Short report

Phaeochromocytoma as a cause of reversible dementia

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SUMMARY The case of a 57 year old man with cognitive impairment, hypertension and insulin dependent diabetes mellitus caused by phaeochromocytoma is reported. One year after removal of the tumour there was a significant improvement with the full scale IQ increasing by 15 points, normotension and minimal glucose intolerance. Possible mechanisms accounting for reversible cognitive impairment in such a situation are discussed. No previous reports of this association have been discovered.

Dementia is clearly a syndrome of heterogeneous aetiology.¹ Hypertension has a well established relationship to dementia² but it is less certain whether aggressive treatment of the hypertension will halt or reverse the process. We describe a patient presenting with dementia who was significantly improved after removal of bilateral phaeochromocytomas, which at the same time rendered him normotensive and largely remedied his diabetes mellitus.

Case report

A 57 year old senior ship's pilot presented for psychiatric evaluation with a one year history of decline in work performance and loss of confidence, becoming more quiet, mentally slow, and with some difficulty in finding words. Previous to this he had an excellent work record, achieving positions of high responsibility in his profession. The change in his mental competence therefore represented a marked decline. There was no past psychiatric history.

During the previous two years there had been two transient episodes of neurological dysfunction of sudden onset. The first involved a tingling sensation in the left arm and a limp affecting the left leg, lasting for several hours. The second was a three day period of topographical disorientation with difficulty in deciding left from right. The episodes were not accompanied by hypoglycaemia. He had had diabetes mellitus for 13 years taking 44 units of insulin per day, his pre-admission HbA1c being 12.4% (normal < 8.5%). There was a family history of diabetes mellitus but none of demen-

tia nor of psychiatric illness. He had given up smoking 20 years previously, and drank only in moderation.

Physical examination revealed diabetic retinopathy and arterio-venous nipping. The blood pressure was 140/95 mm Hg with occasional elevations up to 180/130 mm Hg. There were no neurological abnormalities apart from those revealed on cognitive testing (see below).

Mental state examination showed him to be depressed, apathetic and lacking insight into his difficulties. He was fully orientated in time and place, but performed poorly on tests of memory and showed a mild expressive dysphasia. He was poorly informed about recent events. His verbal IQ on the WAIS was 102 and the performance IQ 93 (see table). This was considered to represent a deterioration in view of his past education and occupation. Performance on the Oldfield-Wingfield test confirmed a mild nominal dysphasia. Memory and learning tasks caused difficulties. He could not learn an eighteen word sentence after six presentations, and required three presentations to repeat a string of eight digits (one above his immediate span). He could not learn five associations of a letter-like symbol and a word; after five consecutive presentations he could only remember three pairs.

CT scan demonstrated small infarcts in the head of the right caudate nucleus and the right cerebellar hemisphere, possible generalised white matter low attenuation and some diffuse cerebral atrophy (fig). The EEG was abnormal with irregular delta waves bilaterally, more pronounced on the right.

Three 24 hour urine collections revealed elevated vanillylmandelic acid between 221 and 253 $\mu\text{mol}/24$ hours (normal less than 36 μmol); metadrenaline was 48 $\mu\text{mol}/24$ hours (normal less than 1.7 μmol) and normetadrenaline 40 $\mu\text{mol}/24$ hours (normal less than 2.8 μmol). Body CT scan revealed bilateral suprarenal masses.

A blood sugar series demonstrated fluctuations between 7.9 mmol/l and 20.8 mmol/l. The creatinine clearance was reduced at 62 ml/min (normal 75–125 ml/min). The electro-

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Table WAIS scores over post-operative follow-up

Subtest of WAIS	Before operation	3 months after operation	11 months after operation
Similarities	11	11	—
Digit span	10	14	15
Vocabulary	11	11	12
Picture completion	8	11	12
Block design	10	11	12
Picture arrangement	8	8	8
<i>IQ scores</i>			
Verbal IQ	102	112	118*
Performance IQ	93	106	108*
Full Scale IQ	99	110	114*

*Calculated estimate since similarities subtest not given.

cardiograph revealed lateral ischaemia and the chest radiograph an unfolded aorta. Investigations within normal limits included full blood count, blood film, ESR, VDRL, Vitamin B12, red cell folate, thyroid function, urea and electrolytes, liver function tests, glutamyl transpeptidase, intravenous urography and urinary 5HIAA.

