Original Article

Efficacy of Endoscopic Third Ventriculostomy in Posterior Fossa Tumors Associated Hydrocephalus

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ABSTRACT

Objective: To assess the efficacy of ETV in hydrocephalus related to the posterior fossa tumors in children.
Study Design: Randomized controlled trial study.
Place and Duration of Study: This study was conducted at the department of Neurosurgery Nishtar Hospital Multan from January 2018 to March 2020.
Materials and Methods: A total of 45 patients were included in this study. Among the Group 1 was divided into Group 1a including 10 patients who underwent endoscopic third ventriculostomy (ETV) and Group 1b including 7 patients who underwent ventriculo-peritoneal (VP) shunt insertion for relieving intracranial hypertension, depending upon personal preference of neurosurgeons attending those patients. CT scan was done on all of these 45 patients after posterior fossa surgery and it was done repeatedly afterwards depending upon clinical conditions.
Results: Later on, 8 (80 %) patients of group 1a, 2 (28.6 %) patients of group 1b, 13 (86.7%) patients of group 2, and 12 (92.3%) patients of group 3 were shunt free, and the difference among these groups was statistically significant.
Conclusion: As the nature of postoperative hydrocephalus is obstructive, ETV should be regarded as a possible treatment procedure in all cases.

Key Words: Endoscopic Third ventriculostomy, Posterior Fossa Tumors, Efficacy, Corticosteroids, Hydrocephalus.

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INTRODUCTION

There is no common opinion found among neurosurgeons regarding the best approach for management and treatment of obstructive hydrocephalus and its complications secondary to posterior fossa tumors and its subtypes. According to some studies it was suggested by the authors that following the surgical approach to the tumor, preoperative indwelling cerebrospinal fluid shunt are most beneficial technique[1,2]. On the other hand, some of them suggested use of corticosteroids as pretreatment, direct approach to the external ventricular drainage and posterior fossa pathology is required for better management[3]. Studies have been made on the management of hydrocephalus associated with posterior fossa tumors [4,5].

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Advantage of immediate tumor removal in normalizing cerebrospinal fluid (CSF) dynamics has been underlined by many past studies. In one third of the cases clinical practices revealed presence of hydrocephalus even in any small lesion[6]. The endoscopic third ventriculostomy (ETV) before surgical procedure includes following advantages: need of emergency procedures is reduced, control of the intracranial pressure (ICP), provide adequate scheduling for operation for removal of tumor, and reduction in risk in case of external drainage along with the reduction in the chances of postoperative hydrocephalus[7]. Another obvious advantage of this procedure according to neurosurgeons is that it allows the removal of lesion in case of relaxed brain and normal ICP which is difficult to weight. In patients only underwent removal of the tumor and those with filed preoperative ETV due to intraventricular bleeding with secondary closure of the stoma, ETV is done postoperatively in case of persisting hydrocephalus[8]. ETV is very advantageous when carried out postoperatively for persisting hydrocephalus[9] and is more selective to use than preoperatively. If it is used in external CSF drainage which is used for controlling the pressure as well as in excluding the cases in which spontaneous cure of the hydrocephalus has reached it has been reported to be disadvantageous in first few days after operation. A number of studies have been conducted over the use of ETV in patients with posterior fossa tumors but the findings have not shown

any significant results. In this study we are going to assess the efficacy of ETV in pediatric patients with hydrocephalus related to the posterior fossa tumors.

MATERIALS AND METHODS

This is randomized controlled trial conducted in the department of neurosurgery Nishtar Hospital Multan from January 2018 to March 2020. The ethical approval for this study was obtained from ethical board of the hospital. Sample size for the study was calculated using the reference study by Ruggiero et al [10]. A total of 45 patients were included in this study. A non-probability consecutive sampling technique was used. Patients unwilling to participate in the study and with any contraindication to anesthesia induction, any severe systematic disease such as CKD, CLD and IHD were excluded from the study.

