Endoscopic Third Ventriculostomy

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Abstract

We prospectively studied 8 patients who had an endoscopic third ventriculostomy performed between 1996 and 1997 in Songkhlanagarind Hospital. The surgical technique was described. Seven operations were successful and one operation failed. Success was found in cases of pure aqueductal stenosis, aqueductal stenosis with Dandy Walker malformation, and posterior fossa tumor. In a patient where an endoscopic third ventriculostomy failed, aqueductal stenosis with marked hydrocephalus was found. Marked dilation of the third ventricle could compress the aqueduct of Sylvius. Although there was communicating hydrocephalus, it looked like non-communicating hydrocephalus. To avoid a valvular shunting complication, we suggest performance of an endoscopic third ventriculostomy in selected non-communicating hydrocephalus patients.

Key word : Third Ventriculostomy - Endoscopy

Hydrocephalus is a common congenital anomaly involving the central nervous system. It is classified into two types. One is communicating hydrocephalus and the other is non-communicating hydrocephalus (Obstructive hydrocephalus). The usual treatment of this anomaly is by extracranial shunt such as ventriculoperitoneal shunt and ventriculoatrial shunt. Extracranial shunt is usually complicated with shunt malfunction and infection in the long-run[1-4]. In order to avoid a complication of extracranial shunt, third ventriculostomy is an alternative surgical procedure to divert cerebrospinal fluid (CSF) from the third ventricle to the subarachnoid space in cases of obstructive hydrocephalus. Fortunately, the floor of the third ventricle is membranous, deprived of neuroglia and thin, thereby reducing the possibility of reclosure. Third ventriculostomy is indicated whenever the subarachnoid space is free and the Pachionion granulation absorbs the CSF normally.

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Our study aimed to preliminary report the result of treatment by endoscopic third ventriculostomy in patients with non-communicating hydrocephalus in our hospital.

MATERIAL AND METHOD

From September 1996 to March 1998, there were 30 patients who received ventriculoscopy. Seventeen patients received diagnostic ventriculoscopy and the others received therapeutic ventriculoscopy. Eight patients who received therapeutic ventriculoscopy had endoscopic third ventriculostomy. After investigation by computerized tomographic scan, all patients with non-communicating hydrocephalus underwent investigation by magnetic resonance imaging (MRI) study to confirm the diagnosis. Some causes of non-communicating hydrocephalus are demonstrated in Fig. 1 and 2.

We used a rigid neuroendoscope with an outer diameter of 0.9 mm. to perform the surgical procedure. After the patient was placed in the supine position, routine skin preparation procedure was done. A burr hole was made at the Kocher's point. The dura was opened in cruciate fashion. A small cortical incision was made and a Cushing brain canula was tapped to the right lateral ventricle. After removing the canula, the neuroendoscopic sheath with stylet was replaced. The stylet was removed and a scope was inserted into the sheath. At this point, we could identify the choroid plexus, septal vein, thalamostriate vein, and foramen of Monro (Fig. 3A, 3B). The scope was advanced into the third ventricle through the foramen of Monro. The landmark for third ventriculostomy is in the midline area behind the pituitary stalk and in front of the mammillary body (Fig. 4A, 4B). We used a Steinman pin to make a small hole in the floor of the third ventricle. A No. 6 French Fogarthy catheter was applied to this hole and dilated with a balloon at the tip of the catheter until the diameter was about 0.5-1 cm. (Fig. 5A, 5B).

Almost all of the successful surgical procedures were evaluated at least 6 months after operation by one of the following criteria:

1. Clinical improvement
2. Head circumference decreased and fontanel soft and closed
3. The size of ventricle was decreased.
4. The disappearance of periventricular radiolucency.

One patient with medulloblastoma of cerebellum lost follow-up 1 month after operation. He showed a good result, so we included this patient in the study. During treatment and follow-up, patients with persistent signs and symptoms of increasing intracranial pressure were treated by ventriculoperitonial shunting.

