was pain free and walking well on a pylon before receiving a definite prosthesis.

Examination of the amputation specimen (Fig. 1) showed an ill-defined red tumour lying deep to the Achilles tendon, tumour nodules mingling with adjacent adipose tissue. A number of separate tumour masses were also present in both superficial and deep fascia, the most proximal being attached to the tibia 12 cm above the lateral malleous. Histological examination of the tumour showed regular polyhedral cells grouped around blood vessels (Fig. 2). There was evidence of tumour infiltration in many areas and an occasional suggestion of vascular invasion. Mitoses were very infrequent. Special stains showed mast cells in considerable numbers in and around the tumour. Comparison of this tumour with known examples of compact glomus tumours left little doubt that this was a glomus tumour but displaying histological evidence of malignancy.

Comment

The diagnosis in this case was complicated by the absence of a palpable tumour and the atypical histological appearances. Although infiltration by the glomus tumour had been recorded by a number of authors (Kohout and Stout, 1961) vascular invasion had been reported on only one previous occasion (Babbini *et al.*, 1944). Another unusual feature of the tumour was the presence of numerous mast cells Mast cell infiltration to this degree had not been found in any other glomus tumour studied.

This case emphasized the need to be aware of the mode of presentation of this rare and illusive soft tissue tumour.

We wish to thank Professor G. W. Taylor for allowing us to report this case history.

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Motor Disorder in "Normal Pressure" Hydrocephalus

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Chronic hydrocephalus of the communicating type has been observed to develop in adults after subarachnoid haemorrhage (Barnett, 1969; Galera and Greitz, 1970), head injury, meningitis, and in cases of widespread meningeal cancer. In some cases it arises without apparent cause (Adams, *et al.*, 1965; Hakim and Adams, 1965; Hill *et al.*, 1967; *Lancet*, 1970), when clear evidence of raised intracranial pressure is characteristically absent. Hakim and Adams emphasized this latter feature by coining the phrase "normal pressure" hydrocephalus. Patients in their series showed progressive dementia, incoordination of the limbs, incontinence, and in some instances a disturbance of gait.

We describe two cases in which the symptoms, radiological findings, and response to ventriculoatrial shunt operation identified them as examples of the disease which Adams described. Unlike Adams's cases, however, these patients presented because of difficulty in walking.

Case 1

A 63-year-old storeman was referred for surgical treatment of tetraparesis thought to be due to cervical spondylosis with myelopathy. He gave a history of progressive weakness of the hands and legs for about six months, with slowing and weakness of gait such that he had given up his job, though he could still get about the house and go for short walks. He had noticed tingling and patchy numbness in both hands and complained that his feet felt perpetually cold. Micturition had become precipitant. There was no clear history of confusion or undue forgetfulness or any helpful past medical history.

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Examination showed an expressionless, depressed-looking elderly man who was slow to perform simple bedside tests of mental function but could calculate accurately. The chief findings related to the limbs, tone being universally increased and movements stiff and sluggish. Moderate weakness was found in the distal musculature of the arms, particularly the left, and throughout both legs. Tendon reflexes were brisk and the plantar responses normal. Pinprick sensation in the left face and limbs was subjectively dulled. His gait was slow, shuffling, and stooped, reminiscent in some regards of the Parkinsonian gait. He could only just get about without help and spent his waking hours sitting in a chair doing nothing. His speech was thick and slurred.

Plain *x*-ray appearances of the skull and cervical spine were normal but an iophendylate myelogram showed partial obstruction to flow by posterior "humping" of the C4-5 and C5-6 intervertebral discs. The lumbar C.S.F. contained 92 mg of protein/100 ml.

Although we thought that myelopathy due to cervical spondylosis was contributing to this picture it seemed that other factors were at work. On that basis he underwent lumbar air encephalography, which showed moderate enlargement of the lateral ventricles, the left being more widely dilated than the right. Air circulated poorly over the convexities, indicating blockage to flow in the basal cisterns, so that the appearances were those of communicating hydrocephalus of moderate degree. A Pudenz ventriculoatrial shunt was installed and he was discharged from hospital 10 days later, substantially unchanged.

At outpatient review six months later noticeable improvement had taken place in all regards. He was back at work performing light duties and reported that he could walk long distances without effort or pain. He said he was a "different man" since the operation. His demeanour was vastly more animated and cheerful, his facial expression was normal, and he gave prompt, pertinent responses to questions and instructions. Power and tone were normal in the arms except for slight residual weakness of left grip and of dorsiflexion at the left wrist. Normal power and very slight residual spasticity were present in the legs. The tendon jerks, including the jaw jerk, remained universally brisk. Fine movements of the fingers were slow but other movements were rapid and precise. His gait had improved strikingly to become swift, dynamic, and free of stoop.

