

Evaluation of Surgical Outcomes of Endoscopic Third Ventriculostomy

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Abstract: Background: Endoscopic third ventriculostomy (ETV) is an accepted and practiced surgical procedure used to manage hydrocephalus caused by obstruction. The endoscopic third ventriculostomy has minimized mortality and morbidity. **Objective:** The purpose of this article is to evaluate the surgical results of 90 patients who underwent endoscopic third ventriculostomy. **Methodology:** A study was conducted at the Department of Neurosurgery in different hospitals in Iraq, hospitals between May 2023 and May 2024 to last for 1 year. The 90 cases included in the study presented obstructive hydrocephalus with obstruction at or distal to the third ventricle in these patients. Endoscopic third ventriculostomy – ETVC was performed in all cases, and the patient's age ranged from 1 to 25 years. All cases were included, evaluated, pre-operatively and post-operatively, and followed in this study. **Results:** A total of 90 patients were enrolled in this study. Operative time of ETV was 186.58 ± 25.92 , anesthesia used was general, postoperative hospital stay was 2-3 days, mortality was 2 cases, stomal malformation was 14 cases, CSF leakage was 2 cases, infection was 3 cases, fontanelle improvement was 78 cases, procedural success was 90%, emotional functioning was 86.63 ± 7.10 , psychological functioning was 82.91 ± 3.77 . **CONCLUSION:** Our current study shows that endoscopic third ventriculostomy is considered the most efficient and effective surgical procedure to cure all patients with obstructive hydrocephalus.

Keywords: Endoscopic third ventriculostomy (EVT); Obstructive hydrocephalus; Complications; AND Quality–Life Questionnaire.

INTRODUCTION

One of the disorders commonly seen at a center that requires surgery is obstructive hydrocephalus [Kulkarni, A. V. *et al.*, 2018; Santos, M. M. *et al.*, 2017; Malheiros, J. A. *et al.*, 2010; Wright, Z. *et al.*, 2016]. Endoscopic third ventriculostomy (ETV) is the treatment of it. Following VPS surgery, there are a lot of problems [Kandasamy, J. *et al.*, 2011]. Numerous world-renowned teams have provided detailed descriptions of the endoscopic third ventriculostomy (EVT) surgical technique. However, it is widely recognized that better outcomes are obtained when intra- and peri-operative treatment is systematized. [Punchak, M. *et al.*, 2019; Lane, J. R. *et al.*, 2021; Page, M. J. *et al.*, 2021; Kulkarni, A. V. *et al.*, 2016; Kestle, J. R. W. *et al.*, 2003]

In certain populations, ETV is currently considered a safe and successful treatment for obstructive hydrocephalus [Kulkarni, A. V. *et al.*, 2017]. Infection, slit ventricle syndrome, and mechanical failure are only a few of the risks and effects associated with ETV, despite its many conceivable advantages [Schiff, S. J. *et al.*, 2021; Haq, N. U. *et al.*, 2022; Higgins, J. P. *et al.*, 2019]. CT or MRI scans that show an obstructive type of hydrocephalus linked to certain anatomical defects located below or around the lower posterior third ventricle, where ventricles cannot interact with one another, are the primary reason that ETV is necessary as a surgical procedure. [LaZerte, S, 2023; Jesuyajolu, D. A. *et al.*, 2022]

Patients with aqueductal stenosis-induced hydrocephalus are often candidates for ETV. ETV removes all of these issues. ETV has been shown in several trials to have fewer issues, be more cost-effective, and result in shorter hospital stays. [Khan, S. M. S. *et al.*, 2021; Idowu, O. E. *et al.*, 2009; Durnford, A. J. *et al.*, 2011; Grunert, P. *et al.*, 2003]

METHODOLOGY

This deployment was planned as a cross-sectional that took place in the Department of Neurosurgery at a hospital in different hospitals in Iraq between the months of May 2023 and May 2024, to take a period of 1 year. In confirming cases of hydrocephalus, MRI or CT scans were utilized. The study population consisted only of patients aged 1 to 25 years, inclusive suffering from obstructive hydrocephalus with the site of obstruction at or below the level of the third ventricle.

This study excluded those suffering from a communicative type of hydrocephalus and those previously treated with a ventriculoperitoneal shunt, patients with abnormal imaging results of ventricular anatomy, severe systemic diseases, or comorbid conditions like diabetes mellitus or hypertension, patients younger than 1 year of age, or those who had post-meningitis hydrocephalus.

Each of the 90 patients had a third ventriculostomy performed endoscopically. The ETV device was a

rigid endoscope. The results that transpired within a month after the surgical procedures are referred to as early surgical outcomes. Upon admission, the patient or their attendants provided a comprehensive medical history. Measurements of head circumferences, fontanelle condition, emesis episodes, and postoperative head circumference measurements, fontanelle changes, emesis episodes, postoperative complications, infection, shunt blockage, ETV failure, and mortality were carefully recorded.

In this study, the outcomes collected after the surgery include fontanelle, head size, vomiting, infection, any fever without causes persisting,

failure of the procedure, and death. The postoperative follow up period lasted for a period of thirty days. Daily clinical notes regarding infected patients were kept and examined. A temperature chart was kept on a daily basis. If there was an elevated temperature, a full blood count was performed.

The SPSS-22.0 Windows program was used for analysis in order to acquire statistical data. A 95% confidence interval was employed, and the analysis's threshold for statistical significance was established at $P < 0.05$.

