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Research Article

OUTCOMES OF ETV APPROACH IN OBSTRUCTIVE HYDROCEPHALUS PATIENTS: AN EXPERIENCE AT A TERTIARY CARE INSTITUTE

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Abstract

Background: Endoscopic Third ventriculostomy (ETV) is the most physiological treatment for managing hydrocephalus. **Materials and Methods:** Prospective Observational study was done at the NRSMCH Kolkata -700014 ,on patients of hydrocephalus undergoing management via ETV in our setting. 25 patients were included and assessed for neurological and radiological parameters along with complication profile. **Results**: The baseline demographic parameters and clinical/radiological parameters were studied. Most common indication for ETV was aqueduct stenosis followed by lesions of the posterior fossa (tumors or bleeds). ETV had a rate of success 85% in conventional group. Almost all the patients experienced a significant improvement in the Evans Index and FOHR postoperatively. It had a complication rate 45%. **Conclusion**: ETV was an equally efficacious and safer technique than the conventional shunting.

Keywords: Conventional, Endoscopic Third Ventriculostomy, Hydrocephalus.

INTRODUCTION

Hydrocephalus is a condition where excess cerebrospinal fluid (CSF) accumulates within the ventricular system leading to increased intracranial pressure (I.C.P.) and related consequences. It can also be described as an imbalance between the production and absorption of CSF [1]. Most commonly used procedures for management of hydrocephalus in paediatric popoulation worldwide are either Ventriculoperitoneal shunting (VPS) or ETV. However, with more neurosurgeons gaining expertise in the ETV, it is now being seen to have lesser complication complication rates and hence better outcomes. [2] Endoscopic Third Ventriculostomy (ETV) has shown promising results and is replacing the traditional shunting technique.2 It is currently the most popular treatment for hydrocephalus. The overall success rate varies from 60-80% depending upon the indications of the surgery.
Since the first description of conventional Endoscopic Third Ventriculostomy for managing Hydrocephalus by Dr William Mixter in 1923, the procedure has evolved with several technical advancements. Although safe in expert hands; [3,4,5] Endoscopic Third Ventriculostomy may have infrequent but dreaded complications. The overall complication rates vary from 2- 15% [4-7]. The potential complications of the ETV are due to the intra-axial nature of the procedure. Certain anatomical limitations preclude the safe performance of the ETV [8]. During the ETV, the subarachnoid dissection in the prepontine space is not technically possible, so the ventricle communicates with a lesser area of the subarachnoid space. The intact membrane of Lilliquist further adds complexity. The conventional ETV is an indirect approach to the third ventricle. It requires transgression of the endoscope through the brain parenchyma, disrupting grey and white matter tracts to reach the frontal horn of the lateral ventricle. This brain parenchyma disruption may produce track-site hematoma and seizure resulting in a high rate of complications.

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In the 21st century, there appears to be resurgence in the lamina terminalis (L.T.) fenestration for managing hydrocephalus. Lamina terminalis is a semi-transparent membrane forming the anterior wall of the third ventricle. Lamina terminalis has been reported to be successfully used for ETV using a trans-ventricular flexible endoscope. [9] The primary objective was to observe the neurological and radiological outcomes (including complication profile) after Endoscopic Third Ventriculostomy for managing obstructive hydrocephalus.

MATERIALS AND METHODS

Study design: Prospective Observational study

Setting: Department of Neurosurgery, NRSMCH Kolkata, India

Duration of Study: Time-bound study(June 2022- December 2023)

Study Population

Inclusion criteria

- All patients with confirmed Hydrocephalus on Radiological imaging.
- Adults with G.C.S. score > 8 o Children 1-4 years of age with children's coma scale (Adelaide Scale) score >8

Exclusion criteria

- Patients having multiloculated Hydrocephalus
- Hydrocephalus secondary to obstruction at Foramen of Monro
- Patients below one year of age.

- Patients having hemodynamic instability (systolic B.P. < 90 mm hg, pulse < 0.05).
- Patient with respiratory failure
- Pregnant women.

Sample size: N = 25 subjects (Convenience Sampling)

Data collection: Within this time period, all eligible patients admitted to the neurosurgery department, NRSMCH, Kolkata ,were included in the study. The study used the hospital medical records to collect the details of basic demographic data, clinical histories, vitals, and blood investigations, and M.R.I. and C.T. Head findings before the procedure were collected.

Outcome Measures

Outcome evaluation were done in terms of both clinical and radiological parameters. Intraoperative adverse events or complications were recorded. Either improvement in clinical signs/symptoms and/or radiological resolution was considered a good outcome.

Primary outcomes

Neurological status – G.C.S., G.O.S., M.R.S., Vision

Radiological status – CT/MRI resolution of hydrocephalus based on Evan's Index -Yes/No

Secondary outcomes: Complications encountered

Statistical analysis plan

The data was compiled and analysed using MS Excel (R) office 365, GraphPad prism 8.4.2 and SPSS version 25. Descriptive statistics were presented in the form of proportions/percentages for categorical variables and mean & standard deviation for continuous data variables.

