Risks of Endoscopic Temporal Ventriculocisternostomy for Isolated Lateral Ventricle: Anatomic Surgical Nuances

Takatoshi Hasegawa[1], Toshihiro Ogiwara[1], Alhusain Nagm[1,2], Tetsuya Goto[1], Tatsuro Aoyama[1], Kazuhiro Hongo[1]

Key words
- Anterior choroidal artery
- Endoscopic neurosurgery
- Hydrocephalus
- Isolated lateral ventricle
- Temporal ventriculocisternostomy

Abbreviations and Acronyms
AChA: Anterior choroidal artery
ILV: Isolated lateral ventricle
MRI: Magnetic resonance imaging
VP: Ventriculoperitoneal

From the [1]Department of Neurosurgery, Shinshu University School of Medicine, Matsumoto, Japan; and [2]Department of Neurosurgery, Al-Azhar University Faculty of Medicine, Nasr city, Cairo, Egypt

To whom correspondence should be addressed: Toshihiro Ogiwara, M.D. [E-mail: togiwara@shinshu-u.ac.jp]

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BACKGROUND: **Entrapment of the temporal horn, known as isolated lateral ventricle (ILV), is a rare type of noncommunicating focal hydrocephalus, and standard treatment has not been established. We report 2 cases of endoscopic surgery for ILV and highlight the anatomic surgical nuances to avoid associated surgical risks.**

CASE DESCRIPTION: **The first patient presented with recurrent ILV following initial shunt placement for ILV, owing to shunt malfunction. In the second patient, ILV recurred secondary to choroid plexus inflammation caused by cryptococcal infection. Endoscopic temporal ventriculocisternostomy was effective in both cases. However, in the second case, the choroidal fissure was fenestrated, which led to cerebral infarction in the territory of the choroidal artery zone, attributed to damage of the branches of the choroidal segment of the anterior choroidal artery.**

CONCLUSIONS: **Although endoscopic temporal ventriculocisternostomy is considered a safe and less invasive procedure for treatment of symptomatic ILV, the technique is still associated with risks. To avoid complications, it is necessary to be familiar with the anatomy of the choroidal arteries and the pertinent endoscopic intraventricular orientation. Additionally, sufficient experience is required before it can be recommended as the treatment of choice.**

INTRODUCTION

Temporal horn entrapment, known as isolated lateral ventricle (ILV), is a rare type of noncommunicating focal hydrocephalus occurring as a result of surgery for brain tumors, intraventricular infections, hemorrhage, or traumatic events. Standard treatment for this condition has not been established.[1] The goal of surgical treatment is to drain the ILV by connecting the temporal horn to the ventricular system or subarachnoid space or shunting to the peritoneum (ventriculoperitoneal [VP] shunt) or the atrium (ventriculoatrial shunt). The efficacy of endoscopic treatment for cerebrospinal fluid pathway obstruction, in particular, endoscopic third ventriculostomy, for obstructive hydrocephalus has been reported, and endoscopic surgeries have been used frequently to treat these conditions. With the development of endoscopic procedures, endoscopic temporal ventriculocisternostomy for ILV can also be considered to be a safe and less invasive technique.[2] We report our experience with endoscopic temporal ventriculocisternostomy, including an unexpected surgical complication, along with an evaluation of this procedure. This study emphasizes the importance of vigilant anatomic attention before performing endoscopic temporal ventriculocisternostomy in patients with ILV.

CASE DESCRIPTIONS

The patients gave their consent for submission of their case reports for publication.

Case 1

A 42-year-old woman presented with headache and numbness in the left extremities, which became gradually worsened. Her clinical history included sudden onset of headache at the age of 16, attributed to right intraventricular hemorrhage owing to a ruptured arteriovenous malformation. The arteriovenous malformation was completely resected. A few months after surgery, she developed ILV with left homonymous hemianopsia. Her condition had been improved following VP shunt placement. In the current presentation, radiologic images revealed right thalamic hemorrhage secondary to migration of the ventricular tube with subsequent recurrence of right ILV (Figure 1A and B). Left homonymous hemianopsia also reappeared. Based on preoperative planning, all available surgical options (including fenestrating the cyst into the rest of the ventricular system) were discussed, and endoscopic temporal ventriculocisternostomy was selected to treat this condition. Under general anesthesia, an intracranial approach was performed with a right temporal burr hole using a neuronavigation system (Brainlab, Munich, Germany).[3] Following dural incision and arachnoid coagulation, the isolated cyst of the lateral ventricle was punctured using a ventricular tap needle under neuronavigation guidance.[3] Using the same trajectory, an endoscopic sheath with an inner diameter of 9 mm

