EXPERIENCE WITH ENDOSCOPIC THIRD VENTRICULOSTOMY IN THE MANAGEMENT OF HYDROCEPHALUS SECONDARY TO POSTERIOR FOSSA TUMOR

Zia ur Rehman[1], Khalid Khanzada[2], Ramzan Husain[3], Mumtaz Ali[4], Mohammad Ali[5]

ABSTRACT

Objective: *To analyze the outcome of endoscopic 3rd ventriculotomy in the management of hydrocephalus secondary to posterior fossa tumor.*

Methodology: *Sixty five cases of hydrocephalus secondary to posterior fossa tumor underwent endoscopic 3rd ventriculostomy in the Department of Neurosurgery, Lady Reading Hospital, Peshawar Pakistan from January, 2011 to June, 2012 (18 months). This was an observational study and the sampling was by simple random method.*

Results: *The study included 65 patients (37 males, 28 females); M/F ratio was 1.32; Age range was 1-45 years. Fifty one percent (33 cases) of posterior fossa tumors occurred in children less than five years, 23% (15 cases) in the 6-10 year age group, 16% (11 cases) occurred in 11-14 years and 10% (06 cases) in age group >14 yrs. Endoscopic third ventriculostomy was performed in 54 (83.07%) patients with successful outcome. Ventriculoperitoneal shunt was required in 5 (7.69%) patients for the suspicion of inadequate ventriculostomy. Ventricular drainage device (EVD) was inserted in 2 (3.07%) cases for hemorrhagic CSF. In 4 (6.15%) patients no drainage procedure was done (4th ventricle floor not involved / Aqueduct opening visible).*

Conclusions: *Preoperative endoscopic third ventriculostomy (ETV) control the intracranial pressure (ICP), avoid the necessity of an emergency procedure, allow appropriate scheduling of the operation for tumor removal, and eliminate the risks related to the presence of an external drainage. The most common age group involved was under 5 years. The success rate of ETV was 83% and Medulloblastoma was the most common Histopathological findings.*

Key Words: *Posterior fossa tumor, Outcome, Hydrocephalus, Endoscopic third ventriculostomy (ETV).*

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INTRODUCTION

Tumors of the central nervous system are the most common solid neoplasms in infancy and most of them are located in the posterior fossa[1, 2]. The proximity of these lesions to the fourth ventricle explains the common presentation of these patients with obstructive hydrocephalus, as described in about 80% of the cases[3, 4].

Children with posterior fossa tumors are frequently very ill on presentation, with severe headache and vomiting as a result of obstructive hydrocephalus. Since brainstem compression is often present, rapid and catastrophic deterioration is always a danger[5-7]. The treatment options for posterior fossa tumors are surgery, radiotherapy and chemotherapy. The surgical goal for nearly all tumors is complete resection[5, 8] provided the floor of the fourth ventricle and brainstem are not infiltrated. In most cases, decompression of the brainstem and reduction of the tumor bulk is the initial objective. Mass effect associated with cystic or hemorrhagic lesion is quickly and effectively reduced by early aspiration. Removal

[1-5]Department of Neurosurgery, Lady Reading Hospital, Peshawar - Pakistan.

Address for Correspondence:
Dr. Zia ur Rehman,
Department of Neurosurgery, Lady Reading Hospital Peshawar - Pakistan.
Email: zia127@yahoo.com

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of CSF via the ventriculostomy is another effective method to reduce intracranial pressure[9, 10].

Endoscopic third ventriculostomy (ETV) is a widely accepted treatment for obstructive hydrocephalus. The procedure was first performed by William Mixter, an urologist in 1923 using an ureteroscope to fenestrate the floor of the third ventricle[8]. The advent of valve-regulated shunting technology proved to be an effective method for treating hydrocephalus of multiple causes. Third ventriculostomy remained a stagnant procedure with percutaneous and stereotactic alterations to the procedure requiring more highly specialized techniques and equipment limiting interest in developing the technique. There has been resurgence in interest of applying ETV to broader pathologies as modern endoscopes with their fiber-optics and advanced light sources that allow for excellent resolution of ventricular anatomy and control the safe fenestration of the floor of the third ventricle[11-13].

