



Case Report

Extensive cerebral venous thrombosis after resection of third ventricle colloid cyst

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ABSTRACT

Background: The third ventricle colloid cyst (CC) is a benign growth usually located in the third ventricle and can cause various neurological symptoms, including sudden death. Modern surgical interventions may still result in a wide range of complications and cerebral venous thrombosis (CVT) is among them.

Case Description: A 38-year-old female with an existing diagnosis of diabetes mellitus (DM) and hypothyroidism and a 6-month history of headaches, blurred vision, and vomiting presented to our clinic 3 days after the headaches became excessively severe. Neurological examination on admission revealed bilateral papilledema without any associated focal neurological deficits. Brain computed tomography and magnetic resonance imaging confirmed the presence of a third ventricle CC and associated non-communicating hydrocephalus involving the lateral ventricles. As a result, the patient underwent emergency bilateral external ventricular drainage (EVD) insertion followed by a third ventricular CC excision under neuronavigation through a right frontal craniotomy. Twelve days postoperatively, the patient developed further headaches followed by a generalized tonic-clonic seizure that led to no postictal neurological deficits. Nonetheless, computed tomography venography of the brain revealed extensive thrombosis of the superior sagittal sinus, inferior sagittal sinus, right sigmoid sinus, and right internal jugular vein. A newly diagnosed CVT was treated with intravenous heparin. The patient was discharged with warfarin, which was discontinued after 12 months. Ten years after her illness, she remained stable and free from any neurological deficits but still suffered from chronic mild headaches.

Conclusion: A preoperative venous study should be performed in all cases to gain a better understanding of the venous anatomy. We advocate meticulous microsurgical techniques to protect the venous system surrounding the foramen of Monro and reduce the amount of retraction during surgery.

Keywords: Cerebral venous thrombosis, Colloid cyst, Foramen of Monro, Thalamostriate vein, Third ventricle

INTRODUCTION

The third ventricle colloid cyst (CC) is a benign growth usually located in the third ventricle, at or near the foramen of Monro, which is situated at the anterior aspect of the third ventricle of the brain.^[1] This epithelial-lined cyst is filled with gelatinous material that commonly contains mucin, old blood, cholesterol, and ions.^[1] Although CC accounts for <2% of all primary brain tumors and approximately 20% of intraventricular primary brain tumors, 99% of all reported cases occur at the rostral end of the third ventricle, at or near the foramen of Monro.^[1]

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CC can cause various symptoms, including headaches, diplopia, memory issues, and vertigo, but rarely result in sudden death. Symptomatic CCs most commonly cause headaches, nausea, and vomiting secondary to obstructive hydrocephalus. In these cases, non-communicating hydrocephalus is precipitated by blocking the egress of cerebrospinal fluid (CSF) from the lateral ventricles at the foramen of Monro, which connects the lateral and third ventricles.^[5]

Patients diagnosed with CC usually require surgical intervention, which may include CSF diversion with a ventriculoperitoneal shunt (VP shunt), aspiration of the cyst through endoscopic, open, or stereotactic approaches, or open surgery through the interhemispheric fissure or transcortical or transsulcal approaches. Although these procedures are safe and can be performed in many institutes, there is no consensus among neurosurgeons regarding the most optimal surgical strategy, primarily due to personal preferences and the complication rates associated with different options. The most common postsurgical complications are memory deficit, bleeding, and seizures, while cerebral venous thrombosis (CVT) involving the cortical veins, deep venous system, or larger sinuses is rare, occurring in approximately 1.5% of CC cases involving intracranial surgery. Thus, one such case was the focus of this study.

CASE REPORT

Clinical presentation

A 38-year-old female with DM and hypothyroidism presented to our hospital with 6-month history of headaches, blurred vision, and vomiting, noting that the headache severity suddenly worsened 3 days previously. Brain computed tomography (CT) scans from her local hospital were reviewed, indicating increased intracranial pressure associated with dilated lateral ventricles. A neurological examination performed on admission revealed bilateral papilledema without any other focal signs.

Laboratory and radiological investigations

The findings yielded by all initial basic laboratory investigations were within normal limits. As shown in Figures 1 and 2, brain CT and magnetic resonance imaging (MRI) revealed a third ventricle CC with dilated ventricles.

