ORIGINAL RESEARCH PAPER
Volume - 13 | Issue - 11 | November - 2024 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

ENDOSCOPIC THIRD VENTRICULOSTOMY IN CASES OF HYDROCEPHALUS: AN INSTITUTIONAL EXPERIENCE – A RETROSPECTIVE CASE SERIES

Neurosurgery

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ABSTRACT

Introduction: Endoscopic third ventriculostomy (ETV) for treating obstructive hydrocephalus is a relatively new concept amongst neurosurgeons of the developing world. With the recent advances in optical and mechanical instrumentation, endoscopic ETV has emerged as the procedure of choice for treating hydrocephalus in selected patients. **Objective:** To study the role of ETV in the therapeutic management of hydrocephalus in a tertiary care centre. **Method:** The present study was conducted at the Institute of Neurosurgery at Madras Medical College, Chennai. ETV was performed as a therapeutic procedure in 29 patients diagnosed with hydrocephalus and required surgical intervention and admitted from January 2023 to December 2023. ETV success was defined by resolution or clinical improvement on follow-up on the 10th day, 3 months and 6 months. ETV failure was considered in patients whose symptoms either deteriorated or did not improve from the baseline and required a ventriculoperitoneal shunt. **Results:** The mean age was 17.67 years. There were 51.4% (15/29) males and 48.5% (14/29) females in this study. Out of 29 patients, 17 of them had congenital hydrocephalus followed by post meningitis hydrocephalus in about 6 patients. Overall, ETV was successful in 27 (93.1%) of patients. ETV failure was observed in 2 (6.8%) patients. One was a post-traumatic case and the other one who underwent ETV for post meningitis sequelae. There was no mortality. **Conclusion:** ETV is a very effective treatment modality with fewer complications for treating obstructive hydrocephalus in well-selected patients and can be successfully practised by neurosurgeons in developing countries.

KEYWORDS

Endoscopic third ventriculostomy, Obstructive hydrocephalus

INTRODUCTION:

Hydrocephalus is an accumulation of cerebrospinal fluid (CSF), which leads to an increase in intracranial pressure. Hydrocephalus affects patients of all ages, resulting from a multitude of causes. It can be either the non-communicating type or the communicating type. Based on the aetiology, it can be further described as posthemorrhagic, postinfectious, posttraumatic, tumour-related mass effect and normal pressure hydrocephalus.(1)

Acute hydrocephalus without prompt treatment can result in brain herniation and death. Pharmacotherapies for the treatment of hydrocephalus have resulted in poor outcomes for patients potentially due to the lack of understanding of the cellular and molecular mechanisms that contribute to the development of hydrocephalus. Surgical interventions with a ventricular shunt placement were the procedure of choice earlier. Though there were many complications post-procedure, it was a life-saving option.(2)

Endoscopic third ventriculostomy (ETV) and choroid plexus cauterization are other possible options in suitable forms of hydrocephalus. ETV has been recommended as the choice of treatment for obstructive hydrocephalus in recent years. (3) With the recent advances in optical and mechanical instrumentation and the availability of better neuro endoscopes, ETV has become more safe and procedure of choice. The immediate success of this procedure can be determined by clinical improvement and the absence of a need for a further surgical procedure, there are several concerns in assessing the long-term outcome.(4) Therefore, in this study, we report experiences, patient selection, success rates, and complications of ETV in patients treated in our tertiary care centre over one year.

AIM:

To study the role of ETV in the therapeutic management of hydrocephalus in a tertiary care centre.

METHODS:

The present study was conducted at the Institute of Neurosurgery at Madras Medical College, Chennai. ETV was performed as a therapeutic procedure in patients admitted from January 2023 to December 2023 who were diagnosed with hydrocephalus and required surgical intervention. All patients admitted to our institution with a diagnosis of hydrocephalus and an indication of ETV were included in the study. Informed consent was taken from each patient to participate in this study and ethical approval was taken from the hospital's ethical committee.

Before the start of the study, a detailed history, physical examination, baseline investigations, and computed tomography (CT) scan were done for all patients. The study excluded patients with Glasgow Coma Scale (GCS) less than 15, normal pressure hydrocephalus, hydrocephalus due to subarachnoid haemorrhage and clinical signs suggestive of meningitis. ETV success was defined by resolution or improvement in clinical symptoms and ETV failure was considered in patients whose symptoms either deteriorated or did not improve from the baseline and required further surgical interventions.

