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Case Report

Acute communicating hydrocephalus after intracranial arachnoid cyst decompression: A report of two cases

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ABSTRACT

Background: Arachnoid cysts (AC) may cause hydrocephalus and neurological symptoms, necessitating surgical intervention. Cyst drainage may result in postoperative complications, however, these interventions are not normally associated with the subsequent development of acute hydrocephalus. Herein, we present two unique cases of AC drainage with postoperative development of acute communicating hydrocephalus.

Case Description: Case 1. A 75-year-old female presented with progressive headaches, cognitive decline, and questionable seizures. Her neurological examination was non-focal, but a head computed tomography scan (CT) identified a large right frontal AC with mass effect. She subsequently underwent craniotomy and decompression of the cyst. Postoperatively, her neurological examination deteriorated, and a head CT demonstrated new communicating hydrocephalus. The opening pressure was elevated upon placement of an external ventricular drain. Her hydrocephalus improved on follow-up imaging, but her neurological examination failed to improve, and she ultimately expired. Case 2. A 61-year-old female presented with headache and seizures attributed to a left parietal AC. She underwent open craniotomy for fenestration of the cyst into the Sylvian fissure. Postoperatively, her neurologic examination deteriorated, and she developed acute communicating hydrocephalus. She was initially managed with external ventricular drainage (EVD). The hydrocephalus resolved after several days, and the EVD was subsequently removed. Late follow-up imaging at 2 years showed that the regression of the AC was maintained.

Conclusion: Acute development of hydrocephalus is a potential complication of intracranial AC fenestration. A better understanding of intracranial cerebrospinal fluid flow dynamics may better inform as to the underlying cause of this complication.

Keywords: Arachnoid cyst, Craniotomy, Hydrocephalus, Surgery

INTRODUCTION

Intracranial arachnoid cysts (AC) are estimated to occur in 0.2–1.7% of adults with the majority discovered incidentally on imaging.[3] AC results from a splitting of the arachnoid membrane.[23] The majority are congenital abnormalities, but a case series of pediatric patients found approximately 15.6% of AC may be secondary to head trauma.[7] Roughly 50% of intracranial AC occurs in the Sylvian fissure with the cerebellopontine angle, vermis, sellar, and suprasellar areas among other common locations.[23] Many AC does not require intervention,

as they are incidentally discovered on imaging with no associated symptoms. A minority of cysts, however, may enlarge and cause symptoms that require intervention such as hydrocephalus, headache, seizure, and weakness.[21] Rarely, cyst rupture may result in subdural hygroma and intracranial hypertension.[2] In cases where cysts require surgical intervention, treatment options include shunt placement, open or endoscopic fenestration, and stereotactic-guided aspiration.[21]

The complications associated with surgical intervention for intracranial AC include weakness, cyst re-accumulation, shunt failure, infection, cerebrospinal fluid (CSF) leak, seizure, and subdural hygroma.[2] A mechanism through which postoperative complications arise from treatment includes derangement of the normal pattern of CSF flow, which can cause frank hydrocephalus. In this report, the authors believe that the surgical fenestration of AC altered the pattern of CSF flow in a manner such that it resulted in acute hydrocephalus.

CASE PRESENTATION

Case 1

A 75-year-old female presented with several months of progressive headaches, cognitive decline, behavioral changes, and possible seizures to an outside hospital. On presentation, she was inattentive oriented to self and place. The neurological examination was non-focal, but she complained of headaches and cognitive slowing, the latter confirmed by her family. Computed tomography (CT) of the head identified a large right frontal AC with mass effect [Figure 1a]. Neurology was consulted. After a thorough discussion and medical optimization, it was thought the AC's mass effect required treatment to see if the patient's condition improved. The symptoms were attributed to the mass effect of AC, and subsequently, she underwent surgical fenestration of the cyst without apparent complication. No bleeding was noted into the ventricle with meticulous hemostasis achieved and a subdural drain was placed to remove any additional fluid. The mental status acutely deteriorated several hours after the procedure, and a head CT demonstrated acute communicating hydrocephalus [Figure 1b]. At this juncture, she was transferred to the authors' hospital for management and our initial intervention was the placement of an external ventricular drain (EVD) was placed. The opening pressure was elevated but normalized rapidly. Subsequent imaging showed improvement in hydrocephalus and pneumocephalus [Figure 1c], but the patient remained obtunded. A stroke work-up including MRI showed no acute infarction [Figure 1d]. After remaining comatose, the family ultimately elected to withdraw care and the patient expired shortly thereafter.

