Endoscopic transtubular resection of a colloid cyst

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ABSTRACT

أن الكيس الغروانية عبارة عن امتداد حميد من سقف البطين الثالث، عادة تستأصل عندما تصبح مسببة للأعراض. تاريخياً تجري العلية نهج بمساعدة زوج من الكامشات ذات الشفرات الثابتة و مجهر التشغيل. تقنيات المناظير بقنوات عمل واحدة أو مزدوجة استخدمت حديثاً في استئصال هذه الأكياس. الحالة المقدمة استخدم فيها تقنية المنظار الضوئي بمساعدة شفرة أنبوبية كميناء عبر القشرة إلى البطين الثالث لاستخراج الكيس الغروانية. يستعرض التقرير حالة امرأة عمرها 29 عاما قدمت مع صداع . أظهر تصوير الدماغ والبطين الثالث كيس غروانية. نوضح في الحالة ميزة استخدام هذه التقنية وأنبوب الميتريكس.

Colloid cysts, benign outgrowths from the roof of the third ventricle, warrant resection when they become symptomatic. Historically, this has been performed by craniotomy and a transcortical or a transcallosal approach that employs a pair of fixed blade retractors and an operating microscope. Less invasive endoscopic techniques have employed rigid endoscopes with single or dual working channels. We report the use of a tubular retractor as a transcortical port to resect a third ventricular colloid cyst. A 29-year-old woman presented with headache. The brain imaging demonstrated a third ventricular colloid cyst. We describe transcortical, transforaminal resection of a colloid cyst using stereotactically guided placement of a tubular retractor, endoscopic visualization, and bimanual dissection with traditional microinstruments. The increased range of viewing angles of the endoscope within the cylinder of access maintained by the tubular retractor facilitates resection of the cyst through a smaller opening.

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Colloid cysts of the third ventricle are not uncommon. Surgical resection is indicated when they are large or symptomatic.[1] Complete resection of a colloid cyst is important to prevent recurrence.[2] Precise, delicate dissection of the cyst wall from its attachments to the fornices, the veins and choroid plexus of the foramina, and the roof of the third ventricle is required to avoid memory loss from forniceal injury, intraventricular hemorrhage, and hypothalamic dysfunction.[2] Surgical options for colloid cysts include transcortical stereotactic aspiration, transforaminal resection using a small endoscope with a thin working channel, or craniotomy for a transcortical or a transcallosal transforaminal approach. Each has its advantages and disadvantages with respect to the trade-off between the angles of view and maneuverability of instruments afforded, and the required brain manipulation and disruption along the surgical corridor.[2] We describe transcortical, transforaminal resection of a symptomatic colloid cyst utilizing a tubular retractor, endoscopic visualization, and bimanual dissection with traditional microinstruments. Our objective in presenting this particular case is to highlight the utility of the endoscope in facilitating a minimally disruptive transcortical approach for a high magnification, high resolution view of intraventricular microdissection.

Case Report. A 29-year-old woman presented with a month-long progression in severity of headache, which she characterized as constant global pressure. The headache had no precipitant or positional dependence. It was most intense in the morning and improved throughout the day. She had no other neurological symptoms. Her general physical and neurological examinations were entirely normal. An MRI of the brain demonstrated obstructive hydrocephalus above a third ventricular lesion at the foramen of Monro. The lesion, hypointense on T1 sequences and inhomogenously hyperintense on T2 sequences, did not enhance with intravenous contrast. It had a diameter of 14-mm, and

