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Case report

Episodic encephalopathy due to an occult spinal vascular malformation complicated by superficial siderosis

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ABSTRACT

Superficial siderosis (SS) of the central nervous system is a rare condition caused by chronic subarachnoid hemorrhage. Clinical manifestations typically include sensorineural hearing loss and cerebellar ataxia. Recurrent episodic encephalopathy in the setting of SS has not been reported. We describe a unique case of SS in a 67-year-old man with an 8-year history of episodic encephalopathy associated with headache and vomiting. The patient also had a history of progressive dementia, ataxia, and myelopathy. A diagnosis of superficial siderosis was made after magnetic resonance gradient-echo images showed diffuse hemosiderin staining over the cerebellum and cerebral convexities. No intracerebral source of hemorrhage was identified. The patient therefore underwent gadolinium-enhanced spinal MRI which suggested a possible vascular malformation. A therapeutic laminectomy subsequently confirmed an arteriovenous fistula which was resected. In SS, there are often long delays between symptom onset and definitive diagnosis. Early identification is facilitated by magnetic resonance imaging with gradient-echo sequences. When no source of hemorrhage is identified intracranially, then total spinal cord imaging is indicated to assess for an occult source of hemorrhage as occurred in our case.

1. Introduction

Superficial siderosis (SS) is a rare condition caused by continuous or episodic bleeding into the subarachnoid space leading to hemosiderin deposition in the subpial layers of the brain and spinal cord. Patients most commonly present with sensorineural hearing loss and ataxia [1]. Additional features include pyramidal signs and, less frequently, dementia [1,2]. We describe an unusual case of a patient with recurrent encephalopathy and progressive dementia who was found to have SS secondary to an occult spinal vascular malformation.

2. Case report

A 67-year-old man had an 8-year history of episodic confusion and agitation associated with headache and vomiting. These episodes generally lasted 1–3 days and were followed by improvement but not complete return to baseline. The first episode occurred after cardiac stenting and was attributed to meperidine. Three years later, while driving home from a vacation, the patient became confused, could not pump gas, and could not locate money in his wallet. At home, he became combative and was immediately taken to a local community hospital. He vomited in the emergency room. Head CT was normal. A lumbar puncture obtained under fluoroscopy the following day had 11,300 red blood cells (RBC)/cm^3, 46 white blood cells (WBC)/cm^3, protein of 73 mg/dL and glucose of 75 of mg/dL. Bacterial, viral (including herpes simplex PCR), acid-fast bacilli, and fungal cultures were negative. The elevated RBC count was attributed to a traumatic tap. Over the next several days, his mental status improved and he returned home.

Over the next four months, he developed frequent falls, impaired fine hand movements, and difficulty with executive function on neuropsychological testing. For the next four years, his episodic bouts of headache, vomiting, and confusion continued as did his cognitive decline. An MRI 4 years prior to our visit showed prominent cerebellar folia, mild generalized atrophy, and minimal hemosiderin over the left superior cerebellum that was attributed to prior subarachnoid hemorrhage. Prior evaluation also included prolonged EEG monitoring without seizures. Labs including thyroid-stimulating hormone, ammonia, erythro-

