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*Video Abstract*

# A challenging case of endoscopic third ventriculostomy

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## ABSTRACT

**Background:** Although controversial, endoscopic third ventriculostomy (ETV) in the management of Myelomeningocele and Chiari type II malformation-related hydrocephalous is gaining wider popularity and use. With variable success rates, it can be proposed as a first or second option after shunt malfunction. ETV in post-infectious hydrocephalus may also be considered as an alternative to shunting. With reported success rates of 50–60%, failure is attributed to anatomical reasons and/or to pathological subarachnoid space scarring that may result from infectious processes. Similarly, ETV in repeated shunt malfunctions is an acceptable option that may offer shunt independency. In all situations, case-by-case selection and discussion are to be considered.

**Case Description:** A 5-year-old boy with a history of surgically treated lumbosacral myelomeningocele and ventriculoperitoneal shunting at six months of age is presented. During the course following the initial surgery, he experienced multiple shunt malfunctions, with two episodes of meningitis, leading to 7 shunt revision surgeries. Lately, the patient presented a large peritoneal cyst formation that needed regular evacuations. With a magnetic resonance imaging (MRI)-scan showing a large bi-ventricular hydrocephalus and a trapped third ventricle with multiple septations, surgical options included either ventriculoatrial shunting or third ventriculostomy. The latter option, offering shunt independency, was chosen after family consent and risk explanation. The expected success rate of the procedure was discussed and evaluated to 40–60% on the ETV success score. The video describes a step-by-step procedure with detailed radiological and correlated anatomical annotations of a completely distorted anatomy of a multifactorial hydrocephalous. No scarring at the prepontine cistern was observed. Shunt independency was achieved. However, the patient died from late postoperative status epilepticus and pulmonary complications. Whether these postoperative events are directly related to the procedure is unclear, although technically and clinically successful in the short term.

**Conclusion:** We believe that ETV should be carefully indicated in selected patients with Chiari II, post-infectious hydrocephalus, by experienced hands, as the surgical anatomy can be extremely complex and misleading.

**Keyword:** Endoscopy, meningitis, hydrocephalus, third ventriculostomy, ETV

**[Video 1]-Available on:**
www.surgicalneurologyint.com

**Annotations**

00:00 – Introduction

In this video, we present a case of a challenging endoscopic third ventriculostomy.

00:05 – Background

Although controversial, endoscopic third ventriculostomy (ETV) in the management of Myelomeningocele and Chiari type II malformation-related hydrocephalous is gaining wider

popularity and use. With variable success rates,[5,7,8] it can be proposed as a first or second option after shunt malfunction. ETV in post-infectious hydrocephalus may also be considered as an alternative to shunting. With reported success rates of 50–60%, failure is attributed to anatomical reasons and/or to pathological subarachnoid space scarring that may result from infectious processes.[4,6,9] Similarly, ETV in repeated shunt malfunctions is an acceptable option that may offer shunt independency.[1,2,5] In all situations, case-by-case selection and discussion are to be considered.

00:31 – Case presentation

A 5-year-old boy with a history of surgically treated myelomeningocele and VP shunt insertion at six months of age for treating hydrocephalus experienced multiple shunt complications during the following years: the patient suffered from seven shunt replacement surgeries, with two intermittent episodes of meningoencephalitis that all led to the onset of epilepsy and functional sequelae.

Three months before admission, a large peritoneal cyst developed around the abdominal catheter, which required regular and repeated evacuation procedures.

The patient then presented to our department for management of shunt malfunction.

On admission, the patient was alert, with a large macrocrania but no signs of raised intracranial pressure (ICP); however, he was suffering severe psychomotor retardation with speech difficulty and inability to walk.

A palpable large later umbilical mass was observed, and evacuation procedures yielded more than 500cc of clear liquid.

