



Original Article

Surgical Outcome of Endoscopic Third Ventriculostomy in Patients Having High ETV Success Score: One-Year Experience at a Tertiary Care Hospital

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ABSTRACT

Background & Objective: Endoscopic third Ventriculostomy (ETV) is an accepted alternative to VP shunt in patients with obstructive hydrocephalus. We will share our experience and outcome.

Materials & Methods: Thirty consecutive ETV cases performed by a single surgeon during 1 year in patients with an ETV success score of 60 or higher were included in this study. Patients' demographics, outcomes, and complications are reported.

Results: (60%) were male and 12 (40%) were female. The mean age in our study was 6.1 years \pm 9 (mean \pm SD). Posterior fossa tumor was the most common etiology in our series (46.6%) followed by aqueductal stenosis (23.3%). Eighty percent of our patients did not experience an ETV failure. The complication rate was 20%. Inadequate ventriculostomy in 6.6% of the patients was the commonest complication.

Conclusion: ETV is safe and effective in patients with high ETV success scores.

Keywords: ETVSS: Endoscopic Third Ventriculostomy Success Score; hydrocephalus; pediatric neurosurgery.

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INTRODUCTION

Hydrocephalus may be defined as "an active dilatation of the ventricles resulting from imbalance between cerebrospinal fluid (CSF) production in ventricles and its absorption to the systemic circulation.¹ In the pediatric population the prevalence varies from 28 to 450 per 100,000 population and is associated with higher morbidity and mortality.² Surgically, hydrocephalus is usually classified as communicating and non-communicating. Ventriculoperitoneal (VP) shunt is most commonly used in communicating hydrocephalus

while Endoscopic third Ventriculostomy (ETV), Ventriculoperitoneal (VP), and ventriculoatrial (VA) shunts are employed in other situations³⁻⁵. Endoscopic third ventriculostomy (ETV) is a safe and effective alternative to ventriculoperitoneal (VP) shunts in selected patients with obstructive hydrocephalus. After its advent in the early 1900s by Walter Dandy, sub-frontal third ventriculostomy was overtaken by the use of valve-regulated shunts. This procedure made a comeback in the later part of the 20th century with advances in camera technology such as ETV.⁶

Ideally, ETV is indicated for non-communicating hydrocephalus of congenital or acquired etiology. The highest and most consistent success has been reported in cases of aqueductal stenosis, followed by posterior fossa masses causing hydrocephalus.⁷ This procedure has some utility in post-infectious and post-hemorrhagic obstructive hydrocephalus; however, its success rate is lower than the noninfectious counterparts.⁸

ETV success score (ETVSS) by Kulkarni et al, was the most commonly used criterion for patient selection. Patients were scored from 0 to 90 based on their age, etiology, and whether a previous shunt had been placed⁹. The number indicates the percentage of chance that ETV will be functional at six months. Patients with a higher ETVSS (80-90) have been shown to have favorable outcomes in 70–80 percent of patients over the short to medium-term.^{10,11} Offering ETV to patients up to 60 – 70 has shown an overall advantage.¹¹

Our center is the largest neurosurgical center in the province and VP shunts have been historically very commonly used in our practice for all types of hydrocephalus. Owing to the complications related to VP shunts, we want to assess the short-term success rate of ETV in patients with moderate to high ETVSS in our patient population. This will help us with better patient selection for ETV and not only reduce

complications by VP shunt but demonstrate the generalizability of ETVSS in our population.

MATERIALS AND METHODS

Study Design & Setting

This prospective case series was conducted from Jan 2021 to December 2021 in the department of Neurosurgery at Lady Reading Hospital, Peshawar after approval from the hospital's ethical and research committee. Informed written consent was taken from the patients or guardians.

Inclusion Criteria

The patients included who were with non-communicating hydrocephalus who had ETVSS 60 and greater.

Exclusion Criteria

Patients aged less than 6 months, patients with hydrocephalus secondary to an infection, and previous ETV failure cases were excluded. All the surgeries were performed by the principal author of this study.

Pre-op Evaluation

All patients underwent a thorough history and physical examination. A preoperative CT and MRI of the brain were performed in all cases. Primary diagnosis and associated pathologies of the patients were noted.

Surgical Procedure

The patient was positioned supine with the head slightly flexed. A burr hole was performed at Kocher's point. A rigid Endoscope of 0 degrees was introduced to the lateral ventricle in its sheath. 3rd ventricle is entered via Monroe's foramen and care were taken not to injure the fornix or vascular structures in this area. After identification of the landmarks, the blunt end of

monopolar lead without applying energy was used to puncture the floor of the 3rd ventricle. The Fogarty catheter was then inflated to enlarge the stoma. The basilar artery was visualized CSF pulsations at the stoma site were observed before standard closure.

Post-op and follow-up

The minimum follow-up duration was 6 months. All patients had regular postoperative visits and contact via mobile phone. A postoperative CT brain was performed in most cases. ETV failure was defined as any patient who underwent a VP shunt or repeat ETV anytime during follow-up.

Statistical analysis

Categorical variables like gender, age group, primary diagnosis, ETV success rate, and operative complications were reported as frequencies and percentages. A chi-square test was applied to compare frequencies of ETV success between age groups.

RESULTS

Demographics and Patient Presentation

A total of 30 patients were included in this study of which 18 (60%) were male and 12 (40%) were females. The mean age in our study was 6.1 years ± 9 (mean ±SD). Thirteen patients each had an age between 6 months to 1 year and 1 to 10 years while four patients were older than 10 years. (Table 1) The mean duration of follow-up in our study was 9.3 months.