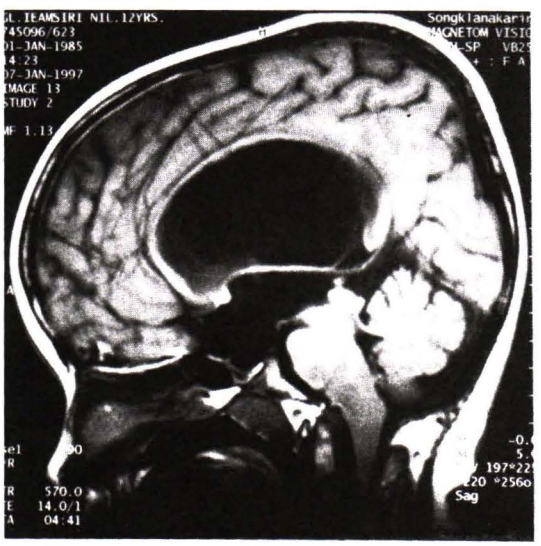


Fig. 1. Midsaggital view of MRI brain of patient No. 1 showing aqueductal stenosis.

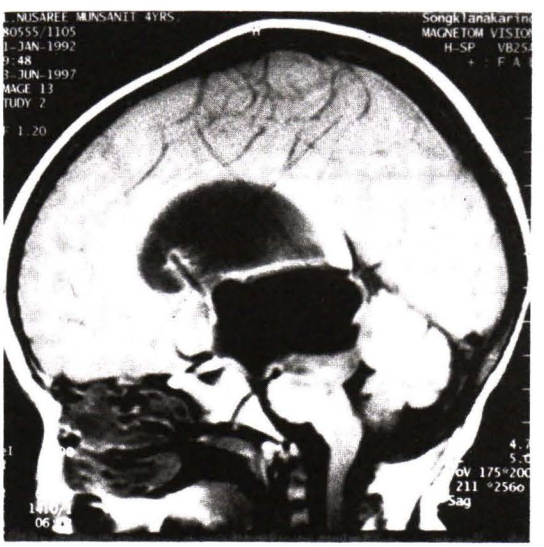
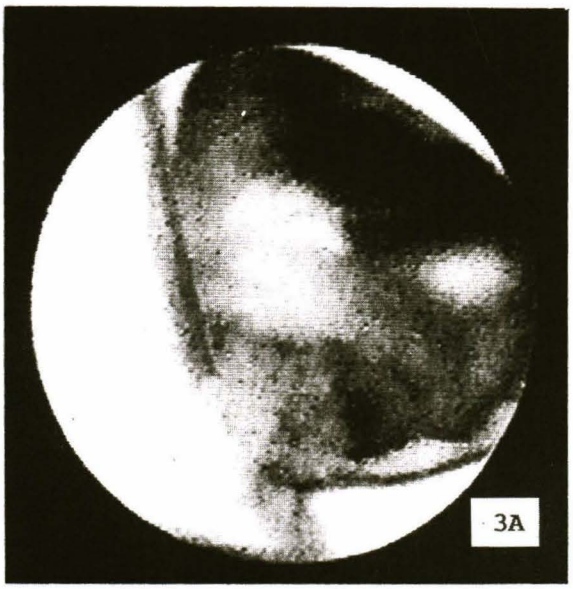
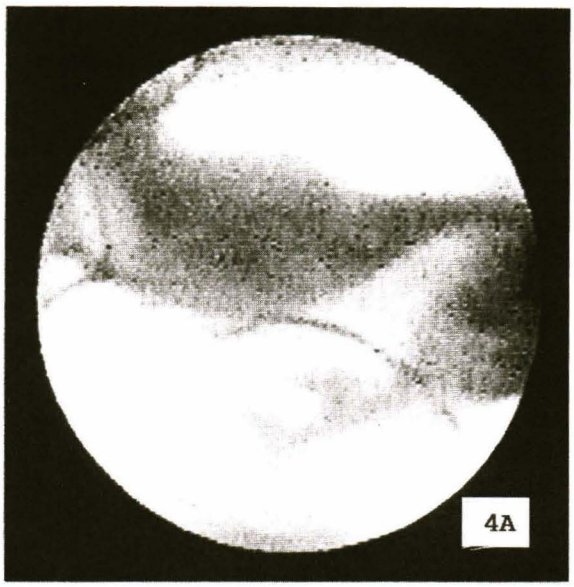
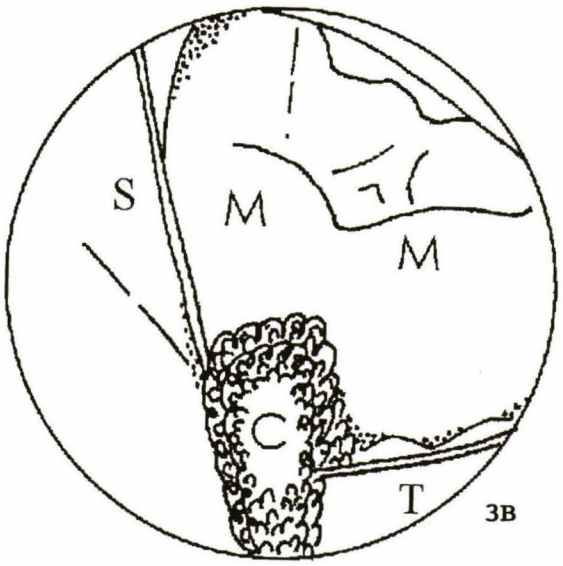


