

Outcome of Endoscopic Third Ventriculostomy

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Abstract

Background : To study the outcome of endoscopic third ventriculostomy (ETV)

Methods: In this observational study an endoscopic third ventriculostomy was applied in patients who suffered from hydrocephaly. The diagnosis of hydrocephalus was determined by physical, neurological and neuro-radiological criteria. Patients with obstructed hydrocephalus whether congenital or acquired, with a dilated 3rd ventricle were included. Linear incision was given 2cm anterior to the coronal suture in mid pupillary line. Right frontal burr hole is made. For ETV, burr hole is placed on a line joining the foramen of monro and inter-peduncular line. Floor of the third ventricle was punctured close to or over the dorsum sellae. Membrane was dilated with balloon. Balloon was inflated and subsequently was taken out from puncture site. It ensured easy visibility of basilar artery and its perforators.

Result: Age of patients ranged from 06 months to 24 years, with a mean age of 4 years . Fourteen patients had posterior fossa tumour's with dilated third ventricle, sixty four patients had aqua ductal stenosis, two patients with CSF ascites as complication of ventriculo-peritoneal shunt, eleven patients had blocked lower end of ventriculo-peritoneal shunt. Seven patients had CSF leak. Time taken to complete endoscopic third ventriculostomy was from 20 to 40 min as compared to 1 hour to 1.30 hours, taken in a VP shunt. Patients who had ETV performed had a mean hospital stay of 3 days, where as patients in whom a VP shunt was performed stayed in the ward for an average of 5 to 10 days, depending on how eventful the post op period was. The cost incurred to the VP shunt patient who remained admitted for an average of 5 days was between Rupees 16,000 to 25,000, as compared to Rs: 2000 for the patient who underwent endoscopic third ventriculostomy.

Conclusion: Patients of ETV, with less per operative time, had decreased length of stay. ETV also was less expensive to the patient and he did not have to buy the shunt apparatus with less re-

hospitalization rates, compared to patients who had undergone shunt.

Key Words: Endoscopic third ventriculostomy, Hydrocephalus, VP shunt

Introduction

Hydrocephalus is the accumulation of excess cerebrospinal fluid (CSF) in the ventricular system of the brain.¹ Causes may be obstructive or non obstructive in nature. Obstructive causes include space-occupying lesions, congenital lesions etc. Non-obstructive causes include infections, bleeding (traumatic/non traumatic).² The standard treatment is inserting a VP shunt, but shunt infections and blockage are common problems.³ An alternative to a VP shunt is endoscopic third ventriculostomy (ETV).⁴ Long-term extra cranial shunting for hydrocephalus can lead to infections.^{5, 6} Patients can be managed, without significant morbidity, by the use of an intracranial cerebrospinal fluid diversion, e.g., third ventriculostomy.⁷ This method employs endoscope's insertion through a burr hole, created just anterior to the coronal suture. Creation of a small hole in the floor of the 3rd ventricle achieves this.⁸ First advocated by Dandy, ventriculostomy was left in favour of extra cranial procedures.⁹ With improved surgical techniques, however, ventriculostomy is now considered to be a viable alternative in selected cases.¹⁰ In patients in whom third ventriculostomy has failed and who have required ventriculo-peritoneal shunts, it is expected that they will remain less dependent on shunts as the hydrocephalus has been converted from a non communicating one to a communicating . This tends not to have a rapid onset or extreme levels of raised intracranial pressure.¹¹⁻¹³

For this procedure patients are evaluated clinically with progressive head enlargement, tense fontanelle with Evan's ratio 0.7 on CT scan Brain Plain. ¹⁴ Tri-ventricular hydrocephalus is confirmed by CT scan brain studies as dilated third ventricle being a prerequisite for ETV.¹⁵⁻¹⁷ The results indicate that ETV is an effective treatment in cases of obstructive hydrocephalus, caused by aqueductal stenosis and space-occupying lesions.¹⁸⁻²⁰

Endoscopic third ventriculostomy (ETV) is now emerging as a first line treatment for non-communicating hydrocephalus and in cases with shunt failure.^{21, 22} Due to Improvements in technology, endoscopic third ventriculostomy is safer than earlier techniques of open third ventriculostomy.²³ The morbidity and mortality have decreased and the effectiveness has also increased. The chance of being permanently cured is 80% in favourable cases.^{24,25}

Patients and Methods

An endoscopic third ventriculostomy was applied in 88 patients who suffered from hydrocephaly; this was done by the department of neurosurgery at District Head Quarter Hospital, Rawalpindi from, 31st March 2014 to 2nd April 2015. Categorical variables studied were age, gender, cause of hydrocephalus, complications, and evaluated, retrospectively. Clinically, most patients frequently presented with headache, nausea and vomiting and altered consciousness. The diagnosis of hydrocephalus was determined by physical, neurological and neuro-radiological criteria. All patients underwent CT scan of the brain (plain) to confirm the diagnosis of hydrocephalus. Patients with obstructed hydrocephalus whether congenital or acquired, with a dilated 3rd ventricle were included. Infants less than 6 months old, patients having hydrocephalus post meningitis, and patients with hydrocephalus secondary to sub arachnoid haemorrhage were excluded. Patient was given general anaesthesia and positioned supine. Head was placed neutral on head ring/horse shoe. Linear incision was given 2cm anterior to the coronal suture in mid pupillary line. Right frontal burr hole was made. For ETV, burr hole was placed on a line joining the foramen of Monro and inter-peduncular line. After entering the third ventricle through the foramen of Monro was identified the mamillary bodies,tuber cinerium. Floor of third ventricle was punctured close to or over the dorsum sellae. In chronic hydrocephalus it was difficult to puncture the membrane with the fogarty catheter. Membrane can also be punctured with bipolar. After puncturing the membrane was dilated with balloon, which was inflated and subsequently taken out from puncture site (Figure 1). It ensured easy visibility of basilar artery and its perforators. Outcome of the procedured (endoscopic third ventriculostomy) was analyzed, with the help of radiological (check CT Scan brain plain) and clinical/neurological outcome of the patient.

