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Original Article

Endoscopic third Ventriculostomy for Malfunction of Ventriculoperitoneal Shunt; Our Experience

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Abstract

Background: *Ventriculoperitoneal (VP) shunt is a common procedure for treating hydrocephalus of various causes. Malfunction of VP shunt like obstruction, infection etc. are encountered with revision surgeries which may not have favourable outcome. Endoscopic third ventriculostomy (ETV) in such cases is challenging, and can be salvageable in appropriate cases.*

Objective: *Aim of the study is to analyze the role of endoscopic third ventriculostomy as an alternative to shunt revision for malfunctioning and infected ventriculoperitoneal (VP) shunts. Method: We report 54 cases from 2012 to 2018 in private setup, retrospectively we analysed in all ages including children and adults. Minimum follow up period was 2 years.*

Results: *In 2 cases we did ETV twice and in 1 case of thalamic glioma where the patient was shunt dependent probably due to post radiotherapy adhesion ETV was successful. The success rate of ETV was 88.9% in our study.*

Conclusion: *Success rate of ETV depends on various factors and careful selection of patients; CSF infection and communicating hydrocephalus are of poor prognosis. ETV is the feasible alternative for the treatment of failed VP shunt cases in non-communicating hydrocephalus.*

Keywords: *Endoscopic third ventriculostomy, Malfunction, Ventriculoperitoneal shunt.*

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Introduction:

ETV is a recognized method for treating non-communicating hydrocephalus. In cases with aqueduct stenosis or restriction of the fourth ventricle's outflow, the success rate of ETV has been reported to be up to 90%.[1] Despite being used in patients with communicative hydrocephalus, ETV fails more frequently than it does in individuals with obstructive hydrocephalus. However, VP shunting continues to be a widely used surgery for treating various kinds of hydrocephalus, particularly communicative ones.[2] The majority of patients with shunt malfunction and/or infection are treated with shunting, although in certain of these individuals, ETV can be utilized as an alternate therapy to reduce intracranial pressure. There hasn't been much research done yet on how endoscopic hydrocephalus therapy affects shunt dysfunction. Numerous studies have identified ETV as the primary therapy for hydrocephalus in patients with shunt failure.[3-5] In light of this, the involvement of ETV following VP shunt malfunction is an intriguing topic in neurosurgery that can be explored through several studies with varying degrees of power. Here, we have examined the records of patients who received ETV treatment for VP shunt dysfunction and then analyzed the outcome of that treatment in retrospectively.

Objective

The aim of this study is to analyze the role of endoscopic third ventriculostomy as an alternative to

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shunt revision for malfunctioning and infected ventriculoperitoneal (VP) shunts.

Methodology

Study procedure

In our retrospective study, a total of 54 patients were enrolled from January 2012 to December 2018. This study was conducted randomly at private hospitals in Dhaka, Bangladesh. Data were collected from our database on patients who underwent ETV for VP shunt malfunction. All patients were categorized from d"15 to >45 years old. Their duration of symptoms were not more than 24 months. The selection criteria of patients for ETV were based on clinical symptoms and signs and the CT scan of the brain or MRI of the brain.

Surgical Technique

The procedure for achieving ventriculostomy requires the perforation of the floor of the third ventricle accompanied by the extension of the defect with either the endoscopic forceps or the balloon dilatation through Fogarty catheter. In our cases, a 3.7 mm - diameter rigid endoscope was used for the ETV treatment. One surgeon used the same technology for all 54 ETVs. All surgeries with patients have been performed supine and under general anesthesia. The burr hole was placed in Kocher's point, and the endoscope was advanced to the third ventricle through the foramen of Monro. The endoscope was advanced to the fenestrated stoma to evaluate the basilar artery and its branches as well as for the presence of second membranes. Following ETV, no external ventricular drain was placed. CSF was sent for culture and sensitivity test. A postoperative CT scan of the brain was regularly conducted at 1 month, 6 months, and 1 year. Infection or high CSF proteins were treated by external ventricular drain (EVD) and sensitive IV antibiotics in individuals till the CSF was sterile. We choose cases of non-communicating hydrocephalus with VP shunt malfunction. In this series, surgical treatments were technically effective, and there was no postoperative mortality.

Follow-up

The minimum follow-up period of the patients in the series was 2 year (24 months). They were followed up to a maximum of 6 years (72 months). Routine postoperative outpatient follow-up appointments were scheduled within 1 month, 3 months, 6 months, and then every 1 year postoperatively.

Statistical Analysis

All statistical analysis was conducted using version 23.0 of IBM SPSS Program. A probability value of $P < .05$ was considered statistically significant.

Results:

Table 1 shows the age and sex distribution of the patients in our study. Here, maximum patients (27.7%) were below 15 years old. And minimum number of patients (7.4%) were upto 45 years. The gender distribution of the patients in our study shows there were 34 (63%) male patients and 20 (37%) female patients in this study. See below-

Table-I

Age and sex distribution of the patients (n=54)

Age group	Male	Female	Total	Percentage (n%)
≤15	9	6	15	27.7%
16-24	8	6	14	25.9%
25-34	9	3	12	22.2%
35-45	5	4	9	16.6%
>45	3	1	4	7.4%
Total	34	20	54	100%

Table 2 shows the clinical presentations of the patients of our study. Here, maximum patients have agitation and irritability and headache (33.3% and 29.6% respectively). See the table below-