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it expanded the left foramen of Monro more than the right (**Figures 1A-C**). This appearance was consistent with the diagnosis of colloid cyst. A stereotactically guided, left frontal transcortical approach for resection of the cyst and fenestration of the septum pellucidum was proposed and was accepted by the patient. A preoperative stereotactic MRI scan with scalp fiducials was performed. General anesthesia was induced, and Mayfield pins were applied. She was positioned supine with minimal neck flexion. A left-sided transcortical, transventricular trajectory was planned utilizing Kocher's point as an entry point and the center of the cyst as a target. A 4-cm linear incision centered on the planned entry point was made, and a 2-cm diameter frontal craniotomy was fashioned. The dura was opened and the small flap turned medially. A ventricular catheter was advanced under stereotactic guidance along the planned trajectory into the frontal horn of the left lateral ventricle. Clear CSF under pressure was encountered. A 1-cm cortical incision in the superior frontal gyrus parallel to the superior frontal sulcus was extended deeply along the catheter until 0.5- x 3-inch cottonoid paddies could be placed on either side of the catheter with their tips breaching the ependyma of the frontal horn. Through this opening, a 14-4 METRx tubular retractor tube (Medtronic, Minneapolis, MN, USA) was placed. It was immobilized by connecting it to the long arm of a Greenberg retractor. Fixing the retractor in the clasp of a Greenberg retractor arm maintained the anatomically desired orientation and prevented retractor migration that might injure the surrounding brain. Magnification and illumination were provided by handheld 2.7-mm diameter 0-degree and 30-degree endoscopes. Microsurgical dissection was performed bimanually with micro dissectors and a 5-Fr fenestrated suction. The anatomical structures of the walls and floor of the left lateral ventricle were identified. The septum pellucidum was fenestrated and CSF was drained to enhance visualization of the left lateral ventricular floor and foramen. The choroid plexus of the lateral ventricle floor was followed anteriorly, to the foramen of Monro. The confluence of the septal vein and thalamostriate veins was identified. The choroid plexus of the lateral ventricular floor just posterior to the foramen of Monro was elevated, coagulated with a microbipolar forceps, and divided to widen the approach to the foramen. The fornix was clearly identified, and beneath it, the lateral aspect of the cyst protruded (**Figure 1D**). Microdissection gently elevated the fornix superomedially off the cyst, providing a larger window through which the cyst could be resected. The cyst wall was punctured with a sharp hook and mucoid-like material was drained and aspirated into the suction. Partial collapse of the cyst facilitated microsurgical dissection of the cyst wall from the fornix, veins associated with more posterior choroid plexus, the roof of the third ventricle, and the contralateral fornix. Progressive evacuation of the high viscosity liquid cyst contents exposed a 5-mm-diameter solid portion of the cyst, which was removed as a single

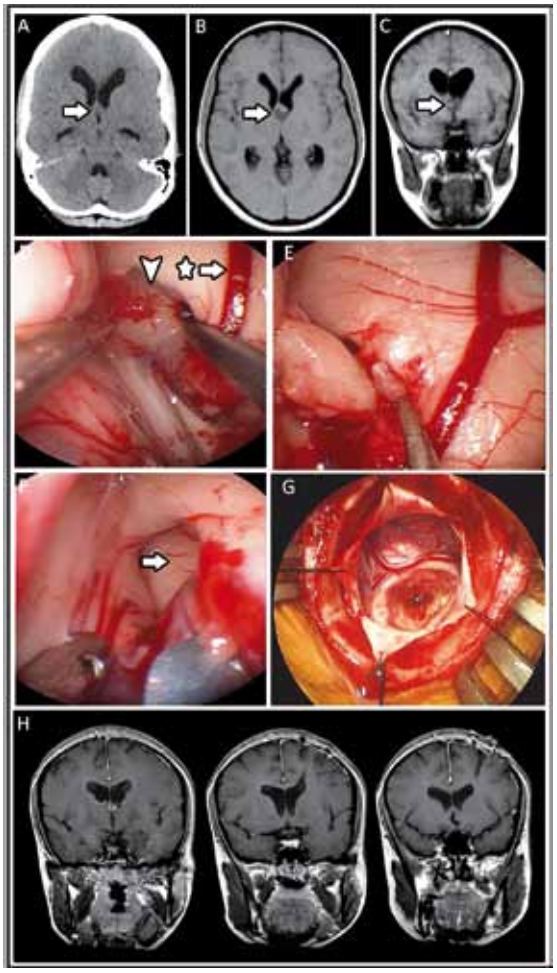

Figure 1 - Illustrative case showing **A)** Preoperative, non-contrast axial CT slice without contrast. **B, C)** Axial and coronal T1 weighted, gadolinium contrast MR images showing dilated lateral ventricles above a colloid cyst (arrow) filling the left foramen of Monro. **D)** Intraoperative endoscopic images of the lateral ventricle showing the colloid cyst (arrowhead) the septal vein (arrow), and the fornix (star). **E)** The cyst wall was opened; the liquid portion of the cyst was aspirated; and a 5 mm solid component of the cyst was removed in one piece, most of the collapsed cyst was delivered into the foramen, the superior posterior attachments of the cyst wall were dissected and all remaining cyst wall was retrieved. **F)** Elevation of the left fornix opened a view through both foramina into the right lateral ventricle (arrow) permitting confirmation of complete removal of the cyst. **G)** The cortical incision at the end of the case. **H)** Postoperative coronal T1, gadolinium enhanced MR image demonstrating the surgical route through the inferior aspect of the superior frontal gyrus and the absence of the cyst.

