Endoscopic Third Ventriculostomy for Treatment of Patients with Obstructive Hydrocephalus in Al-Anbar Governorate

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ABSTRACT

Background: Endoscopic third ventriculostomy is the most commonly performed neuroendoscopic procedure used as an alternative to a cerebral shunt mainly to treat certain forms of obstructive hydrocephalus.

Objective: To analyze the safety, the efficacy and outcomes of endoscopic third ventriculostomy in the treatment of patients with obstructed hydrocephalus.

Methods: Endoscopic third ventriculostomy (ETV) was performed between January 2010 and October 2012 at Al-Ramadi Teaching Hospital on 20 patients with obstructive hydrocephalus (18 newly diagnosed hydrocephalus and two previously shunted (ventriculoperitonial shunt). Selection criteria of patients enrolled in this study included age more than one year and obstructive hydrocephalus due to any cause evidenced by pre operative CT and/ or MRI scan. Under general anesthesia, ETV is done in all patients by using 30-degree rigid telescope.

Results: No major complications occur during the procedures. Eighteen patients improved their symptoms immediately after ETV. One patient died on fourth post operative day. Three months after ETV, an overall clinical improvement was observed in 18 (90%) of 20 patients.

Conclusion: ETV is a minimal invasive, safe, effective and durable means of surgical option in cases of obstructive hydrocephalus that is caused by aqueduct stenosis and space occupying lesion.

Keywords: Endoscopic third ventriculostomy, Obstructive hydrocephalus.

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Hydrocephalus means excess water in the brain with dilatation of ventricular system with raised intracranial pressure in most situation. It is a common neurological problem with an estimated prevalence of 1-1.5%. The management of hydrocephalus needs diversion, either extra-cranial (shunt) or intra-cranial shunt (ventriculostomy). Extra cranial shunts are subject to complications such as blockage, infection and over drainage, often repeated necessity repeated surgical revisions. Endoscopic third ventriculostomy (ETV) obviates all these complication[1-2]. ETV is a procedure used to treat hydrocephalus, as an alternative to a shunt and has accepted as the procedure of choice for the treatment of obstructed hydrocephalus in adults and children because of the minimally invasive nature and offers the surgeon brilliant visual control of the maneuver.

The procedure was attempted years ago, before shunts were invited. A man called Dandy performed it as an open operation in the early twentieth century. But basic endoscopic attempts with primitive endoscopes even preceded this. It was always a logical way to try and treat hydrocephalus[3-4] .

ETV is one-time procedure; 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 out of the blocked ventricular system and into interpenducular cistern (a normal spinal fluid space) thereby shortcutting any obstruction. ETV is used to treat certain forms of obstructive hydrocephalus, such as aqueductal stenosis and space occupying lesion. The procedure is used to normalize pressure on the brain without using a shunt and it is not a cure for

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hydrocephalus, but rather an alternative treatment[5-7].

This study was conducted to analyze the safety, the efficacy of EVT in the treatment of patients with obstructed hydrocephalus and outcomes in consecutive group of 20 patients who underwent ETV for obstructive hydrocephalus at our department.

Methods

Case series study was conducted among twenty patients with obstructive hydrocephalus, who underwent ETV for treatment of obstructive hydrocephalus at the Surgical Department of Al-Ramadi Teaching Hospital, between January 2010 and October 2012.

Patient selection included age more than one year with initial diagnosis based on findings of computed tomography (CT) and/ or magnetic resonance imaging (MRI) scan or both, performed before or at the times of admission, which indicated the presence of obstructive hydrocephalus with the obstruction located in the posterior aspect of or distal to the third ventricle due to any cause. Patients below one year of age, with lesion in the floor of the third ventricle or near basilar artery, and hydrocephalus with infected CSF or hemorrhage were excluded. The study was conducted after approval from the hospital research and ethical committee and a written informed consent was obtained from each patient or his relative. The clinical presentations of the patients enrolled in this study prior to surgery showed that out of the 20 patients, six (30%) patients were presented with congenital obstructive hydrocephalus and 14 (70%) patients were presented with acquired obstructive hydrocephalus

Outcome of ETV was evaluated according to patient's follow up data or patient's status before they were lost to follow-up. The treatment was recorded as success or failure. Success of the ETV was defined as partial or complete relief of symptoms. Failure was defined as no change or deterioration in the condition. Any patient who died as a result of the ETV procedure or had to undergo a shunt implantation operation after the ETV procedure was described as having treatment failure.