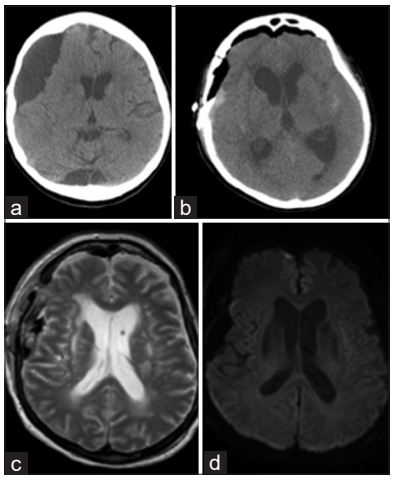

Figure 1: (a and b) Axial head computed tomography scan, (c) T2-weighted axial magnetic resonance imaging scan, (d) Axial diffusion weighted magnetic resonance imaging scan. (a) Large right frontal arachnoid cyst with mass effect. (b) Acute hydrocephalus that developed postoperatively with dilation of the lateral and third ventricles. (c) Improvement in hydrocephalus after external ventricular drain placement. (d) No signs of infarction.

Case 2

A 61-year-old female who presented after extensive workup for left-sided headaches and seizures. The patient had suffered from a total of two syncopal episodes during which she lost consciousness. There was limb shaking bilaterally that was witnessed by a family member, and there was no evidence of aura, incontinence, tongue biting, or a postictal state. The most recent seizure brought her to a neurologist's attention, while the first one - approximately 10 years prior - resulted in a diagnosis of pneumonia. Prior to coming to our neurosurgical attention, she had been evaluated by a cardiologist and also had a routine EEG showing no epileptic discharges or describing any localization. She was then admitted under the neurology service in the epilepsy monitoring unit for long-term video EEG, which did not identify any electrographic seizures. MRI of the brain revealed a left parietal convexity AC [Figure 2a], and she was referred for neurosurgical evaluation. She subsequently underwent left parietal craniotomy and cyst fenestration with the presumption that the cyst was a cause of headache. Intraoperatively, the cyst was found to be under pressure and any adhesions in the subarachnoid space were opened to ensure there was good communication of CSF [Figure 2b].

Postoperatively, the patient's mental status fluctuated, and on postoperative day 2, the patient demonstrated an acute decline in her mental status. A CT of the head showed acute communicating hydrocephalus [Figure 2c]. Cerebellar hemorrhage was noted on the post-operative CT, but the exact cause is unknown. It may have resulted from a rapid change in intracranial pressure after fenestration, causing

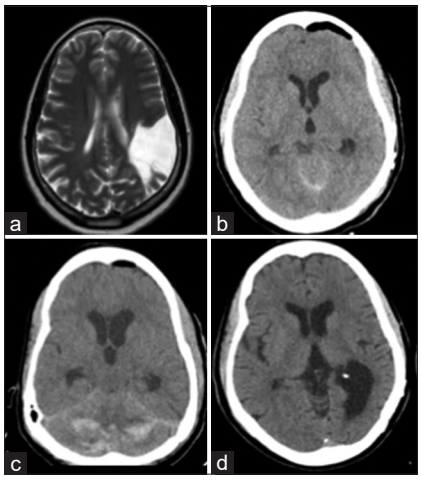

Figure 2: (a) Pre-operative head MRI demonstrating a left parietal arachnoid cyst without hydrocephalus. (b) Immediate post-operative CT with no signs of hydrocephalus. (c) Head CT demonstrating acute hydrocephalus during post-operative period. (d) Last follow-up head CT without signs of hydrocephalus.