specimen (**Figure 1E**). Further dissection isolated the cyst wall from the surrounding structures and permitted its severance with microscissors from attachments to the choroid plexus of the roof of the third ventricle. Complete resection of the cyst capsule was achieved (**Figure 1F**). The cylindrical retractor was removed (**Figure 1G**). The dura was sutured closed, the bone piece was fixed with 2 titanium plates, and the scalp was repaired with galeal sutures and skin staples. After surgery, she remained neurologically intact. She was discharged on postoperative day 3. One month after surgery, she reported complete resolution of her pressure headache. She was normal neurologically. An MRI scan showed decreased ventricular size, no residual cyst, and a narrow surgical track (**Figure 1H**). She remains asymptomatic one year after surgery.

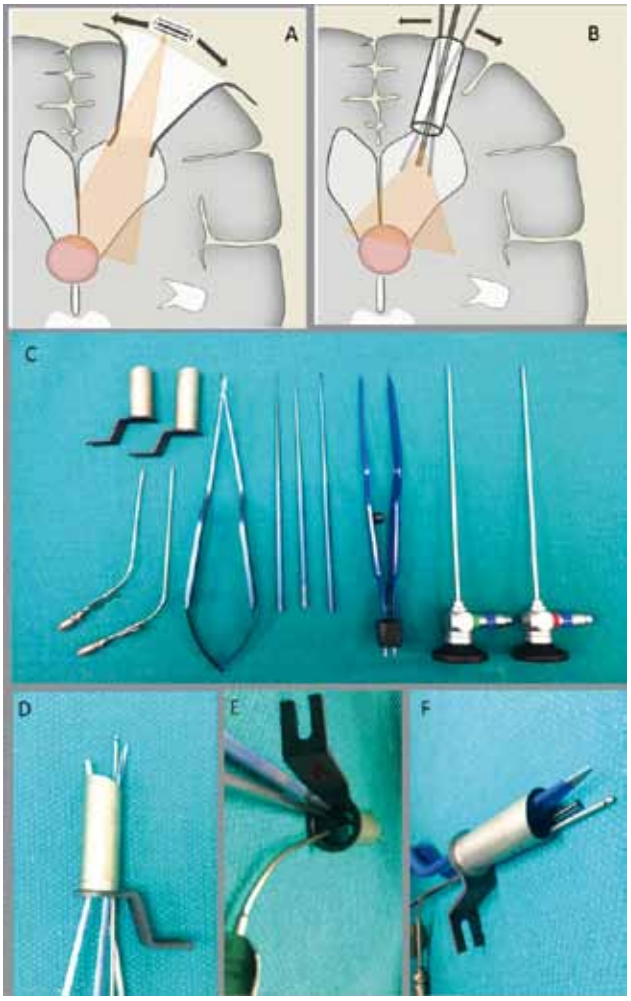

Figure 2 - Surgical approach and instrumentation. Diagrams in the coronal plane of transcortical approaches using either fixed retractors and a microscope **A)** or a tubular retractor and an endoscope **B)**. Varied angulation of endoscopes with different lens angles provides a very wide range of views; this is particularly helpful in dividing attachments of the posterior-superior cyst wall to the choroid plexus of the third ventricular roof and in confirming complete removal of the cyst from the contralateral foramen. **C)** 4 cm and 6 cm long, 14-mm diameter tubular retractors, 0-degree and 30-degree 2.7 mm diameter endoscopes and standard microdissection instruments are pictured. **D-F)** The 14 mm diameter, 4 cm long retractor accommodates multiple microinstruments at various angles.

