midbrain circuit, the present findings are interesting and may assist in the treatment of similar patients.

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Atypical presentation of vascular events in pituitary tumours: "non-apoplectic" pituitary apoplexy

Sudden disabling headache, visual deterioration, or impaired conscious level (sometimes in the context of a known pituitary adenoma under medical treatment) is the classical presentation accompanying acute haemorrhage or infarction of the pituitary gland. We have recently managed three cases in which radiologically and pathologically confirmed vascular events in pituitary tumours presented with ophthalmoplegia in the absence of changes in either visual fields or acuity and in which headache was a minor symptom. This atypical mode of presentation may confound accurate diagnosis and delay appropriate treatment. Surgery for this condition is associated with good functional recovery and low morbidity in most cases. It is therefore important that such atypical presentations are recognised early so that neurosurgical advice can be sought.

Case 1, a 48 year old man of Syrian origin, developed mild headaches and gastrointestinal upset while visiting Syria. He was initially treated for bacterial dysentery and his symptoms subsided. Within 48 hours, however, he had developed double vision. At the time of neurological assessment he seemed well, alert, and was free of headache. On examination there were complete left third and sixth nerve palsy. There was no apparent impairment of fourth or fifth nerve function. Visual acuity, visual fields, and fundoscopy were normal. No signs of meningism were present and the rest of the neurological examination was normal. Brain MRI showed an intrasellar mass compressing the left cavernous sinus and displacing the optic chiasm (figure). Magnetic resonance angiography performed at the same site excluded an aneurysm. At transphenoidal hypophysectomy infarcted pituitary tissue that was under some tension was evacuated; there was a rim of apparently normal tissue evident at the periphery of the lesion. After the operation there was a rapid improvement in the diplopia, which has subsequently completely resolved. Histopathological examination showed infarcted pituitary tissue; there was insufficient viable tumour to allow for immunohistochemistry.

Case 2, a 52 year old man, developed a sudden drooping of his left eyelid accompanied by a mild headache. There had been no alteration in his vision and there was no history of endocrine disorder. Examination showed ptosis and proptosis of the right eye with complete ophthalmoplegia and pupillary involvement. Fundoscopy was normal. Corrected visual acuity was 6/9 on the right and 6/5 on the left; the visual fields were full. Magnetic resonance imaging showed a sellar mass of mixed high signal with supraneal extension to the optic chiasm which was clearly compressing the right cavernous sinus and displacing the right internal carotid artery. The appearances were typical of tumour infarction with haemorrhage. At transphenoidal hypophysectomy a large quantity of overtly necrotic pituitary tumour was removed. Histology confirmed necrosis and haemorrhage. Immediately after operation the ocular movements began to improve. At the time of discharge the fourth and sixth nerve palsies had fully recovered but the third nerve palsy remained evident.

Case 3, a 78 year old woman, originally presented with ophthalmoplegia due to a pituitary adenoma. This had almost completely resolved 18 months after transperoneal hypophysectomy when she developed diplopia of a few days duration accompanied by drooping of the left eyelid. The patient complained of a mild discomfort behind the left eye but no headache. She was alert and lucid. A pupil sparing left third nerve palsy and also a partial left sixth

Postcontrast coronal MRI (case 1) showing a homogenous sellar mass with ring enhancement. There is pronounced compression of the left cavernous sinus.
nerve palsy were present. Perimetry showed full visual fields and visual acuity was 6/9 in both eyes. Magnetic resonance imaging showed appreciable tumour recurrence. Foci of haemorrhage were evident throughout the lesion, which was compressing both cavernous sinuses, although there was no chiasmal compression. A further endonasal transphenoidal hypophysectomy was performed. Overtly haemorrhagic and necrotic pituitary adenomata was identified at operation and later verified histologically. Two months after this procedure the left third nerve palsy had begun to resolve.

