

# Neuroendoscopic Approach to Quadrigeminal Cistern Arachnoid Cysts

## *Kuadrigeminal Sisterna Araknoid Kistlerine Nöroendoskopik Yaklaşım*

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### Abstract

**Objective:** The introduction of neuroendoscopy has provided a minimally invasive modality for the surgical treatment of quadrigeminal arachnoid cysts. Three pediatric patients with arachnoid cyst of the quadrigeminal cistern treated by endoscopic fenestration are reported.

**Materials and Methods:** The hospital records of patients were retrospectively reviewed. All patients had hydrocephalus. A lateral ventricle-cystostomy and endoscopic third ventriculostomy were performed by using rigid neuroendoscopes.

**Results:** There were one boy and two girls with ages 7 months, 9 months and 14 years, respectively. One patient had undergone shunting prior to neuroendoscopic surgery. The postoperative course was uneventful in all cases, with no complications. They showed disappearance of intracranial hypertension symptoms and significant reduction of the cyst size.

**Conclusion:** Neuroendoscopic technique is an effective and suitable method for the treatment of quadrigeminal cistern arachnoid cysts and accompanying hydrocephalus.

**Key Words:** Arachnoid cyst, Neuroendoscopy, Quadrigeminal cistern

### Özet

**Amaç:** Kuadrigeminal araknoid kistlerin cerrahi tedavisinde nöroendoskopi uygulanması daha az invaziv bir girişim imkanı sağlamaktadır. Bu yazıda endoskopik ağızlaştırma yöntemiyle tedavi edilen kuadrigeminal araknoid kisti olan üç çocuk olgu sunulmaktadır.

**Gereç ve Yöntem:** Üç hastanın tıbbi kayıtları retrospektif olarak değerlendirildi. Hastaların hepsinin hidrosefalisi vardı. Rijit endoskop kullanılarak tüm hastalarda kist lateral ventrikül ile ağızlaştırıldı ve üçüncü ventrikülostomi yapıldı.

**Bulgular:** Hastaların biri erkek, ikisi kız ve sırasıyla 7 aylık, 9 aylık ve 14 yaşındaydılar. Bir hastaya nöroendoskopik girişim uygulanmadan önce ventriküloperitoneal şant takılmıştı. Postoperatif hastaların hepsi komplikasyonsuz iyileşti. Artmış kafa içi basıncı bulguları düzeldi ve kist boyutu belirgin azaldı.

**Sonuç:** Nöroendoskopi tekniği kuadrigeminal araknoid kist ve beraberindeki hidrosefalinin tedavisi için uygun ve etkili bir yöntemdir.

**Anahtar Kelimeler:** Araknoid kist, Nöroendoskopi, Kuadrigeminal sisterna

### Introduction

Intracranial arachnoid cysts are anomalous non-neoplastic developmental cerebrospinal fluid collections that form between the arachnoid layers. The quadrigeminal cistern is an unusual location for these cysts. Quadrigeminal arachnoid cysts (QAC)s account for 5% to 10% of all intracranial arachnoid cysts [1-3]. They are frequently diagnosed coincidentally on computed tomography (CT) or magnetic resonance imaging (MRI). They cause symptoms when they become sufficiently large to compress the adjacent brain structures. The traditional treatment options for symptomatic cysts have been surgical resection or fenestration of the cyst with or without placing shunt devices. The use of endoscopy in neurosurgery has provided a minimally invasive modality for treating these cysts. Endoscopic treatment of the QACs was

first reported by Ruge et al. in 1996 [4]. Since then, isolated cases or case series have gradually increased in number.

In this paper, we present three patients with QAC who were treated purely endoscopically in our department and review the pertinent literature.

### Patients and Methods

The hospital records of three QAC patients who had been treated at our center between 2007 and 2009 were reviewed. Informed consent was obtained from the patients.

MRI scans and/or CT scans were performed on all the patients. X-ray films of the shunt system and an abdominal ultrasound were also performed in the patient presenting with shunt malfunction. The CT scans of all the patients were obtained on the day of the surgery, after the procedure. The

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MRI scans were performed in the first postoperative week. When the signs and symptoms of increased intracranial pressure and hydrocephalus improved and the patient no longer needed a ventricular shunt, the endoscopic procedure was considered to be successful. All the patients were followed up with postoperative MRIs at 3 and 6 months after surgery and annually thereafter. The patient follow up ranged from 24 to 48 months.

