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Original Research Article

Short Term Surgical Outcome of Endoscopic Third Ventriculostomy in Patients with Hydrocephalus

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Abstract: ***Introduction***: Endoscopic third ventriculostomy (ETV) serves as a notable alternative to cerebrospinal fluid shunting in the treatment of juvenile hydrocephalus. It entails employing endoscopy to induce an internal cerebrospinal fluid diversion via the third ventricle's floor. The Endoscopic Third Ventriculostomy Success Score (ETVSS) has demonstrated superior accuracy and reliability as a preoperative tool for forecasting ETV outcomes. In order to maximize the benefits of the surgery despite its moderate failure rate, we want to assess ETV success in patients with high ETV success scores over a 6-month period and develop precise selection criteria for individuals with hydrocephalus. ***Methodology***: Total 93 patients with hydrocephalous, age between 6 months to 15 years of both genders were included. Patients with hydrocephalus having previous ETV failure cases, suffering from hydrocephalus who are unconscious and brain dead and who underwent choroid plexus cauterization in addition to ETV and those who received hydrocephalus treatment using methods other than ETV were not included. The expected ETVSS was recorded for every patient, and the chart was utilized to calculate the Endoscopic Third Ventriculostomy Success Score. At least one MRI after surgery demonstrating a patent ETV by a flow void signal across the third ventricle's floor was part of the minimum follow-up time, which was three months. For every age group, success rate was determined. ***Results***: Mean age was 5.43 ± 2.87 years. The majority of the 65 patients (69.90%) were in the age range of 6 months to 8 years. With a male to female ratio of 1.3:1, 61 (65.60%) of the 93 patients were males and 32 (34.40%) were females. The average gestational age was 38.49 ± 1.34 weeks. The average ETVSS was 63.41 ± 9.78. In our study, frequency of ETVSS predicted success rate in patients of hydrocephalous undergoing ETV was found in 60 (65.50%) patients (figure I) with 74.0% success in ETVSS ≥40 and 53.49% in ETVSS <40. ***Conclusion***: According to our research, ETV has a 65.50% success rate and is a successful surgical treatment for hydrocephalus. We recommend that more research be done using VP shunts as the second treatment group and that a longer follow-up period be used.

Keywords: Endoscopic third ventriculostomy, hydrocephalous, success.

INTRODUCTION

Hydrocephalus is characterized by an excessive amount of high pressure cerebro-spinal fluid in the brain's ventricles. Brain atrophy, increased intracranial pressure, headaches, blurred vision, and even death are among the neurological symptoms linked to hydrocephalus.[1] Up to 1.5 percent of diseases are caused by this extremely frequent organism globally. This is difficult because neurosurgeons have faced management challenges throughout the history of medicine.[2] Hydrocephalus is typically treated via extracranial or intracranial CSF diversion. CSF diversion intracranially through the implantation of various shunts has historically been used to treat hydrocephalus. However, all of these systems are linked to issues like infection, obstruction, repeated revisions, unpredictable cognitive results, and dysfunction. Finding alternatives was therefore a constant struggle.[3,4]

Endoscopic third ventriculostomy (ETV) serves as a notable alternative to cerebrospinal fluid shunting in the treatment of juvenile hydrocephalus. It entails employing endoscopy to induce an internal cerebrospinal fluid diversion via the third ventricle's floor. The Endoscopic Third Ventriculostomy Success Score (ETVSS) has demonstrated superior accuracy and reliability as a preoperative tool for forecasting ETV outcomes.[5] Kulkarni et al. assert that the predominant criterion for patient selection was the ETVSS (Endoscopic Third Ventriculostomy Success Score). Scores varied from 0 to 90, depending on the patient's age, the reason for the shunt, and the fact that the shunt had already been put in.[6] Younger patients, especially those under three months, have lower success rates predicted by the ETVSS, which has made it cautious to offer ETV to this age range. Success rates for newborns under three months old can be as low as 40 to 50%, according to Kulkarni's ETVSS, which stands in stark contrast to the increased success rates seen in older children.[7]

A successful ETV lowers many of the long-term issues associated with cerebrospinal fluid shunting and guarantees a long-lasting and straightforward course of treatment. In underdeveloped nations, where the financial burden of the cerebrospinal fluid shunt itself may be too high for many families and problems like shunt infection are less likely to be treated promptly, this is an especially alluring option.[7] ETV is performed while the path is directly visualized. In addition to being device-free, this result makes ETV a secure substitute to prevent long-term problems associated with VPS. However, 30% of patients will not react to ETV, which could lead to early failure and necessitate a CSF shunt as a second treatment. While the ETVSS projected a success rate of 60% for the total patient cohort, the overall success rate (SR) in one research was 82% across all age categories.[8] ETV was successful in 63.8% (n = 44) of the sixty-nine ETV instances that were gathered for this investigation from another study.[9] At the 12-month mark, their ETV stomas were still patent. Notably, within 30 days following the procedure, 24.6% (n = 17) of ETV failures happened. ETV success and ETVSS have a strong correlation in this series.[9] ETV success showed a strong correlation with ETVSS in another series (score 0 = < 1 month (100%), 1–6 months (66.0%), 6 months to < 1 year (71.0%), 1 year to < 10 years (100.0%), and > 10 years (94.0%). Multivariate regression study revealed ETVSS to be a favorable predictor of success in a thorough statistical analysis (coefficient 0.0707, p = 0.04).[8]