Discussion. Colloid cysts are benign lesions of the third ventricles usually discovered incidentally on imaging performed for unrelated symptoms.[2] Surgical intervention is indicated for lesions that are symptomatic by virtue of local mass effect or hydrocephalus.[1] Large lesions clearly blocking one or both foramina are usually resected to prevent sudden neurologic deterioration.[1] Surgical treatments include transcortical stereotactic aspiration, transforaminal resection using a small endoscope with a thin working channel, and craniotomy for a transcortical or a transcallosal transforaminal approach. Simple stereotactic aspiration is challenged by the mobility of the cyst, resistance to needle penetration, solid contents of some cysts; and the limited ability to resect the cyst capsule.[3]

Many surgeons prefer the visualization of cyst-brain interface and surrounding vascular structures afforded by open microscopic or endoscopic techniques. Open microscopic approaches, whether transcortical or transcallosal; however, require relatively large incisions in the brain and significant brain retraction with self-retaining retractors. Such retraction can injure the brain by laceration, or pressure-induced ischemia.[2] Mitigating strategies include focal brain displacement with handheld instruments, intermittent fixed retraction, CSF drainage, and larger craniotomies permitting elevation rather than retraction of the brain.[4] Less invasive endoscopic techniques have employed rigid endoscopes with a single or dual working channels. Rates of gross total resection have exceeded 80% in some series,[2-4] and associated morbidities are reported to be less frequent than with open techniques.[2,5,6] Although dual channel endoscopes allow bimanual manipulation and microdissection, instrument mobility is restricted by the long, fixed channels of the endoscope.

A combination of the reduced invasiveness of endoscopic visualization and the greater instrument mobility of open microscopic techniques is sought in use of cylindrical ports for transcortical resection of ventricular lesions.[7] Ogura et al[8] described a "transcylinder" microscope-aided approach to intraparenchymal lesions using a 0.1-mm thick transparent polyester film rolled into a thin stick and passed to the target through a small cortical incision. The roll of film, when unwound, displaces the brain

centrifugally to create a film-lined 2-cm diameter cylinder of surgical access. It was noted that using similar techniques did not increase the size of the initial cortical incision. Such tubular retractors maintain a cylindrical tunnel of surgical access of fixed diameter; pressure is applied evenly to the surrounding brain. Multiple types have been used in exposing and removing deep brain lesions.[9,10-12] Commercially available systems include the COMPASS stereotactic surgery system (Compass Inc, Rochester, Minnesota, USA) designed specifically for brain use, the METRx (Medtronic) systems initially designed for spine surgery, and the ViewSite Brain Access System (Vycor Medical Inc, Boca Raton, Florida, USA).

We report the novel use of a tubular retractor (METRx) as a transcortical port to resect a third ventricular colloid cyst. A tubular retractor 14-mm in diameter and 4-cm long provided a transcortical working channel sufficient for manipulation of the endoscope and a pair of microinstruments. A ventricular catheter was placed under stereotactic guidance through the cortex and deep white matter into the frontal horn of the lateral ventricle. Transcortical dissection along this catheter then opened a channel of the width needed for the tubular retractor. A 2.7-mm diameter handheld endoscope, whose field of view and orientation could be easily altered, provided excellent, high resolution, highly magnified views of critical anatomy in all directions (**Figures 2A & 2B**). A wide range of views through the endoscope could be achieved within the cross sectional area of a tubular retractor of relatively small diameter by changing the lens angle of the endoscope, the endoscope's orientation, or both. For instance, the contralateral lateral ventricle could be seen through both foramina of Monro by angling a 30-degree endoscope medially (**Figure 1E**).

Despite the theoretical disadvantage of a monocular perspective, these views seemed superior to those usually provided by the operating microscope. Use of a viewing endoscope rather than one with both optical and working channels allowed simultaneous use of a pair of standard microdissecting instruments free of the restrictions of a narrow working endoscopic channel (**Figures 2C-F**). In addition, this strategy permitted removal of the solid portion of the cyst's contents that were too large (5-mm diameter) to be extracted through the working channel of a multifunctional endoscope. The utility and safety of this particular combination of tubular retractor, viewing endoscope, and microinstruments should be further evaluated

In conclusion, we describe transcortical, transforaminal resection of a colloid cyst of the third ventricle using stereotactically guided placement of a 14-mm diameter tubular retractor, endoscopic visualization, and bimanual dissection with traditional microinstruments. This allowed complete removal of the cyst's contents and its wall through a minimally invasive approach.

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