Neuroimaging Highlight

Editor: David Pelz

Susac's Syndrome

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A 40-year-old woman with no significant previous medical history presented with a three month history of ataxia, confusion, memory difficulties, and headaches. Physical examination revealed numbness in the left hand, but was otherwise unremarkable. Magnetic resonance imaging fluid-attenuated inversion recovery (MRI FLAIR) images demonstrated multiple small white matter hyperintensities, including lesions involving the corpus callosum. There were also deep gray nuclei lesions (Figure 1). The corpus callosum lesions involved the central fibers (Figure 2). Post gadolinium T1 images demonstrated enhancement of some of the lesions as well as extensive perivascular and leptomeningeal enhancement (Figure 3). Extensive infectious serology, autoimmune panel, and paraneoplastic antibodies were negative. Lumbar puncture revealed elevated protein (1116 mg/L), but was otherwise normal. Brain biopsy indicated no apparent pathology. The patient was tentatively diagnosed with acute encephalopathy and treated with high dose steroids seven days after presentation. She was subsequently discharged and was sent for rehabilitation.

Three months later, while undergoing rehabilitation, the patient's symptoms returned with progressive left sided hearing loss, bilateral tinnitus, and ataxia. Magnetic resonance imaging (MRI) was repeated and demonstrated improvement in the white matter lesions, and reduced lesion, perivascular, and leptomeningeal enhancement. Fundoscopy (Figure 4) revealed two discrete old branch retinal artery occlusions (BRAO) on the right, and a new BRAO on the left with an area of retinal whitening. Fluoroscein angiography (Figure 5) confirmed the BRAOs, leading to the diagnosis of Susac's syndrome (SS). The patient was started on intravenous solumedrol and was eventually treated with cyclophosphamide.

Nine months after the initial presentation, the patient's confusion, memory problems, and ataxia have resolved. No new neurologic symptoms have developed. No new visual disturbances have occurred. Her hearing has improved but remains reduced from her baseline. She still has tinnitus.

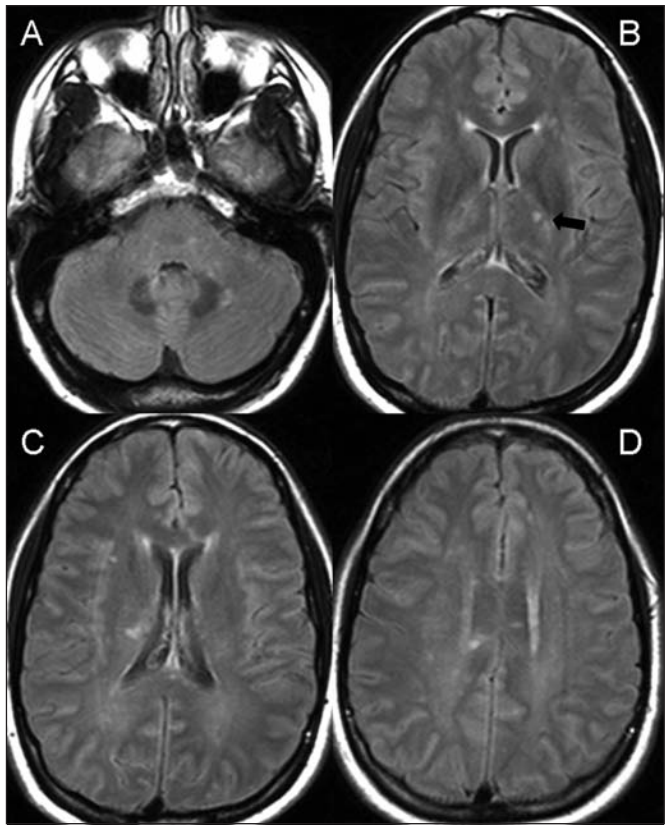

Figure 1: *Axial FLAIR images (A-D) demonstrate multiple infratentorial and supratentorial white matter lesions, including lesions in the corpus callosum. Lesions are also seen in the deep grey nuclei (B, arrow, left thalamus).*

Discussion

Susac's syndrome, or retinocochleocerebral vasculopathy, is characterized by the triad of encephalopathy, multiple branch retinal artery occlusions, and hearing loss. Since the first case report in 1979, there have been over a hundred cases of SS reported[1]. This condition is more commonly seen in women than men (3:1), and the age of onset ranges from 9 to 58 years. Young women between the ages of 20 and 40 are most susceptible[1,2].