Interim treatment

The patient underwent emergency bilateral external ventricular drainage (EVD) insertion and was subjected to a third ventricular CC excision under neuronavigation through a right frontal craniotomy 3 days later. Although the CC was large and strongly adhered to the roof of the third ventricle, contained gelatinous material with a whitish cheesy

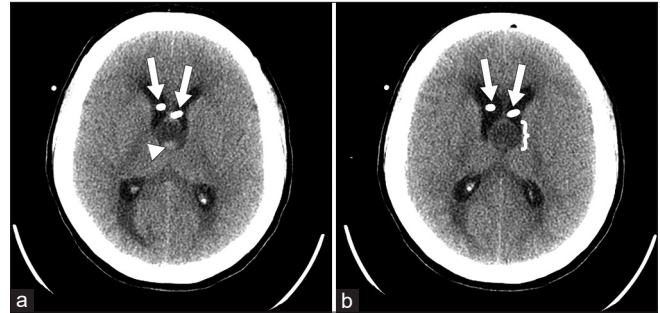


Figure 1: Brain computed tomography brain without contrast: (a and b) well-defined hypodense lesion seen at the foramen of Monro with a hyperdense area in the dependent portion (arrowhead in image a and brackets in image b), most likely representing a colloid cyst. Two linear intraventricular hyperdensities represent bilateral external ventricular drainage shunt insertion (arrows).

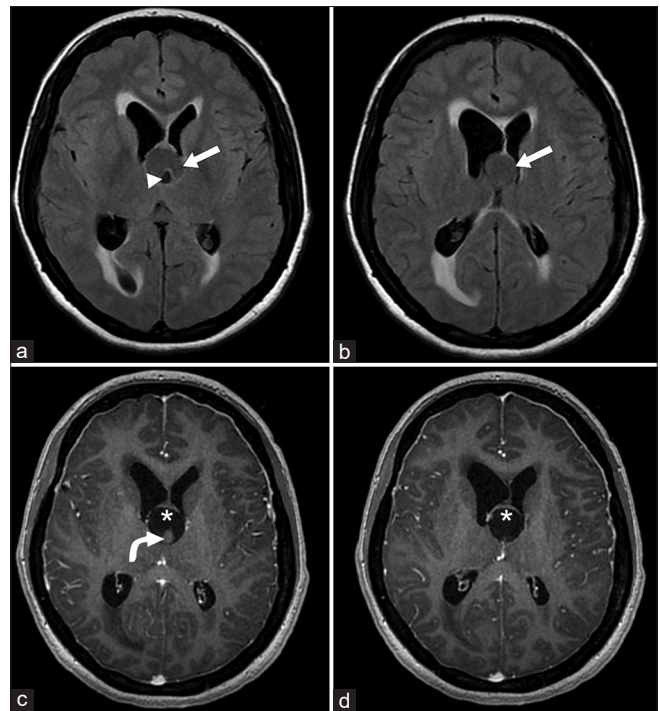


Figure 2: Brain MRI with contrast. Axial FLAIR (fluid attenuated inversion recovery). Image a and b Legend: A well-defined predominantly cystic lesion (arrow) measuring approximately 19 mm in diameter at the foramen of Monro. The hypointense area within the cystic lesion corresponds to hyperdensity at the dependent portion on the prior CT scan (arrowhead). The lesion causes anterior displacement of the fornix pillars and lateral deviation of the posterior part of both frontal horns of lateral ventricles. No significant suppression relative to CSF was observed in the FLAIR images. Brain MRI, axial 3D with contrast. Image c and d Legend: No significant enhancement is observed in the lesion after contrast administration (asterisk) or in the isointense area within the cystic lesion (curved white arrow).

solid portion, and was surrounded by the plexus of veins, the procedure was performed without any complications.

Histopathology findings

Histological sections from the cyst wall showed a small piece of fibrovascular tissue with no epithelial lining, consistent with a CC, whereas the section from the cyst nodule contained eosinophilic, colloid-like material [Figure 3].