Fig. 2. Midsaggital view of MRI brain of patient No. 6 showing brainstem glioma.







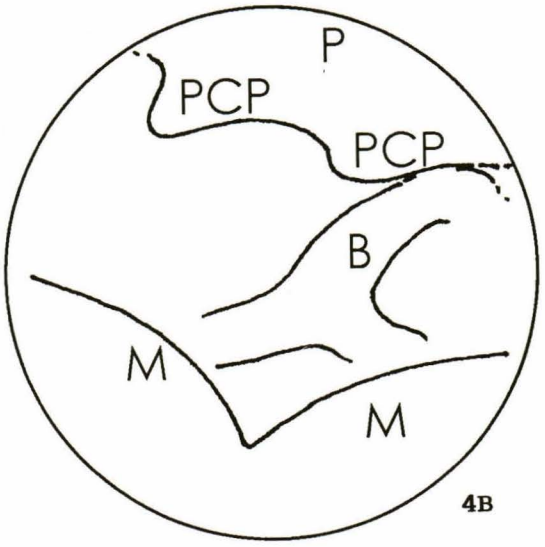
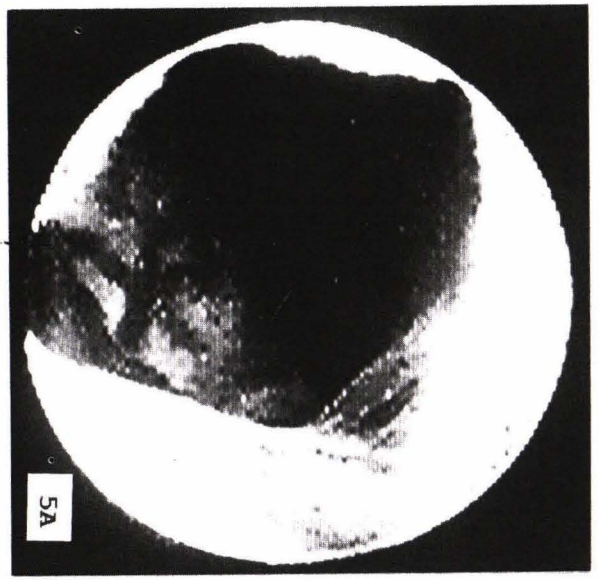


Fig. 3A, 3B. Ventriculoscopic photograph showing foramen of Monro. (C = Choroid Plexus, M = Mammillary body, S = Septal vein, T = Thalamostriate vein).

Fig. 4A, 4B. Ventriculoscopic photograph showing floor of third ventricle. (B = Basilar artery, M = Mammillary body, P = Pituitary stalk, PCP = Posterior Clinoid Process).



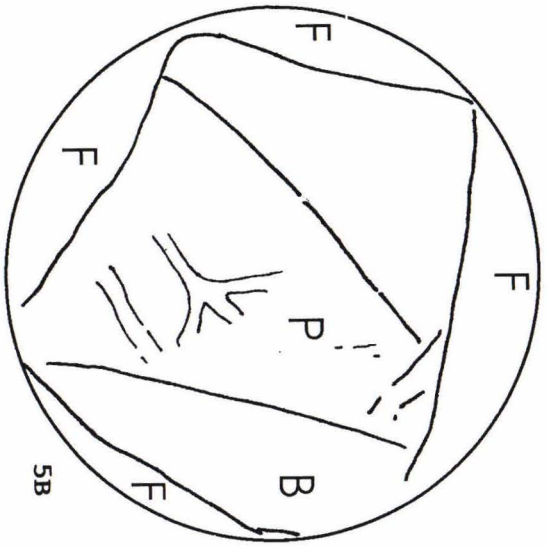


Fig. 5A, 5B. Ventriculoscopic photograph showing floor of third ventricle was punctured and dilated. (B = Basilar artery, F = Floor of third ventricle, P = Pons).

