Neurology Asia 2006; 11 : 145 – 149

Superficial siderosis of the central nervous system: An unusual cause for headache and hearing loss

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Abstract

Superficial siderosis of the central nervous system (SSCN) is a very rare disorder caused by deposition of haemosiderin in the superficial and subpial layers of the central nervous system due to repeated chronic subarachnoid or intraventricular haemorrhage. The clinical syndrome of SSCN consists of sensorineural hearing loss, progressive ataxia and spasticity. A 52 year-old woman who has a history of chronic progressive hearing loss, severe headache and gait instability for one year is presented. The neurological examination revealed bilateral sensorineural hearing loss, cerebellar ataxia and mild spasticity of the lower extremities. Brain MRI showed classical superficial siderosis in the form of hyposignal intensity along the leptomeninges. The prominent sites of hemosiderin deposition in this case were cerebellar vermis, around the brain stem and whole spinal cord surface. Cerebrospinal fluid findings confirmed chronic subarachnoid hemorrhage but bleeding site could not be demonstrated by cerebral angiography. This case report draws attention to this rare complication of chronic subarachnoid hemorrhage, which can be recognized early by its clinical triad and MRI findings.

INTRODUCTION

Superficial siderosis of the central nervous system (SSCN) is a rare condition characterized by deposition of hemosiderin on the cerebellum (especially the vermis), basal frontal lobe and olfactory bulbs, temporal cortex, brainstem and cranial nerves (especially VIII), spinal cord and nerve roots.[1] Deposition of free iron and hemosiderin in pial and subpial structures leads to intoxication of the central nervous system (CNS) and represents the pathophysiological mechanism of superficial siderosis. Hypointensity of the marginal zones of the central nervous system on T2 weighted MR images indicates an iron-induced susceptibility effect and seems pathognomonic for superficial siderosis.[2] This deposition eventually results in destruction and demyelination within the central nervous system, leading to the cardinal clinical findings of superficial siderosis: hearing loss, ataxia, and myelopathy.[3,4]

The deposition of hemosiderin is due to repeated chronic subarachnoid or intraventricular bleeding most commonly secondary to repeated hemorrhages from tumors (especially ependymomas) and vascular malformations.[5] In most cases, no source of bleeding is found.[6] Treatment of superficial siderosis is focused around treating the source of bleeding.[7] This is the report of a patient with SSCN where no cause was found, presenting with headache, deafness and gait ataxia.

CASE REPORT

A 52-year-old previously healthly woman presented with a one year history of mild progressive bilateral deafness, throbbing headache predominantly in frontotemporal regions and gait ataxia. She experienced headache accompanied by nausea, photophobia and phonophobia and were not relieved by analgesics and ergotamines. There was no history of systemic hypertension and craniospinal injury or operation of the brain and spinal cord. She had never experienced any episode of severe headache, nausea and vomiting which would indicate acute subarachnoid hemorrhage. No history of diseases or medications which would cause bleeding tendency was noted. Family history was unremarkable for neurodegenerative diseases. General physical examination was unremarkable. Neurological examination revealed a healthy, alert and cooperative patient with no stiff neck. Mental status examination showed no evidence of cognitive impairment. The Mini-Mental State Exam score was 28/30. The muscle power was normal. Both lower limbs were spastic with brisk deep tendon reflexes and bilateral extensor plantar responses. There was mild dysmetry and dysdiadokokinesia both sides. She could not perform tandem gait due to instability.

Audiogram revealed sensorineural hearing loss of both ears, which was more on the left and high tone frequency loss was more prominent

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than lower tone frequency loss. CT brain scan with contrast was unremarkable. Brain MRI particularly with fluid attenuated inversion recovery (FLAIR) images showed high signal intensity in the cerebellar fissures, basal cisterns, Sylvian fissures and brainstem (Figure 1). MRI of the spine showed diffuse hypointensity at the surface of the whole cord, with no intra or extramedullary lesion (Figure 2). Lumbar puncture revealed a normal open pressure of 130 mm H_2O and the cerebrospinal fluid (CSF) was xanthochromic. CSF analysis revealed 4,200 red blood cells/ml and protein of 60 mg/dl. No organisms were detected by gram stain, Indian ink preparation and culture. VDRL was negative. No malignant cell or siderophage were detected from cytologic examination. CSF iron and ferritin were 4 ug/dl and 89.6 ng/ml respectively. Other CSF and plasma biochemistry results are listed in Table 1. Cerebral digital subtraction angiography (DSA) was normal.

