

The Supposed Intracavernous Sinus Arachnoid Cyst with Abducens Neuropathy: A Case Report

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Abstract

Intracavernous sinus arachnoid cysts are rare intracranial congenital lesions. When present, their anatomic location frequently results in cranial nerve palsy. A 15-year-old boy was admitted to our hospital with diplopia, which had gradually worsened over the previous several months. An arachnoid cyst was identified within the right cavernous sinus and fenestration surgery was performed. The patient recovered well and three months after the surgery, diplopia was disappeared. Surgical decompression of the intracavernous sinus arachnoid cyst is beneficial for symptomatic patients with this condition.

Key words: intracavernous sinus arachnoid cyst, abducens neuropathy, fenestration surgery, selection of the operating tool

Introduction

Arachnoid cysts occur in approximately 1% of all intracranial space-occupying lesions.¹⁾ Some cysts remain asymptomatic while others may expand and cause symptoms depending on their location.²⁾ Arachnoid cysts which are confirmed to the cavernous sinus are rare and have been reported infrequently in the literature. To our knowledge, there have been reports of only three other patients with neuropathy resulting from an intracavernous sinus arachnoid cyst.^{3–5)}

Case Report

A 15-year-old boy was admitted to our hospital with diplopia, which had gradually worsened over the previous several months. Ophthalmological examinations revealed right-sided paresis of the abducens nerve (Fig. 1), normal corneal reflex, clear cornea and lens, and isochoric pupil reflex. A brain computer tomography (CT) scan showed cyst-like fluid collection within the right cavernous sinus. Magnetic resonance imaging (MRI) (Fig. 2) showed that the lesion had low intensity in the T₁-weighted image and had a high signal in the T₂-weighted image. The lesion showed low intensity in the diffusion-weighted image and was not enhanced by infusion of contrast agent. Heavy T₂-weighted image (constructive interference in

the steady state: CISS) showed the high intensity area which represents the pathway of the cerebrospinal fluid (CSF) from the pre-pontine cistern to the cyst.

Surgery was performed on the patient because he showed gradually worsening of right abducens neuropathy. Zygomatic approach was performed to archive an intradural approach to the lateral part of the cavernous sinus. Along the lateral wall of the cavernous sinus, the right cranial nerves V1 and V2 were revealed. The cystic wall was fenestrated and enlarged so that the inner cavity communicated with the subarachnoid space. High-pressure, clear and colorless fluid was drained and the abducens nerve was detected in the cyst cavity (Fig. 3). The postoperative course was uneventful and the patient was discharged without developing any new neurological deficits. On the follow up CT scan, the size of the cyst was found to be reduced (Fig. 4) and the abducens palsy disappeared (Fig. 5).

Discussion

I. Arachnoid cysts

Intracranial arachnoid cysts usually occur in the sylvian fissure (49%), cerebellopontine angle (11%), supracollicular region (10%), vermis (9%), sellar and parasellar area (9%), interhemispheric fissure (5%), and cerebral convexity (4%).⁶⁾ Arachnoid cysts consist of a thin transparent wall separated from the inner dural layer and the underlying pia-arachnoid.⁷⁾ They are

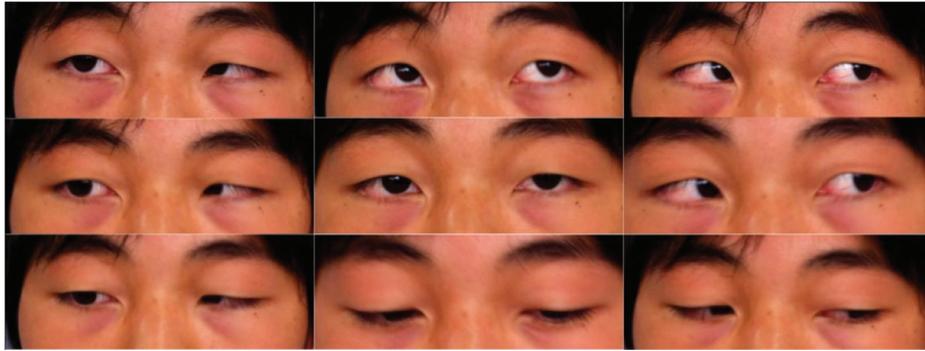


Fig. 1 Ophthalmological examinations before the surgery. Ophthalmological examinations revealed right-sided paresis of the abducens nerve.

