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Endoscopic resection of a giant colloid cyst in the velum interpositum: illustrative case

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BACKGROUND Colloid cysts are an unusual differential diagnosis for lesions in the lateral ventricles. Microsurgery is usually recommended for the treatment of giant colloid cysts. This case is the largest reported colloid cyst in this unusual location treated with an endoscope.

OBSERVATIONS A 39-year-old woman with a history of pulsing headaches presented with nausea, vomiting, vision blurring, and paresthesia of the left leg. On the brain computed tomography, a huge, well-defined homogeneous hyperdense intraventricular lesion with hydrocephalus was observed. Magnetic resonance imaging showed a spherical lesion over the third ventricle inside the lateral ventricles, obstructing the Sylvius aqueduct. There was no enhancement and no diffusion restriction on diffusion-weighted images. Endoscopic third ventriculostomy was undertaken for hydrocephalus treatment. Then the lesion was resected grossly. The cyst wall was resected as much as it was safe. There was no clot or bloody product inside the lesion.

LESSONS Colloid cyst is rarely encountered in the velum interpositum and lateral ventricles, but the authors' giant colloid cyst case along with similar cases led to considering it out of the third ventricle. According to their experience, endoscopic removal is a safe and efficient method for colloid cyst surgery, even in giant cases.

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KEYWORDS lateral ventricles; velum interpositum; colloid cysts; cyst; neuroendoscopy

Colloid cysts are benign tumors of embryonic origin and make up 1% of all intracranial neoplasms.[1] Giant colloid cysts (GCCs) are defined as cysts greater than 30 mm in diameter.[2] These lesions often arise from the anterior part of the roof and grow downwards into the third ventricle. The lesion usually obstructs the foramen Monro and leads to obstructive hydrocephalus.[3]

Most of these cysts contain gelatinous viscous material. Size growth is indolent and usually is due to the accumulation of this gelatinous material, but as a rare phenomenon an acute sudden increase in size could be due to hemorrhage into the cyst. Therefore, it is usually clinically silent for a long time, and often detected only at autopsy.

Symptoms include headache, nausea, vomiting, vision blurring, dizziness, and extreme tiredness due to obstructive hydrocephalus or compression over the thalamus.[3] Sometimes it causes sudden death due to hemorrhage or chemical meningitis.

Imaging findings according to the cyst mucinous content could be very different and have any appearance. However, as a rule, enhancement is absent.

The cavum velum interpositum (CVI) is the space between the superior and inferior Tela choroidea at the roof of the third ventricle of the brain. This space is adjacent to the fornices on both sides at the top, the thalamus at the bottom, and the splenium of the corpus callosum at the back, which may extend to the foramen Monro anteriorly. It contains 2 internal cerebral veins and 2 posterior medial choroidal arteries. Embryologically, CVI originates as a true cistern from the roof of the diencephalon, with the pia mater spreading approximately in the third month of pregnancy.[4]

Colloidal cysts are usually in the third ventricle but could be located in different parts of the brain. They are very rare in the extraventricular system. This illustrated case is the largest (54 mm) reported colloid cyst arising from the velum interpositum, growing

ABBREVIATIONS CCRS = Colloid Cyst Risk Score; CT = computed tomography; CVI = cavum velum interpositum; GCC = giant colloid cyst; MR = magnetic resonance; MRA = magnetic resonance angiography; MRI = magnetic resonance imaging.

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upwards into lateral ventricles, and pushing internal cerebral veins and the third ventricle roof downwards.

Illustrative Case

Presentation

A 39-year-old woman presented with a history of pulsing headaches in the frontal region for approximately 2 years, which had increased in severity 1 month earlier. She was conscious and had paresthesia of the left lower limb and sometimes short-term forgetfulness and vision blurring since 3 weeks previously. No obvious neurological deficit was observed except for the left lower extremity paresis. Routine laboratory tests were normal.