CT scan was done on all the 45 patients in the study and among those Group 1 including 17 patients showed severe hydrocephalus and symptoms of intracranial hypertension. Among the Group 1 was divided into Group 1a including 10 patients who underwent endoscopic third ventriculostomy (ETV) and Group 1b including 7 patients who underwent ventriculo-peritoneal (VP) shunt insertion for relieving intracranial hypertension, depending upon personal preference of neurosurgeons attending those patients. MRI images were attained for 26 patients and schedule for tumor resection was made under non-emergency conditions. Fifteen patients of Group 2 were suffering from mild hydrocephalus and were managed with corticosteroid drugs, diuretics and posterior fossa surgery was done in these patients after MRI examination. Group 3 included 13 patients without hydrocephalus after MRI imaging undergone posterior fossa surgery. Ct scan was done on all of these 45 patients after posterior fossa surgery and it was done repeatedly afterwards depending upon clinical conditions. There were 4 children in which endoscopic third ventriculostomy (ETV) was done. In two of these children, ETV was performed when shunts implanted before tumor removal were malfunctioned and in other two children after 3-7 days of tumor surgery shunt was malfunctioned. Statistical analysis was done using the computer software SPSS version 23. Frequency and percentage was calculated for categorical variables.

RESULTS

Group 1a included 10 patients in which ETV was performed. Tumor was present in midline in 6 patients, in cerebellar hemisphere in 2 patients, in brainstem in one patient, and in cerebellopontine angle in one patient. On tumor type, 5 patients had medulloblastoma, 2 were diagnosed of Ependymoma, one had PNET, one had ganglioglioa and one patient has abscess. Total resection was performed in 6 patients; subtotal resection was performed in 3 patients; and no resection was done in one patient.

Group 1b included 7 patients in which ETV was performed. Tumor was present in midline in 6 patients, and in brainstem in one patient. On tumor type, 3 patients had medulloblastoma, 2 patients had Ependymoma, one had PNET, and one had plessopapilloma. Total resection and subtotal resection was performed in 6 and one patients respectively.

Table No.1: Localization, type and resection extent of tumor

Characteristic	Group 1a (n=10)	Group 1b (n=7)	Group 2 (n=15)	Group 3 (n=13)
Tumor localization				
Midline	6	6	9	10
Cerebellar hemisphere	2	0	3	1
Brainstem	1	1	1	2
Cerebellopontine angle	1	0	2	0
Type of Tumor				
Medulloblastoma	5	3	4	5
PNET	1	1	3	2
Ependymoma	2	2	3	0
Astrocytoma	0	0	1	2
Ganglioglioma	1	0	1	2
Plessopapilloma	0	1	1	1
Abscess	1	0	2	1
Resection Extent				
Total	6	6	9	8
Subtotal	3	1	5	3
Partial	0	0	1	1
Biopsy	0	0	0	1
None	1	0	0	0

Group 2 included 15 patients in which ETV was performed. Tumor was present in midline in 9 patients, in cerebellar hemisphere in 3 patients, in brainstem in one patient, and in cerebellopontine angle in 2 patients. On tumor type, medulloblastoma was diagnosed in 4 patients; Ependymoma and PNET were diagnosed in 3 patients each; abscess was diagnosed in 2 patients; and ganglioglioa, astrocytoma and Plessopapilloma were diagnosed in one patient each. Total resection, subtotal resection and partial resection was performed in nine, five and in one patients respectively.

Group 3 included 13 patients in which ETV was performed. Tumor was present in midline in 10 patients, in cerebellar hemisphere in 1 patient, and in brainstem in 2 patients. On tumor type, medulloblastoma was diagnosed in 5 patients; PNET, ganglioglioa and astrocytoma were diagnosed in 2 patients each; and Plessopapilloma and abscess were diagnosed in one patient each. Total resection was performed in 8 patients; subtotal resection was performed in 3 patients; partial resection was done in one patient; and biopsy was performed in one patient. Table-1

Later on, 8 (80 %) patients of group 1a, 2 (28.6 %) patients of group 1b, 13 (86.7%) patients of group 2, and 12 (92.3%) patients of group 3 were shunt free, and the difference among these groups was statistically significant. Table-2.

