In our case, the history, clinical findings, negative biochemistry and CT and MIBG scans indicated that the lesion might be a non-catecholamine-secreting paraganglioma. The final diagnosis of a vascular malformation was unexpected but revealed an interesting differential diagnosis of a rare pathology. Retroperitoneal vascular malformations of the choledochus, kidney and pancreas have been described but are rare conditions which may

cause digestive or urinary tract bleeding.⁸ In this case the symptoms were unrelated to the excised lesion.

Final diagnosis

Benign vascular malformation.

Keywords: paraganglioma, vascular malformation

- 1 Landsberg L, Young JB, Phaeochromocytoma. In: Wilson JD, Foster D, eds. *Williams textbook of endocrinology*, 8th edn. Philadelphia: WB Saunders, 1992; pp 668–80.
- 2 Ross EJ, Griffith DNW. The clinical presentation of phaeochromocytoma. *Q J Med* 1989; 71: 485–96.
- 3 Huddle KR, Mannell A, James MF, Plant ME. Phaeochromocytoma. *S Afr Med J* 1991; 79: 217–20.
- 4 Frewin DB, Jamieson GG, Russell WJ, et al. Extra-adrenal phaeochromocytoma: report of three interesting cases. *Aust NZ J Surg* 1989; 59: 691–5.
- 5 Khafagi FA, Mortimer RH, Egerton-Vernon JM, Perry-Keene DA. Role of ¹³¹I-metaiodobenzylguanidine in the localization of suspected phaeochromocytomas. *Med J Aust* 1989; 150: 639–44.
- 6 Plouin PF, Chatellier G, Delahousse M, et al. Detection, diagnosis and localization of phaeochromocytoma. *Presse Med* 1987; 16: 2211–5.
- 7 Sinclair D, Shenkin A, Lorimer AR. Normal catecholamine production in a patient with a paroxysmally secreting phaeochromocytoma. *Ann Clin Biochem* 1991; 28: 417–9.
- 8 Tarkington MA, Matsumoto AH, Dejer SW, Regan JB. Spectrum of renal vascular malformation. *Urology* 1991; 38: 297–300.

Ring-enhancing lesions on computed tomography

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A 23-year-old man was admitted with high grade fever and headache for one week, having developed left hemiplegia two days prior to admission. He gave a history of right-sided pleural effusion a year ago that was treated as tubercular effusion. He had, however, discontinued the treatment after a few weeks. He also gave a history of sexual contact with a commercial sex worker. Clinical examination revealed a toxic, febrile, young patient with left hemiplegia but without signs of raised intracranial pressure. Other systems were normal. After preliminary laboratory tests, high doses of broad-spectrum antibiotics were started but the patient's clinical condition deteriorated. A computed tomography (CT) scan of his brain revealed multiple ring enhancing lesions (figures 1 and 2).

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Figure 1 Brain CT scan

Figure 2 Brain CT scan

Questions

- 1 Suggest three causes of these CT appearances.
- 2 What is the most likely diagnosis in this case?

Answers

QUESTION 1

Ring-enhancing lesions may be due to a variety of causes:¹⁻⁴

Pyogenic infections

Many bacterial infections may produce meningitis and brain abscesses at any age in high risk and immunocompromised patients. These abscesses have a characteristic imaging appearance of a well circumscribed ring-enhancing lesion. Pyogenic abscesses have a smooth, thin ring enhancement. They may rupture and cause dissemination.

Non-pyogenic infections

Tubercular meningitis may develop as a primary tubercular infection of the brain in an immunocompromised host. It may result from inadequate treatment of extracranial tuberculosis. Multiple ring-enhancing lesions may be tuberculomas or abscesses. In this patient the gas in the centre of the lesion and surrounding enhancement of the brain parenchyma suggest that they are abscesses rather than tuberculomas.

Fungal infections

Fungal infections may present as granulomas or abscesses. They are mostly seen in immunocompromised patients having opportunistic infections. They have also been seen in patients on cytotoxic drugs, long-term corticosteroid treatment and those with diabetes mellitus. Cryptococcal meningo-encephalitis with coccomas are increasingly being reported in patients with HIV infections.

Viral and parasitic infections

Viral encephalitis may be diffuse or focal. CT scan usually reveals poorly defined areas of abnormal densities due to necrosis and haemorrhages. In addition to herpes simplex encephalitis other arboviruses may also produce multiple brain lesions. Neurocysticercosis can be diagnosed by imaging techniques. The lesions may be a solitary cyst or multiple ones, measuring from a few millimeters up to 10 cm.

These are calcified granulomas and usually have no surrounding inflammatory reactions. They may produce multiple ring-enhancing lesions.

Miscellaneous

Lesions such as metastatic lesions from other extracranial malignancies may sometimes produce ring-enhancing lesions on CT scan.

QUESTION 2

Tuberculosis.

After preliminary investigations had failed to make a diagnosis, we put the patient on high doses of broad-spectrum antibiotics and cerebral decongestion. However, he deteriorated and as soon as the CT scan was available the possibility of brain abscesses was put forward. A neurosurgical consultation was requested. The neurosurgeon aspirated 20 ml of frank pus from the larger lesion, and 10–15 ml from smaller one. The pus did not show any pyogenic organisms, fungi or acid-fast bacilli and culture did not grow any organisms. We therefore presumed that the multiple abscesses were tubercular in origin and restarted the antitubercular therapy. Following aspiration, the patient rapidly improved and has made a near complete recovery from hemiplegia. Repeat scan after four weeks revealed near complete healing of most of the lesions. The patient has been followed up for six months and is fully active without any neurological deficit.

Drainage of the abscesses may not be indicated in every case because of the inherent disadvantages of the operative procedure itself, anaesthesia and dissemination.⁵ The role of corticosteroids is also controversial,⁶ but they should be used to reduce cerebral oedema and possibly prevent adhesions.

Final diagnosis

Multiple tubercular brain abscesses.

Keywords: tuberculosis, computed tomography, abscess

- 1 Hasso AN. Imaging of central nervous system infections. In: Harwood-Nash DC, Pettersson H, eds. *Neuroradiology*, NICER Series on Diagnostic Imaging, London: Merit Communications, 1992; pp 180–92.
- 2 Haines SJ, Mampalam T, Rosenblum ML, Nagib MG. Cranial and intracranial bacterial infections. In: Youmans JR, ed. *Neurological surgery. A comprehensive reference guide to the diagnosis and management of neurosurgical problems*, 3rd edn, vol 6. Philadelphia: WB Saunders, 1990; pp 3707–35.
- 3 deLouvois J, Gortavi P, Hurley R. Antibiotic treatment of abscesses of the central nervous system. *BMJ* 1977; 2: 985–7.

- 4 Sugawara A, Ebina K, Hirano T, Ohi H, Yoshimura S, Akabane M. Multiple aspergillus brain abscess complicated with systemic lupus erythematosus. Case report. *Neurol Med Chir* 1991; 31: 986–90.
- 5 Bronitsky R, Craig RH, McGee ZA. Multiple brain abscesses: combined medical and neurosurgical therapy. *South Med J* 1982; 75: 1261–3.
- 6 Rosenblum ML, Mampalam T, Pons V. Controversies in the management of brain abscess. *Clin Neurosurg* 1986; 33: 603–32.