Endoscopic Management of Arachnoid Cysts

Manejo endoscópico dos cistos de aracnóide intracranianos

Flávio Ramalho Romero¹
Eduardo de Freitas Bertolini²
Adalberto Sestari²
Sérgio Soares Guerrero²
Ramon Barbalo Guerrero²
Modesto Cerione Jr.²

RESUMO

Objetivo: Cistos aracnóideos são lesões expansivas congênicas ocupadas por líquido semelhante ao líquor e delimitada por uma membrana semelhante à aracnóide, com etiologia e história natural controversas. Endoscopia tem sido utilizada com sucesso durante décadas para tratar uma variedade de afecções no sistema nervoso central.

Métodos: Treze pacientes submetidos a fenestração endoscópica para tratamento de cistos aracnóideos foram selecionados para o estudo. A indicação cirúrgica e a técnica foram revisadas, e o sucesso do procedimento e o prognóstico foram avaliados.

Resultados: Cinco pacientes apresentavam cistos em fossa media, 2 na fossa posterior, 3 na cisterna quadrigeminal e 3 cistos supraselares. A abordagem endoscópica consistiu em cistoventriculostomia em 8 pacientes e cistocisternotomia em 5 pacientes. Não houve mortes ou morbidade intra-operatória.

Discussão: Cistos aracnóideos são lesões relativamente benignas que podem ser abordadas por fenestração endoscópica de sua parede para o sistema ventricular ou cisternas contendo líquido cefalorraquidiano.

Conclusão: Seleção adequada de pacientes, planejamento pré-operatório do trajeto do endoscópio, utilização de aparelhos de navegação e avanço na tecnologia das lentes e na captação de imagens fazem deste procedimento seguro e com ótimo prognóstico.

Palavras-chave: Cisto Aracnóideo, Fenestração Endoscópica, Neuroendoscopia.

ABSTRACT

Object: Arachnoid cysts are developmental space-occupying lesions filled with CSF-like content and surrounded by a membrane resembling arachnoid mater, with controversial etiology and natural history. Endoscopy has been successfully used for decades to treat a variety of pathologies within the central nervous system.

Methods: Thirteen patients who underwent endoscopic fenestration for treatment of arachnoid cyst were selected for this study. The surgical indications and techniques were reviewed, and surgical success rates and patient outcomes were assessed.

Results: Five patients had middle fossa cysts; 2 a posterior fossa cyst; 3 a quadrigeminal cistern arachnoid cyst and 3 a suprasellar arachnoid cyst. Endoscopic management consisted in a cystoventriculostomy in 8 patients and cystocisternotomy in 5 patients. There was neither mortality nor operative morbidity.

Discussion: Arachnoid cysts are a relatively benign pathological entity that can be managed by performing endoscopically guided cyst wall fenestrations into the ventricular system or cerebrospinal fluid containing cisterns.

Conclusion: Proper patient selection, preoperative planning of endoscope trajectory, use of frameless navigation, and advances in endoscope lens technology and light intensity combine to make this a safe procedure with excellent outcomes.

Key words: Arachnoid Cyst, Endoscopic Fenestration, Neuroendoscopy.
INTRODUCTION

Arachnoid cysts are developmental space-occupying lesions filled with CSF-like content and surrounded by a membrane resembling arachnoid membrane with controversial etiology and natural history. With the use of fluid-attenuated inversion recovery and diffusion sequence MRI, the definitive radiologic diagnosis of arachnoid cysts turned out easy and these lesions can be differentiated from intracranial epidermoids and other cystic intracranial lesions. Preoperative cine-mode MRI has shown a slit-valve mechanism that has been confirmed by means of the endoscopic intervention. Most arachnoid cysts are found incidentally and can be managed conservatively; however symptomatic patients need surgical intervention.

The optimal surgical treatment for symptomatic temporal arachnoid cysts is controversial. Therapeutic options include cyst shunting, endoscopic fenestration, and craniotomy for fenestration.

