



Idiopathic Normal Pressure Hydrocephalus: Surgical Outcome of Endoscopic Third Ventriculostomy Comparing VP Shunt

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Authors' contributions

This work was carried out in between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Background: Normal-pressure hydrocephalus (NPH) affects the older people and the presentations are gait disturbance, incontinence and dementia. The reason is still unknown and there is increased CSF volume causing pressure to the periventricular brain causing the symptoms where there is no evidence of absorption failure or obstruction of the CSF pathway.

Aims: The main objective of this study is to compare the surgical outcome of endoscopic third ventriculostomy (ETV) and VP shunt (VPS) in NPH.

Methodology: A total of 24 patients were included in the study where 12 patients underwent ETV and 12 patients VPS. Patients having a definite cause of hydrocephalus and multiple co-morbid diseases were excluded from the study. Various Scoring systems were studied to see the efficiency of ETV.

Results: About 60% of patients were successfully recovered. 40% needed to revision surgery either VP shunt or LP shunt. Some scales showed higher efficiency of ETV.

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Conclusion: ETV in NPH is a safe and effective procedure. Whether the CSF absorption is hampered at arachnoid granulation is doubtful for failure cases. ETV is a short procedure with a good success rate in selected patients.

Keywords: Hydrocephalus; endoscopic; ventricular; shunt.

1. INTRODUCTION

The term normal pressure hydrocephalus (NPH) was given by Hakim and Adams [1]. Two types of NPH exist: Primary or idiopathic (INPH) of unknown origin and secondary NPH due to subarachnoid hemorrhage, traumatic brain injury, cerebral infarction, brain tumor, brain surgery and meningitis [2]. For INPH the volume of CSF is increasing for unknown reasons. Cerebrospinal fluid (CSF) is the fluid that circulates around the brain and spinal cord and through spaces within the brain called ventricles. In the absence of elevated pressure of the cerebrospinal fluid (CSF), it is associated with ventricular enlargement for unknown reasons. In nature, the enlargement of ventricles is characteristically triventricular and the hydrocephalus is of the type of communication. The symptoms of some patients with INPH are thought to be improved by an operation to drain away from the excess CSF. This was typically done by inserting a tube (a shunt) into the chest or abdomen to drain fluid (ventriculoatrial or ventriculoperitoneal shunts). Endoscopic third ventriculostomy (ETV) is a modern and less invasive surgical technique involving cutting a tiny hole in one of the ventricle's ground. Ventriculoperitoneal (VP) shunt surgery is a widely established INPH intervention although there is no conclusive evidence from controlled trials showing superior outcomes of VP shunting. The shunting of cerebrospinal fluid (CSF) has long been the standard hydrocephalus procedure. It's a simple procedure that can help to have a relatively normal life. High shunt complication rates such as slit ventricle syndrome are unacceptable under current standards [3,4]. During the last two decades, endoscopic third ventriculostomy (ETV) has been a routine surgical practice and provides an alternative to the CSF shunt. CSF diversion is a straightforward procedure. Association Survey 2003–2005, patients who underwent surgery had a non-significant reduction in the relative risk of dependent living compared with non-operative management. While more shunt patients reported improved health-related quality of life, they required heightened care compared with endoscopic third ventriculostomy patients. ETV's

utility and safety for obstructive hydrocephalus which occurs secondary to aqueductal stenosis have been proven.

1.1 Objective

The aim of the study is to compare the surgical outcome of endoscopic third ventriculostomy (ETV) and VP shunt (VPS) in NPH.

2. METHODS

2.1 Study Procedure

In our prospective randomized study, a total of 24 patients were enrolled. All of them were patients of IPNH. This study was conducted randomly from 2009 to 2018 at a private hospital (Comfort hospital) in Dhaka, Bangladesh. All patients were between 55 to 75 years old. Their duration of symptoms were not more than 24 months. We have included cases where we have found the patients did not have other dementia syndromes and malignant diseases. And we have excluded patients having symptoms for more than 24 months. Patients not capable of walking were not included in this study. Twelve patients underwent ETV and 12 patients underwent VPS. Various Scoring systems were studied to see the efficiency of ETV.