The patient was diagnosed as idiopathic SSCN. She was given supportive treatment including 500 mg/day paracetamol in severe headache attacks, and 2,400 mg/per day piracetam for gait disturbance. The headache gradually improved over the subsequent year, and the neurological status remained stable.

DISCUSSION

SSCN was first described in 1908. There were several publications on its pathogenesis and clinical manifestations during the 1960s.[8,9] Nevertheless, the origin of SSCN remains undetermined in most cases. Highly vascular spinal tumours, CNS vascular abnormalities and posterior fossa surgical procedure are the most commonly identified sources of chronic bleeding.[10,11] A past history of trauma can be elicited in some patients and prior intradural surgery may be a further risk factor. The presence of a fluid-filled collection in the spinal canal is a common finding on MRI in these patients. With longitudinally extensive cavities, a dynamic CT myelogram may help localize the defect and direct the site of laminectomy.[6] As a fluid-filled cavity can result in spinal medullary compression, laminectomy may be beneficial in selected patients. In operated patients, spinal medullary compression has been shown to resolve upon MRI scanning without reversing the clinical picture. For this reason, a history of trauma and surgery should be elicited in all patients.[7] In our patient there was no history of trauma. As spinal MRI was normal, CT myelogram was not performed in our case.

Some of the reported etiological factors identified in cases of SSCN are shown in Table 2. Since Brain CT scan was unmarkeble, brain MRI was performed in this case. Brain MRI has been shown to be superior to CT in the determination of the underlying etiology in previous studies.[9,12,16] MRI showed symmetrical rims of low signal intensity in the upper folia of the cerebellar hemispheres, the Sylvian and other fissures indicating hemosiderin deposits.[5,7] This deposition results in the destruction of myelin and is considered a possible cause of myleopathy. In some cases of SSCN, pre-existing spinal surgery or trauma are considered as another possible cause for myeleopathy.[6]

Figure 1. **A.** Sagittal T2-weighted magnetic resonance (MR) image shows diffuse hypointensities around Sylvian fissure and the cerebellar tentorium. **B.** Axial T2 weighted images show a hypointense rim surrounding the mesencephelon and **C.** pons.

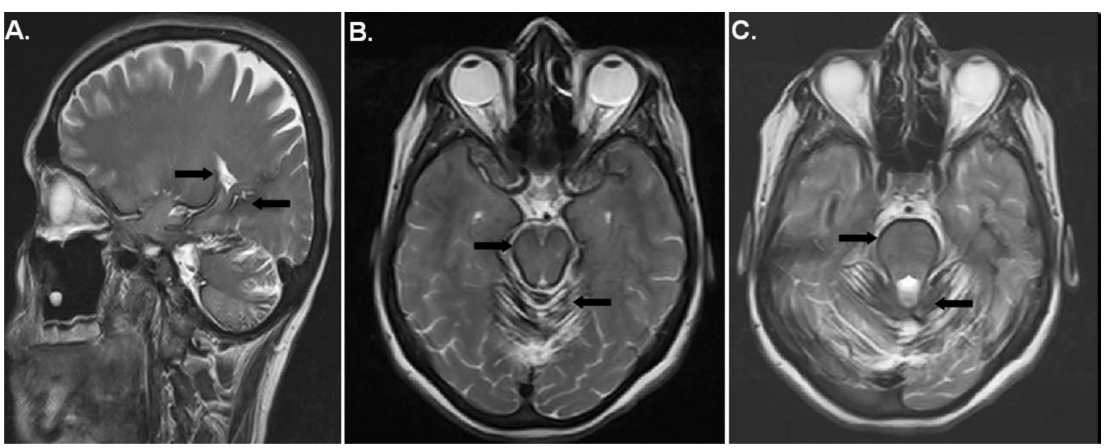

Figure 2. Sagittal T2-weighted MR image brainstem and spinal cord. Hypointense hemosiderin staining is seen around A. quadrigeminal cistern, pons and cervical **B.** thoracal **C.** lomber spinal cord.

