

## Age Related Role of Endoscopic Third Ventriculostomy in Treatment of Hydrocephalic Children

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### Abstract

**Objective:** To know the surgical outcome of endoscopic third ventriculostomy (ETV) in hydrocephalus. **Setting:** Neurosurgery department of Benha university hospitals. From January 2016 to February 2020. **Materials and methods:** A total of 58 patients with hydrocephalus, irrespective of gender discrimination were included in this study. Hydrocephalus with CSF loculations or tumour was excluded. Hydrocephalus was diagnosed by CT scan brain and MRI. The information regarding patient details, causes of hydrocephalus and complications of procedure were documented in patient's Performa. The data was analyzed by SPSS version 26. Frequency and percentage was calculated for categorical variables. Mean  $\pm$  SD was calculated for age. Results were presented as tables. **Results:** A total of 58 patients with hydrocephalus were included in the study. Out of 58 patients, There were 32 males (55.2%) of patients and 26 females (44.8%). The mean age was 22.86 months. congenital aqueductal stenosis was the commonest cause of hydrocephalus. Post-operatively CSF leakage was present in 20 patients (34.5%). Post-operative infection is present in 6 patients (10.3%). **Conclusions:** Endoscopic third ventriculostomy is safe and effective procedure. Those patients who meet the criteria, endoscopic third ventriculostomy offers the possibility of freedom from shunt dependency.

**Key words:** Children, Endoscopic Third Ventriculostomy, Hydrocephalus.

### 1.Introduction

Endoscopic Third Ventriculostomy (ETV) is a good alternative for shunt dependence; an opening is created in the floor of the third ventricle using an endoscope placed within the ventricular system through a burr hole. This allows the movement of cerebrospinal fluid (CSF) out of the blocked ventricular system and into the interpenducular cistern (a normal CSFspace) thereby bypassing CSF obstruction. ETV is used to treat obstructive Hydrocephalus, such as aqueductal stenosis. The objective of this procedure is to normalise pressure on the brain without using a shunt.

(1,2,3) . Although open ventriculostomies were performed as early as 1922, they became a less common method of treating Hydrocephalus in the 1960s, with the introduction of shunt systems. Despite recent advances in shunt technology and surgical techniques, however, shunts remain inadequate in many cases. Specifically, extracranial shunts are subject to complications such as blockage, infection, and over-drainage, often necessitating( 1,4,5) repeated surgical revisions. The ultimate goal of ETV is to render a shunt unnecessary. Although ETV is ideally a onetime procedure, evidence suggests that some patients will require more than one surgery to maintain adequate (3,6,7) opening and drainage . The purpose of this study was to know the surgical outcome of ETV in patients with

non-communicating hydrocephalus.

### 2.Materials And Methods

This study was done at neurosurgery department of Benha university hospitals. From January 2016 to February 2020. from A total of 58 patients with hydrocephalus, irrespective of gender discrimination were included in this study. Age of patients ranged from 2 months to 10 years with mean age of 22.86 months and Hydrocephalus with CSF loculations or tumour was excluded. Hydrocephalus was diagnosed by CT scan Brain and MRI. Carl Storz endoscope with lenses of 0 and 30 degrees with 6mm outer diameter wesusedin ETV.

Clinical Outcome of ETV was evaluated by the time of discharge and on subsequent follow up visits. Base line CT brain was done to all patients post operatively. The treatment was recorded as a success or failure. Success of the ETV was defined as partial or complete relief of symptoms. Any patient who subsequently needed VP shunting after the ETV procedure was described as having treatment failure. The information regarding patient details, causes of hydrocephalus and complications of procedure was documented in patient's data. The data was analyzed by SPSS version 26. Frequency and percentage was calculated for categorical variables. Mean + - SD was calculated for various results were presented as tables.