Follow-up and clinical outcome

Twelve days after surgery, the patient developed further headaches. A few days later, she experienced a 5-min generalized tonic-clonic seizure, during which she bit her tongue and her eyeballs rolled upward. At this time, she also noticed oozing from the surgical site on the right side of the head but reported no new neurological deficits. However, as shown in Figure 4, brain CT venography confirmed extensive thrombosis of the superior and inferior sagittal sinuses, right sigmoid sinus, and right internal jugular vein. Heparin infusion for CVT and levetiracetam for seizures were initiated immediately. Vasculitis and hypercoagulability screening revealed no abnormalities. As the patient's headaches improved and no further seizures occurred, she was discharged on warfarin, which was discontinued after 12 months. Ten years after her illness, the patient remained stable without neurological deficits, but had chronic mild headaches.

DISCUSSION

Brain tumors involving the third ventricle are rare and are estimated to account for only 0.6–0.9% of all cases.^[1] However, CCs at or around the foramen of Monro in the third ventricle carry a unique challenge due to their unique location. Although Wallmann was the first to report a CC case in 1858, the first complete and successful CC resection from the third ventricle was achieved by Dandy in 1912 using the transcortical-transventricular approach.^[7,12] This initial success prompted other surgeons to adopt different techniques and approaches for managing CC with diverse results. Due to its deep-seated location and relationship with important neurovascular systems, less invasive techniques are now favored, as they improve surgical outcomes and reduce complication rates. Although some surgeons still use open craniotomy through the transcortical-transventricular

approach, others favor interhemispheric-transcallosal, endoscopic, or stereotactic aspiration, while many advocate minimally invasive brain ports or brain syringes.^[2,13,14] With the introduction of CT and MRI, the safety profile of CC removal has significantly improved in recent decades, and the use of less invasive approaches has increased. These and other advanced technologies have also facilitated decision-making and have improved our understanding of the natural history of CC, including the risks of death and neurological deterioration.^[6] Nonetheless, modern surgical interventions may still result in a wide range of complications, including hydrocephalus, seizures, infections (including meningitis), cortical and deep venous system infarction, memory deficit, intraparenchymal hematoma, intraventricular hematoma, subdural hematoma, pneumocephalus, mutism, weakness, and hemiplegia. According to Symss *et al.*, who examined the surgical outcomes of 80 patients with CC, seizures were the most common complication in this cohort, followed by hydrocephalus and venous infarction.^[10]

To avoid venous infarction, Apuzzo recommended vascular imaging as a part of the preoperative planning process and emphasized the importance of preserving the venous system when treating CC cases.^[3] According to the pertinent literature, venous infarction types resulting from the CC surgical procedure can be divided into cortical veins, deep venous systems (thalamostriate veins), and mixed pattern categories. Venous injury during CC excision is associated with serious clinical sequelae and was the cause of death in two patients in the study conducted by Symss *et al.*^[10] Empirical evidence also indicates that injury to the veins can cause venous bleeding or venous infarction, while air embolism is a relatively rare complication. To mitigate these risks and preserve cortical veins, Sugita *et al.* developed a technique that can be adopted during transcallosal approach, reporting very low venous infarction rates.^[9] In their work, Hirsch *et al.* provided very useful information on the anatomical orientation of the striothalamic vein and suggested a process for its safe coagulation, while noting that the same process can be harmful if applied to the thalamostriate vein.^[8]

The case reported here pertains to a patient with DM and hypothyroidism in whom extensive venous infarction

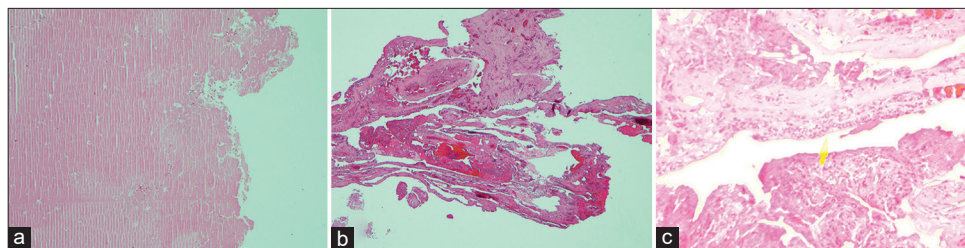


Figure 3: Pathology slide picture. (a) The colloid content of the cyst (×20). (b) The fibrovascular wall of the cyst (×4). (c) The lining of the cyst is attenuated and inflamed (×20).