In order to maximize the benefits of the surgery despite its moderate failure rate, we want to assess ETV success in patients with high ETV success scores over a 6-month period and develop precise selection criteria for individuals with hydrocephalus. Being the biggest neurosurgery facility in the city, we frequently do VP shunts for all forms of hydrocephalus. We aim to evaluate the short-term success rate with respect to ETV in persons with moderate to high ETVSS in our sample cohort because of the problems associated with VP shunts. In addition to lowering VP shunt problems, this will aid in improving patient selection for ETV and proving the efficacy of ETVSS in our community.

METHODOLOGY:

The Department of Neurosurgery, PIMS, Islamabad conducted this longitudinal study between July 2025 to December of 2025. After being approved by the institutional ethical review committee, 93 patients who satisfied the inclusion criteria were selected via non-probability sequential sampling. The informed consent of each patient will be sought. A sample size of 93 cases is determined using the WHO calculator for single percentage, with a 95% confidence interval, 10% absolute precision, and a 60% ETVSS predicted success rate.[8] All patients with hydrocephalous (all of the following are present: The swelling of the optic disc caused by increased intracranial pressure (>15 mmHg) during ophthalmoscopy is known as papilledema. Inability to look up: As determined by a clinical examination, pressure on the tectal plate via the suprapineal recess As determined by a clinical examination, unilateral or bilateral sixth nerve palsy is defined as the incapacity of an eye to turn outward and Radiography of the skull: To identify "beaten copper cranium" (or "beaten silver cranium"), or sella turcica erosion), age between 6 months to 15 years of both genders were included. Patients with hydrocephalus having previous ETV failure cases, suffering from hydrocephalus who are unconscious and brain dead and who underwent choroid plexus cauterization in addition to ETV and those who received hydrocephalus treatment using methods other than ETV were not included.

Documentation included the gestational age at birth, the age at surgery, the etiology of hydrocephalus, the occipitofrontal circumference measured at presentation using the glabella and occiput as reference points, and the history of prior shunting. The expected ETVSS (total score was 0-80 and was calculated according to Kulkarni's ETVSS) was recorded for every patient, and the chart was utilized to calculate the Endoscopic Third Ventriculostomy Success Score. A consultant neurosurgeon with at least three years of post-fellowship experience performed the operation on all patients. At least one MRI after surgery demonstrating a patent ETV by a flow void signal across the third ventricle's floor was part of the minimum follow-up time, which was three months. For every age group, success rates (Remission of symptoms and no need for Ventriculoperitoneal (VP) Shunt after 6 months of surgery) was determined. A pre-made proforma was used to record all of this information, including the demographic data.

SPSS version 25.0 was used for statistical analysis. For age, gestational age, and ETVSS, the mean ± SD were computed. Gender, hydrocephalous type, etiology, prior treatment (yes/no), ETVSS category, and success (yes/no) were all considered when calculating frequency and percentage. The chi square test was used to compare the success rate of hydrocephalous patients undergoing ETV based on ETVSS, and a p-value of less than 0.05 was considered significant. Using stratifications, effect modifiers such as age, gestational age, gender, hydrocephalous type, etiology, and prior treatment status (yes/no) were managed. To determine their impact on the success rate, the post-stratification chi square test was used, and a p value of less than 0.05 was deemed significant.

RESULTS:

Mean age was 5.43 ± 2.87 years. The majority of the 65 patients (69.90%) were in the age range of 6 months to 8 years. With a male to female ratio of 1.3:1, 61 (65.60%) of the 93 patients were males and 32 (34.40%) were females. Table I displays the distribution of the various variables. The average gestational age was 38.49 ± 1.34 weeks. The average ETVSS was 63.41 ± 9.78. Table II displays descriptive statistics for several factors.

In our study, frequency of ETVSS predicted success rate in patients of hydrocephalous undergoing ETV was found in 60 (65.50%) patients (figure I) with 74.0% success in ETVSS ≥40 and 53.49% in ETVSS <40 (Table III). Stratification of success with respect to effect modifiers is shown in Table IV.