Table 1. Data of 8 patients with non-communicating hydrocephalus in which endoscopic third ventriculostomy was performed.

No.	Name	Sex	Age	Symptoms	Diagnosis	Result	Follow-up	Complication
1	AN	F	12 years	Ataxic gait	Aqueductal stenosis	successful	1 year 1 months	bleeding from small w.
2	ST	F	7 months	Head enlargement	Aqueductal stenosis with Dandy Walker malformation	successful	1 year	-
3	SN	M	5 months	Head enlargement	Aqueductal stenosis (marked dilation of 3 ventricle)	failure	-	bleeding from small w.
4	SV	F	2 months	Head enlargement	Aqueductal stenosis	successful	8 months	-
5	VC	M	6 years	Ataxic gait	Medulloblastoma	successful	loss F/U 1 month	-
6	NM	F	4.5 years	Ataxic gait	Brain stem Gioma	successful	10 months	-
7	TS	M	8 months	Head enlargement	Aqueductal stenosis with Dandy Walker malformation	successful	6 months	-
8	AS	M	2.6 years	Head enlargement	Aqueductal stenosis	successful	8 months	-

F = Female, M = Male

RESULTS

There were 8 patients with non-communicating hydrocephalus in which an endoscopic third ventriculostomy was performed (Table 1). Four patients were male and the other 4 patients were female. Age range was from 2 months to 12 years. Causes of hydrocephalus consisted of pure aqueductal stenosis in 4 patients, aqueductal stenosis with Dandy walker malformation in 2 patients and posterior fossa tumors in 2 patients.

Intraoperative complication was found in 2 patients. There was bleeding from a small vessel in the floor of the third ventricle. The bleeding was stopped by tamponade of the Fogarthy balloon or by coagulation by monopolar[5]. No bradycardia was found when the floor of the third ventricle was punctured.

Surgical failure was found in 1 patient who had aqueductal stenosis with mark hydrocephalus. A ventriculoperitoneal shunt was performed in this patient. Surgical treatment was considered successful in the remaining 7 patients.

DISCUSSION

Third ventriculostomy was first performed by Walter Dandy in 1922[6]. He used open operation (temporal craniotomy) to perform this surgical procedure. One year later, Mixter used urethroscope to perform ventriculoscopy and puncture the floor of the third ventricle as a treatment[7]. After that, there were many reports of third ventriculostomy. These reports showed a high mortality rate and failure rate of this surgical procedure[4,5,8-12]. After the introduction of the valvular shunting device in 1951, the third ventriculostomy was not mentioned for many years[13].

Extracranial shunting was associated with shunt malfunction and infection in long term treatment[1-4]. The advent of stereotaxis and endoscopic neurosurgery eliminated the high mortality rate[14-23]. The third ventriculostomy was reintroduced. The third ventriculostomy was not recommended in cases of communicating hydrocephalus because of the incompetence of subarachnoid space where absorbable defect of arachnoid granulation is expected[8,15,16,18]. There is previous literature which showed that the endoscopic third ventriculostomy was successful in cases of non-communicating hydrocephalus. Some reports showed spontaneous third ventriculostomy with good results[24]. There was no doubt that the third ventriculostomy had better long term treatment [9,18,19,21,22,25].

In our study we found that the third ventriculostomy was suitable for patients with non-communicating hydrocephalus from pure aqueductal stenosis and posterior fossa tumors. Failure of this surgical procedure was found in 1 patient with marked dilation of the ventricle. It may be that marked dilation of the third ventricle could kink or pinch, therefore shuting the aqueduct of Sylvius[25-27]. In spite of the appearance of non-communicating hydrocephalus, we found many of them had communicating hydrocephalus. Although success was found in patients who had aqueductal stenosis with Dandy Walker malformation in our study, there was only one previous literature reporting performance of a third ventriculostomy in patients who had aqueductal stenosis with Dandy Walker malformation[15]. This report showed success in all 3 patients but one of them had extracranial shunting. There was not enough report of the success rate for this surgical procedure in these patients.