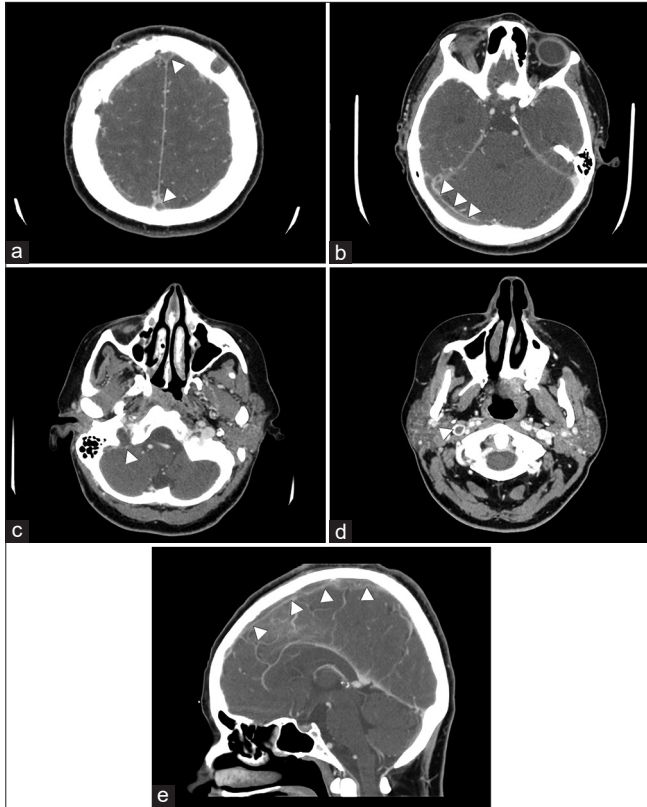


Figure 4: Brain computed tomography (CT) venography. (a-d) CT venography shows an extensive filling defect at the level of the anterior and posterior superior sagittal sinus (arrowheads in a), right transverse sinus (arrowheads in b), right sigmoid sinus (arrowhead in c), and right internal jugular vein with peripheral calcification (arrowhead in d). (e) Sagittal CT venogram shows an extensive filling defect of the superior sagittal sinus (arrowheads in e).

occurred 20 days after CC surgical excision. The thrombosis rate in this patient was extensive and was attributed to injury to a single draining vein; according to the surgeon, retraction to the frontal lobe was appropriate, no retraction injury occurred, and the utilization of bipolar coagulation was not aggressive. The surgical team, however, noticed a complex venous plexus surrounding the CC, which could be just a congested normal vein that was difficult to tell as there were no preoperative venous images, and intraoperatively, the CC was large enough to allow appropriate evaluation of these venous plexuses. It is also worth noting that the transcortical-transventricular approach is less likely to lead to venous infarction than the midline approach (i.e., transhemispheric-transcallosal approach).

We posit that even though the patient had no notable medical history (apart from DM and hypothyroidism), a non-diagnosed transient or hypercoagulable state led to this unfortunate complication. Thus, we suggest that the coagulopathic state of each patient should be carefully

evaluated before the CC surgical procedure, while also reducing the amount of retraction during surgery, particularly lateral retraction. We advocate meticulous microsurgical techniques to protect the venous system surrounding the foramen of Monro, during which excessive bipolar coagulation should be avoided. Finally, preoperative vascular imaging should be performed to understand the anatomy of the venous system and improve identification of veins that could be at risk.^[4]

CONCLUSION

This case highlights the possibility of cerebral venous thrombosis as a potential complication after third ventricle colloid cyst surgery. A preoperative venous study should be performed in all cases to gain a better understanding of the venous anatomy. We advocate meticulous microsurgical techniques to protect the venous system surrounding the foramen of Monro and reduce the amount of retraction during surgery.

Learning points

- Utilization of the appropriate surgical technique is essential, especially when the patient has significant ventricular dilatation and hydrocephalus, for which the transcortical-transventricular approach is suggested
- The patient needs to be evaluated carefully for any unrecognized transit hyper-coagulopathy
- A preoperative venous study (such as MRV) should be performed in all cases to gain a better understanding of the venous anatomy and to identify veins that might be at risk for injury
- A microsurgical technique is always preferable, as is minimal use of bipolar coagulation.

Declaration of patient consent

The Institutional Review Board (IRB) permission obtained for the study.

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Conflicts of interest

There are no conflicts of interest.

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