cerebellar shift and rupturing a small vessel. An EVD was placed. The opening pressure was mildly elevated but normalized quickly with subsequent improvement in the patient's mental status. The patient's ICP remained normal to low over the course of a week, and the EVD was ultimately removed. At two-year follow-up, the patient is neurologically well with resolution of her headaches and seizures. The latest imaging demonstrated hydrocephalus ex-vacuo of the left lateral ventricle, encephalomalacia of the left parietal lobe, and resolution of the AC [Figure 2d].

DISCUSSION

AC are non-neoplastic lesions containing CSF occurring within the arachnoid layer.[23] They account for approximately 1% of intracranial lesions, with the majority located in the middle cranial fossa.[3,13] These lesions are infrequently diagnosed in the elderly, with large series reporting approximately 20% of surgical cases being over 60 years of age, with averages in the mid 40's.[17] Surgical treatment aims to reduce the volume of the AC by communicating it with normal subarachnoid space through fenestration.[11,14,17] Shunting the AC into the subdural or peritoneal space has also been described.[4,17] In the cases presented here, both were compressive collections. We aimed to see if open craniotomy and drainage would remedy the patient's presenting problems. If the collections persisted despite drainage then we would consider cyst-shunt placement, however, our institutional bias is to avoid shunting unless necessary.

The outcome and incidence of relief of preoperative symptoms following the surgical management of adult patients with AC is incompletely understood. Agopian-Dahlenmark *et al.* assessed 21 patients with supratentorial AC treated surgically and found that surgery offered significant improvement for cognitive function, echoing the findings of Moss *et al*.[1,18] Rabiei *et al*., however, failed to find a clear relationship between cyst reduction and improvement in clinical metrics including motor and neuropsychological tests.[22] This lack of consensus is important when considering surgical treatment, which is associated with an 18–21% rate of complications, though the endoscopic surgical approach may bear lower risk.[6,10,12]

The development of hydrocephalus in a patient after open treatment for an AC has previously been reported, but this was a case of low-pressure hydrocephalus. In addition, this case differed in that postoperatively the patient developed a CSF fistula from the cranial wound and bacterial meningitis prior to the development of hydrocephalus.[9] Hydrocephalus is known to possibly occur following surgery or subarachnoid hemorrhage from inflammatory reaction to ectopic blood in the subarachnoid space and impaired CSF absorption via the normal arachnoid granulations secondary to obstruction by blood product.[5,16] The authors believe the cases presented in this report, however, are notable for the acute elevation in pressure, possibly resulting from an acute change in the established flow pattern of CSF causing the hydrocephalus. These two cases may have resulted from an alteration in the brain's transmantle pressure with a disturbance in the differential pressures between the ventricular space and cranial subarachnoid space.[20] A similar finding was reported after spinal AC excision with development of hydrocephalus 7-weeks postoperatively, requiring placement of a ventriculoperitoneal shunt.[19]

In cases of acute hydrocephalus with elevated intracranial pressure, clinicians often explain the pathophysiology as it relates to the circulation theory. Normally, hydrocephalus is thought of as a an impairment of CSF flow due to a blockage, such as aqueductal stenosis, intraventricular hemorrhage, or impairment of CSF reabsorption through arachnoid granulations, such as following aneurysmal SAH.[8] In addition to circulation theory, other researchers have posited that osmotic gradients contribute to CSF homeostasis with impairment of paravascular or lymphatic clearance of macromolecules from the CSF precipitating hydrocephalus.[15]

CONCLUSION

Acute development of hydrocephalus is a potential complication of intracranial AC fenestration. A better understanding of intracranial CSF flow dynamics may better inform as to the underlying cause of this complication.

Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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Conflicts of interest

There are no conflicts of interest.

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