ETV was done on all patients admitted with hydrocephalus after considering the exclusion criteria. ETV is performed in supine position with the head flexed so that the burr hole site is at the highest point. A Burr hole was made on the right Kocher's point. A 0-degree endoscope (diameter 4 mm) was then passed through the Foramen of Monro. Peel-away sheath with a diameter, just slightly larger than the endoscope was used. This enables an easy insertion of the endoscope into the ventricle without repeated trauma to the cerebral cortex and ependymal vessels. The peel-away sheath also facilitates copious irrigation in case of haemorrhage.

Foramen of Monro can be identified by the confluence of the thalamostriate vein, septal vein and choroid plexuses. Perforation in the third ventricle floor was made after negotiating the endoscope through the foramen of Monro. A Fogarty catheter was used to bluntly fenestrate the floor of the third ventricle (between mammillary bodies and infundibular recess at the pre-mammillary membrane). The basilar artery was identified to avoid injury and bleeding during the procedure. CSF flow causing pulsatile movement at the site of the stoma in the floor of the third ventricle indicated proper fenestration. Intraoperative bleeding was managed with warm fluid irrigation until all bleeding was visibly stopped and the ventricular CSF was clear. An external ventricular drain was kept if there was any oozing of blood. Any bleeding, from the cortical surface, if seen while the endoscope is removed, was cauterized.

Postoperative management was done as per the individual case requirement and patients were discharged when clinically stable. The outcome was assessed on the 10th day after the procedure and at 3 months and 6 months. ETV was considered successful if resolution or improvement in clinical symptoms such as headache and vomiting occurred. ETV was considered a failure in patients who reported no improvement and/or further deterioration in symptoms and required subsequent VP shunt.

Statistical Analysis:

The data was analysed using IBM SPSS statistics for Windows version 20 and MS Excel. For descriptive analysis, the data is presented as

means ± SD for continuous variables and as proportions for categorical variables.

RESULTS:

Out of 162 patients admitted with hydrocephalus, 29 patients underwent ETV after considering the exclusion criteria. The mean age of the study participants was 17.67 years. The minimum age in the study was 6 months and the maximum age was 48 years. There were 51.4% (15/29) males and 48.5% (14/29) females in this study.

The distribution of study participants based on the aetiology is shown in Table 1. In the present study, the cause of hydrocephalus was Congenital hydrocephalus in 58.6% (17/29), post meningitis hydrocephalus in 20.9 % (6/29), Lipo Myelomeningocele in 10.3 % (3/29), post-traumatic hydrocephalus in 6.8 % (2/29) and Posterior fossa tumor in 3.4% (1/29) cases.

Table 1: Distribution Of Study Participants Based On The Aetiology Of Hydrocephalus (n=29)

Cause of hydrocephalus	Number of patients (n)	Percentage (%)
Congenital hydrocephalus	17	58.6
Post meningitis hydrocephalus	6	20.9
Lipo Myelomeningocele	3	10.3
Post traumatic hydrocephalus	2	6.8
Posterior fossa tumor	1	3.4

In the present study, on follow-up, ETV was found to be successful in 93.1 % (27/29) of cases. ETV failure was documented in 2 patients (6.8 %) who then underwent a ventriculoperitoneal insertion procedure for hydrocephalus. One was a post-traumatic case and the other one who underwent ETV for post meningitis sequelae as shown in figure 2. Intraoperative bleeding occurred in one case which was controlled by abundant warm irrigation and the procedure was not aborted. In the present study, the mortality rate was nil. The summary of presenting characteristics, outcomes and complications of the present study is shown in Table 3.

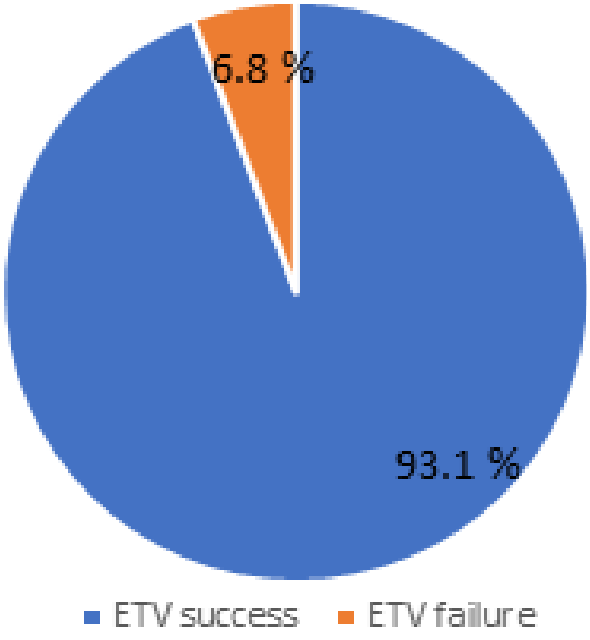
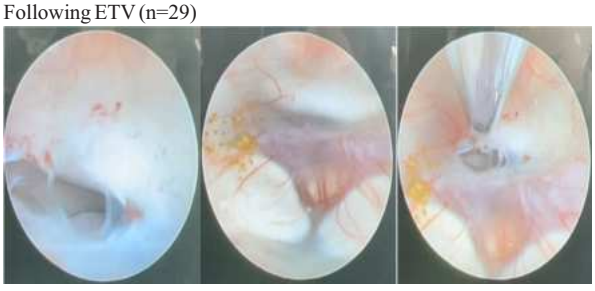