Endoscopy has been used successfully for decades to treat a variety of pathologies within the central nervous system (CNS), including removal of colloid cysts, biopsy sampling and removal of intraventricular brain tumors, treatment of obstructive hydrocephalus, and management of intracranial cysts. Other cystic lesions, including arachnoid, septum pellucidum, porencephalic, and pineal cysts, and cysts from multiloculated hydrocephalus, are equally favorable to be treated endoscopically, because of their position adjacent to subarachnoid or intraventricular spaces. We present our experience in the endoscopic management of arachnoid cysts in 13 patients.

METHODS

All the patients with arachnoid cysts endoscopically managed at our institution between March 2009 and February 2011 were included. Based on cyst location documented by magnetic resonance imaging (MRI), the examined cases were subdivided in middle fossa cysts, quadrigeminal cistern cysts, suprasellar cysts, posterior fossa cysts. The neuroendoscopic procedures were performed with a 0° rigid endoscope (Fig. 1). The surgical plan and best trajectory were based on preoperative MR imaging. Postoperatively, all patients underwent CT scans in the first 48 h after surgery and MR control 3 months after surgery.
Because of their often asymptomatic presentation and their benign pathological features, the optimal management for arachnoid cysts may range from conservative observation to surgical intervention. The most favorable surgical candidates are chosen based on two major criteria: symptomatology and lesion location. Patients who are asymptomatic are generally poor surgical candidates. In some circumstances, extremely large asymptomatic lesions, especially in growing children, may be more aggressively approached based on the rationale that decompression may help prevent developmental delays. In the adult population, surgical management of asymptomatic lesions must have a more rigorous justification, such as evidence on neuroimaging of progressive growth or early obstructive hydrocephalus.

**RESULTS**

There were 13 patients (9 M/4F). The mean age at diagnosis was 8.95 years. Five of 13 cases were adult patients. Five patients had middle fossa cysts; 2 patients had a posterior fossa cyst; 3 patients had a quadrigeminal cistern arachnoid cyst and 3 patients had a suprasellar arachnoid cyst. Six patients had an associated hydrocephalus at the time of the surgical treatment. All patients underwent endoscopic management of their cystic lesion as primary procedure. Endoscopic management consisted in a cystoventriculostomy (CV) in 8 patients and cystostomies in 5 patients (CC). Third ventriculostomy (ETV) was associated to CV in six cases, and it was performed at the same time of the CV procedure in all these cases. There was no mortality, neither operative morbidity.

At a mean follow-up of 8 months (3-20 months), a complete resolution of preoperative clinical symptoms and signs was recorded in 80.9% of symptomatic patients. Control MRI showed a reduced cyst size in 12/13 patients and a stable cyst size in the last case, with signs of CSF flow between the cyst and the cerebral ventricles in all cases. None of 6 patients with associated hydrocephalus had a persistent ventriculomegaly or signs of increased intracranial pressure.

**DISCUSSION**

With advances in neuroimaging, a large number of asymptomatic arachnoid cysts are being routinely diagnosed. The management of these lesions in asymptomatic patients remains somewhat controversial, especially in the pediatric populations where avoidance of developmental delays or endocrinological or visual abnormalities may outweigh the risk of surgery in an asymptomatic child. Conservative management in asymptomatic adults is less controversial. When surgery is deemed appropriate, a wealth of experience is now available to guide the appropriate surgical approach.

Arachnoid cysts are intraarachnoid CSF-containing lesions that are not in direct communication with the ventricular system. They constitute approximately 1% of intracranial masses, with 50 to 60% occurring in the middle cranial fossa. Due to their preponderance in the pediatric population, they are believed to arise as developmental anomalies, although they are not normally associated with other such anomalies of the CNS. Arachnoid cysts are often incidental neuroimaging findings, and many patients remain asymptomatic. When the cysts become symptomatic, they can cause headaches, increase...
in head circumference, developmental delay in younger children, visual loss and precocious puberty if located in the suprasellar cistern, or seizures and focal neurological deficits if more cortically centered\textsuperscript{2,13,14,18,22,24}.