Results

Our study included 88 patients who presented with hydrocephalus, from March 2014 to April 2015. Fifty six patients were male and 32 were females (Age range 6 months to 24 years). As their primary pathology to perform third ventriculostomy, fourteen patients had posterior fossa tumours with dilated third ventricle, sixty one patients had aqueductal stenosis, two patients with CSF ascites as complication of ventriculo-peritoneal shunt, Eleven patients had blocked lower end of ventriculo-peritoneal shunt (Table 1). CSF leak was the commonest complication . Five patients died (Table 2).

Table 1: Indications of third ventriculostomy (n=88)

Diseases	Number	Percentage
Aqueductal stenosis	61	70
Posterior fossa tumours	14	15
Blocked VP shunt	11	13
CSF Ascites	2	2



Colour

Figure 1: Completion of the balloon dilation after removal of the Fogarty balloon.

Table 2:Complications of Endoscopic third ventriculostomy (n=13)

Complications	Number	Percentage
CSF leak	7	7.9%
Chemical meningitis	5	5.7%
Hypothalamic trauma	3	3.4%
Intracereberal bleed	7	7.9%
Wound infection	1	1.1%
Fits	13	14.9%
Death	5	5.7%

Discussion

CSF shunting is the mainstay of the treatment of hydrocephalus. CSF shunting is associated with problems related to under drainage (obstruction, disconnection), over- drainage, and infection.¹ The spectrum of hydrocephalus treatment is drifting

towards endoscopic methods instead of shunts.² It provides a rapid access via small burr holes without the need for brain retraction. Cure of hydrocephalus cannot be ensured.³ The ventriculostomy is usually being made with a blunt instrument such as a guide wire, closed forceps, coagulation with monopolar or bipolar diathermy, laser fiber, dormia basket, bugbee wire or the endoscope itself. Fever and bleeding are common complications.⁴ Short-term memory loss can be anticipated, since the procedure may affect the hypothalamus and the areas of the mamillary body, which are responsible for memory.⁵ Diabetes insipidus is a transient complication.⁶ Arrhythmias are also reported during perforating ventricular floor.^{7,8,9,13}

Third ventriculostomy is considered successful when a patient shows improvement in clinical symptoms or decrease in ventricular size; and does not require placement of a shunt.^{14,15} In some cases, ventricles may remain large, in spite of a return to normal intracranial pressure.¹⁶⁻¹⁸ Failed procedures can occur due to the block in the subarachnoid pathways or inability to absorb CSF at arachnoid villi, as in cases with tuberculous meningitis and with thick membrane at 3rd ventricular floor.¹⁹

Endoscopic third ventriculostomy (ETV) can due to poor absorption of cerebrospinal fluid (CSF) or development of a new or continuing obstruction of CSF pathways.²⁰ In infants, ETV failures are due to a still poorly developed CSF absorptive capacity.²¹ Patterns of endoscopic findings observed are, reclosure of the ventriculostoma, narrowing of the ventriculostoma and patent ventriculostoma with new arachnoid membranes in the basal cisterns below the floor of the third ventricle, not present at the time of the first ETV.²² In all patients, a new obstruction of CSF pathways was seen during repeated ETV or shunt surgery.²³ The presence of preoperative third ventricular bowing is predictive of ETV success, with nearly a 3-fold likelihood of success compared with patients treated with ETV in the absence of such bowing. Although bowing is predictive, 33% of patients without bowing were also treated successfully with ETV. Patients with hydrocephalus often present with both intraventricular obstructive and communicating components, and determination of the predominant component is difficult. Other investigators have observed that third ventricular floor deformation, or "bowing" of the third ventricular floor, is a good indicator of intraventricular obstructive hydrocephalus, resulting in higher success rates with endoscopic third ventriculostomy (ETV).^{24,25}

In present study rigid endoscope and Fogarty balloon, for making third ventriculostomy, was used. In floor with tough membrane a bipolar diathermy probe was used to achieve the initial perforation, which was then enlarged by inflating the balloon of the Fogarty catheter. Age less than 6 months, was the strongest predictor of a poor ETV outcome, but the cause of hydrocephalus and the presence of a prior shunt were also found to have predictive value.

Complications should be kept in mind perioperatively by both surgeons and anaesthesiologists, as prompt detection and action can help minimize the risks associated with neuro-endoscopic procedures.^{1,2} Presence of prepontine arachnoid membranes and the use of EVD negatively influenced the chance of success.³ In present study patients who had any previous CSF diversion procedure, were excluded.

Sankey EW et al⁴ analyzed patients with obstructive hydrocephalus due to aqueductal stenosis. They exhibited symptomatic improvement after ETV, with a relatively low failure rate. In our study the aqueductal stenosis (70%) was the major indication for the endoscopic third ventriculostomy. Waqar M et al⁵ described long-term outcomes of endoscopic third ventriculostomy (ETV) in adults with hydrocephalus.⁵ Critical analysis of their study showed that only previous shunt was found to influence outcomes ($P = 0.021$), with shorter ETV survival noted in patients with a previous shunt. while in our study we excluded those patients who had any previous CSF diversion procedure.

Conclusion

1. ETV has less per operative time, decreased length of stay. It is less expensive, as the patient does not to buy the shunt.

1.ETV is a safe procedure with acceptable rates of long-term efficacy, however, failure can occur, and patients should be instructed to seek medical advice if symptoms recur.

2.A previous shunt is associated with a higher ETV failure rate.

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