Figure 1: Pie Diagram Showing The Success And Failure Rates Following ETV (n=29)



Images Showing Liliequiest Membrane Fenestration

Table 2: Summary Of Presenting Characteristics, Outcomes And Complications Of The Procedure (n=29)

Characteristics		Number (%)
Gender	Male	15 (51.4)
	Female	14 (48.5)
Outcome	Successful	27 (93.1)
	Failure	2 (6.8)
Intra operative complications		1 (3.4)

DISCUSSION

Management of hydrocephalus has evolved from complicated invasive ventricular procedures to less invasive procedures like ventricular shunt surgery and endoscopic third ventriculostomy. Various studies have proven that ETV is superior compared to standard shunt surgery for both obstructive and communicating hydrocephalus. Hence the present study aimed at sharing our institutional experience by following up on 35 patients who underwent ETV procedures from January 2023 to December 2023.

Various studies conducted to date reported a wide range of success rates for ETV ranging from 60 to 91.5%.(1) (5) (6) (7) Our study has reported a success rate of 94.3%. The overall failure rate in our study was 2(6.8 %). It was relatively low compared to the study done by Sohail Amir et al., and Prarthana Saxena et al., across centres in India. They have reported failure rates of 22(25.8%) and 21(24.7%) respectively. (5) (1) However, a study done in Madhya Pradesh reported a 100% success rate in the 0-1 year age and 80% in the 1-2 years age groups. Only 2 patients required re-operation in the form of VP shunt. (8) A 20-year retrospective analysis done by Igor Vilela Faquini et al., reported that better results were observed in patients with tumours, aqueductal stenosis and arachnoid cysts, while those whose primary causes of hydrocephalus were myelomeningocele, infections, or bleeding had higher failure rates. (9) This could be the reason for the high success rates in our study as the majority of the patients had Congenital hydrocephalus.

The commonest complication reported in our study was recurrence for which ventriculoperitoneal shunt insertion was done. Other studies have reported complications like inadequate ventriculostomy, perioperative significant bleeding, seizures and intraventricular haemorrhage. (5) (10) Intraoperative bleeding was common during ETV, as reported in a few studies. (1) Intraoperative bleeding can be controlled by abundant warm irrigation. Also, careful intraoperative monitoring by anaesthesiologist is necessary for early warning of hemodynamic instability that may occur at any stage of the procedure.

Ahmed A. Farag et al., have performed an extensive literature review and reported complications of ETV procedures in a correlated manner with the surgical steps. After analysing the complications, they have suggested various measures like having comprehensive knowledge of the ventricular anatomy with proper orientation of the landmarks as well as meticulous studying of the sagittal MRI is of paramount importance to avoid complications. (11) However, studies have reported frequent occurrences of intraoperative complications of ETV such as haemorrhage (the most severe being due to basilar rupture) and injury of neural structures. In the immediate postoperative period, complications like hematomas, infections, and cerebrospinal fluid leaks occur. Late sudden deterioration, leading to patient's death, has been reported. (12) Hence in the present study, the outcome was assessed on the 10th day after the procedure and also at 3 months and 6 months to assess the success of the procedure.

The present study determined success rates by resolution or improvement in clinical symptoms. Few studies have used preoperative scoring systems like endoscopic third ventriculostomy success score (ETVSS) to predict the procedure's outcome. They concluded that ETV's early outcome was directly related to the preoperative ETVSS. (13) (14) Hence, preoperative scoring systems might be beneficial in improving the outcome following ETV. Metanalysis reports comparing the outcomes of endoscopic third ventriculostomy (ETV) and ventriculoperitoneal shunt (VPS) have concluded that VPS resulted in a higher complication rate compared to ETV. (15)

CONCLUSION

ETV is a very effective treatment modality with fewer complications for treating obstructive hydrocephalus in well-selected patients and can be successfully practised by neurosurgeons in developing

countries. The outcome of the procedure can be improved by proper preoperative evaluation, having comprehensive knowledge of the ventricular anatomy with proper orientation of the landmarks and meticulous intra and post-operative monitoring of complications. However, more extensive studies dedicated to ETV with a larger sample size and with various aetiologies are required.

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