Arachnoid cysts arise from a gradual expansion of clefts or duplications in or adjacent to normal arachnoidal cisterns. The cysts expand when CSF pulsations, which are concordant with the cardiac cycle, become entrapped between the leaflets of the membrane\textsuperscript{2,17}. It thus follows that their usual contents are indistinguishable from normal CSF, although occasionally cysts with more highly proteinaceous contents can be identified\textsuperscript{2,22,24}. In contrast to these developmentally acquired cysts, a separate category of acquired arachnoid cysts exists, in which the pathological entity develops secondary to trauma, surgery, or infections\textsuperscript{22,24}. These acquired lesions are also referred to as leptomeningeal cysts, and are similarly thought to arise from violations of one of the arachnoid membranes and a ball valve-like mechanism of CSF pulsation, which favor gradual expansion of the cyst\textsuperscript{6,12,22}.

Arachnoid cysts occur in multiple locations throughout the intracranial compartment. We have highlighted three common regions (the middle fossa, the septal region, and the preptioineal cistern) as locations amenable to endoscopic cyst fenestration, but arachnoid cysts can also occur in the posterior fossa, the cerebellopontine angle, interhemispherically, along the quadrigeminal plate, and anywhere along the cortical surface\textsuperscript{2,12,22,24}. In addition, a large array of other cystic lesions is amenable to endoscopy: cysts associated with tumors, such as craniopharyngiomas; or cysts amenable to decompression through an attenuated ventricle wall (for example, diencephalic mass); and infections (loculated multicystic hydrocephalus)\textsuperscript{2,7,16,12,22,24}.

Historically, arachnoid cysts have been treated successfully by using cystoperitoneal CSF shunting or open craniotomy for cyst fenestration\textsuperscript{22,24}. Although these were often successful, avoidance of a permanent shunt has obvious advantages, such as removing the possibility of obstructions, infections, and surgery-related morbidity such as hemorrhage and catheter misplacement\textsuperscript{22,24}. Craniotomies have their own associated morbidities that are not typically incurred when performing a burr hole opening for an endoscopic cyst fenestration\textsuperscript{22}. Reports of endoscopic cyst fenestration were rare just 5 years ago, but the field has since seen a large increase in the number of surgeons who are comfortably and routinely using the endoscope to approach these lesions. In addition, combined procedures, especially in the middle cranial fossa, in which small craniotomies are made for exposure, followed by endoscopic cyst wall fenestrations, are becoming the standard of care\textsuperscript{6,12,22,24}. The best procedure remains the one in which the cyst can be fenestrated successfully and safely by a given surgeon.

There remain operator-based preferences, including the use of rigid or flexible endoscopes\textsuperscript{12,13}. We prefer the rigid endoscope for its superior optics, and we change the degree of the endoscope when it is necessary to watch difficult angles rather than using the steerable device. Some surgeons routinely use a low-wattage laser system to incise the cyst wall or shrink the lesion to smaller dimensions. We prefer to use only bipolar diathermy and blunt dissection on the cyst wall, and we never use any heat source near any neural or vascular structures (such as in the opticocarotid recess or preptioineal cistern), thereby removing any potential for transmitted heat injury.

The rate of long-term patency of our endoscopic fenestrations is excellent. We have required only one return to the operating room for a repeated fenestration. There have been no hemorrhages necessitating aborting the procedure and no procedure-related complications. The MR imaging modality has become an excellent tool through which to judge the success of CSF flow through fenestrations and overall cyst volume reduction. The T2-weighted and fluid-attenuated inversion-recovery sequences should be routinely used as part of postoperative evaluations.

**CONCLUSION**

Although arachnoid cysts are a relatively benign pathological entity, preemptive treatment in children, or in patients with symptomatic lesions regardless of age, can be managed with endoscopically-guided cyst wall fenestrations into the ventricular system or CSF-containing cisterns. Proper patient selection, preoperative planning of endoscope trajectory, use of frameless navigation, and advances in endoscope lens technology and light intensity combine to make this a relatively safe procedure with excellent outcomes.

**REFERENCES**