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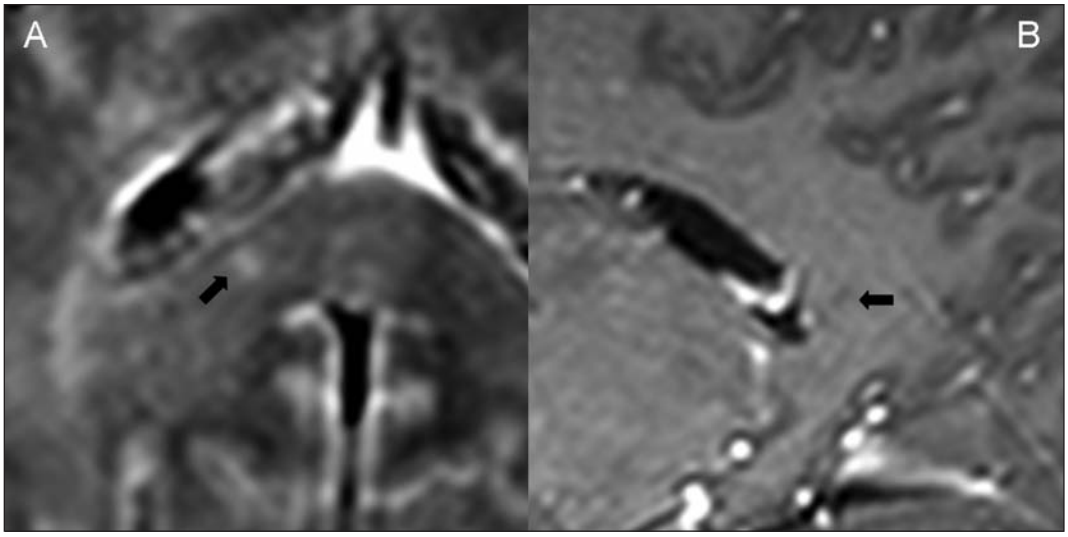

Figure 2: *Axial FLAIR image (A) and sagittal T1 post gadolinium image (B) demonstrating a corpus callosum lesion involving the central fibers (A and B, arrow).*

The classic triad of SS, although pathognomonic, does not always present in its entirety at the time of onset. Encephalopathy often presents with headache, confusion, memory loss, behavioral changes, and dysarthria[3]. New BRAO are best detected by careful ophthalmic examination but older BRAO may be clinically subtle and more easily detected by using fluorescein angiography. They are usually bilateral, and can be either subtle or extensive. Segmental loss of vision in one or both eyes, and visual scintillating scotoma are usual visual complaints[3]. Hearing loss often presents acutely and is associated with tinnitus, vertigo, nausea, vomiting, nystagmus, and unsteady gait. Sensorineural hearing loss is best demonstrated using audiometry[3]. The clinical course is generally self-limited, usually ranging from two to four years. Patients then stabilize with often permanent residual cognitive disturbance, impaired hearing, and/or vision loss[3]. Previous cases suggest that delayed treatment may result in worsened degrees of permanent deficits[4].

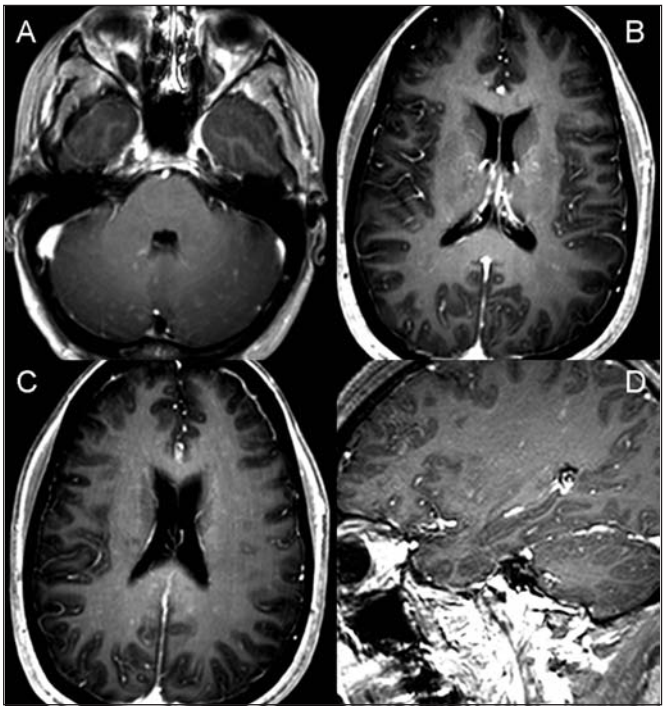

Figure 3: *Axial (A-C) and sagittal (D) T1 post gadolinium images demonstrate enhancement of some of the white matter lesions as well as increased perivascular and leptomeningeal enhancement.*

Magnetic resonance is the most suitable imaging modality for visualizing the intracranial pathologies of SS. This condition is highly associated with lesions in white matter. Previous studies demonstrate that all patients with SS presented with multi-focal lesions involving the corpus callosum. The central region of the corpus callosum was especially affected. This presents differently from multiple sclerosis or acute disseminated encephalomyelitis as they typically involve the inferior aspects of corpus callosum. Deep gray basal ganglia and thalamus lesions are seen in 70%. Both gray and white matter lesions may also enhance with gadolinium in 70% of the cases[3]. Leptomeningeal enhancement is seen in 33% of cases.