### 3.Results

58 patients were operated during our study period. Age of patients ranged from 2 months to 10 years with mean age of 22.86 months. 51.7% of cases were above 1 year of age (30 cases). In succeeded cases (34 cases) the median age was 19 months, (IQR): 11.75-33.75. In failed cases (24 cases) the median age was 6.5 months, (IQR): 3.25-15.25. which is statistically highly significant. The relation between age groups that are shown in table (1) and success is also statistically highly significant.

There were 32 males (55.2%) of patients and 26 females (44.8%). 40 patients (69%) have congenital aqueductal stenosis. 18 patients (31%) have Chiari type I malformation. ETV surgery is successful in 34 patients (58.6%) and failed in 24 patients (41.4%).

As shown in table (2), History of Previous shunt was present in 12 patients (20.7%). Vomiting was present in 40 patients (69%). Previous History of infection was present in 4 patients (6.9%). Head circumference had a mean of 47.5 cm ranging from 39 to 57 cm, ( $\pm$ SD 4.62 cm).

Complications noted after

**Table (1):** Relation between success of ETV and age distribution of patients.

ETV	Succeed (34)		Failed (24)		Statistical test	P value
	No	%	No	%		
Age						
Mean $\pm$ SD	27.0 $\pm$ 27.58		17.0 $\pm$ 24.38		St t= 1.43	0.16
Median (IQR)	19.0 (11.75-33.75)		6.5 (3.25-15.25)		MWU= 3.19	0.001**
1m-	4	11.8	10	41.7	FET= 14.94	0.001**
6m-	4	11.8	8	33.3		
1y-	24	70.6	6	25.0		
$\geq$ 10y	2	5.9	0	0.0		

**Table (2):** Relation between pre-operative findings and ETV success.

ETV	Succeed (34)		Failed (24)		Statistical test	P value
	No	%	No	%		
Previous shunt						

Yes	10	29.4	2	8.3	FET= 2.63	0.097
No	24	70.6	22	91.7		
Vomiting pre- op						
Yes	26	76.5	14	58.3	X2= 2.16	0.14
No	8	23.5	10	41.7		
Fits pre- op						
Yes	14	41.2	4	16.7	X2= 3.95	0.047*
No	20	58.8	20	83.3		
Infection pre- op						
Yes	2	5.9	2	8.3	FET= 0.0	1.0
No	32	94.1	22	91.7		
Cranial nerve affection						
Yes	18	52.9	2	8.3	X2= 12.39	<0.001**
No	16	47.1	22	91.7		
Head circumference						
Mean ±SD	49.35±4.03		45.0±4.25		St t= 3.96	<0.001**

**Table (3):** Relation between ETV success score values and results of ETV surgery.

ETV	ETV score					
	40	50	60	70	80	90
Succeed (34)	(25.0)2	(33.3)4	(33.3) 2	(90.0) 18	(60.0) 6	(100) 2
Failed (24)	(75.0) 6	(66.7) 8	(66.7) 4	(10.0) 2	(40.0) 4	(0.0) 0
Total	8	12	6	20	10	2

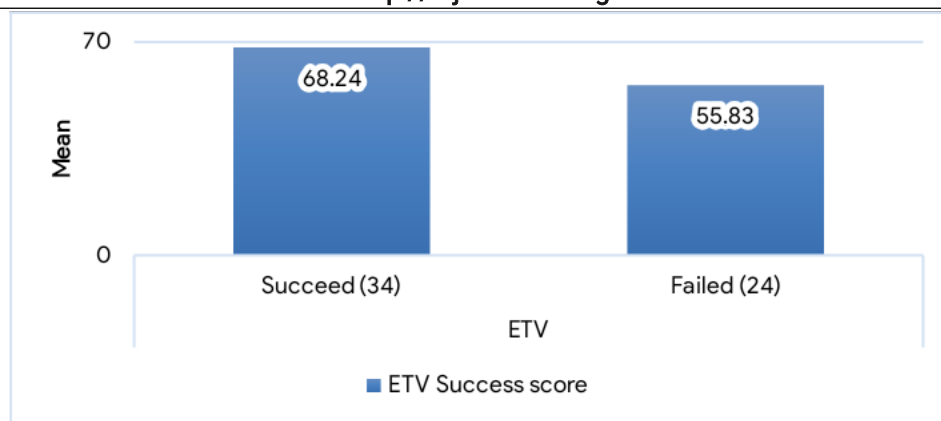


Figure (1):Relation between ETVSS mean, median and results of ETV surgery.