Imaging

On the brain computed tomography (CT) scan, a huge (51 $\times$ 48 $\times$ 54 mm), well-defined homogeneous, hyperdense, midline intraventricular mass extending from the interthalamic region upwards into the lateral ventricles was observed. There was associated obstructive hydrocephalus with periventricular edema (Fig. 1A). There was no calcification.

On magnetic resonance imaging (MRI), it had a unique appearance. The lesion had a spherical shape over the third ventricle inside the lateral ventricles. Its signal was heterogeneous and had an intensity gradient from the anteroinferior corner (dark and hypodense signal) to the posterosuperior (bright and isointense to hyperintense signal) on T1- and T2-weighted sagittal images, which suggests a layering pattern. There was no enhancement on the T1-weighted postcontrast images and no diffusion restriction on diffusion-weighted imaging/apparent diffusion coefficient.

The lesion pushed the third ventricle roof (Fig. 1C) and compressed it to the midbrain and closed aqueduct. The lesion extended from the foramen of Monro anteriorly to the splenium of the corpus callosum posteriorly. The superior part of the mass extension was near the body of the corpus callosum. Internal veins and medial posterior arteries were displaced inferolaterally over the thalamus (Fig. 1D). There was no vascular lesion on magnetic resonance (MR) angiography (MRA). Internal cerebral veins were displaced down on MR venography.

Obstructive hydrocephalus was evident. Anterior to the lesion, cavum septum pellucidum was noticeable (Fig. 1E). Posterior to the tectum at the quadrigeminal cistern, there was a cystic lesion with a different appearance in comparison to the greater noted mass lesion. This cystic lesion was hypointense on T1-weighted images and hyperintense on the T2-weighted images without enhancement on postcontrast images, suggestive of arachnoid or entrapped subarachnoid space (Fig. 1B) due to the tumor. This cystic lesion had compression over the cerebellum and tectum. The Sylvius aqueduct was obstructed and the fourth ventricle was slit.

Differential Diagnosis

Because of hyperdensity on brain CT and a layering appearance on MRI without contrast enhancement on postcontrast images, 2 possibilities were considered. First, a tumor (e.g., pilocytic astrocytoma) or a cyst (arachnoid, colloid, inclusion, or teratoma cyst) with intralesion hemorrhage, and the second possible diagnosis was a cyst with mucinous or proteinous content (e.g., colloid cyst or craniopharyngioma).[5,6] Vascular lesions (e.g., aneurysm) due to location and MRA findings were not taken into consideration.

Operation

The patient underwent surgery through an endoscopic approach to the lesion. After entering the ventricular space from the right side, the lesion was observed. At first, a cerebrospinal fluid sample was taken and an endoscopic third ventriculostomy was undertaken for hydrocephalus treatment.

Then, after the mass wall opening at the superior part, there was a firm nonsuctionable solid gray-yellow material inside the lesion, which was not typical for a colloid cyst. Thus, the solid lesion content was resected in a piecemeal manner. At the inferior part of the lesion, semisolid gelatinous content compatible with the usual colloid cyst was seen and evacuated. The cyst wall was resected partially as much as was safe to do. There was no clot or bloody product inside the lesion. After 2 years of follow-up, there has been no recurrence of the cyst.

Postoperation

The patient's condition was stable after surgery and there was no complication. Postoperation brain CT showed some pneumocephalus and the lesion was totally resected (Fig. 2A). Control MRI showed gross total resection of the lesion. Internal cerebral veins and the third ventricle roof had returned to the normal position. The quadrigeminal cyst without any direct intervention had faded (Fig. 1B–E).