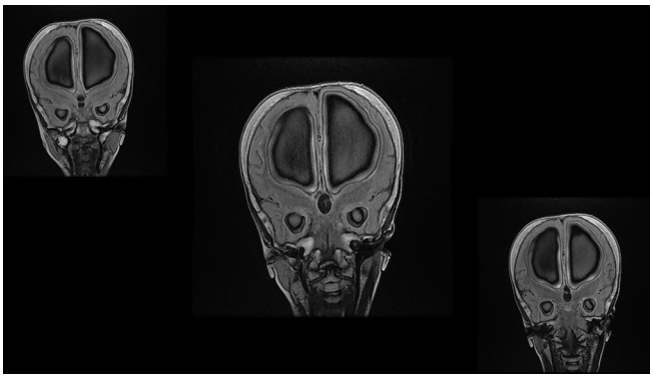
01:02 – Imaging

On a T1-weighted MRI scan, we could observe a large, multilobulated biventricular hydrocephalus, with almost a collapse of the third and fourth ventricles. On T2-weighted sequences, the third ventricle appears trapped with multiple septae, visible on Flair coronal images.

Abdominal MRI reveals a large cyst with compression of internal organs.

01:26 – Management

Given the history of the patient and his clinical condition, treatment options consisted of either a ventriculoatrial shunt insertion (to avoid replacing the catheter with a scarred abdomen) or a third ventriculostomy. The latter option was chosen after a full explanation of the expected success rates (based on the ETV Success Score ETV success score[3]) and the failure risks. In fact, although challenging technically, the shunt independency that third ventriculostomy could offer was more convincing given the multiple shunt failures. The pathological background of this case is a multifactorial hydrocephalous.



**Video 1:** Video of the procedure describing the challenging ETV case.

Some anatomical considerations needed to be taken into account before surgery: The Monro foramen seems to be completely obstructed, and the floor of the 3rd ventricle may be difficult to access due to the multiple septations that were visible on MRI. Neuronavigation may be helpful in confirming surgical landmarks, although its accuracy may be compromised by brain shift from cerebrospinal fluid leak. Last, the possible scaring of the prepontine cistern from the previous infectious episodes may lead to procedure failure.

02:13 – Procedure [Video 1]

On entry to the right lateral ventricle, the first challenge was to identify key anatomical landmarks and stay oriented in this completely distorted anatomy. We first identified the ventricular catheter that was pointing to the temporal horn in a large and deep ventricular cavity, then moved upward to explore the rest of the ventricles.

02:40 – A suspected area of Monro foramen obstruction was observed. The thalamostriate and septal veins were merely visible under dense fibrous tissue. The frontal horn and the caudate nucleus could easily be identified.

03:12 – The second step of the procedure consisted of performing a septostomy through a dense septum with the existence of a septum pellucidum.

03:33 – Then, after multiple checks and a thoughtful understanding of the anatomy, we decided to explore the suspected area of foramen obstruction.

Careful introduction of the Decq cisternostomy forceps allowed to open the first membrane and get into an underlying trapped cavity. Enlargement of the entry is performed with the Fogarty catheter, allowing for the second membrane to become visible before it is also opened and enlarged. You can note the presence of multiple septae and fibrous trabeculations.

04:21 – After passing the second membrane, the floor of the third ventricle was suspected to be at reach.

04:32 – Visualization of the infundibulum confirmed our thoughts, and the classical bulging floor was finally observed.

04:50 – Perforation and opening of a thickened floor of the third ventricle was performed and enlarged, taking care to open the underlying arachnoid membrane.

05:41 – Exploration of the cisternostomy and the prepontine cistern, which fortunately was not scarred, and the basilar artery could be easily recognized.

06:09 – Postoperative evolution

In the postoperative period, the immediate outcome was favorable; the shunt was ligated, and the patient did not present any signs of intracranial hypertension, then discharged over a week.

Control computed tomography (CT) showed the opening of the Monro foramen.

At six months follow-up, the patient's condition was stable, with no raised ICP signs. The control CT scan showed a favorable result with a more relaxed brain. The procedure was considered successful, and catheter withdrawal was to be scheduled.

However, the patient later presented a status epilepticus that required intensive care unit admission and died from pulmonary complications.

Whether these postoperative events were directly related to the procedure, as a complication, is unclear, although technically and clinically successful in the short term.

This video aimed to demonstrate how complex ventricular anatomy can be in Chiari II hydrocephalous with previous infectious episodes and multiple shunt malfunction and how good knowledge and understanding of the anatomy is important in such a challenging case.

### Ethical approval

The Institutional Review Board approval is not required.

### Declaration of patient consent

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

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Nil.

### Conflicts of interest

There are no conflicts of interest.

### Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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