#### 4.Discussion

Endoscopy is currently widely applied in neurosurgery either alone or in combination with other procedures. ETV is well established as a treatment option for obstructive hydrocephalus. and might also be useful in other circumstances, such as the VPS failure (8).

this study was carried out upon 58 patients. In this study, age of the patients was a constant criterion for patient selection. All our patients were under the age of 18 years (58 cases). There was 58.6% success while the overall success in patients older than one year was 81.2. The relation between age groups and success was found to be statistically highly significant.

This indicates that age is an important factor in outcome of ETV patients and this statement coincide with the results of many other authors who believe that the age is important factor in determining the outcome and is the most important independent risk factor for surgical effectiveness and long-term functional outcome (9).

Our success rate in patients was 58.6 % and this coincide with the the results of B Warf, in 2005 was 53 % and Kadrian et al. who found the success 58 % in patients below 2 years (10 , 11).

In our study the success rate in patients with aqueductal stenosis was (70%). this results are coping with most of studies in the literature as ( 12, 13). However many authors found the results much higher about (70-90 %) (14, 15 ). Other authors found the success below 40 % especially in the younger age groups ( 16 ).

In our study the success rate in patients with Chiari malformation was (30%).while Ray et al., reported it to be (0%)(17).

Our results in the group of

malfunctioning V-P shunt was 70% and this is near to the work of Gupta and his colleagues (80 %) (18 Gupta et al., 2017) and other authors as(19).

Like other surgical procedures, ETV can have various degrees of complications.

In our study, ETV succeeded in 58.6% of patients and failed in 41.4%. the overall complications occurred as follows: Post-operative CSF leak was present in 17.6% of succeeded cases and in 58.3% of failed cases, ( 34.5 % of all cases). this is statistically highly significant. CSF leakage is considered as a sign of ETV failure. 10.3% of patients had hemorrhage. 10.3% of patients had infection. Mortality occurred in 4 cases (7%) of all 58 cases.

In our study when etv success score is higher, success rate increase especially after success score of 70 or more. This is similar to results of Labidi et al. who showed that success above ETVSS of 70 or more is associated with more percentage of success.(20)

The difference in the complication rate between different studies may be due to the difference in the number of cases; our study was done on 58 patients, study of Seung-Ki Kim and colleagues on 32 cases.(21) but other studies were done on a patient number ranging from 155 to 450 patients.

In our study, no vascular injuries had occurred but only minor hemorrhage which was due to injury of small blood vessels during the neuroendoscopic procedures. The hemorrhage was controlled by continuous irrigation with lactated ringer solution.

The mortality rate of ETV is 0-1%, and it is usually acute following a vascular injury during the procedure. Nevertheless, there can also be delayed fatalities due to secondary infection or acute

hydrocephalus after ventriculostomy closure (22).

Endoscopic third ventriculostomy selection criteria have continued to expand to include patients with infection. (23), neural tube defects (24), and other forms of hydrocephalus.(25) These patients who were conventionally believed to be at higher risk of ETV failure. With long-term follow-up data on these high-risk patients, ideal patient selection criteria will be further identified (26).

### 5.Conclusions

Endoscopic third ventriculostomy in treatment of hydrocephalus in previously shunted patients presenting with mechanical shunt malfunction is a valuable and relatively safe procedure, as it helps to avoid shunt dependency with its long term complications. More success rate was above one year of age.

Due to the possibility of early or delayed failure, the outpatient follow-up is still necessary. In addition, informing the parents about the nature of the procedure, expected complications and long term follow up is still crucial especially in this procedure where failure would be expected.

### 6.References

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