Posterior fossa tumor was the most common etiology in our series (46.6%) followed by aqueductal stenosis (23.3%), tectal tumors (13%), Cerebellopontine angle tumors (13%) and colloid cyst of the third ventricle (3%) (Table 2).

Outcomes

Overall 80 percent of our patients did not experience an ETV failure. Among age groups, 1- to 10-year-old patients had the highest success rate (84.6%). Although, the difference between age groups was not statistically significant (Table 3).

Complications

The overall complication rate in our study was 20%. Inadequate ventriculostomy in 6.6% of the patients was the commonest complication. In our study of 30 patients, no wound infection was observed (Table 4).

Table 1: Age-wise distribution (n = 30).

Age Group in Years	No. of Patients	Frequency
6 months to < 1 year	13	43.33%
1 yr to < 10 years	13	43.33%
> 10 years	4	13.33%

Table 2: Etiology of obstructive hydrocephalus (n = 30).

Etiology	No. of Patients	Frequency
Posterior fossa tumors	14	46%
Aqueductal stenosis	7	23%
Tectal tumors	4	13.3%
CP angle tumors	4	13.3%
Colloid cyst	1	3.3%

Table 3: Mean ETVSS and ETV Success rate by age group.

Groups	Age (mean ± SD)	Number of Patients	ETV Success Score (Mean ± SD)	Failed ETV Cases (%)	ETV Success Rate (%)	Pearson Chi-Square (P Value)
Group 1	6 Months to < 1 year (8.3 months ± 1.8)	13	65.3 ± 5.1	3 (23)	77%	0.855 (insignificant result)
Group 2	1 year to < 10 years	13	71.5 ± 8	2 (15)	85%	

	(64 months ± 35)				
Group 3	> 10 years	4	85 ± 5.7	1 (25)	75%
	(26 years ± 15)				
Overall	(6.1 years ± 9.9 years)	30	70.6 ± 9.0	6 (20)	80%

Table 4: Complications (n = 30).

Complications	No. of Patients	Frequency
Inadequate ventriculostomy	2	6.6%
Per op bleeding	1	3.3%
Seizure	1	3.3%
CSF leak	1	3.3%
Intracerebral hemorrhage	1	3.3%
Wound infection	0	0%

DISCUSSION

Endoscopic third ventriculostomy (ETV) has shown to be successful in 80 percent of our patients in the short to medium term. This trend is consistently demonstrated in literature for selected patients with obstructive hydrocephalus.^{12,13} It has also been proven to reduce morbidity and overall healthcare costs compared to VP shunt placement in a select group of patients.^{14, 15} This is especially true in the context of low-income countries, where shunt-related complications are a huge burden for already strained resources.¹⁶

We use ETV for the majority of obstructive hydrocephalus based on the ETV success score. Our series' most common etiology of obstructive hydrocephalus was posterior fossa tumors followed by aqueductal stenosis. Although there is some benefit to performing ETV in selected cases of infective etiology, those cases were excluded from the current study. Literature shows the same common indications throughout for ETV. In a series by Labidi et al, 35% of the patients operated on had aqueductal stenosis and 23% had non-tectal tumors.¹¹

ETV's success rate has been reported from 40 – 90 percent.^{15,17} This difference is explained mostly by the difference in the hydrocephalus's

etiology and the patient's age. Deopujari et al, described several clinical, radiological, and technical factors that influence outcomes Apart from ETVSS, the success rate is also directly influenced by the patient flow of the pediatric center, surgical technique, the sophistication of instruments, and individual differences in ventricular anatomy.¹² Other series showed radiological features like third ventricle floor bowing in preoperative imaging was associated with better ETV success rate.^{5,18} In our series the ETV had successful outcomes in 24 (80%) patients. Consequently, three patients had repeat ETV, 2 (6.6%) patients were subjected to VP shunt because ventriculostomy was not working while 1 (and 3.3%) patient underwent external ventricle drainage due to intraventricular bleeding. In our series, posterior fossa tumor was the most common etiology as opposed to aqueductal stenosis in the above-mentioned studies.

Various complications of the procedure have been reported including CSF leak, neurovascular injuries, endocrine abnormalities, and injury to neural structures.¹⁹ The most common complication in our series was inadequate ventriculostomy followed by bleeding, seizure, and CSF leak. The overall number of these complications was too small to derive any conclusions.

There are some limitations to our study. We only look at patients with high ETVSS who underwent ETV. As there is no comparison arm, it is not known how these patients will perform with a VP shunt. Another limitation of the study is the duration of follow-up. Long-term follow-up is required to assess the success of ETV. The effect on Quality of life needs to be assessed as it is the most important aspect of the intervention.

CONCLUSION

ETV is a successful procedure in a carefully selected group of patients with minimal morbidity. Patients with obstructive hydrocephalus and ETV success score of 60 to 90 are good candidates for this procedure with a high chance of ETV patency at 6 months.

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Additional Information

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Human Subjects: Consent was obtained by all patients/participants in this study.

Conflicts of Interest:

In compliance with the ICMJE uniform disclosure form, all authors declare the following:

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Sr.#	Author’s Full Name	Intellectual Contribution to Paper in Terms of:
1.	Muhammad Nawaz Khan	1. Study design and methodology.
2.	Farooq Azam	2. Paper writing.
3.	Muhammad Nawaz Khan and Majid Nawaz Khan	3. Data collection, literature review, and calculations.
4.	Farooq Azam	4. Analysis of data and interpretation of results.
5.	Muhammad Shaheer Akhtar	5. Literature review, editing, referencing, and quality ensure.