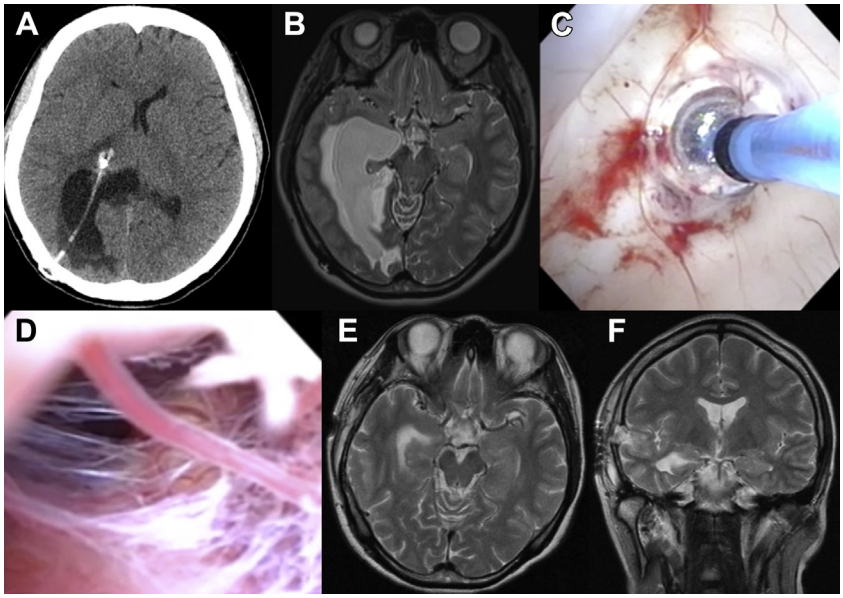

Figure 1. Case 1. (**A**) Preoperative computed tomography scan showing right thalamic hemorrhage owing to migration of a ventriculoperitoneal shunt tube and enlargement of the trigone of the right lateral ventricle. (**B**) Preoperative magnetic resonance imaging showing right isolated lateral ventricle with perifocal edema. (**C** and **D**) Intraoperative endoscopic pictures showing fenestration of the mesial temporal wall with a balloon catheter to the basal cistern. (**E** and **F**) Postoperative magnetic resonance imaging demonstrating improvement of isolated lateral ventricle and perifocal edema.

(Neuroport; Olympus Corp., Tokyo, Japan) was introduced, and the lateral ventricle was reached.[3] The stretched thin uncus was incised and fenestrated to the basal cistern with a flexible videoscope (Olympus Corp.) (Figure 1C and D). Postoperative magnetic resonance imaging (MRI) confirmed resolution of the right ILV and improved perifocal edema (Figure 1E and F). The postoperative course was uneventful without any complications, and the patient's symptoms completely resolved. The patient underwent MRI follow-up 13 months postoperatively, which documented no recurrence.

Case 2

An 80-year-old woman with a history of chronic renal dysfunction presented with a cognitive disorder and progressive low activity for 3 months' duration. She had no motor or sensory disturbances and had neither headache nor symptoms suggesting increased intracranial pressure. Brain MRI revealed right ILV with enhancement of the choroid plexus (Figure 2A and B). The cerebrospinal fluid was clear, and cytologic examination showed no evidence of malignant cells. Endoscopic temporal ventriculocisternostomy, including opening of the choroidal fissure, was selected based on preoperative planning. Under general anesthesia, endoscopic surgery was performed with right keyhole craniotomy using ViewSite (inner diameter 17 mm/11 mm; Vycor Medical, Inc., Boca Raton, Florida, USA) under neuronavigation guidance.[3] The choroidal fissure was opened with coagulation of tiny vessels of the choroid plexus, and the quadrigeminal cistern was visible. Communication between the lateral ventricle and quadrigeminal cistern was achieved but was unsatisfactory, as both the ventricular wall and the choroid plexus were strongly adherent together (Figure 2C). There were a few unusual septa in the intraventricular wall that suggested previous infection or inflammation. Fenestration of the medial wall of the temporal horn was added (Figure 2D). A biopsy specimen from the suspicious choroid plexus was obtained. These endoscopic procedures were performed with a rigid scope 2.7 mm in diameter and 18 cm in length, with 0° angled lens (KARL STORZ GmbH & Co. KG, Tuttlingen, Germany). Postoperative MRI showed improvement of the right ILV. However, cerebral infarction occurred at the right anterior choroidal artery territory (Figure 2E and F). Although the patient's cognitive dysfunction improved, her newly developed severe left hemiparesis remained. The histopathologic diagnosis disclosed cryptococcal choroid plexitis (Figure 3A–C), and amphotericin B was administered. Follow-up MRI performed 21 months postoperatively demonstrated no recurrence of right ILV.

DISCUSSION

There is no known established standard treatment for ILV. Based on several previous reports, surgical options for ILV are VP shunt, temporal ventriculocisternostomy (including endoscopic fenestration of the mesial temporal ventricular wall with or without stent placement), and fenestration of the choroidal fissure.[1] The ILV has traditionally been treated with VP shunt placement. Although VP shunt is a safe and well-known technique, treatment of hydrocephalus with multiple septa and compartments is difficult and sometimes fails with the usual methods of shunt placement. Furthermore, complications can occur during or after the procedure. Moreover, there are risks specific to VP shunting that can be serious and potentially life threatening if left untreated.

With the recent development of neuroendoscopic surgery, endoscopic ventriculocisternostomy (including fenestration of the mesial temporal ventricular wall[1,2]) and fenestration of the choroidal fissure for ILV have been reported. Fenestration of the mesial temporal ventricular wall is less invasive, and the risks of infection are low compared with the distinct complications of VP shunt. However, intraoperative disorientation and postoperative stoma obstruction are matters of concern. To prevent stoma closure, a ventricular tube can be placed through the stoma as a stent to secure its flow.[4,5] Placing a stent carries inherent risks, including stent occlusion, migration, infection, and direct injury to vital structures (cerebral peduncle, cranial nerves, and arteries).[4] Stent placement after ventriculocisternostomy would be beneficial, particularly in cases of ILV associated with malignant brain tumors.[1] Fenestration of the choroidal fissure can be accomplished without damage to normal structures. This procedure allows