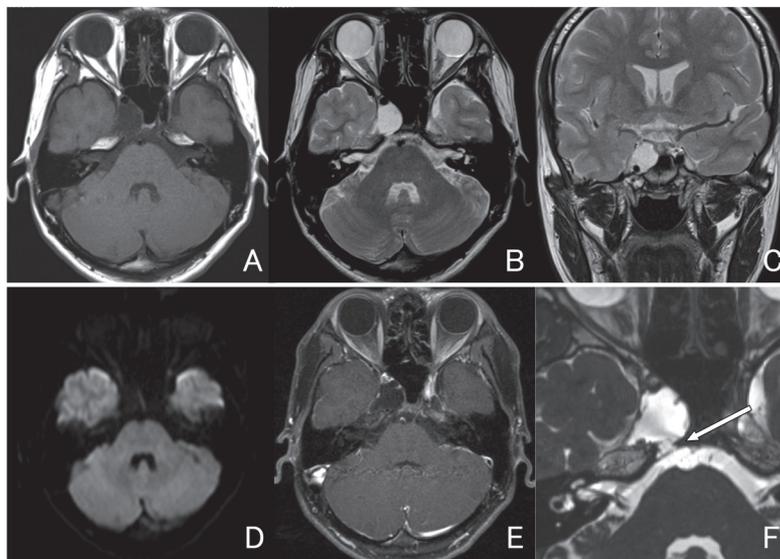


Fig. 2 Preoperative magnetic resonance imaging (MRI) images. Preoperative axial T₁-weighted (A), axial T₂-weighted (B) and coronal (C), diffusion-weighted (D) and enhanced T₁-weighted MRI showed the lesion which had the same intensity as the surrounding subarachnoid space. The cyst wall was not enhanced. Heavy T₂-weighted imaging (F) showed the pathway (arrow) of the cerebral fluid from pre-pontine cistern to the cyst.

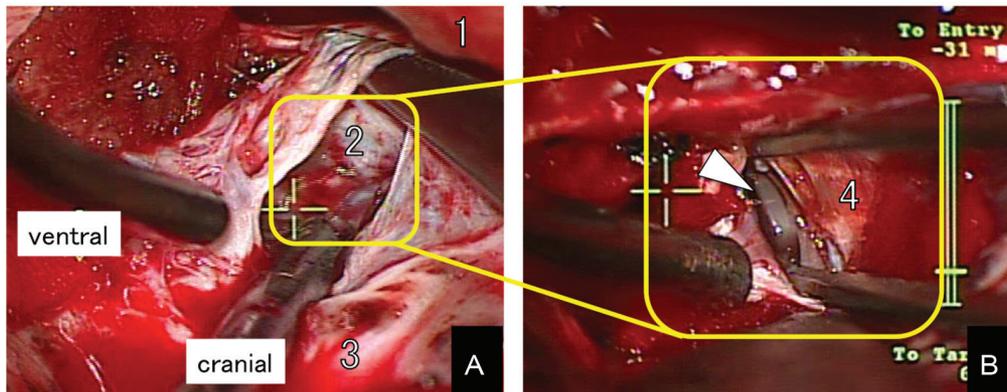


Fig. 3 Operative view. A: Intradural observation of the anterior aspect of the temporal fossa. 1: temporal bone, 2: lateral wall of the cavernous sinus, 3: dura of temporal lobe. B: The cyst wall was fenestrated. The abducens nerve (arrowhead) was detected in the cyst cavity. 4: Maxillary nerve (V2) at the lateral wall of the cavernous sinus.

fluid-filled cavities located entirely within the arachnoid membrane. The etiology of arachnoid cysts results from either congenital compromise during arachnoidal development, acquired inflammatory reaction, or trauma in the subdural space.

An arachnoid cyst often has a communication with the subarachnoid space. Cranial nerves in the lateral wall of the cavernous sinus are enclosed by separate arachnoid epithelial membranes whose elements penetrate the nerve sheaths and inner dura to form arachnoid granulations within the cavernous sinus. Therefore, it is possible that a splitting of the arachnoid membrane in one of these locations allowed an arachnoid cyst to form,³⁾ and progressive enlargement may occur because of a ball-valve mechanism.⁸⁾ In the present case, we presume that an abnormal flow of CSF from the prepontine cistern to the cyst occurred. Heavy T₂-weighted imaging which showed the pathway of the CSF would support this presumption.



Fig. 4 Computer tomography after the surgery. It revealed that the cyst size was reduced.

II. Imaging studies and differential diagnosis

In our patient, a CT scan demonstrated well-margined low density lesions. The MRI images showed identical signal intensities like CSF in the T₁- and T₂-weighted images, low intensity in the diffusion-weighted imaging, and without any contrast-enhancement. These findings are similar to the previous three reports of intra cavernous sinus arachnoid cysts.³⁻⁵⁾ A mass with a cystic appearance within the cavernous sinus might be a pituitary adenoma, craniopharyngioma, Rathke's cleft cyst, epidermoid cyst, dermoid cyst, cranial nerve schwannoma, or hydatid cyst. However, the cyst contents of these lesions are not iso-intense with CSF.³⁾ For instance, the diffusion-weighted imaging suggested that the mass was not an epidermoid cyst because the fluid within an epidermoid cyst produces an abnormally high intensity. A cystic schwannoma in the cavernous sinus is also unlikely in the present case because they are usually well enhanced with gadolinium.⁹⁾

In our patient, we could not get enough tissue of the cyst wall to be diagnosed histopathologically, however; arachnoid cyst was strongly suspected from the feature of the imaging studies and the operative findings.