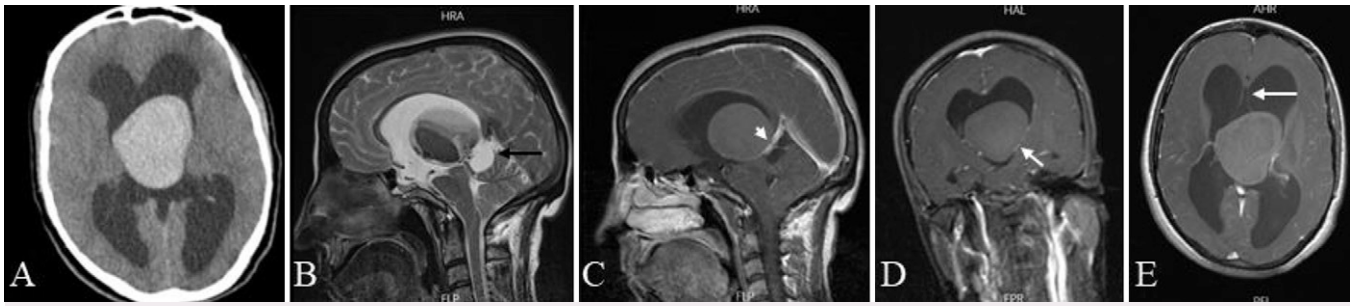

FIG. 1. Preoperative images. Brain CT shows a giant hyperdense lesion over the third ventricle inside the lateral ventricles (**A**). Sagittal T2-weighted MRI (**B**) shows a signal gradient inside the lesion, suggesting material layering. The *black arrow* shows a different cyst at the quadrigeminal cistern. The *arrowhead* (**C**) shows ICVs were pushed inferiorly. The *short arrow* (**D**) shows inferolateral displacement of the ICV. The *long arrow* illustrates cavum septum pellucidum (**E**). ICV = internal cerebral vein.

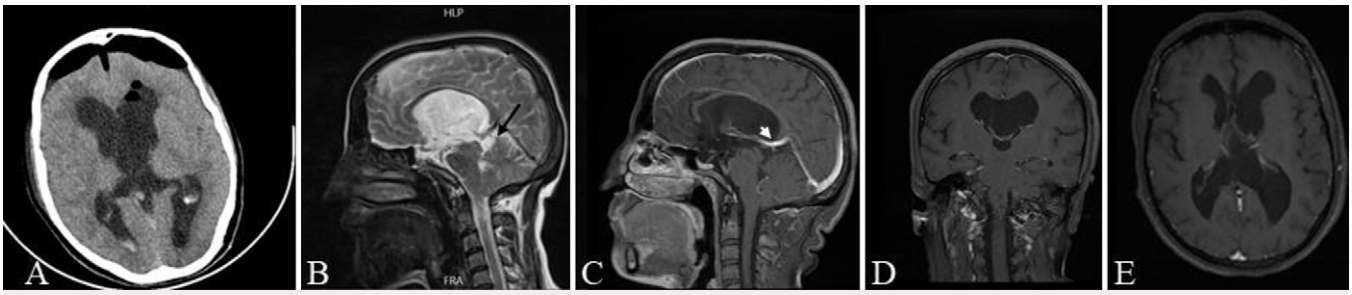

FIG. 2. Postoperative images. Brain CT shows the lesion was resected and there is some pneumocephalus (**A**). The *black arrow* shows a cyst at the quadrigeminal cistern that faded without direct intervention (**B**). The *arrowhead* shows ICVs back upwards (**C**). Coronal (**D**) and sagittal (**E**) postcontrast images show complete lesion resection.

Histopathology

Pathological examination confirmed the colloid cyst diagnosis.

Discussion

Colloid cysts are rare, benign intracranial lesions. The giant and unusual location of the velum interpositum is a particularly rare variant. According to our review, there have been only 4 reported cases of velum interpositum[7–9] and this illustrated case is the largest reported colloid cyst in this location resected endoscopically. The first one was a 33-year-old woman who presented with headache and epilepsy[8] and the second was an 11-year-old boy with a history of memory problems, which was discovered incidentally after head trauma.[9] Both of these cases underwent surgery with a microsurgical transcallosal approach.[8,9] The third one was a 23-year-old man who presented with temporary binocular strabismus who declined surgery due to stability of his symptoms.[7]

Observations

Our case was a 39-year-old woman who presented with nausea, vomiting, vision blurring, and paresthesia in the left leg. She had a giant cyst, which was resected through an endoscopic approach. Inside the lesion, there was firm, hardly suctionable, solid gray-yellow material, which is not typical for a colloid cyst. At the inferior part of the lesion, semisolid bright gelatinous content compatible with a usual colloid cyst was seen and evacuated.

