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Endoscopic third ventriculostomy for obstructive hydrocephalus: Outcome analysis of 120 consecutively treated patients from a developing country

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HIGHLIGHTS

- Neurosurgical centers in developed countries report good outcomes with ETV.
- Surgeons in developing world are reluctant to perform ETV for many reasons.
- Advanced endoscopy training/equipment is required to do this challenging surgery.
- We report ETV's safety and utility in a large series from a developing country.
- ETV can replace VP shunts for treating hydrocephalus in developing countries.

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ABSTRACT

Objectives: Endoscopic third ventriculostomy (ETV) for the treatment of obstructive hydrocephalus is a relatively new concept amongst neurosurgeons of the developing world. Therefore, this study was conducted to report our experience, patient selection, success rates and complications of ETV and compare our results with the literature from the developed countries.

Methods: We performed ETV on 120 patients at our centre and prospectively collected their clinical data on pre designed questionnaires. Success was defined as clinical improvement on 3rd month post operative clinic visit. The data was analyzed using SPSS version 20.

Results: There were 79 male and 41 female patients. The mean age was 36.1 ± 14.3 years. Overall, ETV was successful in 107 (89.2%) of patients. 4 patients had intra operative bleeding, 4 patients developed CSF leaks while 1 patient had a transient gaze palsy. There was no mortality.

Conclusion: ETV is a very effective treatment modality for treating obstructive hydrocephalus in well selected patients and can be successfully practiced by neurosurgeons in the developing countries.

1. Introduction

Walter E Dandy pioneered neuroendoscopy by utilizing a cystoscope to visualize the lateral ventricle in the early 1900s [1]. In 1923, Mixter became the first surgeon to successfully perforate the floor of the third ventricle under endoscopic guidance [2]. Shunts were first developed by Nulsen and Spitz in 1951 and soon replaced ETV as the procedure of choice as ETV was associated with a higher rate of mortality and morbidity in that era [3]. However, the ideal shunt system has not been developed yet and complications such as shunt malfunction and infections remain a major concern [4]. Over time there has been a resurgence in the acceptance of ETV as the procedure of choice in the treatment of obstructive hydrocephalus in selected patients globally due to technological advances in stereotactic guided procedures and in both optical and mechanical instrumentation [2–4]. However, the bulk of available literature on this subject is from the developed countries with advanced health care facilities. Therefore, this study was conducted to report experiences, patient selection, success rates and complications of ETV in patients treated in a developing country and to compare our results with the literature from the developed countries.

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2. Materials and methods

2.1. Patients

Our inclusion criteria included all patients admitted through our outpatient or emergency department with obstructive hydrocephalus due to aqueductal stenosis, tumors or cysts between January 2005 and June 2013. Detailed history, physical examination, baseline investigations and a CT scan of all patients was performed. The clinical data of these patients was prospectively collected on a pre designed questionnaire and included information on patient's demographics, etiology of hydrocephalus, post operative CT scan findings and resolution of hydrocephalus. Patients with recurrent hydrocephalus in whom a VP shunt had been placed previously or patients in whom the etiology of hydrocephalus was determined to be sub arachnoid hemorrhage, communicating or infectious were excluded from this study. Informed consent was taken from each patient to participate in this study and the study was approved by the hospital's ethical review committee.

2.2. Study intervention

All patients underwent ETV. Preoperatively, all patients were adequately hydrated and given IV antibiotics. After intubation, patients were positioned supine with their head flexed. A burr hole was placed on the right side just anterior to the coronal suture and about 2.5–3 cm lateral to the midline. Foramen of Monro was localized by identifying the site of confluence of thalamo-striate vein, septal vein and choroid plexus. The endoscope was negotiated through the foramen of Monro and a blunt fenestration was made in the floor of the third ventricle anterior to the basilar artery between mammillary bodies and infundibular recess at the most transparent site in order to avoid injury and intra operative bleeding. Initially multiple concentric small holes were made which were then connected to create one large hole measuring about 5 mm in diameter, and the entire endoscope was passed through the hole. Adequate fenestration was confirmed by direct endoscopic visualization of the basilar artery in the interpeduncular cistern. Further as the endoscope was withdrawn back into the third ventricle, the edges of the fenestration were seen flapping up and down as CSF moved between the third ventricle and the basal cisterns. The edges of the fenestration were coagulated with laser to widen the hole. Copious warm fluid irrigation was used in case of hemorrhage until all bleeding stopped and the ventricular CSF became clear. A microvascular doppler probe was inserted through the endoscope and used to locate the basilar artery when it could not be clearly visualized with the endoscope.