2.2 Surgical Technique

The procedure for achieving ventriculostomy requires the perforation of the floor accompanied by the extension of the defect with either the endoscopic forceps or the tip of the flexible endoscope. In maximum cases, a 3.1 -or 3.7 mm-diameter flexible endoscope was used for the ETV treatment.

2.3 Scales Used

We used some scales to see the scores in both groups of patients. These are Mini-Mental Status Examination (MMSE), The Berg Balance Scale (BERG), Dynamic Gait Index (DGI), NPH Japanese Scale (NPH Scale), Timed Up and Go (TUG).

3. RESULTS

3.1 Socio-demographic Characteristics

3.1.1 Age and gender distribution

A total of 24 patients were included in our study. There were 14 (58%) males and 10 (41%) females. The mean age was 65 years (range, 55-75 years). The maximum number of patients was found between 65 to 70 years (see Table 1).

Table 1. Age distribution of the patients of both groups (ETV and VPS)

Age in years	Male	Female
55-60	2	1
60-65	3	2
65-70	5	4
70-75	4	3
Total	14	10

3.2 Clinical Data

The clinical preoperative progression ranged from 3 to 12 months. Clinical signs and symptoms included gait irregularities in 11 patients (46%), bladder incontinence in 4 patients (16%), and insufficient or mild cognitive impairment in 9 patients (38%). The median period of the hospital stay was 2 days (range, 1-45 days).

3.3 Surgical Outcome

About 60% of patients were successfully recovered. 40% needed to revision surgery either VP shunt or LP shunt at their follow-up period of 2 to 12 months (see Fig. 1).

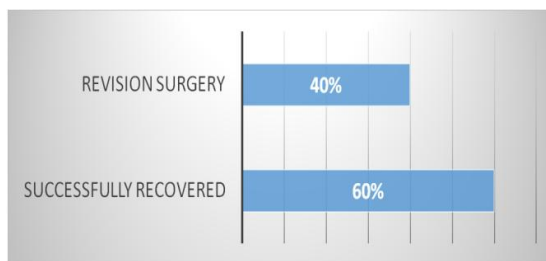


Fig. 1. Recovery level of patients

3.3.1 ETV group

In this group of 12 patients randomly assigned to the ETV group, 3 patients had anatomical features that made the surgical procedure

somewhat dangerous. Of the patients undergoing ETV, 2 did not show any clinical improvement after 3 months. Patients then underwent VPS, but only 1 showed improvement after a long period of follow-up. Other patients improved at 3 months post-ETV, but this improvement was maintained only partially after 12 months. In 12 patients with some degree of clinical improvement, oscillatory up and down movements were observed on the third ventricle floor in the intraoperative period immediately following ETV. There was no intraoperative or postoperative complications such as bleeding, damage, inflammation, hematoma or CSF leakage. There was no significant reduction in ventricular size in the brain in any patients of the ETV community.

3.3.2 VPS group

The other 12 patients were randomly assigned to the VPS group. In the VPS community, 2 patients had low-pressure valve over-drainage with a significant reduction in ventricular size and recurrent subdural hematoma. These patients underwent a further operation during which hematoma drainage was performed. 40% needed to revision surgery either VP shunt or LP shunt at their follow-up period of 2 to 12 months.

3.4 Comparison on the Basis of Some Scales

The ETV group had slightly better scores on some of the scales (MMSE, BERG, NPH Scale, and TUG) after 2 months and this improvement was partially maintained. Some of the scales had a lower score (BERG, DGI). After a year, the VPS group showed better scores on the motor scales.

3.5 Surgical Complications

The surgical complication was found in the follow-up that was present in the VPS community. No major intraoperative complications have occurred. One patient had a confirmed occlusion of the stomach 1 month postoperatively. Some mild complications involved transient fever and vomiting in 1 patient. Subdural hematoma occurred in 2 of 12 patients in the VPS group. Nevertheless, these two patients underwent successful valve replacement surgery and subsequently had a positive outcome. There were no confirmed ETV-related infections.