Endoscopic third ventriculostomy in the management of hydrocephalus secondary to posterior fossa tumors was proposed, for the first time, by Chumas et al, in 1995[14] and its efficacy was reviewed by Sainte-Rose et al, in 2001[15]. Sainte-Rose et al, reviewed 67 ETVs performed before tumor removal in patients with severe hydrocephalus. In this series there were no deaths and no permanent morbidity related to the procedure, a 98.5% rate of immediate symptomatic resolution, and a 94% rate of shunt-free patients after tumor removal.

Neurosurgeons are still divided in their opinions concerning the best way to manage obstructive hydrocephalus secondary to posterior fossa tumors. Some authors propose a preoperative indwelling cerebrospinal fluid shunt as most advantageous for the subsequent surgical approach to the tumour. Others propose a pre-treatment with corticosteroids and direct approach to the posterior fossa pathology, when possible, or external ventricular drainage (EVD), when necessary[16-18]. Based on recent reports, we adopted the policy of performing a preoperative endoscopic third ventriculostomy (ETV) in cases of symptomatic hydrocephalus. The procedure provide a valid alternative to placement of a permanent shunt in cases in which hydrocephalus develops following posterior fossa surgery and will help the neurosurgeon to remove the tumor with relax brain and normal ICP.

METHODOLOGY

In this prospective study 65 patients with hydrocephalus secondary to posterior fossa tumors underwent endoscopic 3rd ventriculostomy. These patients were operated in 18 months' time from January 2011 to June 2012. This study was carried out in Neurosurgery department of LRH; Peshawar Sampling technique was by Consecutive (Non-probability sampling). The inclusion criteria were to include all patients with posterior fossa tumors with associated hydrocephalus, patients of all ages, both genders and patients with Kornofsky score above 60. The Exclusion criteria consisted of patients with history of VP Shunt or ETV, Recurrent tumor on the basis of history and medical records and Kornofsky score below 60.

This study was considered after approval by the ethical committee of LRH, Peshawar. A complete history of all patients, meeting inclusion criteria was taken and thorough physical examination done at the time of admission in Neurosurgery ward those meeting the inclusion criteria were enrolled in the study through OPD and were admitted in the ward for further workup. Informed written consent was taken from patient or relatives. Exclusion criteria were followed strictly to avoid any bias or confounding factors in our results. All the surgeries were performed by single experienced neurosurgeon having minimum of 3 years of experience. The collected information was entered in Statistical Package of Social Sciences (SPSS) version 10 and for analysis. Frequency and percentage were calculated for categorical variables like gender and post-operative outcome. All results are presented as graphs and tables.

ETV was considered successful in clinically improved patient with and without radiological improvement and was considered failed in patient who did not improve clinically even with patent stoma VP shunts/ EVD was considered in failed cases and no repeat ETV was attempted, patients were sent home on 3rd post-operative day.

RESULTS

The study included 65 patients (37 males, 28 females; M/F ratio, 1.32; Age range. 1-45 years. Fifty one percent (33 cases) of posterior fossa tumors occurred in children less than five years, 23% (15 cases) in the 6-10 year age group, 16% (11 cases) occurred in 11-14 years and 10% (06 cases) in age group >14 yrs.

Endoscopic third ventriculostomy was performed in the 54 (83.07%) patients with successful outcome. Ventriculoperitoneal shunt was required in 5 (7.69%) patients for the suspicion of inadequate ventriculostomy. Ventricular drainage device (EVD) was inserted in 2 (3.07%) cases for hemorrhagic CSF. In 4 (6.15%) patients no drainage procedure was done (4th ventricle floor not involved / Aqueduct opening visible).

The signs and symptoms of increased intracranial pressure (ICP) resolved after ETV in all patients.

