Short report

Intracranial calcified deposits in neurofibromatosis

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SUMMARY Three patients with the central type of neurofibromatosis, who on CT showed multiple subependymal calcified deposits, are presented. The literature on intracranial non-tumorous calcifications in neurofibromatosis is briefly reviewed. On the basis of our findings and the literature, it is proposed that such intracranial calcified deposits may be part of the neurofibromatosis syndrome and are caused by calcium deposits in glial proliferations, analogous to the calcified deposits seen in tuberous sclerosis.

Recently, neurofibromatosis (Von Recklinghausen's disease) has been separated into a "classical" or "peripheral" and a "central" or "acoustic" type.¹⁻³ Non-tumorous intracranial calcified deposits have been described both in central and peripheral neurofibromatosis.^{4,5} Nevertheless, such calcified deposits have so far not been recognised as a possible part of the syndrome.

Jacoby *et al*⁴ described a patient (no. 8) with peripheral neurofibromatosis who on CT showed parenchymatous calcification in the right cerebellar hemisphere (not histologically verified) and punctate calcification at the level of the foramina of Monro. Another patient (no. 13) was described as having a lesion of calcific density in the temporal horn of the right lateral ventricle, and a third (no. 18) with thalamic calcification, but CT scans were not shown.

Vouge *et al*⁵ described a patient (no. 1) with presumably the central type of neurofibromatosis, who on CT showed punctate calcification in the wall of the third ventricle. Another patient (no. 2), with peripheral neurofibromatosis, showed two areas of nodular calcification within the left basal ganglia. These authors considered their patients to have both neurofibromatosis and tuberous sclerosis.

Finally, Boruta *et al*⁶ showed a CT scan of a patient with central neurofibromatosis with bilateral acoustic

neuromas. This patient clearly had subependymal calcification in the right lateral ventricle, but the authors do not mention this in the text.

In this paper, we present three non-related patients with the central type of neurofibromatosis, who showed typical non-tumorous calcified subependymal deposits. On the basis of these findings and the previous literature, we propose that non-tumorous intracranial calcified deposits may be a, albeit rare, sign in neurofibromatosis.

Case reports

Patient 1, a normally intelligent girl who had never had convulsions, was seen at age 13 years because of left foot drop. Hearing at the time was normal. She was a slim and small girl, showing multiple subcutaneous nodules, but only two café-au-lait spots. Cutaneous or ocular signs pointing to tuberous sclerosis were not found. A biopsy of one of the nodules was diagnostic of neurofibromatosis. A CT scan showed bilateral acoustic nerve tumours and multiple subependymal calcified deposits (fig 1). These calcifications did not have a space-occupying effect. Administration of intravenous contrast media did not produce enhancement around them. At age 15, the appearance of the deposits was unchanged. Examination of the mother and sister revealed no signs of neurofibromatosis; the father could not be examined.

Patient 2, a normally intelligent girl who had never had convulsions, was seen at age 13 years because of decreased hearing on the left, and later on the right. Examination revealed multiple subcutaneous nodules, scoliosis, and left-sided hypotrophy. In Wood's light, neither café-au-lait spots nor depigmented macules were seen. No other cutaneous or ocular signs of tuberous sclerosis were present. A biopsy of one of the nodules revealed a schwannoma. A CT scan showed

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Fig 1 Contrast-enhanced CT scan of a 13-year-old girl with neurofibromatosis, showing multiple subependymal calcified deposits (a, b).

bilateral acoustic nerve tumours, causing a triventricular hydrocephalus, and multiple subependymal calcified deposits (fig 2), without a space-occupying effect or abnormal contrast enhancement. Family investigation was not possible. In the family of the paternal grandmother, neurofibromatosis was said to occur frequently.

Patient 3, a girl of normal intelligence, suffered from decreased hearing on the left at the age of 20 years. Symptoms and signs of increased intracranial pressure were present. CT showed a non-communicating hydrocephalus, a left cerebello-pontine angle tumour (proving to be a schwannoma), an enlarged internal meatus on the right, suggestive of an acoustic nerve tumour, and calcified processes near the right sphenoid bone, the crista galli, and around the intra-orbital portion of the left optic nerve (probably three meningiomas). Multiple subependymal calcified deposits were present in the walls of the ventricular system. Neither cutaneous nor ocular signs of tuberous sclerosis were present. She did not have epilepsy. The family history revealed that her father had died from a brain tumour at the age of 29 years.