Table-II

Clinical presentations of the patients

Clinical presentations	Frequency (n=54)	Percentage (n%)
Sleepiness	13	24%
Frequent vomiting	8	14.8%
Agitation and irritability	18	33.3%
Inflammation around distal tube	6	11.1%
Fever	4	7.4%
Headache	16	29.6%
Exposure of shunt reservoir	7	12.9%
CSF leak from distal wound	3	5.5%
Swelling around reservoir	2	3.7%
Swelling around distal tube	3	5.5%
Scrotal swelling	1	1.8%

Table III shows the causes of hydrocephalus of the patients in our study. Here, maximum patients (53.7%) had myelomeningocele and only 1 patient had Dandy Walker syndrome. See below-

Table-III

Causes of hydrocephalus

Cause of hydrocephalus	Frequency (n=54)	Percentage (n%)
Myelomeningocele	7	53.7%
Aqueductal stenosis	29	12.9%
Post hemorrhagic	9	16.7%
Dandy Walker syndrome	1	1.8%
Tumor	8	5.5%
Meningitis	5	9.2%

Table-IV

Complications of the VP shunt patients

Related to proximal catheter and reservoir	Frequency (n=54)	Related to distal catheter	Frequency (n=54)
Misplaced catheter	1	Infection around the tube	2
Ventriculitis	2	Fracture of the tube	1
Proximal obstruction by debris	2	Obstruction by pseudocyst	1
CSF over drainage	1	Extra peritoneal placement	2
Exposure of the reservoir	3	Skin exposure overlying the tube	3
CSF collection around reservoir	1	CSF collection around distal tube	2

Table V is showing the relationship between predicted ETVSS and outcome of ETV of our study. Here, success rate of ETV was 88.9% and failed ETV was observed in 11.1% cases. See the detailed informations in the table below-

Table-V

The relationship between predicted ETVSS and outcome of ETV

Predicted ETVSS Score	No of patients	Mean ETVSS score	Successful ETV	Failed ETV
10–40	14	31.6 ± 9.12	11	3
50–70	19	61.7 ± 7.53	17	2
≥80	21	82.6 ± 5.31	20	1
Total	54	62.63	48 (88.9%)	6 (11.1%)

Table IV shows the complications found among the patients in our study. Here, maximum patients faced misplaced catheter who had proximal catheter and reservoir. In 2 cases we did ETV twice and in 1 case of thalamic glioma where the patient was shunt dependent probably due to post radiotherapy adhesion ETV was successful. We found CSF high protein is the contraindication for ETV, assumed to be persistent infection. Choroid Plexus Coagulation (CPC) in children along with ETV is a good choice. Among patients who had distal catheter, maximum faced skin exposure overlying the tube. See the table above.

Discussion

The implantation of a vp shunt malfunction, typically a ventriculoatrial shunt, has historically been used to treat various kinds of hydrocephalus. The way that hydrocephalus is treated has altered as a result of advancements in neuroimaging and less intrusive surgery. With success rates of up to 90% in cases with aqueductal stenosis, ETV is a viable option today for the treatment of obstructive hydrocephalus. [2] The hydrocephalic patient was aided by ETV to overcome shunt reliance and its difficulties as a foreign body. ETV's effectiveness and success rate in patients whose main shunts have failed, however, have been in question.[6,7] Patients who have had prior VP shunts have reportedly experienced more ETV issues both during surgery and in the days following.[4,8] In previously shunted patients with acute VP shunt malfunction, some authors have maintained ventricular catheters with reservoirs or Ommaya reservoirs after ETV surgery.[8] Similar to the findings of several previous papers, our series' greatest ETV success rate was attained in situations involving patients who had myelomeningocele with preterm hemorrhage.[7,8] Previous VP shunt placement with overdrainage symptoms may diminish ventricular wall compliance, which eliminates compensatory mechanisms during acute intracranial hypertension.[9] It has been noted that ETV failure in shunted patients happens over a longer length of time than it does in patients receiving main ETV as the initial course of treatment for hydrocephalus.[4] Shunt-related problems afflict the VP shunt, despite it being a successful treatment for hydrocephalus.[10] Multiple surgical procedures may be needed over the course of a lifetime due to the lifelong commitment that is a VP shunt.[11]

Vanaclocha et al. noted that some of the clinically undetected infections that led to shunt dysfunction occurred in infected shunts. They claimed that the prevalence of shunt infection may be higher than often reported and that shunt infection in defective shunts could still occur despite negative cultures from CSF taps.[12] 20% of the 440 patients in Peacock and Currer's series had shunt obstruction, they discovered [13]. Children who underwent operations in Nairobi for non-tumor hydrocephalus had an infection rate of 24.6%, according to Mwan'gombe and Omulo.[14] In their investigation on shunt malfunction, Hamada and Abou Zeid discovered that misdirection of the proximal catheter was present in two (7.1%) patients, which is roughly similar to the findings of the current study, where misdirection of the proximal catheter was present in three (10%) patients.[15]

Based on our experience, the diagnosis and treatment of ETV require long-term follow-up. Surgical procedures were technically successful without intraoperative major complications. In our series ETV was done twice in 2 cases and we did successfully in 1 case of thalamic glioma where the patient was shunt dependent, most likely because of post-radiotherapy adhesion. Assumed to represent a persistent infection, we discovered that ETV is contraindicated in cases of elevated CSF protein. Although there were no serious problems from endoscopic treatments in our series, it is important to stress that these procedures should only be performed by a surgical team with extensive competence in neuroendoscopic operations.

Conclusion:

Success rate of ETV depends on various factors and careful selection of patients; CSF infection and communicating hydrocephalus are of poor prognosis. ETV is the feasible alternative for the treatment of failed VP shunt cases in non-communicating hydrocephalus.

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