Table No.2: Shunt-free patients percentage

Group	Number	Percentage
1a	8	80.0
1b	2	28.6
2	13	86.7
3	12	92.3
P value	0.007	

DISCUSSION

In children, association between the lethal condition posterior fossa tumors with hydrocephalus, need urgent surgical treatment. Rate of morbidity and mortality rate was reduced by shunt placement preoperatively. Quick normalization and postoperative prevention of intracranial pressure (ICP) elevation, risk of infection was reduced which occurred due to continuous extraventricular drainage (EVD), betterment of general conditions of patients, and execution of diagnostic and therapeutic procedures via reservoir may also be possible as reported as few advantages of preliminary shunting reported in a study by Bhm et al[11]. However, there have been a lots of arguments against use of systematic shunting preoperatively. In another study done by Richard, when compared to EVD, the risk of morbidity was reported with 2.2% complication rate for less than 5 days[12]. In patients with posterior fossa tumors with systematic shunting preoperatively, cases of upward herniation (10%) were reported by Epstein and Murali[13]. There were also cases of medulloblastomas spreading through ventriculo-peritoneal shunts in a study by Hoffman[14] and Fiorillo et al[15]. The requirement of shunt placement has been questioned by neurosurgeons due to different arguments and developments in accessibility and type of neuroimaging systems. In different studies policy for treatment of posterior fossa tumor and its associated hydrocephalus is suggested like early surgery, treatment with corticosteroid, and drainage from external ventricle. Use of steroids causes reduction in posterior fossa swelling.

Patients with medulloblastomas suffering from severe hydrocephalus before surgical removal of tumor are predicted to require shunt placement[16]. Hydrocephalus of obstructive nature may be caused by obstruction at 4th ventricle outlet level that provides the rational basis of ETV. Purpose of ETV is to build a communication, at the level of the third ventricle floor, between the ventricular system and subarachnoid spaces. In a study done by Sainte-Rose et al. patients with severe hydrocephalus underwent ETVs before removal of tumor were reviewed in 67 cases. When ETV was compared with "conventional treatment" such as steroids, surgery, ventricular drainage etc. performed in patients with severe hydrocephalus after tumor removal and without ventricular enlargement evidence, proved that ETV had a prophylactic and curative effect on intracranial hypertension. Achievement of normal CSF hydrodynamics preoperatively leads to permanent decrease in the impairment of CSF circulation, postoperatively.

Success rate of ETV for management of hydrocephalus was reported to be 100% when performed in 8 patients according to a study conducted by Sainte-Rose et al.[17]. Inflammation of the cerebellum, reabsorption of CSF alteration due to subarachnoid haemorrhage after surgery and formation of adhesions at 4th ventricle outlet level and cisterns were some of the multi-factorial causes of hydrocephalus when carried out postoperatively according to outcomes of previous studies[17]. As operative position plays an important role in allowing reduced intraoperative bleeding, more fine clearance of blood and other surgery related debris to the sitting adopted by Sainte-Rose's patients. There was more perioperative bleeding, inaction of blood and debris, increased contamination risk of the subarachnoid space, and postoperative adhesions prone to position used in patients included in the past study[18]. Due to local recurrence of tumor or of subarachnoid space spread, it can cause occurrence of postoperative hydrocephalus after months or years[17.]

CONCLUSION

ETV prevents postoperative hydrocephalus due to cerebellar swelling but it does not prevent hydrocephalus in all cases. CSF infection risk is also

eliminated due to ETV that was related to external drainage and also reduces the risk of over drainage to minimal as it presents more physiological CSF drainage compared to other procedures. As the nature of postoperative hydrocephalus is obstructive, ETV should be regarded as a possible treatment procedure in all cases.

Author's Contribution:

Concept & Design of Study:	Syed Zahid Hussain Shah
Drafting:	Shoaib Saleem Khan
Data Analysis:	Muhammad Aamir
Revisiting Critically:	Syed Zahid Hussain Shah, Shoaib Saleem Khan
Final Approval of version:	Syed Zahid Hussain Shah

Conflict of Interest: The study has no conflict of interest to declare by any author.

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