During the ETV procedure, the patient was positioned supine and the head is elevated to 20-30 degree with slight flexion of the neck stabilized in a Mayfield head holder using 30- degree rigid telescope manufactured by Karl Storz. The procedure was done under general anesthesia. The neuroendoscope is introduced to the lateral ventricle of the brain through an entry bur hole of approximately 1 cm in diameter placed approximately 13 cm from the nasion, 3 cm lateral to the midline and 1 cm at or just anterior to the coronal suture, this will provide a direct trajectory from the entry the foramen of Monro into the third ventricle, the foramen of Monro is located where the thalamostriate and septal veins, as well as the choroid plexus of the lateral ventricle, coverage.

The data were collected from all patients with hydrocephalus who underwent endoscopic brain surgery. The diagnosis of obstructive hydrocephalus was made by a neurosurgeon and confirmed by repeated MRI and/ or CT scan.

Results

A total of 20 cases of ETVs were performed on 20 patients (12 females and 8 males) during the study period. Their age ranged from 10-72 years, with a mean age of 25.6 ± 6.8 years. The follow-up period lasted from one month and 36 months. The median follow-up period was four months.

The symptoms of obstructive hydrocephalus included headaches in 16 patients, visual disturbances in 13 patients, vomiting in nine patients, ataxia in eight patients, mental disturbances in three patients, decreased level of consciousness in three patients, urinary disturbances in one patient

The preoperative diagnosis depending on CT and/or MRI scan revealed that the obstructive hydrocephalus was congenital in six (30%) patients and acquired in 14 (70%) patients. Among the six patients who presented with congenital obstructive hydrocephalus (aqueductal stenosis), there were four patients (66.6%) had not received shunt previously while the other two patients (33.6%) had malfunctioning shunt. Also, four patients out of those six patients who had congenital aqueductal stenosis, presented at early age (2-5 years old) and had not received shunt.

On the other hand, it was found that the remaining fourteen patients who presented with acquired obstructive hydrocephalus, were due to or secondary to posterior fossa tumor in nine patients, pineal body tumor in two patients, foramen magnum meningioma in two patients, and intraventricular tumor in one patient.

Post-operative evaluation results depending on clinical presentations of the patients and findings of CT and/ or MRI scan, found that 18 patients improved their symptoms immediately after ETV. One patient died on third post-operative day of management due to unknown causes. One patient with obstructive hydrocephalus due to congenital aqueduct stenosis has developed recurrence of symptoms after 20 days from initial ETV although redo ventriculoscopy has shown patent stoma and patient required VP shunt. Two patients were excluded from the follow-up due to rapid deterioration of their condition from tumor progression.

Four months from initial ETV an overall clinical improvement was observed in 18 of 20 patients giving a success rate of 90% (18 of 20 cases) and did not required shunt placement. Previously shunted patient (5%) became shunt free after ETV. One patient (5%) needed placement of V-P shunt due to ETV failure. One young patient of 25 years old (5%) having posterior fossa tumor with hydrocephalus died on third post-operative day. However, no major complications were reported during the procedure. A high rate of functioning ETVs was found in the study group: five of six patients in the congenital aqueductal stenosis and 13 of 14 patients in tumor had functioning ETVs. ETV was also successful in the two patients with shunt malfunction. By performing endoscopic biopsy in patients who underwent ventriculostomy, pathological diagnosis confirmed for two meningiomas. Five of six patients with aqueductal stenosis improved after initial of ETV.

One patient developed intraoperative interventricular hemorrhage. This complication was overcome by temporary tamponade and irrigation. Poor visualization hindered carrying out the ventriculostomy in the second patient who underwent a successful ETV after clearance of CSF through ventriculostomy wound**.**

Discussion

ETV has become the treatment of choice for the treatment of certain type of obstructive hydrocephalus. ETV has been considered to be an effective and safe treatment for obstructive hydrocephalus by many authors[5,8,9].