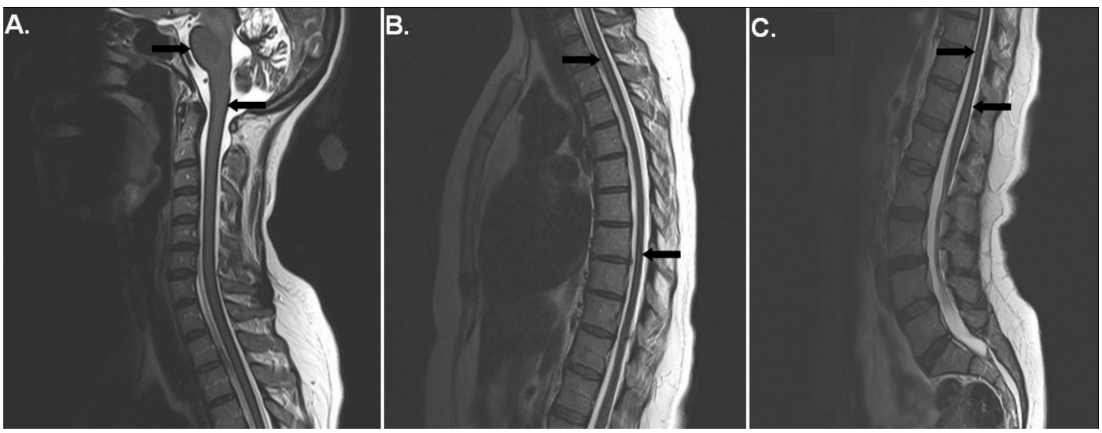

Table 1 Cerebrospinal fluid (CSF) and plasma findings of the patient

	CSF	Normal values*	Plasma	Normal values*
Glucose in mg/dL	55	50–80	94	70–110
Protein in mg/dL	60	15–45	7.3	6.4–8.2
Sodium in mmol/L	144	136–145	138	136–145
Potassium in mmol/L	2.9	2.6–3.0	3.6	3.5–5.1
Iron in microg/dL	4	23–52	80	35–150
Ferritin in ng/mL	89.6	2.73–3.41	130.2	20–250

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Lumbar puncture revealed a mildly increased blood cell count and the CSF ferritin level was high (89.6 ng/mL, normal values = 2.73–3.41 ng/mL) supporting a diagnosis of leptomeningeal siderosis. Audiogram revealed sensorineural hearing loss of both ears in our case. Sometimes, a hemosiderin deposit of the VIIIth cranial nerve can be found. MRI using axial three-dimensional constructive interference in the steady state (CISS) images are a particularly useful technique for demostrating this.[3,4,17,21] Hemosiderin deposits on other cranial nerves, including cranial nerves I, II, V, VII, and X, have also been reported.[22] The VIIIth cranial nerve is particularly vulnerable to hemosiderin deposition, often resulting in bilateral sensorineural hearing loss.[3,22]

In most cases treatment is limited to being symptomatic. In our case this including paracetamol for headaches and a trial of piracetam, the latter having no clear proven benefit. The only definite treatment for SSCN is in patients with an identifiable scource of bleeding.[1,7] Iron chelating agents have not been proven to have any beneficial effect.[14] In order to reduce the oxidative toxic effect of the heme-iron complex, selegiline (monoamine oxidase B inhibitor) and vitamin C have been administered without a clealry discernable benefit.[3,14] More therapeutic studies are clearly needed.

To conclude, headache combined with sensorineural hearing loss, may represent the first symptoms of SSCN which can be easily detected by brain MRI. Only rarely can a scource of bleeding be identified.

Table 2 Etiological factors of SSCN in the literature.

Authors	Etiological Factors
Haroun *et al*. 2000[12]	Cerebral arteriovenous malformation
Li *et al*. 2001[13], Leussink *et al*. 2003[14]	Cavernous malformations
Yoshida *et al*. 2002[15]	Spinal teratoma
Kitis *et al*. 2003[16]	After endoscopic third ventriculostomy
Kitis *et al*. 2003[16]	Pituitary macroadenoma
McCarron *et al*. 2003[11]	After posterior fossa surgery
Jin *et al*. 2004[17]	Familial leptomeningeal amyloidosis
Kole *et al*. 2004[5]	Bleeding pseudomeningocele
Messori *et al*. 2004[9], Kitis et al. 2003[16]	Spinal ependymoma
Sakamoto *et al*. 2004[18]	After subtotal removal of pituitary adenoma
Aquilina *et al*. 2005[4]	Cervical nerve root avulsion
Cohen-Gadol *et al*. 2005[20]	After spinal surgery
Hino *et al*. 2005[19]	Meningeal melanocytoma
Kumar *et al*. 2005[7]	Traumatic fluid-filled cavity on spinal cord

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