Figure 1: Age wise distribution

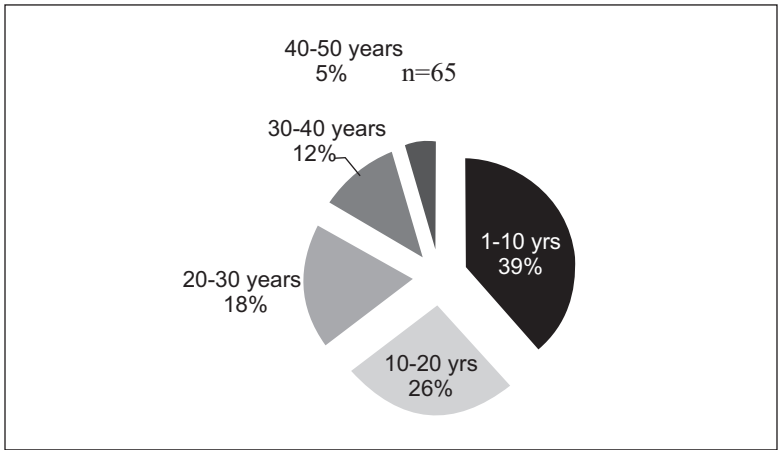


Figure 2: Incidence and type of tumor

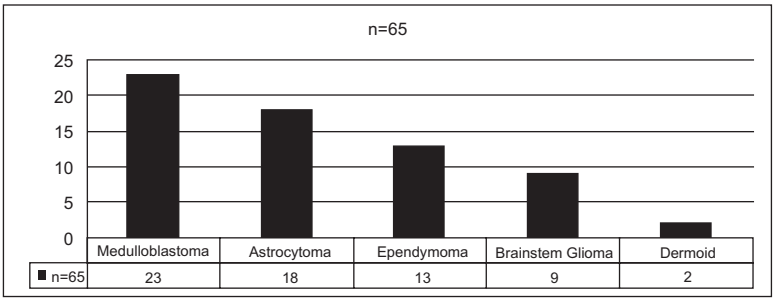


Figure 3: Surgical procedures performed

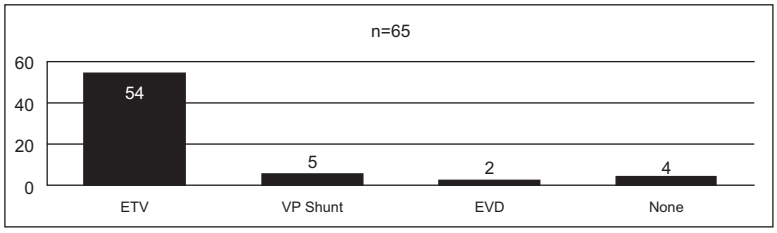


Figure 4: Extent of decompression

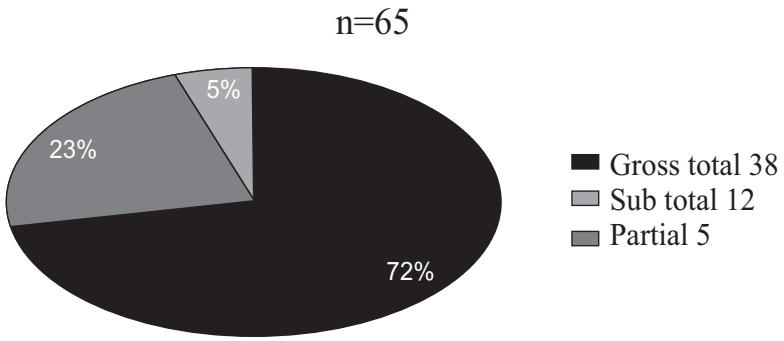


Figure 5: Complications of ETV

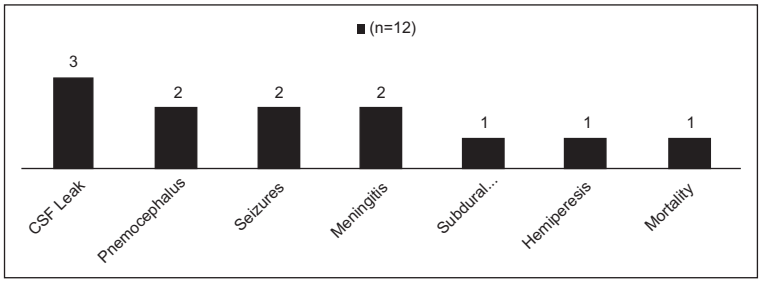
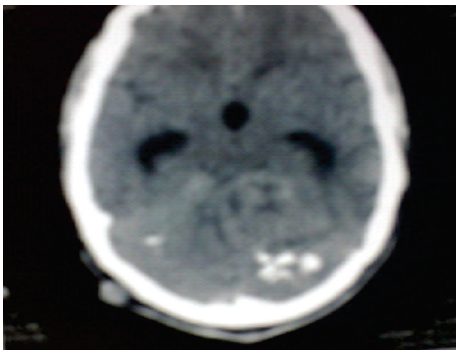
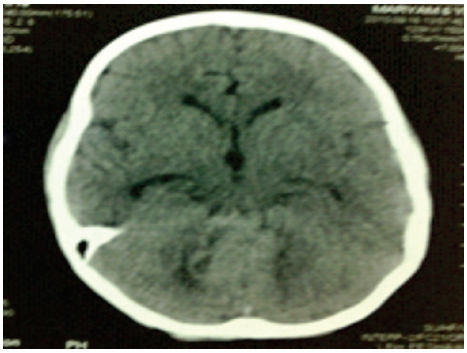


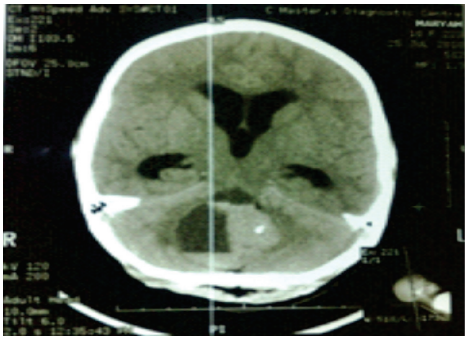
Figure 6: Pre and Post-op CT scans



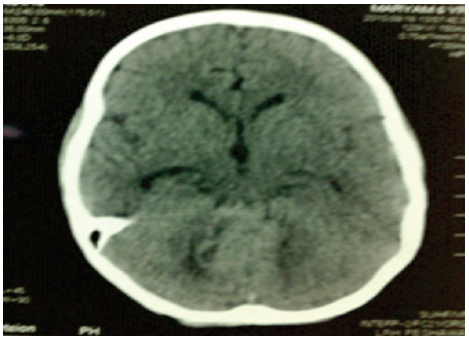
Pre-Op (ETV)



Post-Op (ETV)



Pre-Op (ETV)



Post-Op (ETV)

Follow-up brain CT scan showed no complications related to third ventriculostomy except for insignificant asymptomatic pneumocephalus in 2 cases and subdural hematoma in 1 case. The most common post-operative complication observed was CSF leak (3), followed by seizures (2 cases), meningitis (2 cases) and hemiparesis (1 case). All the patients with complication were treated conservatively. One patient died after ETV as a result of reverse conning.

The patients were sent home after ETV/VP shunt on 3rd post-operative day and were asked to come after 4 weeks for definitive surgery. Follow-up CT Brain was performed showing reduction in ventricular size and resolution of signs of increased ICP in all patients after 4 weeks. Those patients with EVD/No drainage procedure performed were subjected to tumor surgery on next available list. The definitive surgery showed satisfactory posterior fossa condition in relation to the CSF pressure, even cases which showed some tightness in the posterior fossa the routine measures were adequate to control the pressure, especially after the cisterna magna was opened and more CSF released.

In 68% (44 patients), gross total resection of the tumor was performed. In 22% (14 patients), the tumor was resected sub totally and in 10% (7 patients),

we performed partial tumor resection due to severe adhesion to the brain stem and involvement of the cranial nerves. The anatomical pathway of the CSF was opened in all cases with satisfactory flow. The postoperative period showed no complications related to CSF pressure; there was no hydrocephalus, no CSF leak, or any CSF collection in the wound area in all cases. None of the 54 patients needed any further drainage procedures early postoperative or later on follow-up visits.

DISCUSSION

In our study the results show that the number of patients requiring VP-Shunt has been reduced to 7.69%. As reported by McLauren in his study this number may be reduced to 6% if an endoscopic third ventriculostomy (ETV) is performed as the first CSF diversion technique or in combination with a ventriculostomy[19].