### Operative technique

All of the surgical procedures were performed under general anesthesia. The patient was positioned in the neutral supine position, and the head is minimally elevated. After a 3 cm straight scalp incision, a 10 mm burr hole 1 cm anterior to the coronal suture in the mid pupillary line is created. In children younger than 1 year, an incision for the entry point of the endoscope was made at the lateral margin of the open anterior fontanel. Once the dura has been opened, a rigid endoscope sheath is used to cannulate the lateral ventricle. Then, a zero-degree straightforward rigid neuroendoscope (Karl Storz, Tutlingen, Germany) is inserted into the endoscope sheath. After identifying the main anatomical landmarks, including the choroid plexus, fornix and veins, the endoscope was advanced to the foramen of Monro. The QAC was bulging into the lateral ventricle in all cases. A wide ventriculocystostomy (VC) is performed using bipolar coagulation and sharp dissection. If a secondary aqueductal stenosis due to the compression of QAC is detected in a patient, the endoscope is then advanced into the third ventricle, and an endoscopic third ventriculostomy (ETV) is performed when feasible. At the end of the procedure, the burr hole is packed with a gelatin sponge, and the galea is tightly sutured. The skin is sutured in layers using atraumatic sutures.

### Results

The patients consisted of one boy, aged 7 months, and two girls, aged 9 months and 14 years. Case 1 presented with abducens nerve palsy and epileptic seizures. Case 2 presented with nausea, vomiting, feeding difficulties and developmental delay. Case 3 was a 14-year-old patient who had undergone shunting prior to the neuroendoscopic surgery. This patient presented with the symptoms and signs of shunt malfunction.

The CT and MRI scans showed a non enhancing cystic lesion in the quadrigeminal cistern with accompanying non communicating hydrocephalus (Figure 1).

The QACs were surgically observed to be bulging into the lateral ventricles in all the patients. The bulging of the cyst was observed in the trigone region. The cyst wall was translucent and hypovascular. The cyst wall was fenestrated

by bipolar coagulation and enlarged with a 3 Fr Fogarty balloon catheter (Figure 2). The endoscope was advanced into the cyst through the fenestration to explore the cyst cavity. Therefore, the endoscope was advanced into the third ventricle, and ETV was performed in all the patients (Figure 3).

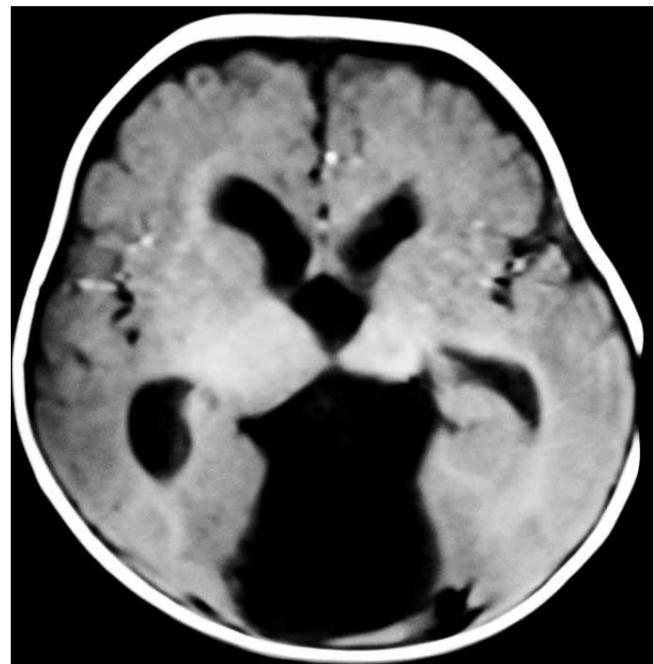
There were no perioperative or postoperative complications. All the cases improved clinically and no longer showed symptoms of intracranial hypertension. The follow-up MRIs showed a significant reduction of the cyst size in the first two cases (Figure 4). The size of the cyst remained unchanged in the third case.

### Discussion

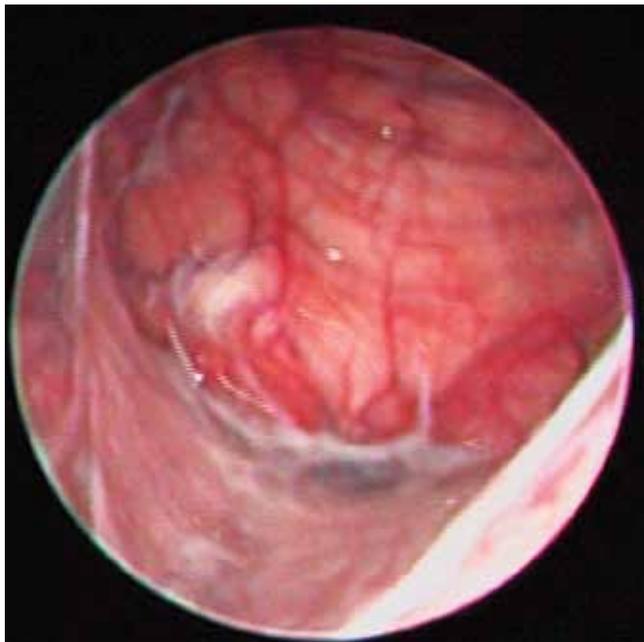
Quadrigeminal cistern cysts are rare lesions. According to Almeida et al., 79 cases were reported in the literature up to 2008 [2]. A Pubmed search revealed 38 new cases since then [5-14].