2.3. Follow up and outcomes assessment

Postoperatively, all patients were kept nil by mouth and given intravenous fluids, antibiotics, analgesics, proton pump inhibitors and anti-emetics. They were allowed oral diet after 6 h and discharged 48 h after surgery. All patients were called for post operative visit to neurosurgery clinics after 10 days, 1 month and 3 months of their ETV procedure. Outcomes assessment was done on the 3rd month visit based on clinical parameters. Success was defined by resolution or improvement in clinical symptoms. The procedure was considered failed in patients whose symptoms either deteriorated or did not improve from the baseline.

2.4. Statistical analysis

The data was analyzed using IBM SPSS statistics for windows version 20 (Armonk, New York: IBM corp.). For descriptive analysis, the data is presented as means ± SD for continuous variables and as proportions for categorical variables. A Mann Whitney U test was used to assess the statistical significance of age with resolution of hydrocephalus. A chi squared test was used to assess the differences of outcomes in terms of gender and etiology.

3. Results

Out of the 120 patients included in this study, there were 79 (65.8%) males and 41 (34.2%) females. The mean age of the patients was 36.1 ± 14.3 years. 67 (55.8%) patients had hydrocephalus due to tumors, 44 (83%) patients had aqueductal stenosis while 9 (17%) patients had benign cysts.

The mean duration of follow up was 7.6 ± 1.3 months. On the basis of follow up, resolution of hydrocephalus was documented in 107 (89.2%) patients in this study. The success rate was highest for obstructive hydrocephalus secondary to tumors (91%) followed by aqueductal stenosis (88%) and the least in cases of benign cysts (78%), however, the differences were not statistically significant (Table 1).

Intraoperative bleeding occurred in 4 patients. Bleeding was controlled and the procedure was not aborted in any of these cases. A CSF leak was documented in 4 patients. 1 patient developed a transient gaze palsy which had resolved when he came for his follow up visit on 10th post operative day. There were no mortalities.

We could not find a statistically significant association between sex and outcomes (p value = 0.747). Similarly, there was no statistically significant association between etiology and outcomes in our case series (p value = 0.534) (Table 2).

4. Discussion

The management of obstructive hydrocephalus is challenging and many studies have analyzed different treatment options and their outcome [5–7]. ETV is being increasingly favored over the conventional shunting procedures for the treatment of obstructive hydrocephalus in selected patients in the neurosurgical centers of developed countries with neuroendoscopic expertise [2,3,8]. This rising popularity is due to the fact that ETV provides the opportunity for the patient to be shunt free and is effective in the management of hydrocephalus regardless of the etiology, patient age, and other contributing factors. However, there are reported differences in success rates [2,7,9–11]. Hopf et al. analyzed outcome of 100 consecutive procedures performed in 95 patients and found that ETV is most effective in treating uncomplicated obstructive hydrocephalus caused by aqueductal stenosis and space-occupying lesions. It was also judged to be successful in two-thirds of the patients in whom the etiology of hydrocephalus was either infection or intraventricular bleeding. Further, Hopf et al. also proposed that patients with obstructive hydrocephalus who have previously

Table 1
Summary of presenting characteristics, outcomes and complications.

Characteristics		Number (percentage)
Gender	Male	79 (65.8%)
	Female	41 (34.2%)
Etiology	Tumor	67 (55.8%)
	Aqueductal stenosis	44 (36.7%)
	Cysts	9 (7.5%)
Outcomes	Successful	109 (90.8%)
	Failed	11 (9.2%)
Complications	Intra operative bleeding	4 (3.3%)
	CSF leak	4 (3.3%)
	Transient neurological deficit	1 (0.8%)