Haemorrhage within pituitary adenomas is a common finding either at the time of operation or on subsequent histopathological examination and is often subclinical. It has been suggested that in cases of subclinical haemorrhage, tissue necrosis is an uncommon finding whereas it is common in those presenting with clinical apoplexy. Repeated minor haemorrhage within vascular adenomas probably accounts for the clinically occult group, whereas swelling secondary to ischaemic oedema or haemorrhagic infarction in an adenoma which has outgrown its blood supply, is proportionately related to the more likely sequence of events in cases of clinical apoplexy. The second mechanism seems to have been responsible for the three cases presented here, where extensive necrosis was uniformly seen. The absence of severe headache, obtundation, and altered visual acuity accords with the finding that whereas ophthalmoplegia is compatible with a good state, defects in visual acuity are more often associated with impaired consciousness.

The mortality and morbidity of untreated classical pituitary apoplexy is high, whereas the results of expedient surgical intervention for pituitary apoplexy are generally good. Misdiagnosis of pituitary apoplexy even in its more typical presentation is common, however, and it is therefore important that those involved in the initial evaluation of patients are aware of the variability in clinical presentation and the need for early and appropriate radiological evaluation. Management of patients presenting with imaging combined with high-diagnostic accuracy with excellent anatomical detail particularly in the coronal plane (figure).

The case for urgent surgical decompression is the occurrence of obtundation or actual or threatened visual loss is generally supported. In the alert patient presenting with ophthalmoplegia in the absence of visual field deficit or impaired acuity the surgical role is less clearly defined and many advocate conservative management in this instance. Steroid treatment and close clinical observation is certainly associated with spasm resolution in some patients, although there do not seem to be any reliable predictive criteria on which such patients can be identified. The clinical course is unpredictable and the possibility of rapid deterioration with blindness or death must be borne in mind and weighed against the surgical alternative. The transphenoidal approach in experienced hands is the better tolerated and surgery ensures immediate decompression of the parasellar structures and affords the opportunity to obtain tissue for histological evaluation to aid subsequent management. Extraocular muscle palsies may occur as the sole manifestation of infarction or haemorrhage in pituitary adenomas. Early recognition of this “non-apoplectic” mode of presentation allows prompt neurosurgical management, hopefully averting permanent ophthalmoplegia and the possibility of life threatening upward extension of the pituitary mass, while permitting definitive treatment of the underlying adenoma.

**Excitotoxic amino acid neurotransmitters are increased in human cerebrospinal fluid after subarachnoid haemorrhage**

Experimental evidence suggests a role for glutamate neurotoxicity in many neurodegenerative disorders, but few clinical studies have been conducted to substantiate this hypothesis. We have measured excitatory and inhibitory amino acid neurotransmitters including glutamate, aspartate, taurine, and alanine in human CSF in the acute stage of subarachnoid haemorrhage in relation to clinical outcome.

The study protocol was approved in advance by the local ethics committee and informed consent was obtained from a relative. Ten patients who had a subarachnoid haemorrhage due to a ruptured cerebral aneurysm were included in this study (table) and their ruptured aneurysm was clipped within 48 hours of ictus. A ventricular catheter was placed, CSF was intermittently drained to maintain the intracranial pressure below 20 mm Hg, and CSF samples were collected from day 3 to day 8 after the haemorrhage and for at least two days after operation. Samples were deproteinised and stored at -20°C for analysis. Control CSF samples were collected and stored in the same way from patients without neurological disorders who underwent spinal taps for spinal anaesthesia.

The CSF samples were diluted 10 times with distilled water and 30 μl aliquots were used. Amino acids were measured three times for each CSF sample by high performance liquid chromatography, NMR with an electrochemical detector (ECCOM, Kyoto, Japan) after a 4-6 mm (diameter) × 150 mm reverse phase precolumn (ECCOM, Kyoto, Japan) derivatisation procedure with o-phthalaldehyde and ethylmercaptan. The liquid phase was 0.1 mol phosphate buffer (pH 6.0) with a 30% methanol gradient. Standards of aspartate, glutamate, taurine, and alanine in concentrations of 9, 90, and 900 pmol (Wakojunyaku, Tokyo, Japan) were measured using multiple sample analyses to obtain calibration curves. The retention time was identified from the standard chromatograms and the area was used for the calculation of CSF amino acid neurotransmitters. We estimated the maxi-

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