Brain biopsy shows microinfarctions in the cortex as well as in the white matter and leptomeninges[2]. In our case the brain biopsy, taken from the right frontal cortex, was normal. The negative biopsy in our case may have been due to the small size of the biopsy specimen which was mostly gray matter, and due to the fact that the brain at the biopsy location looked relatively normal on MRI.

The etiology and pathogenesis of SS is currently unclear. An immunologic origin is presumed, and theories of infection-induced mechanisms have been proposed[4-6]. The unknown pathogenesis ultimately leads to small infarcts of cochlear, retinal, and encephalic tissues, resulting in the clinical triad that is characteristic of this condition. The main treatment for SS is

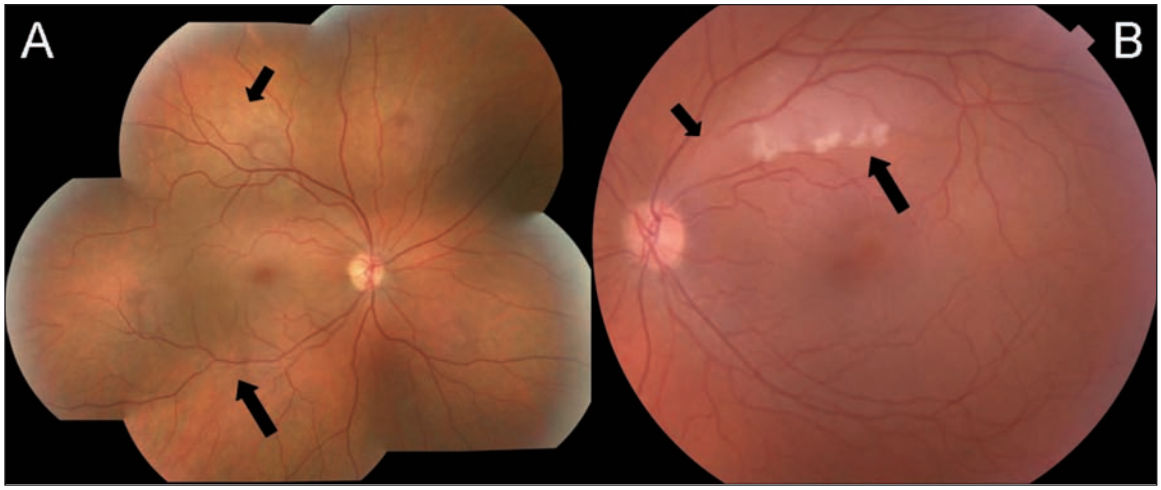

Figure 4: *Colour fundus photographs of right eye (A) demonstrating old BRAOs along the supertemporal (small arrow) and inferotemporal (large arrow) vascular arcades; and left eye (B) demostrating recent BRAO (small arrow) and associated retinal whitening/infarction (large arrow). (See colour figure on-line)*

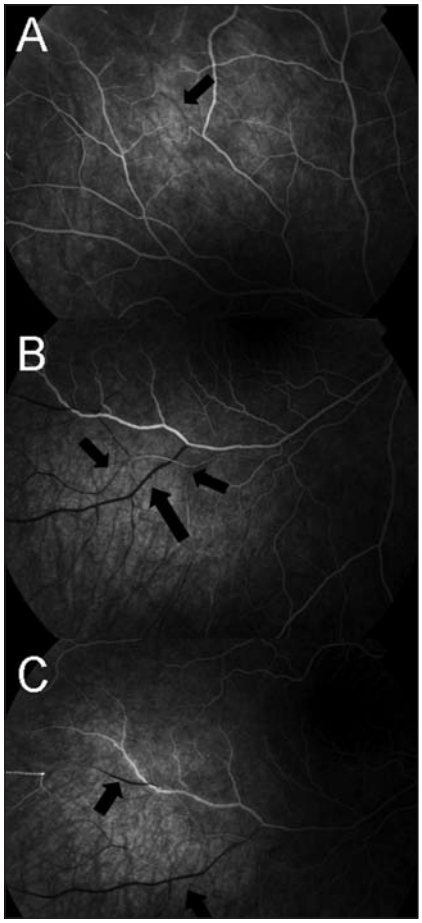

Figure 5: *Mid arteriovenous phase fluorescein angiogram of the right eye demonstrating vascular filling defect hypofluorescence in retinal arterioles affected by BRAOs (small arrows) in the superotemporal (A) and inferotemporal (B,C) vascular arcades. More pronounced hypofluorescence is noted in the retinal veins (large arrows) representing delayed filling secondary to the proximal arterial occlusion rather than occlusive or vasculitic phenomena in the venous system.*

corticosteroids and immunosuppressive agents, particularly cyclophosphamide. Intravenous immunoglobin can also be used in conjunction[1,4].

Despite the rarity of this condition, radiologists should suspect Susac's syndrome in any adult or young patient presenting with a subacute encephalopathy, proteinorachia, multiple small white matter and callosal hyperintensities with or without visual or auditory symptoms. Such presentation should be followed by dilated funduscopy and fluorescein angiography as needed for the identification of branch retinal artery occlusions, which is highly indicative of Susac's syndrome.

References

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