Although the first intracranial endoscopic procedures were performed at the beginning of this century, endoscopic techniques have never achieved widespread popularity among neurosurgeons. With the extent of the indications for ventricular endoscopy, the neuroendoscopic approach to quadrigeminal cysts has gained increasing acceptance. Several authors have reported cases [1, 4, 5, 9-12, 15-20] or series [3, 5, 13] of neuroendoscopic quadrigeminal cyst treatment.

The deep location and close proximity to the pineal quadrigeminal region nervous and vascular structures makes mini-



**Figure 1.** A T1-weighted axial MR image showing the quadrigeminal arachnoid cyst and ventricular dilatation (Case 2).



**Figure 2.** An endoscopic view of the cyst cavity (Case 1).

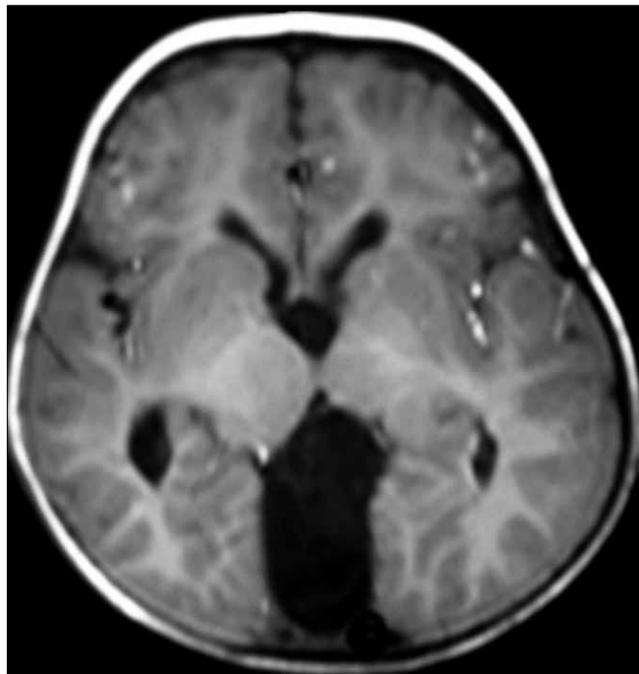


**Figure 3.** An endoscopic view of the fenestrated third ventricle floor (Case 1).

mally invasive treatment of these cysts important. Moreover, these cysts are usually associated with hydrocephalus. This complication actually makes endoscopic treatment more technically feasible because of the large working area.

Different endoscopic approaches have been used to treat these cysts. The endoscopic approach is planned according to the extension of the cyst. The cyst can extend to the trigone cranially, to the supracerebellar cistern caudally and to the third ventricle anteriorly. Other endoscopic treatment options include cyst fenestration and removal via the suboccipital supracerebellar approach, lateral-ventriclecystostomy and third-ventriclecystostomy. The endoscopic fenestration and removal of the posterior cyst wall via a suboccipital supracerebellar approach has been performed by Ruge et al. in two cases [4]. Because of certain anatomical and technical difficulties, this approach has never been preferred by other neurosurgeons. Lateral-ventriclecystostomy and third-ventriclecystostomy have been used in the remaining reported cases [3, 5, 13].

Many authors have shown that limited openings in the cyst walls may be sufficient to reestablish functional CSF circulation and reduce the cyst size. Neuroendoscopy has the major advantage of allowing the cysts to open into the ventricular system through a minimally invasive approach. In addition, an endoscopic cystostomy associated with a third ventriculostomy has a higher success rate for treating quadrigeminal cistern arachnoid cysts than endoscopic cystostomy alone [20].



**Figure 4.** A T1-weighted axial MR image showing the marked reduction in the cyst and ventricle size (the two-year follow-up MR image for Case 2).

It is difficult to determine whether the third ventriculostomy or the cyst fenestration with recanalization of the aqueduct plays the major role in the clinical improvement. Failures of endoscopic fenestration, either alone or in combi-

nation with third ventriculostomy, have been reported in the literature [3, 14, 21].

In conclusion, neuroendoscopy is a safe and effective treatment option for quadrigeminal arachnoid cysts and should be seriously considered for the initial therapy. Neuroendoscopy can reduce the surgical trauma to a minimum, and craniotomies and shunt dependence can be avoided.

**Conflict of interest statement:** The authors declare that they have no conflict of interest to the publication of this article.

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