3.6 Successful Outcomes of ETV

In both classes, the surgical result was analyzed. The overall proportion of excellent/good clinical outcomes was 75%, of which 45% were excellent and 30% were good. 9 of the 12 patients had a satisfactory outcome and 3 patients had a poor outcome. A good level of improvement has been found in patients in the ETV group.

Table 2. Overall ETV success rate in the ETV patients, (n=12)

Rate of success/failure	Number of patients	Percentage
Success rate	9	75%
Failure rate	3	25%
Total	12	100%

4. DISCUSSION

The surgical techniques used for INPH patients in our study have shown us the results in a better way. Both processes were successful in some cases and complicated in a few. Several results were reported inadequately and these were highly imprecise where we were able to calculate the estimates with confidence intervals. The results were compatible with no difference or with either intervention being superior. Nevertheless, we found only one eligible trial that assessed ETV's effectiveness in comparison with VP shunting. The score of INPH treatment involves CSF diversion by means of a shunt. Various shunt types have been used, including shunts of the ventriculoperitoneal (VP) and Lumbar-peritoneal shunt (LP shunt). Although there had not been proven differences in outcomes between shunt configurations, VP shunts are commonly used. In our study, the ETV group had slightly better scores on some of the scales like MMSE, BERG, NPH Scale, and TUG, etc. And the VPS group showed better scores on the motor scales. A randomized clinical trial was conducted and it suggested that VP shunting be the superior surgical treatment, with 12 months postoperatively better results [5] Which mechanism yields better results is unclear and there is no difference in clinical outcomes or shunt survival [6]. In addition, authors compared various valve pressure settings, and found no statistically significant association with the shunting result [7]. Programmable valves allow non-invasive pressure adjustments that can optimize clinical improvement and alleviate complications associated with drainage. Shunting malfunctions, infections, headaches,

and subdural hematomas or effusions related to the drainage are common complications. In our study, no major intraoperative complications have occurred but one patient had a confirmed occlusion of the stomach 1 month postoperatively. And a subdural hematoma occurred in 2 of 12 patients in the VPS group. Ironically, some scholars have questioned whether shunt-related complications cause any adverse long-term effects at all. Most studies show longer follow-up periods and also face differentiating difficulties between shunt-related complications and other complications related to age or comorbidity. It is important to note that general surgical complications, including deep venous thrombosis, pulmonary embolism, and myocardial infarction, may also occur. Postoperative delirium is common too. Some authors have also proposed endoscopic third ventriculostomy (ETV) as an alternative treatment to shunting VP. Using ETV for INPH patients, it was found that the improvement rate was 69.1% and the complication rate was 6.4%. [8] Although some authors with ETV have shown similar promising results. Another study showed an inferior short-term safety profile for ETV compared to VP shunting [9,10]. As such, without further prospective, randomized studies, ETV's role in INPH was unclear. ETV and fixed-pressure VPS represent various tools for INPH management. It is not yet known the mechanisms and predictors of late ETV failure which could cause rapid deterioration. In our study, we found fewer complications in the ETV group and the patients of that group showed a good success rate. The overall proportion of successful clinical outcomes was 75% here. Thus we observed that ETV is a better procedure with more success rates in selected patients.

5. CONCLUSION

ETV is more safe and convenient than other alternative procedures in NPH. This is one of the ways to CSF shunting procedures in obstructive hydrocephalus conditions such as aqueductal stenosis. It is a minimal procedure in selected patients, with a good success rate. Compared to VPS, ETV is associated with increased perioperative mortality and complication rates, which can counterbalance ETV's promise as a potential method for avoiding long-term shunt dependence. This study suggests that medical comorbidity is a crucial predictor of worse short-term safety outcomes and reinforces the importance of ETV and VPS patient selection for INPH once again.

CONSENT

As the authors, we declare that, 'written informed consent was obtained from the patients for publication of this research paper'.

ETHICAL APPROVAL

As the authors, we hereby declare that, all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki. Ethical approval was taken from Institutional Review Board (IRB).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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