Some suggested not performing the third ventriculostomy in congenital hydrocephalus, subarachnoid hemorrhage, metastasis, and meningitis because of an abnormality of the subarachnoid space[8,15,16,18]. After performing the third ventriculostomy, CSF could not flow through the subarachnoid space normally.

In short, we agree with the previous literature in performing the third ventriculostomy in patients with pure aqueductal stenosis and posterior fossa tumor. But in cases of hydrocephalus associated with other CNS malformations, there was not enough reports to confirm a success rate for this surgical procedure. Neurosurgeons should study the literature to collect the data of this surgical procedure in cases of hydrocephalus associated with other CNS anomalies before deciding to perform endoscopic third ventriculostomy.

SUMMARY

Endoscopic third ventriculostomy was performed on 8 patients. The result of treatment was satisfactory in cases of pure aqueductal stenosis and posterior fossa tumor. By contrast, failure was

found in a patient who had aqueductal stenosis with marked dilation of the ventricle. To avoid the complication of valvular shunting devices, we should perform endoscopic third ventriculostomy only in selected non-communicating hydrocephalus patients.

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การผ่าตัดโดยใช้กล้องส่องในโพรงสมองเพื่อเจาะผนังของโพรงสมองส่วนที่สาม ในการระบายน้ำหล่อสมองและไขสันหลัง

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การศึกษาฉบับนี้ได้รายงานผลการผ่าตัดด้วยวิธีใช้กล้องส่องในโพรงสมองเพื่อเจาะผนังของโพรงสมองส่วนที่ 3 เพื่อระบายน้ำหล่อสมองและไขสันหลังในผู้ป่วย 8 ราย ที่มีภาวะโพรงน้ำในสมองโตอันเนื่องมาจากการอุดกั้นทางเดินของน้ำหล่อสมองและไขสันหลังในโรงพยาบาลสงขลานครินทร์ตั้งแต่กันยายน 2539 ถึง มีนาคม 2541 พบว่าผู้ป่วย 7 ราย ประสบความสำเร็จในการผ่าตัด แบ่งเป็นผู้ป่วย Aqueductal stenosis เพียงอย่างเดียว 3 ราย ผู้ป่วย Aqueductal stenosis ที่มี Dandy Walker Malformation ร่วมด้วย 2 ราย และผู้ป่วยเนื้องอกของก้านสมองและสมองน้อย 2 ราย ในผู้ป่วย 1 ราย ที่มี Aqueductal stenosis ร่วมกับโพรงน้ำในสมองส่วนที่ 3 โดยอย่างมากไม่ประสบความสำเร็จในการผ่าตัด อาจมีสาเหตุอันเนื่องมาจากการโตของโพรงสมองส่วนที่ 3 กดเบียดซ่องของ Sylvius ทำให้การวินิจฉัยผิดพลาดทั้งที่เป็นภาวะโพรงน้ำในสมองโตชนิดไม่มีการอุดกั้นทางเดินของน้ำหล่อสมองและไขสันหลัง เพื่อหลีกเลี่ยงปัญหาการติดเชื้อและการทำงานบกพร่องของท่อระบาย อันเนื่องมาจากการผ่าตัดด้วยวิธีระบายน้ำหล่อสมองและไขสันหลังออกนอกกะโหลกศีรษะเพื่อดูดซึมในที่อื่น การผ่าตัดด้วยวิธีดังกล่าวนี้จึงเหมาะสมในผู้ป่วยที่มีภาวะโพรงน้ำในสมองโตชนิดอุดกั้นทางเดินของน้ำหล่อสมองและไขสันหลังที่มีทางเดินของน้ำหล่อสมองและไขสันหลังบริเวณ Cistern ต่าง ๆ และผิวสมองปกติรวมถึงมีการดูดซึมน้ำหล่อสมองและไขสันหลังที่ปกติด้วย

คำสำคัญ : การเจาะผนังโพรงสมองส่วนที่สาม – การผ่าตัดโดยใช้กล้องส่อง

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