RESULTS

A total of 25 patients were included in the final analysis. The baseline demographic and clinical assessment parameters were noted [Table 1]. Most common indication for ETV was aqueduct stenosis followed by lesions of the posterior fossa (tumors or bleeds) [Table 1]. In terms of the overall outcomes, ETV had a rate of success of 84% The MRS and GOS at final follow up were similar to previous studies available in literature [Table 2].

Table 1. Baseline parameters

Parameters	Conventional
Age [Mean±SD (range)]	26.45±19.79 (1-65)
Male/Female [Ratio]	10:15
Preoperative GCS [Mean±SD (range)]	14.40±1.04 (12-15)
ETV Success score [Mean±SD (range)]	87.50±5.50 (70-90)
Preoperative Evans Index [Mean±SD (range)]	0.44±0.15 (0.34-0.65)
Preoperative FOHR [Mean±SD (range)]	0.52±0.12 (0.34-0.70)
Follow-Up Duration [Mean±SD (range)]	13.30±4.53 (6-21)
Aqueduct Stenosis	14 (56%)
Posterior Fossa Tumours	6 (24%)
Pineal Region Tumours	2 (10%)
Posterior Fossa/ Thalamic Bleeds	1 (5%)
Vertebrobasilar Dolichoectasia	-
Failed VP Shunt	2(8%)

Table 2. Success rate assessment and Post operative outcomes in patients

Parameters	No.(%)
Hydrocephalus Resolved – Success	21 (84%)
Hydrocephalus Not Resolved – Failure	4(16%)
Rescue VP shunt needed	4 (16%)
GCS At Discharge	14.48±0.36 (14-15)
Postoperative Evans Index	0.36±0.10 (0.21-0.51)
Postoperative FOHR	0.44±0.11 (0.29-0.63)
MRS At Final Follow-up	0.51±1.00 (0-3)
GOS At Final Follow-up	4.90±0.58 (3-5)

Table 3. Pre-operative and Post-operative parameter comparison (for patients with success)

Parameter	Conventional ETV		Value
	Preoperative	Postoperative	
Evans index	0.44±0.15 (0.31-0.65)	0.36±0.10 (0.21-0.51)	0.001
Mean of difference	0.06		
FOHR	0.52±0.13 (0.34-0.70)	0.44±0.11 (0.29-0.63)	0.001
Mean of difference	0.06		

Table 4. Complication profile

Parameters	Conventional
Complications +	11(44%)
CSF Leak	2 (8%)
Pseudo-meningocele	2 (8%)
Seizure	1 (4%)
Minor fornix Contusions	2 (10%)
Minor intraventricular bleeding	1 (5%)
Brain contusion	4 (16%)
Electrolyte disturbances	3 (15%)

It was also seen that patients experienced a significant improvement in the Evans Index and FOHR postoperatively [Table 3]. ETV was seen to have complication rate 44%, out of which none were serious. 1 patient had seizures in post op period which was successfully managed without any appreciable neurological deficit. While 4 patients had contusions in post operative CT imaging, which gradually subsided in consecutive imagings in follow up [Table 4].

DISCUSSION

ETV has been in use for quite a time. But still due to lesser availability of equipments, lack of endoscopic training, easy availability of low cost Chhabra's shunts are some of the factors preventing its large scale use in India. In a very recent systematic review and meta-anaylystucal study by Minta *et al.* in 2024, it was seen that combined success rates were 81.8% (n = 283/346) in the ETV group and 86.7% (n = 182/210) in the VPS group (median follow-up 41 months). with no difference in success rates between ETV and VPS groups (risk ratio 0.84, 95% confidence interval [0.80–0.90], $I^2 = 0\%$, p = 0.93) . [10]
A Jesuyajolu et al. study [11] similarly observed no significant difference between VPS and ETV treatments, although they noted a slightly higher mortality risk of 0.05% in VPS compared to 0.01%. Sheik et al. study [12], which involved 100 patients treated with either VPS or ETV, suggested that VPS might carry a higher risk of long-term complications. Santamarta *et al.* (2008) [13**]** showed an overall 9% reduction in the mean Evans' Index and a 25% reduction in the mean third ventricle index in cases of successful ETV. Similar improvement in the Evans Index was seen in our study too. Our study only assessed the clinico-radiological outcomes in the patients undergoing ETV. An assessment of flow across the

stoma was not done in our study. Three patients developed wound-related complications in the conventional group (two CSF leaks and one pseudo-meningocele). CSF leak from the surgical wound usually happens when CSF is not passing through the pre-mammillary membrane fenestration and the stoma is not functioning. The CSF, under pressure, seeps back to the parenchymal track and finally through the wound.

Conclusion

Both the procedures, be it VPS and ETV are equally efficacious in management of HCP in children with ETV being safer as gathered through many previous studies. However more RCTs and comparative studies need to done to efficiently validate the same. Also, ETV studies on larger scales need to done to better study the rarer complications and hence further outcomes.

Ethical approval: This study was exempted from ethical approval in line with the NHS Research Regulations.

Conflict of interest: The authors declare no competing interests.

Financial Disclosures: none

Conflict of interest : none

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