Table I Distribution of different variables (n=93)

Confounding variables		Frequency	%age
Age (years)	6 months to 8	65	69.90
	9-15	28	30.10
Gender	Male	61	65.60
	Female	32	34.40
Gestational age (weeks)	<37	15	16.10
	≥37	78	83.90
Type of hydrocephalous	Communicating	58	62.40
	Non-communicating	35	37.60
Etiology	Infectious	50	53.80
	Non-infectious	43	46.20
Previous treatment	Yes	38	40.90
	No	55	59.10
ETVSS	≥40	50	53.80
	<40	43	46.20

Table-II: Descriptive statistics.

	Mean ± SD
Age (years)	5.43 ± 2.87
Gestational age (weeks)	38.49 ± 1.34
ETVSS	63.41 ± 9.78

Figure I: Frequency of ETVSS predicted success rate in patients of hydrocephalous undergoing ETV (n=93).

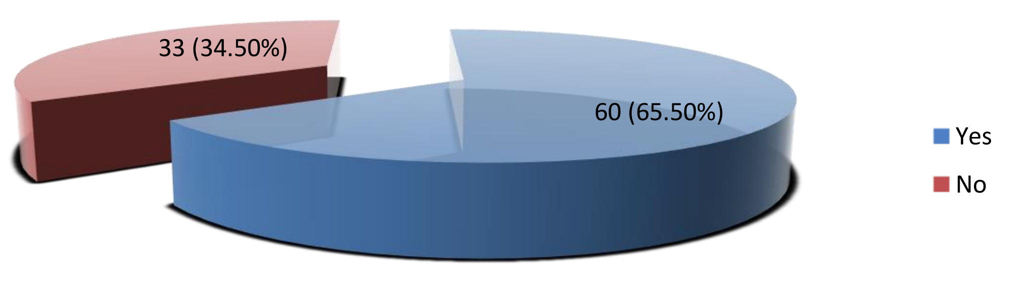

Table III: Comparison of the success rate among patients of hydrocephalous undergoing ETV based on ETVSS.

		Yes (n=60)	No (n=33)	P-value
ETVSS	≥40	37 (74.0%)	13 (26.0%)	**0.039**

	<40	23 (53.49%)	20 (46.51%)	

Table IV: Stratification of success with respect to effect modifiers.

		Yes (n=60)	No (n=33)	P-value
Age (years)	6 months to 8	42 (64.62%)	23 (35.38%)	**0.976**
	9-15	18 (64.29%)	10 (35.71%)	
Gender	Male	40 (65.57%)	21 (34.43%)	**0.769**
	Female	20 (62.50%)	12 (37.50%)	
Gestational age (weeks)	<37	10 (66.67%)	05 (33.33%)	**0.849**
	≥37	50 (64.10%)	28 (35.90%)	
Type of hydrocephalous	Communicating	38 (65.52%)	20 (34.48%)	**0.795**
	Non-communicating	22 (62.86%)	13 (37.14%)	
Etiology	Infectious	36 (72.0%)	14 (28.0%)	**0.104**
	Non-infectious	24 (55.81%)	19 (44.19%)	
Previous treatment	Yes	22 (57.89%)	16 (42.11%)	**0.267**
	No	38 (69.09%)	17 (30.91%)	

DISCUSSION:

This study examined endoscopic third ventriculostomy (ETV) as a therapeutic option for obstructive hydrocephalus and found that the severity of hydrocephalus significantly improved after surgery.[10] The data showed that ETV may be able to lessen the symptoms of obstructive hydrocephalus, as demonstrated by the significant change in patients' classifications from severe to mild.[11] This result is consistent with the larger story in the neurosurgical literature, which highlights the value of ETV as a less invasive option than shunt installation, mainly because it lessens reliance on implanted devices.[12]

The population in this study was 5.43 ± 2.87 years old on average. Six months to eight years old accounted for the bulk of the 65 patients (69.90%). Of the 93 patients, 61 (65.60%) were men and 32 (34.40%) were women, with a male to female ratio of 1.3:1. The mean age of the 20 male and 23 female patients in a study by Konar S et al.[13] was 9.6 years. The mean age of the pediatric patients in El-Ghandour's RCT was 6.5 ± 2.7 years, whereas the ETV and VPS groups had mean ages of 7.2 ± 2.6 years. The study's male-to-female ratio was 1.3:1. In their systematic review and meta-analysis, Dewan et al.[14] discovered that hydrocephalus was more prevalent in male children than in female children. According to Eguiluz-Melendez et al.[15], their study population consisted of 56.37% females and 43.6% males.

Most of the research have not addressed the clinical profile and symptomatology of the patients. In their RCT, ElGhandour et al.[16] reported that headaches were the most prevalent symptom. Twenty individuals with larger heads and protruding fontanelles were included in the investigation by Rahman et al.[17] According to Konar et al.'s study[13], headache was the most prevalent symptom, followed by visual problems and vomiting.