RESULTS

Table 1: Enroll of patients' characteristics who underwent endoscopic third ventriculostomy.

Characteristics	No. of participants, [90]	Percentage, [%]
Age		
1 – 5	41	45.56%
6 – 10	23	25.56%
11 – 15	10	11.11%
16 – 20	9	10.0%
21 – 25	7	7.78%
Gender		
Male	56	62.22%
Female	34	37.78%
Comorbidity		
Yes	78	86.67%
No	12	13.33%
Diabetes Type II	7	7.78%
Hypertension	3	3.33%
Asthma	2	2.22%
BMI, Kg/m ²		
Underweight	9	10.0%
Normal weight	56	62.22%
Overweight	20	22.22%
Obese	5	5.56%

Table 2: Distribution of symptoms on patients who are treated by ETV

Symptoms	No. of participants, [90]	Percentage, [%]
Severe headaches	76	84.44%
Nausea	55	61.11%
Vomiting	34	37.78%
Blurred	15	16.67%
Difficulty walking	18	20.0%
Changes in mental status	47	52.22%
Urinary incontinence	66	73.33%

Table 3: Distribution of Etiology of hydrocephalus on patients who are treated by ETV

Etiology	No. of participants, [90]	Percentage, [%]
Congenital aqueductal stenosis	27	30.0%
Overproduction of CSF	14	15.56%
Tumor-related	18	20.0%
Improper Absorption	12	13.33%
Bleeding into the brain	19	21.11%

Table 4: Surgical outcomes of ETV

Variables	No. of cases, 90	Percentage
Operative time, min, (mean \pm Sd)	186.58 \pm 25.92	
Anesthesia used	General anesthesia	
Blood loss, mL, (mean \pm Sd)	683.87 \pm 45.38	
No patients with transfusion, N (%)		
Yes	16	17.78%
No	74	82.22%
Postoperative hospital period, days	2 – 3 days	
Mortality rate		
Yes	2	2.22%
No	88	97.78%
Postoperative pain (mean \pm Sd)		
1 st day	4.21 \pm 0.14	
2 nd day	2.65 \pm 0.081	
3 rd day	1.01 \pm 0.002	
Postoperative complications		
Yes	68	75.56%
No	22	24.44%
Stomal malformation	14	15.56%
Infection	3	3.33%
Pseudo meningocele	0	0.0%
CSF leakage	2	2.22%
Subdural hematoma	2	2.22%
Extradural hematoma	1	1.11%
Over drainage	0	0.0%

Table 5: Fontanelle's findings

Variables	No. of cases, 90	Percentage
Fontanelle improved	78	86.67%
Preoperative vomiting	74	82.22%
Postoperative vomiting	6	6.67%
Procedure failure	9	10.0%
Procedure success	81	90.0%

Table 6: Assessment of general health-related quality of life in post-operative (ETV)

Items	HRQOL Scores
Physical functioning	78.11 \pm 6.51
Psychological functioning	82.91 \pm 3.77
Emotional functioning	86.63 \pm 7.10
Social functioning	81.17 \pm 5.40
Daily activity	76.89 \pm 4.80

DISCUSSION

In the current study, there were 90 participants enrolled. As per the American study, there seems to be a higher rate of ETV failure among children aged 2-5 months. It is debatable, but patients younger than six months have also not done very well with ETV and procedures for this age group are not widely recommended by several authors. [Buxton, N. *et al.*, 2018; Feng, H. *et al.*, 2004; Drake, J. M. *et al.*, 2006; Lindsay, K. W. *et al.*, 2004]

Bleeding during surgery was observed in 16 patients (17.78%), and there were two instances (2.22%) of cerebrospinal fluid (CSF) leaks. In the current study work on group ETV, CSF leak complication was observed in 2 patients (2.22%) while pseudo meningocele was not seen in any patients, foetal glue stoma failure was observed in 14 (15.56%) patients, and infections were noted in 3 patients.

According to [Di Rocco, C. *et al.*, 2006] Dutch research, there is a lower proportion of ETV

(6.2%), which is treated as a failure. In this respect, concerning treatment failure, nine patients had ETV failure 10% of the time in the previous analysis. A 5-year follow-up study from Spain [El-Ghandour, N. M. *et al.*, 2010] indicated a 26% failure rate of ETV. Also, there was no mortality due to ETV. In this study, early surgical outcomes following ETV and a follow-up period of 3 months after the procedure were addressed. 81 (90%) patients exhibited clinical improvement following the ETV procedure.

Twenty patients with bulging, tense, and pulsating fontanelles, head hypertrophy, and vomiting symptoms were included in the current study. The clinical outcomes of this surgery were good. Clinical improvement, however, was observed far more quickly for the case of ETV surgery. Fontanel alterations, vomiting, operation failure, and death were examined in early postoperative follow-up data. [Teo, C. *et al.*, 2018; Buxton, N. *et al.*, 2001; Koch-Wiewrodt, D. *et al.*, 2006; Rezaee, O. *et al.*, 2007]

Following ETV, remarkable modifications in the fontanelle region and cessation of vomiting were observed. In the ETV group, there was a 10% rate of procedure failure, and two fatalities were recorded among ETV patients. Thus, this particular study focuses on one early postoperative outcome following ETV, which is in favor of obstructive hydrocephalus patients.

CONCLUSION

The surgical results demonstrated that endoscopic third ventriculostomy is an optimal surgical procedure, exhibiting a low complication rate, excellent efficacy, high recovery rate, and a brief hospital stay.

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