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Original Research Article.

Endoscopic Third Ventriculostomy in Hydrocephalus: An Institutional Experience in Tertiary Care Centre

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ABSTRACT

Introduction: Hydrocephalus is a clinical condition in which an excess of CSF fluid accumulates within the ventricular system of the brain. The treatment of hydrocephalus depends on patient's clinical condition and etiology. Neuroendoscopy is becoming more widely used for diagnostic and therapeutic purposes of many different conditions including treatment of hydrocephalus.

Materials and Methods: This prospective study of 52 patients was carried to analyze the safety and efficacy of Endoscopic Third Ventriculostomy (ETV). 24 cases of obstructive and 28 cases of communicating hydrocephalus underwent ETV.

Results: Most (43%) of the patients were less than 10 years of age. 59% of patients having obstructive hydrocephalus and only 28% of patients having communicating hydrocephalus had good outcome.

Conclusion: ETV should be considered as first line of treatment in patients of obstructive hydrocephalus.

Key words: ETV, Hydrocephalous, Endoscopy.

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INTRODUCTION

Hydrocephalus is a clinical condition in which an excess of CSF fluid accumulates within the ventricular system of the brain due to either obstruction or defect in absorption and subsequent rise in intracranial pressure. The condition is not a disease but results from various conditions that affect the fetus, infant, children and adults.

The treatment of hydrocephalus depends on patient's clinical condition and etiology. If there is a mechanical block, removal of the block by debulking the lesion or shunting the excess CSF to other body cavities remains the treatment option.

The problems and complications associated with shunt includes- Insertion of a foreign body, increased chance of infection, opening of other body cavities (peritoneum, pleura, etc.), shunt dependency, slit ventricular syndrome, shunt blockade, shunt disconnection, breakage, erosion of soft tissues.[1,2]

Neuroendoscopy is a field that is becoming more widely used for diagnostic and therapeutic purposes of many different conditions. The technological development of optical and mechanical instrumentation, in addition to stereotactic or ultrasound-guided procedures, provide new modes of treatment that are minimally invasive and, therefore, less traumatic for the patient. Neuroendoscopic procedures for treatment of various neurological disorders like congenital hydrocephalus, post tuberculous meningitis, neurological cyst and tumour biopsies & excision are being increasingly performed.

We conducted a prospective study of 52 cases of hydrocephalus due to various causes to analyze the safety and efficacy of Endoscopic Third Ventriculostomy (ETV) in patients at the Department of Neurosurgery, RIMS, Ranchi between March 20016 and January 2018.

OBJECTIVES

To evaluate the safety and efficacy of ETV in patients with hydrocephalus due to various etiology.

METHOD

We conducted a prospective study of 52 cases of hydrocephalus due to any cause either admitted to Neurosurgical service or referred by other departments at the RIMS, Ranchi between March 20016 and January 2018. 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 associated with the clinical features of raised ICP. After confirmation of raised ICP, all patients included in this study underwent endoscopic ventricular exploration. For ETV the Gaab Universal Endoscope (Karl Storz) was used. Access was through a right coronal bur hole under general anesthesia. After entry of the endoscope into the lateral ventricle, CSF was collected and a diagnostic ventriculoscopy was performed in all patients to look for ependymal tubercles, septations, adhesions, and blockage at the Monro foramen. Once the third ventricle was entered, it was examined for tubercles, septations, adhesions, and aqueductal stenosis, and the status of the floor was assessed. The mammillary bodies were then identified and ETV was performed by making a hole in the premammillary area using the tip of a 4 Fr Fogarty catheter. The stoma was then dilated to approximately 5 mm by balloon inflation of the Fogarty catheter. The endoscope was advanced further to look for any second membrane, which was then punctured if present. Septations, if present in the cistern, were broken and the cistern was thoroughly irrigated with saline to clear it of the cisternal exudates and debris. To and fro movements of the margins of the stoma site with CSF flowing through it confirmed the patency of stoma.

Follow-Up Assessment: All patients were followed up by means of thorough clinical examination at 4 weeks, 8 weeks, and 6 months after endoscopic intervention. CT scan was done at 2 months follow up to detect radiological improvement

Table 1: Causes of Hydrocephalus in 52 studied patients and its distribution as communicating or non-communicating variety

Findings	Communicating	Noncommunicating	Total
TBM hydrocephalus	23(44%)	04(8%)	27(52%)
Congenital aqueductal stenosis	-	06(11%)	06(11%)
Idiopathic aqueductal stenosis	-	11(21%)	11(21%)
Hydrocephalus due to cyst/tumors	-	07(14)	07(14)
Post-traumatic hydrocephalus	01(2%)	-	01(2%)
Total	24(46%)	28(54 %)	52(100%)

Table 2: Age distribution of 52 studied patients with Hydrocephalus

Age group	6 month - 10 yrs	11-20	21-30	31-40	41-50	51-60	Total
TBM hydrocephalus	14	06	03	02	01	01	27
Congenital aqueductal stenosis	06	-	-	-	-	-	06
Idiopathic aqueductal stenosis	-	07	02	01	01	-	11
other hydrocephalus	02	01	-	-	03	02	08
Total	22(43%)	14(27%)	05(9%)	03(6%)	05(9%)	03(6%)	52(100%)

Table 3: Etiology of hydrocephalus in 52 studied cases

Type of hydrocephalus	Males	Females
TBM hydrocephalus	14	13
Congenital aqueductal stenosis	04	02
Idiopathic aqueductal stenosis	08	03
Hydrocephalus due to cyst/tumors	04	03
Post-traumatic hydrocephalus	01	-
Total	31(59%)	21(41%)