Discussion

The three patients described here bring the total num-

ber of patients with neurofibromatosis and non-tumorous intracranial calcified deposits described so far to nine, four with the peripheral and five with the central type of neurofibromatosis. Of these, seven patients showed calcified deposits related to the ventricular walls. Such deposits have hitherto been considered typical of tuberous sclerosis; they also occur in congenital infections, but the CT appearance and location of the latter are different. Moreover, our patients had no signs pointing to a congenital infection, and Jacoby *et al*⁴ and Vouge *et al*⁵ mention no symptoms or signs suggesting any of these affections. A diagnosis of tuberous sclerosis seems highly unlikely in our patients since none of them had any of the common clinical, cutaneous or ophthalmological abnormalities usually occurring in this disorder. Therefore, we suggest that in these seven patients the calcified deposits are not caused by tuberous sclerosis or any congenital infection.

The basal ganglia calcification in the two other patients^{4,5} may have been part of the neurofibromatosis syndrome, but they could also have been coincidental, as asymptomatic basal gan-

Fig 2 Contrast-enhanced CT scan of a 13-year-old girl with neurofibromatosis showing a CSF circulation disorder caused by bilateral acoustic neuromas, and multiple subependymal calcified deposits (a, b).

glia calcification is known to occur in otherwise healthy people as a chance finding.⁷

It is likely that such non-tumorous calcified deposits may also occur in other parts of the brain, for example the hippocampus or the cerebellum. It is of course very important in these cases to differentiate between non-tumorous calcified deposits and tumours with partial calcification.

Although we do not have pathological confirmation, it is tempting to speculate about the pathological basis of non-tumorous calcified deposits in neurofibromatosis. In tuberous sclerosis, these deposits are known to occur in glial proliferations, which are considered to be hamartomatous, non-tumorous lesions. From the few existing pathological investigations of the brain itself in neurofibromatosis,⁷⁻¹⁰ it is known that these glial proliferations do occur, although they seem to be rather a rare event.⁸ It seems logical to assume that calcification of such glial proliferations could occur as well in neurofibromatosis as in tuberous sclerosis.

Therefore, we propose that non-tumorous intracranial calcified deposits, especially subependymal deposits, in patients with neurofibromatosis are not

an expression of another, coincidental disorder, but are a part of the protean neurofibromatosis syndrome. They are probably caused by calcium deposits in hamartomatous glial proliferations.

References

- ¹ Riccardi VM. Von Recklinghausen Neurofibromatosis. *N Engl J Med* 1981;**305**:1617-27.
- ² Young DF, Eldridge R, Gardner WJ. Bilateral acoustic neuroma in a large kindred. *JAMA* 1980;**214**:347-53.
- ³ Kanter WR, Eldridge R, Fabricant R, Allen JC, Koerber T. Central neurofibromatosis with bilateral acoustic neuroma: genetic, clinical and biochemical distinctions from peripheral neurofibromatosis. *Neurology* 1980;**30**: 851-9.
- ⁴ Jacoby CG, Go RT, Beren RA. Cranial CT of neurofibromatosis. *Am J Radiol* 1980;**135**:553-7.
- ⁵ Vouge M, Pasquini U, Salvolini U. CT findings of atypical forms of phakomatosis. *Neuroradiology* 1980;**20**: 99-101.
- ⁶ Boruta P, Nadvornik P, Vrtelova N. CT diagnosis of central neurofibromatosis. *Medicamundi* 1984;**29**:118-9.
- ⁷ Vles JSH, Lodder J, Van der Lugt PJM. Clinical

- significance of basal ganglia calcifications detected by CT. *Clin Neurol Neurosurg* 1981;**83**:253–6.
- ⁸ Pearce J. The central nervous system pathology in multiple neurofibromatosis. *Neurology* 1967;**17**:691–7.
- ⁹ Rosman NP, Pearce J. The brain in multiple neurofibromatosis (Von Recklinghausen's disease): a suggested neuropathological basis for the associated mental defect. *Brain* 1967;**90**:829–38.
- ¹⁰ Kramer W. Lesions of the central nervous system in multiple neurofibromatosis. *Psychiat Neurol Neurosurg* 1971;**74**:349–68.
- ¹¹ Lott IT, Richardson EP. Neuropathological findings and the biology of neurofibromatosis. *Advances in Neurology* 1981;**29**:23–32.