In our study we performed ETV in 65 patients before tumor removal in patients with severe hydrocephalus. In 54 (83.07%) patients ETV was performed successfully with good outcome while in 5 (7.69%) of patients VP shunt was placed due to inadequate drainage. There was no permanent morbidity relate to ETV only one patient died secondary to CSF leak and Meningitis. The results of our study are comparable with that of Sainte-Rose et al[14]. Sainte-Rose et al, reviewed 67 ETVs performed before tumor removal in patients with severe hydrocephalus. In this series there were no deaths and no permanent morbidity related to the procedure, a 98.5% rate of immediate symptomatic resolution, and a 94% rate of shunt-free patients after tumor removal. Preoperative normalization of CSF hydrodynamics seems to decrease the risk of permanent postoperative impairment of CSF circulation. However, by performing an ETV in every child with hydrocephalus and posterior fossa tumor, one would be exposing 70% of children to the morbidity of an extra surgical procedure[20]. Riva-Cambrin and co-workers have developed a pre-operative clinical grading system to aid in determining the need for post-operative CSF diversion. This grading system scores children based on age (<2 years), initial degree of hydrocephalus, tumor histological features, and presence of metastasis to predict probability of hydrocephalus at 6 months. This system can aid the surgeon in determining whether to perform CSF diversion (shunt or ETV) prior to surgical removal of tumor[21].

The success rate of ETV in our study is 83.07% performed in 54 patients. The success rate is comparable with that of Hopf et al, have reported a significant experience in 17 cases of ETV in severe hydrocephalus secondary to posterior fossa tumor, with a 76% success rate in controlling hydrocephalus[9].

Similarly the study conducted by Valenzuela and Trellez, have also reported their experience in 21 cases of ETV in severe hydrocephalus before posterior fossa tumor surgery, with a 76% success rate in controlling hydrocephalus[11].

The overall complications related to ETV as shown in our study were 7.8% with no deleterious sequela like upward herniation. CSF leak was noted in 3 patients while pneumocephlus, meningitis, seizures were observed in 2 patients each, mild hemiparesis was observed in one patient and one patient died due to CSF leak and meningitis. While comparing with other studies shows that there is considerable morbidity when compared with EVD for less than 5 days with a very low complication rate (2.2%), reported 10% rate of upward herniation in cases of posterior fossa tumors subjected to preliminary shunting[22], and spreading of medulloblastomas through ventriculo-peritoneal shunts[23]. These arguments and the improvements in the availability and type of neuroimaging systems that permit earlier diagnosis have caused neurosurgeons to question the need for routine shunt placement.

Our study shows no post-op infection and upward herniation except hemorrhage in 2 (1.3%) patients in which EVD was performed. The patients were having normal ICP with no pseudomeningocele formation and pseudobulbar palsy except CSF leak, observed in 3 patients.

In comparison with the study conducted by Rappaport, Schmid and Seiler on External ventricular drainage used in these situations reported 10% and 4.9% infection rate respectively and upward herniation or haemorrhage[24]. Seventeen to 40% of patients treated with this protocol have uncontrolled hydrocephalus after tumor removal and require placement of a definitive CSF shunt. This kind of hydrocephalus occurs predominantly within the first month of surgery. These patients, placed at risk of suffering ICH, have an increased rate of CSF leakage and pseudomeningocele formation, a prolonged hospitalization and a high risk of pseudobulbar palsy.

CONCLUSION

Preoperative endoscopic third ventriculostomy (ETV) control the intracranial pressure (ICP), avoid the necessity of an emergency procedure, allow appropriate scheduling of the operation for tumor removal, and eliminate the risks related to the presence of an external drainage. The most common age group involved was under 5 years. The success rate of ETV was 83% and Medulloblastoma was the most common Histopathological findings

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CONTRIBUTORS

ZR prepared the first draft of manuscript and did the data collection. KK, RH, MA review the paper for finalization. MA supervised the study. All the authors contributed significantly to the research that resulted in the submitted manuscript.