave deceleration time (DT).^{5,6} In line with current recommendations,² patients with an LVEF of <50% are excluded from mitoxantrone treatment, and treatment is discontinued if the LVEF drops to a value of <50% or if there are clinical signs of cardiac dysfunction. If a difference of >10% is found compared with the preceding value, the infusion is not applied. After 4–8 weeks we perform a follow-up echocardiography and may then continue treatment if the LVEF has returned to baseline value and our cardiologists agree to further mitoxantrone treatment. Unless dose reduction is required owing to haematological abnormalities, our patients routinely receive a mitoxantrone dose of 12 mg/m² BSA at three-monthly intervals up to a cumulative dose of 100 mg/m² BSA, the maximum approved mitoxantrone dose for treatment of multiple sclerosis in Germany.

Case reports

All four patients (table 1, fig 1) were scheduled to receive mitoxantrone according to our protocol. None of the patients had a history of cardiac disease, cardiovascular risk factors or pretreatment with cardiotoxic substances. Assessment of cardiac status showed no abnormalities (physical examination, blood pressure, electrocardiogram, transthoracic echocardiogram, normal values of serum glucose, cholesterol and triglycerides). Except for interferon- β treatment, none of the patients had received any immunomodulatory or immunosuppressive agents before.

Patient 1 had a pretreatment LVEF of 64% and the first mitoxantrone dose was well tolerated. After 3 months, before application of the second dose, LVEF was found to be 48% and additional signs of diastolic dysfunction were detected (prolonged DT and IVRT, E/A ratio with E<A). Although the patient did not show clinical signs of cardiac failure, the second infusion was cancelled in line with our treatment protocol. Two months later LVEF was 60%, but diastolic parameters had not returned to normal values. The patient discontinued mitoxantrone treatment because his Expanded Disability Status Scale had progressed to >6, which rules out further use of mitoxantrone in Germany. A follow-up echocardiogram 10 months later confirmed a normal LVEF of 60% but persistence of prolonged DT, suggesting incomplete remission of diastolic dysfunction.

In patient 2, the LVEF before treatment was 66% and the first mitoxantrone dose was well tolerated. The LVEF after 3 months was 54%, and so the second infusion was cancelled in line with our protocol. Prolonged DT indicated subtle diastolic dysfunction. The patient showed no clinical signs of cardiac dysfunction. Although LVEF was 71% and DT had also returned to normal value after 2 months, the patient refused continuation of treatment because she was concerned about the potential cardiac side effects.

In patient 3, the LVEF before treatment was 65%. Follow-up echocardiogram 3 months later was normal, and both the first and the second infusions were well tolerated. Follow-up echocardiogram before the third scheduled infusion showed a decrease in LVEF to 52%, as well as prolonged DT and IVRT; as a result, the