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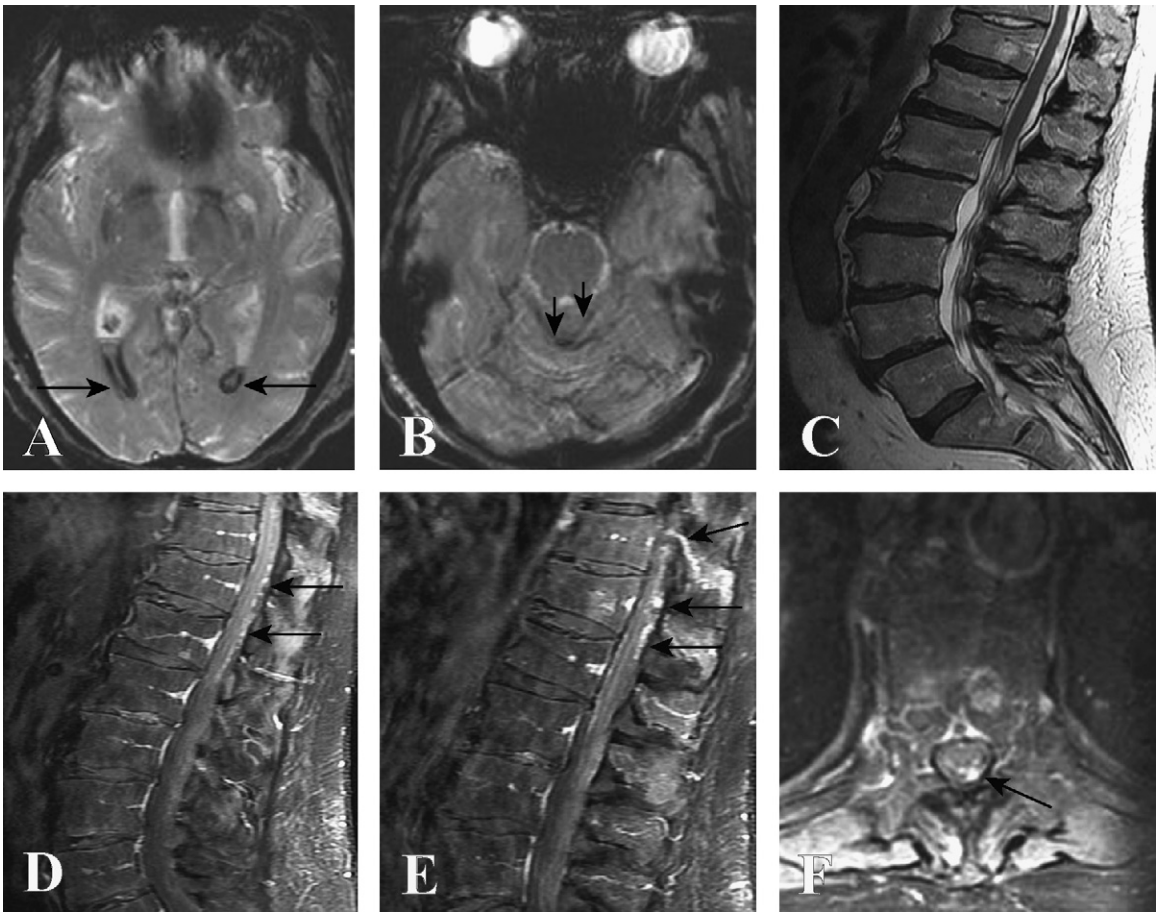

Fig. 1. Evidence of superficial siderosis. Blood in the occipital horns of the lateral ventricles (arrows, A) and hemosiderin staining of the folia of the cerebellum (arrows, B) is easily demonstrated on these axial gradient-echo magnetic resonance images (A and B). Gradient-echo is superior to T2-weighted magnetic resonance imaging for demonstrating the hypointensity of blood. Gradient-echo imaging of the spinal cord was not obtained. (C) Sagittal T2-weighted fast spin echo magnetic resonance image fails to show flow voids in or adjacent to the spinal cord or any cord edema. There is no evidence of a vascular malformation. Post-gadolinium sagittal (D and E) and axial (F) T1-weighted magnetic resonance images demonstrate abnormal vessels, most likely veins, suggestive of a vascular malformation. A venous pouch is present at T11 (arrow, F) and the vein draining to the pouch is visible (superior arrow in E). Subsequent surgical exploration confirmed the presence of a low thoracic arteriovenous (AV) fistula.

cyte sedimentation rate, vitamin B12, heavy metals, and Lyme titers were negative as was testing for porphyria, paraneoplastic syndromes, and cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy (CADASIL). He carried a diagnosis of possible Lewy body dementia. The patient was referred to our institution for further evaluation.