Table 4: Outcome according to type of hydrocephalus after ETV in 52 studied cases of Hydrocephalus

Type of Hydrocephalus Finding	Communicating	Noncommunicating	Total	Success Rate
Congenital aqueductal stenosis with hydrocephalus	00	06	6	04(66%)
Acquired aqueductal stenosis	00	12	12	08(66%)
TBM hydrocephalus only	23	02	25	06(24%)
TBM hydrocephalus w/ shunt in situ	02	00	2	01(50%)
Tumors/cyst with hydrocephalus	00	07	7	04(57%)
Total	25	27	52	23(44%)
Success rate	7 (28 %)	16 (59 %)	23 (44%)	

Table 5: Outcome according to etiology of ETV in 52 studied cases of Hydrocephalus

Type of hydrocephalus	Successful	Unsuccessful	Total
Hydrocephalus due to aqueductal stenosis-congenital	04	02	06
Hydrocephalus due to aqueductal stenosis-acquired	08	03	11
TBM hydrocephalus	07	20	27
Hydrocephalus sec.to obstruction by tumors	01	02	03
Hydrocephalus sec.to obstruction by cysts	03	01	04
Post-traumatic hydrocephalus	-	01	01
Total	23(44%)	29(56%)	52(100%)

RESULTS AND DISCUSSION

Incidence and Cause of Hydrocephalus

Hydrocephalus affect both pediatric and adult patients. Pediatric hydrocephalus affects one in every 500 live births making it one of the most common disabilities. Hydrocephalus could be communicating or non-communicating. The cause of hydrocephalus could be congenital or acquired. Among the acquired causes, Infections like TBM accounts for the majority, followed by cysts /tumors, intracranial haemorrhage and rarely trauma [post traumatic hydrocephalus].

In congenital hydrocephalus causes are usually genetic defect (that causes aqueductal stenosis) and developmental disorders (such as those associated with neural tube defects including spina bifida an encephalocele).[1-3]

In our study, 48 % of patients had communicating hydrocephalus and 52 % of patients had non communicating hydrocephalus. Around 1/3rd of the patients had congenital hydrocephalus and ¾ th of them had acquired hydrocephalus. TBM accounted for about half of the patients with hydrocephalus, whereas cysts and accounted for 13 % and trauma for 2 % of hydrocephalus. (Table 1) Hydrocephalus is more common in children. In our study, the percentage of children (52 %) and adults (48 %) with hydrocephalus was almost equal, and in our study, 31 patients (59 %) were males and 21 (41%) were females. [Table 2 and 3]

Outcome

In our study, 25 patients had communicating hydrocephalus, all of them are secondary to TBM, out of which 7 (28 %) of them had successful outcome with ETV. 27 patients had noncommunicating hydrocephalus, out of which 6 were congenital aqueductal stenosis, 12 were acquired aqueductal stenosis, 7 were due to tumors and cyst, and one was posttraumatic hydrocephalus. Out of total 27 patients of noncommunicating hydrocephalus, 16 (59 %) patients had successful outcome with ETV. [Table -5]

Figaji et al concluded that ETV operations were more difficult to perform than for hydrocephalus due to aetiologies other than for TBM hydrocephalus. Although ETV is technically possible in this situation, it is imperative that the patients are adequately selected for the procedure to ensure optimal treatment and that the surgeon has experience with difficult cases.[3]

Ghandour studied fifty-three pediatric patients with a midline posterior fossa tumor (32 medulloblastomas and 21 ependymomas) associated with marked hydrocephalus treated with ETV and found 6.2 % failure rate. He concluded that the shorter duration of surgery, the lower incidence of morbidity, the absence of mortality, the lower incidence of procedure failure, and the significant advantage of not becoming shunt dependent make ETV be recommended as the first choice in the treatment of pediatric patients with marked obstructive hydrocephalus due to midline posterior fossa tumors.[4]

Feng H et al. studied 58 patients with obstructive hydrocephalus with ETVs and found that ETV failed in eight patients (13.8%).[5] In our study, patients of TBM hydrocephalus out of 27 the condition of 7 patients (25 %) improved after the endoscopic procedure only, that of 19 (71%) improved after shunt placement in addition to the endoscopic procedure, and that of 1 patient (4 %) did not improve even after shunt placement following endoscopic procedures.

COMPLICATIONS

Five patients had intraoperative bleed while ETV, out of which 3 patients died. Two patients had basilar artery injury with profuse bleed while ETV procedure and both died. Three patients had diffuse intraoperative bleed from small vessels from third ventricular floor which was managed with irrigation and external ventricular drainage. Intraoperative hemodynamic changes like bradycardia was noticed in 5 patients and hypertension in 2 patients. Postoperative CSF Leak was found in 3 patients.

Leach et al.[6] have reported profound bradycardia in two occasions during endoscopic third ventriculostomy leading to short-lived, spontaneously resolving episode of asystole. Both patients in their series over 140 patients woke up unharmed. They advocated that if irrigation is to be used, care should be taken to keep the fluid strictly at body temperature.

CONCLUSION

Endoscopic third ventriculostomy should be considered as the first surgical option in all patients of non-communicating hydrocephalus who require CSF diversion surgery.

It offers the added advantage of allowing the surgeon to perform other procedures such as septostomy, foraminoplasty, biopsy, and aqueductoplasty to treat related conditions.

We do not recommend ETV as the initial surgical option in patients with post-TBM hydrocephalus. Serious complications including intraoperative bleeding with injury to basilar artery causing death may occur. One should be extremely cautious while making the opening in the floor of third ventricle to avoid injury to the basilar artery.

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