At operation bilateral adrenal tumours were removed. Histology revealed pheochromocytoma. Follow up fifteen months after operation revealed good blood sugar control (HbA1 8.5%, random blood sugar 6.5 mmol/l) on glibenclamide 5 mg only. Without antihypertensive treatment his blood pressure was 160/80 mm Hg lying and 140/90 mm Hg standing. Steroid replacement consisted of fludrocortisone 0.1 mg and dexamethasone 0.5 mg.

Cognitive testing showed substantial improvement with a 15 point rise in full scale IQ (table). There was no evidence of nominal dysphasia. In detail there was an increase in the scores of both performance and verbal tests. The improvement was most marked in digit span, picture completion and block design, demonstrating better attention and visuo-spatial ability. His memory was also improved, being able to remember an eighteen word sentence at the third attempt. Tests still indicated some difficulties with new learning. He was unable to learn an arbitrary association without semantic links. The picture arrangement subtest also failed to improve. Such deficits are usually seen with patients with frontal lobe dysfunction and will be discussed below. The follow up CT scan showed resolution of the infarcts but there was no change in the white matter low attenuation. The EEG showed some improvement.

He regained a good deal of his former vitality though still remaining quieter than formerly. Over the next two years his general health remained satisfactory but no further cognitive gains were achieved. He ultimately retired early at the age of 59 years.

Discussion

The dramatic improvement in postoperative glucose tolerance and blood pressure was to be expected, but it remains to be considered what may have accounted for the presenting dementia and subsequent improvement in cognitive ability. The rise in IQ by a full standard deviation is more than would be expected by practice effect. Better control of his hypertension may have been responsible. Heaton *et al*³ showed that 50% of patients with hypertensive

encephalopathy improved in mental functioning when control of blood pressure was adequate, although when the diagnosis of dementia was made there was no improvement. Our patient showed no evidence of sustained severe hypertension nor papilloedema. There is some evidence that less severe hypertension may be associated with reduction in IQ,⁴ but Schultz *et al*⁵ were unable to demonstrate any cognitive improvement with reduction in blood pressure by diuretics.

The history and CT scans suggest that multiple infarcts may have been responsible for the cognitive decline. Against this one would expect a continuing step-wise decline in function, rather than improvement.⁶ One other cerebrovascular possibility is Binswanger's encephalopathy, a condition of intellectual deterioration associated with ischaemic damage of the deep white matter.⁷ The CT scans of our patient revealed white matter low attenuation similar to that reported by Valentine *et al*⁸ who demonstrated its association with hypertension and dementia. We have been unable to find any reports of amelioration of the condition with treatment of the hypertension.

The evidence linking diabetes mellitus to dementia is less convincing. Bale⁹ has shown a relationship between brain damage assessed psychometrically and the frequency of hypoglycaemic episodes. Our patient's hypoglycaemic episodes had been infrequent and mild. There is however evidence of diffuse as well as focal brain damage in diabetes, perhaps deriving in part from metabolic disturbances within the brain parenchyma.¹⁰ It is conceivable that some of the improvement in our patient could be related to a sustained normal blood glucose.

The failure of our patient to make a full recovery might be due to the residual right caudate infarct. Psychometric evidence showed no improvement in the picture arrangement subtest of the WAIS nor on a task which required the learning of semantically unrelated material. Both of these tasks have been shown to be impaired in patients with frontal lobe dysfunction.^{11 12} Interestingly, patients with Huntington's dementia show the very same focal cognitive deficits¹³ which are perhaps attributable in both cases

to the close anatomical relationship between frontal and caudate regions.

What conclusions may be drawn from this case report? Whatever the pathophysiology of the dementia and its recovery, it seems indubitable that a relationship existed to the phaeochromocytoma itself. The lack of similar reports could be due to the failure to exclude phaeochromocytoma in hypertensive patients of later life with dementia. It is possible that cognitive changes may only appear after the tumour has been present for a considerable period of time, and it could be relevant that our patient had had diabetes mellitus for 13 years. In view of the fact that our patient improved, we would currently recommend excluding phaeochromocytoma in any patient presenting with dementia who has hypertension, particularly if accompanied by glucose intolerance.

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Fig (a) CT scan showing right head of caudate infarct and enlargement of sylvian fissures. (b) CT scan showing white matter low attenuation, particularly on the left.