III. Symptoms

The symptoms of arachnoid cysts vary depending on their location on the surrounding neural structures. Cavernous sinus lesions may cause cavernous sinus syndromes which are characterized by multiple cranial neuropathies.⁴⁾ Our patient had a relatively large intracavernous sinus arachnoid cyst. The cranial nerves along this pathway may have been involved. The abducens nerve runs lateral to the internal carotid artery but medial to the oculomotor and trochlear nerves and ophthalmic and maxillary divisions of the trigeminal nerve which run from superior to inferior within the lateral dural border of the cavernous sinus.¹⁰⁾ Our patient had exhibited diplopia which might have been caused by direct compression of the abducens nerve. The surgical findings confirmed high cystic pressure on surrounding neural tissues, especially on the abducens nerve. In the previously reported cases,



Fig. 5 Ophthalmological examinations after the surgery. On follow-up 3 months later, the right abducens palsy disappeared.

Table 1 Cases of arachnoid cysts associated with the cavernous sinus, listed in historical order

Number of report	Reference	Age/sex	Localization	Clinical aspects	Diagnosis	Treatment	Outcomes
1	Kobayashi et al., 1987 ⁵⁾	24/F	Left cavernous sinus	Diplopia due to isolated partial sixth nerve palsy	CT cisternography	Conservation	NA
2	Barr et al., 1999 ³⁾	67/M	Left cavernous sinus	Diplopia and anisocoria due to third nerve palsy	MRI findings	Conservation	NA
3	Cheng et al., 2010 ⁴⁾	18/M	Bilateral cavernous sinus	Right red eye and decreased visual acuity	NA	Surgical fenestration with neuroendoscopes	Improvement of symptoms
4	Present case	15/M	Right cavernous sinus	Diplopia due to isolated partial sixth nerve palsy	MRI findings	Surgical fenestration with microscope	Improvement of symptoms

CT: computed tomography, F: female, M: male, MRI: magnetic resonance imaging, NA: not applicable.

a 67-year-old man and 24-year-old woman had exhibited long-standing left third nerve palsy.^{3,5)} An 18-year-old man had exhibited progressive decreased visual acuity and red eye⁴⁾ (Table 1). In the former two cases, the symptoms can be explained by the mass effect of the cyst. Cheng et al. suggested that the cause of the decreased visual acuity and red eye might have been due to direct compression of the optic nerve or to venous stasis of ophthalmic draining veins.⁴⁾

IV. Treatment

Patients with symptomatic arachnoid cysts regardless of age and cyst location were treated with the advance modern treatment techniques but debate continues regarding the most effective surgical treatment.^{11,12)} Treatment options for arachnoid cysts include the expectant management, cyst shunting, craniotomy for fenestrations, deviation of cyst fluid to another intracranial space, stereotactic aspiration, and endoscopic fenestration.²⁾ Cyst-peritoneal (CP) shunting is minimally invasive and achieves a high rate of resolution on neuroimaging. However, in the absence of definite symptoms, alternate options to shunting were considered because of the resulting shunt dependency.¹³⁾ Duz et al. avoided shunt placement as the first treatment option.²⁾ Patients with a cyst in close communication with a ventricle or a cisternal compartment are candidates for undergoing an effective fenestration either endoscopically or microscopically.²⁾ Cheng et al. fenestrated the wall of arachnoid cyst within the right cavernous sinus to the basal cistern microscopically with the aid of a neuroendoscope.⁴⁾ The patient's visual acuity improved dramatically after intervention. Selection of the operating tool (either a microscope or an endoscope) will depend on the individual characteristics of the cyst. It is important to create adequate communication between the cyst

and the normal cerebral spinal fluid pathway near the lesion.¹⁴⁾ Therefore, we fenestrated the cystic wall and microscopically enlarged the hole communicating with the subarachnoid space. The postoperative improvement of diplopia justified surgical intervention to release pressure on the adjacent cranial nerves.

Conflicts of Interest Disclosure

The authors have no personal, financial, or institutional interest in any of the drugs, materials, or devices in the article. All authors who are members of The Japan Neurosurgical Society (JNS) have registered online Self-reported COI Disclosure Statement Forms through the website for JNS members.

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