Our initial clinic exam revealed a Mini-Mental Status Exam (MMSE) of 18/30, scanning speech, increased tone, hip flexor weakness, postural and intention tremor, brisk reflexes, and an upgoing right toe. Gait was wide-based and ataxic with leftward leaning.

Three days after this visit, the patient became acutely confused, developed headache, and vomited. Upon hospital admission, he was combative and encephalopathic. Lumbar puncture under fluoroscopy demonstrated 2 WBC/μL, 98 RBC/μL, glucose 51 mg/dL and protein 60 mg/dL. Two days later, his encephalopathy cleared. In addition to prior findings, he now had slowed rapid alternating movements, saccadic pursuit, and an MMSE of 14/30. MRI with gradient-echo images demonstrated intraventricular hemorrhage as well as diffuse hemosiderin staining of the cerebellum and cerebral convexities consistent with SS (Fig. 1A and B).

A spinal MRI was performed to search for a bleeding source. While T2-weighted imaging was unremarkable (Fig. 1C), post-gadolinium imaging suggested a possible vascular malformation (Fig. 1D–F). Spinal angiography was subsequently performed and was considered negative. However, given the patient's ongoing episodes, clear evidence for siderosis on brain MRI, and concern for a possible bleeding source on spinal MRI, a neurosurgical exploration was performed.

Laminectomy from T10-12 revealed an arteriovenous (AV) fistula corresponding to the prominent vessels on spinal MRI. The neurosurgeon noted considerable hemosiderin staining in the arachnoid. The feeding artery was ligated and the AV fistula was then deflated and cauterized. Pathology was consistent with a vascular malformation.

Nine months post-surgery, our patient has had no further bouts of episodic encephalopathy. Unfortunately, he remains severely demented with debilitating gait instability due to his advanced SS.

3. Discussion

In superficial siderosis, hemosiderin deposits are most prevalent over the cerebellar vermis and folia, around the brainstem, and along cranial nerve VIII [2,3]. The cerebral convexities may also be affected. Signs and symptoms correlate with deposition sites: approximately 90% of SS patients have sensorineural hearing loss and cerebellar ataxia [1]. Myelopathy and a distinct pattern of cognitive and social impairments are also reported [4]. Severe headache suggesting subarachnoid hemorrhage was uncommon in one review article [2] but a prior review suggested 37% of SS patients had such headaches [1].

Over an 8-year course, our patient developed progressive dementia, ataxia, and myelopathy—all recognized manifestations

of SS. Bouts of recurrent encephalopathy in this setting, however, have not been reported. We presume that episodic subarachnoid hemorrhage from the spinal vascular malformation caused the bouts of encephalopathy and headache. Cognitive deficits, delirium, and psychosis have all been reported in the acute setting after subarachnoid hemorrhage [5–7]. Additionally, intraventricular hemorrhage complicating subarachnoid hemorrhage is more strongly associated with delirium [5]. Our patient had intraventricular hemorrhage on MRI imaging during his acute bout of encephalopathy at our hospital. Over time, the vascular malformation's recurrent hemorrhage into the subarachnoid space (manifest as the patient's episodic encephalopathy) caused hemosiderin deposition and resulted in the patient's insidious superficial siderosis (with dementia, ataxia, and myelopathy).

Like our patient, many SS patients are misdiagnosed with a neurodegenerative disorder [2]. Red blood cells on lumbar puncture may be inaccurately attributed to a traumatic tap. Unfortunately, even when SS is suspected or diagnosed, a source of bleeding is identified in only approximately 54% of cases [1]. Without a source to treat surgically, chelation therapy can be tried but frequently shows no benefit [8–10]. When clinical history and brain imaging studies do not reveal a source of hemorrhage, then imaging of the spine should be performed. The increasing use of gradient-echo sequences and gadolinium-enhanced MRI should allow a higher percentage of patients to have a specific source of SS detected earlier in the clinical course of disease.

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