Case 2

A 68-year-old retired Admiralty clerk gave a history of lumbar backache and progressive impairment of gait for three years, and he was referred for investigation of possible lumbar spinal stenosis. The lumbago was central and dull, "like toothache," and independent of posture or activity. There was no classical radiation. Concurrently, gait had become awkward and uncomfortable, with

pain throughout both lower limbs arresting his progress after 10 yards (9 m) or so. Earlier in the illness "forced running" or festination had been a feature; his legs would uncontrollably run away wth him for 20 yards (18 m) or more. In addition, urinary control had deteriorated, micturition becoming increasingly hesitant with occasional episodes of incontinenence.

On examination he was found to be an apathetic elderly man of sluggish wit and demeanour. Expressive movements of the face were almost absent. He walked in a shuffling, clumsy way with the help of a stick and pleaded to sit down after covering about 8 yards (7 m). The arms swung poorly or not at all and his carriage was stooped and stiff in the manner of a patient with Parkinsonism. Lumbar spinal movements were moderately limited in all directions but straight leg raising was tolerated to 90 degrees bilaterally. Power seemed full in all muscle groups of all four limbs. Although mild spasticity was apparent to passive manipulation the tendon jerks were not exaggerated or radiating and indeed both ankle jerks were sluggish. The plantar responses were normal.

X-ray pictures of the lumbar spine showed degenerative changes of moderate severity without pronounced narrowing of the neural canal. "Waisting" of the theca opposite each lumbar intervertebral disc was apparent in a positive contrast myelogram without frank signs of disc prolapse at any one level.

On the basis chiefly of the history, which seemed to be that of the so-called cauda equina claudication syndrome, we offered lumbar laminectomy and exploration. At operation no major abnormality was encountered. Postoperatively a state of animated disorientation persisted for about a week and was not accompanied by any fresh or focal neurological signs. This led us to consider a cerebral origin for the disturbance of gait and posture. A lumbar air encephalogram showed moderate symmetrical ventricular dilatation with poor external circulation of gas. The diagnosis of communicating hydrocephalus was supported by an encephalogram taken with radioiodinated serum albumin, which showed intraventricular retention to 36 hours of the isotope and relatively poor surface circulation. A record of intracranial pressure monitored with an intraventricular catheter for 24 hours indicated a mean pressure of 14 $\pm$ 2 mm Hg, but with pronounced fluctuation in association with cardiac and respiratory variations.

A Pudenz ventriculoatrial shunt was installed and the patient recovered uneventfully from the operation. Within 10 days he was walking with the help of a stick and with much less tendency to shuffle and stoop. He showed more interest in his surroundings and began to relate more freely to other patients and to the hospital staff. Psychometric assessments before and after operation showed definite all-round improvement postoperatively in I.Q., digit span, general knowledge, and performance tests. The lumbago which had brought him initially to hospital troubled him much less and he professed himself well and satisfied at the time of his discharge a week later.

He was last seen six months after operation, when further improvement had occurred. He could walk several hundred metres without any help or support and watched television with interest and recall. His gait looked normal apart from lack of arm-swing. He carried on a lively, apposite conversation, displaying a sound grasp of current events and a wealth of subtlety and nuance previously absent.

Comment

A disabling disturbance of gait, posture, and limb movement in both these patients responded to ventriculoatrial shunt operation. Thus, while their intercurrent spinal disease cannot be ignored, we believe that the motor disorder had a largely cerebral basis. Its mechanism remains obscure but certain clinical features tend to incriminate the extrapyramidal motor system.

Both patients, moreover, displayed abnormalities of mentation and affect responding to ventricular drainage. Published accounts of Adams's syndrome emphasize dementia as the chief symptom with other features such as incoordination, incontinence, and disturbed gait being present in each patient. The present patients were atypical in that the motor symptoms overshadowed the mental ones; they lie, in other words, at the opposite end of the spectrum to Adams's propositi.

We submit that the symptomatology of primary communicating hydrocephalus in adults comprises a range of disparate abnormalities which include dementia, incontinence, incoordination, and disturbances of gait, posture, and limb control, and whose relative proportions vary from case to case. Especially important is the notion that intellectual deterioration will not dominate the picture in every instance.

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