

# OUTCOME OF ENDOSCOPIC THIRD VENTRICULOSTOMY IN HYDROCEPHALUS

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## ABSTRACT

*Objective* To elucidate the outcome of endoscopic third ventriculostomy (ETV) in patients with hydrocephalus.

*Study design* Descriptive case series.

*Place & Duration of study* Neurosurgery Department Peoples Medical College Nawabshah, from 1<sup>st</sup> January 2009 to 31<sup>st</sup> December 2009.

*Methodology* Patients aged more than 2 years with hydrocephalus were included. Endoscope used with free hand technique and third ventriculostomy performed with Fogarty balloon. Success was defined with clinical improvement and radiological reduction in ventricular size.

*Results* The study population consisted 19 patients with male preponderance 12 (63.15%) males and 7 (36.84%) females. Age ranged from 3 years to 55 years with mean age 20.8 years. Shunt conversion was done in 5 patients (26.31%). The most common indication was tuberculous meningitis. Success rate was 68.41% (13 cases).

*Conclusions* ETV is an alternative and effective method of treating hydrocephalus in patients with normal ventricular anatomy and thin membrane at the third ventricular floor. Patients with thick membrane and tuberculous meningitis and obscure anatomy had high failure rate.

*Key words* Hydrocephalus, Neuroendoscopy, Endoscopic third ventriculostomy.

## INTRODUCTION:

The management of hydrocephalus needs diversion, either extracranial (shunts) or intracranial (third ventriculostomy<sup>1</sup> or magendiestomy<sup>2</sup>). Extra-cranial shunts are subject to complications such as blockage, infection, and over drainage, often necessitating repeated surgical revisions.<sup>3</sup> Endoscopic third ventriculostomy obviates all these complications.

The ventriculostomy has been performed by Torkildsen,<sup>4</sup> microsurgical,<sup>5</sup> stereotactic<sup>6</sup> or fluoroscopic methods.<sup>7</sup> Endoscopic third ventriculostomy is recently added in the armamentarium of hydrocephalus treatment. The ETV bypasses a stenotic aqueduct or fourth ventricular outlet by perforating the third ventricular floor to deviate the CSF into the inter-peduncular and pre-pontine cisterns.

Apart from ETV, neuroendoscopy may be useful in the management of intraventricular and paraventricular lesions and cystic lesions of the brain. Septum pellucidotomy or septostomy can be performed endoscopically to treat isolated lateral ventricles.<sup>8</sup> Multiloculated hydrocephalus can also be managed by multiple fenestrations. Aqueductoplasty can be used

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for the trapped fourth ventricle syndrome and aqueductal stenosis. Choroid plexus coagulation and framinopty of foramen of Monro or Magendie are alternate options.

The purpose of this study was to describe the epidemiology and outcome of ETV in patients with hydrocephalus in various age groups with different causes and in relation to 3<sup>rd</sup> ventricular floor anatomy.

#### METHODOLOGY:

This study was conducted in Neurosurgery ward Peoples Medical College Nawabshah from 1<sup>st</sup> January 2009 to 31<sup>st</sup> December 2009. Patients above 2 years of age with obstructed hydrocephalus and with clear CSF were included. Patients with systemic problems (uncontrolled diabetes, uremia, hepatic failure, recent myocardial infarction) and hydrocephalus with infected CSF or hemorrhage were excluded.

Diagnosis of hydrocephalus was established when temporal horns were more than 2mm, Evan's ratio (ratio of the largest width of the frontal horns to maximal biparietal diameter) was greater than 30%, ballooning of frontal horns and third ventricle (Mickey Mouse appearance); and peri-ventricular hypo-attenuation on CT scan.

Aesculap endoscope of 0 and 30 degree with 6mm outer diameter were used. Sheath had 4 channels. Largest channel is meant for optic element (endoscope). Working channel is situated above the viewing element and there are two side channels, one for irrigation and other for aspiration. Aesculap 1-chip video camera system (DAVID PV 140/PV 142 Camera) was used. The system also consisted of light source, monitor and working elements.

Under general anaesthesia the patients were placed supine with the head in the anteflexed position and elevated approximately 30° to minimize excessive CSF loss and pneumocephalus. A right pre-coronal incision was made 3cm from midline and 1cm medial to coronal suture. Eight mm burr hole made with undercutting to accommodate the endoscope. Bone dust was kept for placement during closure. Dura was opened in cruciate manner and brain needle was inserted into the ventricle and CSF drawn was sent for examination.

Endoscope was passed with free hand technique into the ventricle and irrigation started after entering ventricle to avoid white matter edema. Irrigation was done with Ringer's solution at 36°C. Ventricle inspected and choroid plexus and thalamostriate veins identified and traced towards foramen of Monro. Endoscope negotiated into the 3<sup>rd</sup> ventricle and damage to the fornix avoided. Structures at the 3<sup>rd</sup> ventricular floor were inspected and the membrane bulging in front of

mamillary bodies and behind the infundibular recess selected for making a hole. Fenestration in the roof of third ventricle was usually done with Fogarty catheter 6FR. Balloon inflated to widen fenestration (5mm to 8mm).

