Fornix damage from solitary subependymal giant cell astrocytoma causing postoperative amnesic syndrome

Introduction

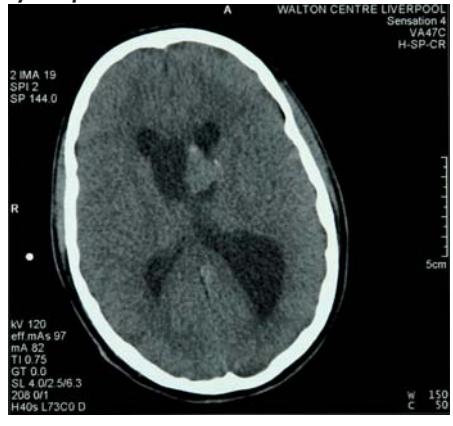
The amnesic syndrome is characterized by difficulty learning and recalling information, either previously encoded (retrograde) or newly encountered (anterograde). Various structures within the medial temporal lobe and limbic system of the brain are thought to be important in memory formation and retrieval, as evidenced by the fact that damage to these areas may result in an amnesic syndrome (Papanicolaou, 2006). For example, anterograde amnesia associated with damage to the fornix (Sweet et al, 1959), a fibre bundle connecting the hippocampus to the mamillary bodies within the limbic system, is well described following removal of third ventricle colloid cysts (Hodges and Carpenter, 1991; McMackin et al, 1995; Aggleton et al, 2000), suggesting the importance of the fornix as one of the anatomical substrates of the distributed neural network underpinning memory functions (Mesulam, 1990). This article reports the cognitive impairments associated with left fornix damage which became apparent following surgical removal of a solitary subependymal giant cell astrocytoma.

Discussion

This patient had evidence of a persistent anterograde amnesia, with some additional executive dysfunction, caused by damage to the left fornix by an invasive tumour. The relatively selective neuropsychological impairments, with sparing of language and visuospatial functions, were comparable to those reported with left fornix injury following removal of third ventricular colloid cysts (Hodges and Carpenter, 1991; McMackin et al, 1995; Aggleton et al, 2000). These cases have been associated with persistent anterograde amnesia, and sometimes also with retrograde amnesia. Severity of left fornix damage has been suggested as the most important determinant of severity of verbal memory impairment (McMackin et al, 1995). This patient's gradual cognitive improvement during follow up may reflect resolution of tissue damage and/or the development of new learning strategies.

Pathological causes of fornix damage other than colloid cyst resection have on occasion been reported to result in neuropsychological deficits including amnesia, such as splenial tumours (Rudge and Warrington, 1991), temporal lobe epilepsy (Kuzniecky et al, 1999), focal vascular infarction (Moudgil et al, 2000), and carbon monoxide poisoning (Kesler et al, 2001).

Figure 1. Uncontrasted axial computed tomography scan of the brain showing heterogeneous intraventricular lesion causing obstructive hydrocephalus.



Case Report

A 24-year-old right-handed woman with well-controlled insulin-dependent diabetes mellitus presented with a 1-week history of vomiting. She also gave a 1-year history of intermittent generalized headaches without obvious features of raised intracranial pressure. Neurological examination was normal. Structural brain imaging showed hydrocephalus secondary to an intraventricular heterogeneous mass lesion which compressed the left frontal horn (*Figure 1*) but without any brain parenchymal lesions or signal change. At operation, tumour was found to have invaded the left fornix but spared the thalamus and caudate nucleus. Histologically the lesion was moderately cellular with both ganglionic and astrocytic type cells, without evidence of mitosis or necrosis; appearances consistent with a subependymal giant cell astrocytoma. Neither the patient nor her family had any history of cutaneous stigmata of tuberous sclerosis.

Postoperatively, it became apparent to care staff that the patient had short-term memory problems, repeatedly asking the same question and needing to be reminded about activities to perform. Mini-mental state examination (MMSE) 2 weeks postoperatively was 14/30. This rose to 24/30 by 10 weeks, and on the Addenbrooke's Cognitive Examination-Revised (ACE-R; Larner, 2007), a more detailed bedside test of cognitive function, she scored 75/100 (*Table 1*), with evidence of impaired delayed recall for verbal material (ACE-R memory subscore 17/26), and also for visual material (ad hoc object recall test 0/10), with recognition better than recall. There was impaired verbal fluency for both letter and category (ACE-R fluency subscore 3/14).

Reassessed 9 months later, almost 1 year after tumour excision, the patient and her family noted continuing subjective improvement in memory but she needed external memory aids to remind herself of appointments, and remained vague about happenings in the year before her surgery, suggesting some possible retrograde memory impairment. She was now at ceiling on the MMSE (30/30) and on ACE-R scored 88/100 (*Table 1*) with improved delayed recall for verbal material (ACE-R memory subscore 21/26) and visual material (ad hoc object recall test 4/10). Verbal fluency for letter and category was also improved (ACE-R fluency subscore 8/14).

Dr I Ibrahim *is Specialist Registrar in Neurorehabilitation,* **Professor CA Young** *is Consultant Neurologist and Honorary Professor of Neurology in the Neurological Rehabilitation Unit and* **Dr AJ Larner** *is Consultant Neurologist in the Cognitive Function Clinic, Walton Centre for Neurology and Neurosurgery, Fazakerley, Liverpool L9 7LJ*

Correspondence to: Dr AJ Larner

Table 1. Postoperative course of cognitive function

Time post-operation	2 weeks	10 weeks	50 weeks
Mini-mental state examination	**14/30**	**24/30**	**30/30**
Orientation in time	0/5	2/5	5/5
Orientation in place	1/5	4/5	5/5
Registration	3/3	3/3	3/3
Attention	5/5	5/5	5/5
Recall	0/3	1/3	3/3
Naming	2/2	2/2	2/2
Repetition	1/1	1/1	1/1
Close eyes	1/1	1/1	1/1
3-step	0/3	3/3	3/3
Sentence	0/1	1/1	1/1
Pentagons	1/1	1/1	1/1
Addenbrooke's Cognitive Examination-Revised	**-**	**75/100**	**88/100**
Attention and orientation	-	14/18	18/18
Memory	-	17/26	21/26
Fluency	-	3/14	8/14
Language	-	26/26	25/26
Visuospatial	-	15/16	16/16

Subependymal giant cell astrocytoma is classified as a non-invasive (World Health Organization grade I) astrocytic tumour. Lesions typically occur near the interventricular foramen of Monro, obstruction of which may cause hydrocephalus and raised intracranial pressure. Although the tumour is benign, local invasion may occur. Subependymal giant cell astrocytoma develops in 6–14% of patients with the neurocutaneous syndrome of tuberous sclerosis (Roach, 2004), and some authors state that subependymal giant cell astrocytoma only occurs in tuberous sclerosis (Taylor and Nakahara, 2008). Solitary subependymal giant cell astrocytoma is rare, and has been suggested to represent an atypical presentation of tuberous sclerosis (Kawahara et al, 2004).

Since the body of the fornix runs in the medial wall of the third ventricle before diverging into paired columns at the margin of the opening of each interventricular foramen of Monro, it might be anticipated that subependymal giant cell astrocytoma would be associated with fornix damage and memory problems. However, only one prior account of memory problems associated with solitary subependymal giant cell astrocytoma has been identified, these occurring before tumour excision (Yamamoto et al, 2002). This case shows that solitary intraventricular subependymal giant cell astrocytoma may locally invade the fornix causing anterograde amnesia, with greater impairment of recall than recognition. BJHM

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