In our study, 60 (65.50%) hydrocephalous patients receiving ETV had an ETVSS predicted success rate of 74.0% in ETVSS ≥40 and 53.49% in ETVSS <40. Of the 69 ETV cases collected for this study from another study, eight ETV was successful in 63.8%.[9] Their ETV stomas were still patent at the 12-month mark. Interestingly, 24.6% of ETV failures occurred within 30 days after the surgery. In this series, there is a high association between ETV success and ETVSS.[9] In the short to medium term, our study shows that ETV has a success rate of 65.50%, which is in line with other studies on particular patients with obstructive hydrocephalus.[18,19] According to numerous research, ETV's success rate ranges from 60% to 91.5%. At the conclusion of follow-up, Sainte-Rose et al.[20] have a 94% success rate. The ETV group's success rates were 74%, 86%, and 75%, according to Konar et al[23], Mohanty et al[21], and Dewan et al.[14] In their RCT on newborns, Rahman et al.[18] found that the ETV and VPS groups had failure rates of 20% and 40%, respectively. The study conducted by Frisoli et al.[22] had a failure rate of sixteen percent. Success rates for the ETV and VPS groups were 76.19% and 100%, respectively, according to Eguiluz-Melendez et al.[15] For the ETV and VPS groups, Konar et al[13] reported success rates of 81.8% and 42.2%, respectively. Our results aligned with these investigations. The variations in follow-up periods across different research can be the cause of the disparity in ETV success rates. It is clear that ETV is helpful in reducing disease and total healthcare costs, particularly in economically challenged nations where shunts are a problem. The ETV success score indicates that ETV is the recommended course of treatment for obstructive hydrocephalus.

A higher ETVSS is correlated with a higher ETV success rate. The study's mean ETVSS was 63.41 ± 9.78. The research ETV group of Kulkarni et al.[23] had a mean ETVSS of 71 ± 16. In their RCT, which included newborns, Navaei et al.'s mean ETVSS was 49.04 ± 14.70.[24] The ETVSS was not incorporated into the procedure of the majority of earlier research in order to validate the success rate and score itself. In another study, ETV success demonstrated a good link with ETVSS (score 0 = < 1 month (100%), 1–6 months (66.0%), 6 months to < 1 year (71.0%), 1 year to < 10 years (100.0%), and > 10 years (94.0%). ETVSS was found to be a positive predictor of success in a comprehensive statistical analysis using a multivariate regression research (coefficient 0.0707, $p = 0.04$).[8]

Changes in ventricular structure as well as clinical, radiological, and technical factors affect the success of ETV.[20,25] Age groups did not significantly correlate with the successful outcome, according to our research. A study indicated a greater success rate of ETV in patients aged 1 to 10 years, with a higher percentage of successful outcomes in male subjects compared to female subjects.[18] However, no correlation between gender and successful outcome was established; nonetheless, a higher percentage of successful outcomes in the male gender was noted. Complications from ETV include brain structural deterioration, endocrine abnormalities, neurovascular injury, and CSF leakage. Inadequate ventriculostomy, bleeding, and CSF leak were the most common problems in our series. Nevertheless, the frequency of these issues was insufficient to draw firm conclusions. Although ETV successfully tackles the structural issues of hydrocephalus, its impact on the range of comorbid diseases is still unclear, according to the nuanced analysis.[26] The statistical analysis indicates that the benefits of ETV are mainly morphological, with limited impact on systemic health issues that frequently accompany hydrocephalus, as seen by the static character of comorbidities post-ETV.[27] This distinction is critical for the all-encompassing care of patients, emphasizing the need for integrated care strategies that meet this population's neurosurgical as well as general health needs.[28]

The study's rigorous approach to assessing ETV outcomes, which uses reliable statistical metrics to gauge the intervention's efficacy, is one of its key strengths.[29] However, the limitations of the study's scope are shown by examining the status of comorbid conditions after ETV.[30] The necessity for more research that takes into account the many effects of ETV is highlighted by the complexity of comorbidities in patients with hydrocephalus, which calls for a holistic investigation that goes beyond the scope of this study.[31]

Studies like this add empirical information to support therapeutic decision-making and deepen the discussion of ETV in the treatment of obstructive hydrocephalus.[32] However, the controversy continued, especially when it came to the long-term results of ETV in comparison to conventional shunt systems and the procedure's suitability for a variety of patient populations. Within the neurosurgical community, a lively discussion regarding optimizing treatment paths for obstructive hydrocephalus was fueled by the complexities of patient selection criteria, procedural success rates, and the subtleties of postoperative care.[33]

CONCLUSION

According to our research, ETV has a 65.50% success rate and is a successful surgical treatment for hydrocephalus. We recommend that more research be done using VP shunts as the second treatment group and that a longer follow-up period be used.

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