The matter of unusual location of this and similar cases of colloid cysts is notable; colloid cysts are not only restricted to the third ventricle and should be in the differential diagnosis of lateral ventricle cystic lesions. The development of these lesions has not been fully elucidated, Ciric and Zivin[10] tried to describe the origin of cysts above and below the third ventricle roof, considering the developmental anatomy of this area. They originate from the neuroepithelium in the diencephalic roof, through invagination into the third ventricle, or as a result of evagination into the velum interpositum. Therefore, colloid cysts are more appropriately termed "neuroepithelial cysts." This description of development could explain material layering with different characteristics from the anteroinferior corner near the third ventricle roof (possible germinal center) to the posterosuperior corner inside the lesion in our case. However, it needs to be elucidated more precisely because the ectopic foregut endoderm hypothesis is now widely accepted.[11]

Colloid cysts usually are diagnosed with conventional MRI and CT findings and there are no diagnostic challenges in the third ventricle. Nevertheless, in the future, new MRI techniques such as MR spectroscopy and perfusion MRI[12] may be helpful for further discrimination of the differential diagnosis in unusual locations and materials inside lesions and germinal center localization.

Beaumont et al.[3] described the natural history of colloid cysts. Incidentally discovered colloid cysts have the capability of both lesion enlargement or, less frequently, shrinkage and symptom regression. Incidental lesions rarely result in acute obstructive hydrocephalus in the absence of trauma. The Colloid Cyst Risk Score (CCRS) is a simple 5-point clinical tool that identifies and stratifies the risk of obstructive hydrocephalus. A CCRS $\geq$ 4 as the high-risk subgroup should be considered for surgical intervention.

Hydrocephalus of third ventricle lesions at the foramen of Monro requires bilateral ventricular drainage or septostomy with unilateral drainage. For small ($<$ 10-mm) incidental asymptomatic lesions, close observation is recommended. The endoscopic resection method is suggested for moderate-size (10–20-mm) colloid cysts with ventriculomegaly, T2 bright signal on MRI, and an intraforaminal location. Stereotactically guided endoscopic port surgery by means of minimal invasive surgery is recommended for cysts with small lateral ventricles, T2 dark signal on MRI, and posterior pedicle in the third ventricle.[13] Microsurgical methods with different approaches (such as transcallosal and transcortical transventricular) are suggested for large ($>$ 20-mm) and giant ($>$ 30-mm) symptomatic colloid cysts. Nonetheless, according to our case and similar cases, the endoscopic method could be an efficient, safe, and minimally invasive technique[5] with small-sized craniotomy,[14] even for GCC cases.

Sayehmiri et al.[15] reviewed the literature on microsurgical and endoscopic resection outcomes. They concluded that the microsurgical method had a higher rate of gross total resection and a lower rate of recurrence, whereas the endoscopic group had a lower duration of surgery, rate of complications, and shorter hospitalization time. Considering the improved techniques and instruments in endoscopic procedures, it seems that endoscopic results will be better than previous reports even in giant cases.

Lessons

A colloid cyst is rarely encountered in the velum interpositum and lateral ventricles, but our GCC case along with similar cases led to considering it out of the third ventricle. In our experience and similar cases, endoscopic removal is a safe and efficient method for colloid cyst surgery, even in the giant cases.

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Disclosures

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Author Contributions

Conception and design: Arjipour, Gharib. Acquisition of data: Arjipour, Gharib. Analysis and interpretation of data: Arjipour. Drafting of the article: all authors. Critically revising the article: Arjipour. Reviewed submitted version of the manuscript: Arjipour. Approved the final version of the manuscript on behalf of all authors: Arjipour. Administrative/technical/material support: Arjipour. Study supervision: Arjipour, Gharib.

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