Endoscopic third ventriculostomy for paediatric hydrocephalus: experience from a Singapore children's hospital

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Abstract

Endoscopic third ventriculostomy (ETV) is a surgical procedure widely used for the treatment of hydrocephalus. This retrospective study aims to evaluate the outcomes and complications associated with ETV in our local paediatric institute, and see if there is good correlation with the previously established Endoscopic Third Ventriculostomy Success Score (ETVSS).

We performed a retrospective study of ETVs between January 2007 and June 2022 that went on to have follow-up. Primary outcome measure was ETV success ('failure' defined as need for a shunt for CSF diversion at any point in time following ETV). Procedural complications, time of failure (early was defined as within 30 days of the ETV), presence of distorted 3rd ventricular anatomy, and ETVSS were also included. Success of procedure was plotted against the ETVSS to examine extent of correlation. Next, logistic regression was performed on collected variables to identify those with significant influence on the primary outcome.

ETV was successful in 44 of 69 cases (63.8%); 17 of the 25 failures occurred within 30 days of ETV, and the rest occurred between 30 and 270 days. No ETVs that were patent at 1 year eventually failed. Success of cases correlated well with their corresponding ETVSS. Logistic regression analysis confirmed correlation of age and prior shunting with success, but pathology and distorted 3rd ventricular anatomy did not. Only 4.3% of cases developed procedural complications – 2 patients developed fever with 1 proven to have ventriculitis, and 1 had postoperative CSF leak.

Our study corroborates findings from other previous publications looking at ETV outcomes, and shows that predicting success using the ETVSS is applicable in our local population context. Prospective efforts to recruit more patients are needed to ascertain a significant difference among pathology groups.

Introduction

To prognosticate the success rate of ETV, Kulkarni et al devised the ETV success score (ETVSS) in 2009[1].Since then, multiple studies have validated this tool and standardized its use as a predictor of success before recommending it as an option to patients.[2] We hypothesized that it correlates well with our local paediatric population and could be routinely used to advise patients of likely ETV outcome.

Methods

A retrospective analysis of all neuroendoscopic procedures performed at our national paediatric hospital between January 2007 and June 2022 was conducted. Of 74 cases, 71 ETVs were performed; 2 of these did not receive follow-up in Singapore.

Primary outcome of ETV success was recorded, as was initial pathology causing hydrocephalus, procedural complications, time of failure, presence of distorted 3rd ventricular anatomy, ETVSS, and patient characteristics. Mean ETVSS within age groups as defined by Kulkarni et al. and pathology groups were correlated with ETV outcomes. Statistics were generated via SPSS version 27 (IBM, New York).

Results

A total of 69 patients were included in the analysis (**Figure 1**). **Table 1** displays the relevant patient characteristics.

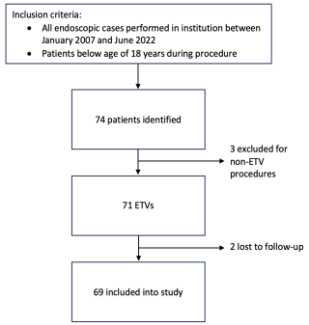

Figure 1. Inclusion process of patients into study.

Characteristic	No. of Patients (%)
Total included	69
Sex	
Male	41 (59.4)
Female	28 (40.1)
Age at ETV	
1 – 6 months	9 (13.0)
6 months – 1 year	6 (8.7)
1 – 10 years	32 (46.4)
10 – 18 years	22 (31.9)
Ethnicity	
Chinese	39 (56.5)
Malay	14 (20.3)
Indian	6 (8.7)
Others (e.g., Caucasian, etc.)	10 (14.5)
Origin of hydrocephalus	
Benign aqueductal stenosis	16 (23.2)
Tectal tumour	8 (11.6)
Pineal tumour	20 (29.0)
Posterior fossa tumour	11 (15.9)
Other supratentorial tumour	4 (5.8)
Post-haemorrhagic	1 (1.4)
Infection	3 (4.3)
Others	8 (8.7)
Procedural-related	
Prior shunting	4 (5.8)
Distorted third ventricular anatomy	4 (5.8)

Table 1. Patient and baseline characteristics of included patients.

Mean ETVSS in each pathology group and ETV outcome correlated well (**Figure 2**), with the exception of the infection group (n = 3, p = 0.009). The ROC area under curve was 0.677. Logistic regression of variables found significance when age (in months) and prior shunting was included, but not for pathology, distorted 3rd ventricular anatomy or other patient variables (**Table 2**).

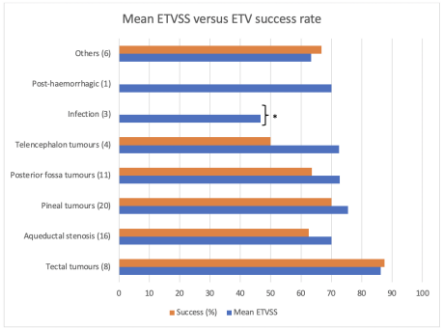

Figure 2. Mean ETVSS within each pathology and ETV success rates (Group sample size *n* in brackets). There was fair correlation in the aqueductal stenosis, tumour groups and those in Others category. *The Infection category was significant from deviating from expected success rate predicted by ETVSS.

Results (cont'd)

	p Value	Odds Ratio	95% CI Lower	95% CI Upper
Age (in months)	**0.016**	**1.011**	1.002	1.020
Prior shunting	**0.030**	**0.42**	0.002	0.733
Pathology				
Aqueductal stenosis	0.223			
Non-tectal tumours	0.404			
Post-haemorrhagic	0.999			
Infection	1.000			
Others	0.607			

Table 2. Logistic regression of variables with ETV outcome. Age and prior shunting (in bold) were significant with an odds ratio of 1.011 (per month) and 0.42 (with prior shunt) respectively. Pathology was not significant, likely due to large variability in group sizes.

Kaplan-Meier survival analysis of ETV patency showed that ETV failures generally occurred within the 1st year, with 68.0% occurring within the first 30 days (Figure 3). From our data, there were no failures beyond 1 year from ETV date. We note from existing literature that sporadic cases of ETV failures still occur with a mean of 7 years.[3]

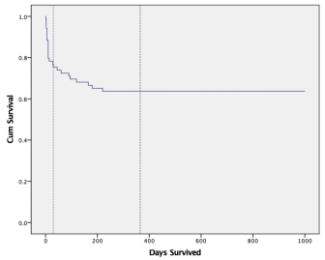

Figure 3. Kaplan-Meier survival analysis of ETV success with time. 17 of 25 (68.0%) failure cases occurred within the first 30 days (1st vertical line), the rest occurred between 30 to 270 days. There were no failures beyond 1 year (2nd vertical line).

Discussion

Our ETV outcomes are comparable with published retrospective literature and correlate well with the ETVSS, despite the heterogeneity of underlying conditions. Higher numbers, particularly in the infection and post-haemorrhagic group, will likely be beneficial for accurate assessment of the correlation. The ETVSS can be reliably used to predict ETV outcome prior to the procedure. Our survival analysis postulate that concluding follow-up at 1 year is likely sufficient, as long as patients are aware of the remote possibility of ETV failure beyond that.

References

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