Different opinions exist about the effectiveness of ETV. Most authors consider clinical improvement as criteria for obstructive hydrocephalus. In present study, improvement in consciousness level of the patient who underwent ETV has been considered as an assessment for effectiveness of ETV[9,10-12].

Effectiveness of ETV ranges from 51-100%[13-14]. In present study, after three months of initial ETV among patients, an overall effectiveness (clinical improvement) of ETV was 90% {18 out of 20 patients).

The present finding was higher than that generally reported in most series. Grand and Leonard[15] found 80% success rate in a series of 41 ETVs, Ur Haq[9] showed 78.4% effectiveness, Sufianov et al[16] found 71.4% , while Brohi et al[17] found 68% effectiveness. On the other hand, our finding was slightly lower than that reported by Rahman et al[7] and

Rezaee et al[5] who found an overall clinical improvement of 92% among series of ETVs among patients who underwent ETV procedure.

One of the most controversial subjects related to ETV is the success rate in infants. Fritsch et al found that infants with obstructive hydrocephalus had 100% success rate[18].

In contrast, Javadpour et al documented a success rate of 21% in infants. These discrepancies show how variable success rates with ETV can be[19]. However, the age does not present a contraindication for ETV, nor does it increase the pre-operative risk. Some authors reported that the failure rate of ETV ranged from 6% to 50%[20-21].

In this study, the ETV procedure failed in two of 20 patients (10%). The time to failure after ETV for whole group was three to four months after surgery. The risk of failure increase with intracerebral infection likely because of obliteration of cerebrospinal fluid pathway. In this series, treatment was failed in two out of 20 patients (10%) with non post infectious hydrocephalus and a large fourth ventricle.

Many factors have contributed to the attractiveness and popularity of ETV. This treatment is minimally invasive and so patients need short hospital stay. Improvement of symptoms of hydrocephalus occurs immediately after ETV (seizer, headache, ataxia, visual disturbances, consciousness level, repeated vomiting) occurs immediately after ETV procedure; however some of these complications of ETV has been reported by some authors[5,7,18]. Common intraoperative complications include bleeding from the choroid plexus, ventricular wall, or ventriculostomy, Injury to basilar artery complex is most dangerous and reported in some studies. In present study, no major complications were reported during the ETV procedure except some hemorrhage which we managed efficiently by worm saline irrigation. This finding was in agreement to that founded by Rahman et al[7].

With congenital hydrocephalus due to aqueductal stenosis, several authors have reported poor outcomes when treating the condition with third ventriculostomies because of the insufficiently developed subarachnoid space postulating that there had been a congenital failure of the normal fluid pathways outside of the brain to develop[11,22-23], while others have successfully treated congenital hydrocephalus with this procedure[14,24].

The present study has demonstrated that patients with aqueductal stenosis and tumors obstructing outflow from the third or forth ventricle are good candidates for ETV. The success rate was 90% for both aqueductal stenosis and those with tumors. In study conducted by Dusick et al among series of 108 patients who underwent ETV, found that shunt independence occurs in 79% of patients[14].

Lastly, I have no previous data on the effectiveness of ventriculoperitoneal shunting (V-P shunt) procedure on patients with obstructive hydrocephalus through follow up the outcome of patients who underwent V-P shunt to compare with those who underwent ETV procedure. Gonda et al[25] studied 16 patients treated with ETV and 36 patients were treated with V-P shunt. They found that the overall efficacy of symptomatic palliation was comparable in the ETV and VPS patients (ETV = 69%, VPS = 75%). In both groups, patients with more severe hydrocephalic symptoms such as nausea, vomiting, and lethargy were more likely to benefit from the procedure. The overall complication rate for the two groups was comparable (ETV = 12.6%, VPS = 19.4%), although the spectrum of complications differed. The overall survival, initial Karnofsky performance status (KPS), and three-month KPS, were similarly comparable (median survival: ETV 3 months, VPS 5.5 months; initial KPS: ETV = 66 ±7, VPS = 69 ±12; 3 months KPS: ETV = 86 ±7, KPS = 84 ±12).

In conclusion, ETV is most effective in patients with obstructive hydrocephalus caused by aqueductal stenosis and space occupying lesion. Early clinical diagnosis and treatment play an important role in predicting the outcome of ETV. ETV if performed correctly, it is safe, simple and effective treatment option with an acceptable level of complications.

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