CSF flow through the hole indicated good communication between the ventricles and subarachnoid space. Haemosatsis secured with continuous irrigation, balloon tamponade and/ or bipolar diathermy. Gelfoam was placed in the burr hole and bone dust over it prevent CSF leak. Scalp was sutured in one layer.

Success of third ventriculostomy was labeled when symptoms of raised intracranial pressure resolved. Radiological improvement was labeled when ventricular size decreased and peri-ventricular lucency decreased. In the event of failure a revision third ventriculostomy was performed in cases with favorable anatomy or converted into ventriculoperitoneal shunt in patients with obscure anatomy or thick membrane. Patients were followed regularly to assess clinical improvement and complications.

#### RESULTS:

Over a period of one year we had 19 patients comprising of 12 (63.15%) males and 7 (36.84%) females with male to female ratio (1.71: 1). Age ranged from 3 years to 55 years with mean age 20.8 years. Causes of hydrocephalus are listed in table 1.

Aetiology	Number (%)
Tuberculous Meningitis	7 (36.84%)
Blocked Shunt	3 (15.78%)
Communicating Hydrocephalus	3 (15.78%)
Aqueductal Stenosis	3 (15.78%)
Posterior Fossa Tumors	2 (10.52%)
Cystic Craniopharyngioma	1 (5.26%)
Total	19

Anatomy of third ventricular floor revealed apart from mamillary bodies and infundibular recess, a membrane on front of the mamillary bodies and behind infundibular recess. Details are in table II.

The most common indication was tuberculous meningitis. Success rate was 68.41% (13 cases). All patients with thin membrane had successful third ventriculostomy. Failures were observed in patients with thick membrane and obscure anatomy at third

**Table II: Findings at Third Ventricular Floor**

3 <sup>rd</sup> Ventricular Floor	No of Patients	Success Rate
Thick Opaque	9 (47.4%)	5(26.3%)
Thin Transparent	7 (36.8%)	7(36.8%)
Obscure Anatomy	2 (10.5%)	0
Cystic Craniopharyngioma	1 (5.3%)	1 (5.3%)
Total	19 (100%)	13 (68.4%)

ventricular floor. Shunt conversion was done in 5 patients (26.31%). Two patients had minor haemorrhage during the procedure which was stopped with balloon tamponade and diathermy. One of our patients had transient memory disturbance for few days. Three patients had CSF leak which stopped spontaneously. Postoperative pyrexia was observed in 3 patients.

#### DISCUSSION:

With this notion that no shunt is preferable to a perfect shunt, the spectrum of hydrocephalus treatment is drifting towards endoscopic methods instead of shunts. It provides a rapid access to the target via small burr holes without the need for brain retraction. It does not guarantee for cure of hydrocephalus. Rigid and flexible endoscopes are being used. 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. Authors used rigid one and fogarty balloon for making third ventriculostomy. In floor with tough membrane we used a bipolar diathermy probe to achieve the initial perforation, which was then enlarged by inflating the balloon of the Fogarty catheter.

The common complications of endoscopic third ventriculostomy are fever and bleeding. Short-term memory loss is another potential complication of endoscopic third ventriculostomy, since the procedure may affect the hypothalamus and the areas of the mamillary body, which are responsible for memory. Diabetes insipidus is another transient complication. Baykan et al had reported arrhythmias during perforating third ventricular floor and stressed the vigilance of anesthesiologists during perforation of 3<sup>rd</sup> ventricular floor.<sup>9</sup> In our series two of our patients had transient recent memory disturbance which improved within few days. One of our patients with craniopharyngioma had diabetes insipidus before operation and was managed with oral vasopressin. Fever was noted in 3 patients and managed with tepid sponging.

Success in terms of third ventriculostomy are usually

considered when a patient shows improvement in clinical symptoms or decrease in ventricular size; and does not require placement of a shunt. It is important to note that, in some cases, ventricles may remain large, in spite of a return to normal intracranial pressure. Success rate in our series was lower (68.4%) as compared to 80-90% in literature.<sup>10, 11, 12</sup>. Failed procedures are attributed to the block in the subarachnoid pathways or inability to absorb CSF at arachnoid villi that is why failure rate was high in patients with tuberculous meningitis and with thick membrane at 3<sup>rd</sup> ventricular floor. We found thick membrane in 9 patients (47.36%).

Buxton N et al had safe and effective ETVs in patients with obstructed shunts.<sup>13</sup> We had 3 patients with blocked shunts and all of them were effectively managed with ETVs. Hailong et al had success rate of 44% in communicating hydrocephalus. We performed ETVs in 3 patients with communicating hydrocephalus and two of them showed improvement. The alternative to VP shunting in third ventriculostomy failure is reperforation of the original hole. In ETV failure cases we preferred VP shunt (5 patients).

#### CONCLUSIONS:

ETV is an alternative and effective method of treating hydrocephalus in patients with normal ventricular anatomy and thin membrane at the third ventricular floor. Patients with thick membrane and tuberculous meningitis; and obscure anatomy have high failure rate. Third Ventriculostomy provide an intracranial CSF diversion and freedom from shunt dependency. Patients who have previously undergone shunting and had shunt failure benefit from ETV.

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