



Original Article (BRAIN)

Per-Operative External Ventricular Drainage Results in Children with Posterior Fossa Tumors and Hydrocephalus

Abdul Mannan Aftab, Abdul Aziz Khan, Khalid Zadran, Aamir Zaman

Department of Neurosurgery, Ayub Teaching Hospital, Abbottabad, Pakistan

ABSTRACT

Objective: We determined the outcome of per operational external ventricular drainage in pediatric patients with posterior fossa tumors and hydrocephalus.

Material And Methods: 54 patients included presenting with posterior fossa tumors and mild to moderate hydrocephalous were considered for per operative external ventricular drainage. The external ventricular drain was then weaned off in one week. If it cannot be removed due to persistent hydrocephalous it was converted into a permanent ventriculoperitoneal shunt.

Results: In the study, the mean age was 7 years. Twenty-seven children had ependymoma, 19% of children had medulloblastoma, and 54% of children had pilocytic astrocytoma. Moreover, 67% of children had weaned off and 33% of children had converted to VP shunt. There existed an insignificant difference in the outcome (yes/ no) concerning age groups, gender, and tumor type.

Conclusion: Our study concludes that the outcome of per operative external ventricular drainage was weaned off (67%) and converted to VP shunt (33%) in pediatrics with posterior fossa tumors and hydrocephalous.

Keywords: External Ventricular Drainage, Posterior Fossa Tumor, Hydrocephalous.

Corresponding Author: Prof. Dr. Abdul Aziz Khan

Department of Neurosurgery

Ayub Teaching Hospital, Abbottabad

Email: drabdulazizkhan2121@gmail.com

Date of Submission: 02-02-2022

Date of Revision: 03-03-2022

Date of Acceptance: 02-06-2022

Date of Online Publishing: 30-06-2022

Date of Print: 30-06-2022

DOI: 10.36552/pjns.v26i2.685

INTRODUCTION

The study aimed to know the outcome of per operative External ventricular drainage in pediatrics with posterior fossa tumors and hydrocephalous presented in the Neurosurgical Unit of Ayub Teaching Hospital. Children are more likely than adults to develop posterior fossa tumors. The posterior fossa is the site of genesis for between 54% and 70% of all juvenile brain tumors. Adult brain cancers arise in the posterior fossa in around 15 – 20% of cases. 82 Tumors of the central nervous system are prevalent in

children, with the majority of them occurring in the infratentorial compartment.¹ At the time of presentation, about 71 – 90 percent of patients with posterior fossa tumors had hydrocephalus. The majority of hydrocephalus is obstructive, caused by an obstruction of CSF routes at the aqueduct or fourth ventricle level. Because tumor excision relieves hydrocephalus in 91 percent of patients, this obstructive hydrocephalus has been defined as an intra-axial process. However, 29 percent of patients experienced delayed recovery in CSF pressure following tumor removal, indicating an extra-axial mechanism contributing to hydrocephalus that is reversible and at the subarachnoid space level.²

Only around 10% to 40% of individuals with posterior fossa tumor excision have residual hydrocephalus. Bognar et al. discovered that in patients undergoing posterior fossa tumor excision with per op EVD, 62 percent of those who had an EVD for more than 8 days required the shunt, whereas only 21.4 percent of those who had an EVD for less than 8 days required the shunt. Many risk factors contribute to post-resection or persistent hydrocephalus, including young age, moderate to severe hydrocephalus, transependymal edema, and the presence of brain metastases.³ When compared to EVD or Endoscopic third ventriculostomy, ventriculoperitoneal shunting is a superior alternative for individuals with metastatic posterior fossa tumors and allows for earlier oncologic therapy.⁴ Preoperative therapy of hydrocephalus offers various advantages since it improves the patient's overall state and gives time for planned elective tumor removal. However, around 2.3 percent of patients who had hydrocephalus pre-resection care for posterior fossa tumors suffered problems such as intratumoral hemorrhage or upward herniation, both of which have a poor prognosis.⁵

The majority of individuals with posterior fossa tumors have cerebellar impairments. In patients with prior symptoms, further localized

neurologic abnormalities may arise. Except for a sixth nerve palsy, which may be present as a result of generalized increased intracranial pressure, ocular motor impairments are very common and tend to be of localizing importance. 79 Cerebellar impairments occur in the majority of individuals with posterior fossa malignancies.⁶ The most prevalent symptom in people with posterior fossa tumors is a headache. Tonsillar herniation into the foramen magnum is suggested by associated neck discomfort, stiffness, or head tilt. Headache is a sneaky and sporadic ailment. In children, headaches present as irritation and trouble being managed. Patients with posterior fossa tumors receive surgery for the following reasons: to decompress the posterior fossa to relieve pressure on the brain stem and/or to reduce intracranial pressure and avoid herniation, and Histopathology is used to identify the tumor and to select the best course of treatment based on the characteristics of the tumor. When needed, shunting cerebrospinal fluid (CSF) to the peritoneal cavity, ETV (internal CSF drainage), or even no drainage is considered to treat hydrocephalus. Even yet, many people differ on the best shunting method.⁷

MATERIAL AND METHODS

Study Design & Study Setting

A case series study was conducted at the Neurosurgery unit of Ayub Teaching Hospital, Abbottabad. The study was conducted for 6 months from 2/8/2019 to 2/8/2020.

A nonprobability consecutive sampling was considered.

Inclusion Criteria

Patients of both genders of age between 1 – 15 years were included. Patients with posterior fossa

tumors and mild to severe hydrocephalus were included in the study.

Exclusion Criteria

Cases of all other brain tumors were excluded. Cases of congenital abnormalities were not included.

Data Collection

The study was started after taking approval from the hospital ethics committee. Informed written consent was taken from each patient. A total of 54 patients with posterior fossa tumors and associated mild to moderate hydrocephalus are included. Clinical information was recorded on a pre-designed proforma. All patients presenting with posterior fossa tumors and mild to moderate hydrocephalus were considered for per operative external ventricular drainage. The external ventricular drain was then weaned off in one week. If it cannot be removed due to persistent hydrocephalus it was converted into a permanent ventriculoperitoneal shunt.

Data Analysis

The data was entered in SPSS version 23. Descriptive statistics were used to calculate means \pm standard deviation for the age of the patient. Frequencies with percentages were calculated for gender and outcome variables. The effect modifiers like age, gender, and tumor type were controlled by the stratification method. Post-stratification chi-square test was applied.

RESULTS

Age Distribution

14 (25%) children were in the age range 1 – 3

years, 32 (60%) were between 4 – 10 years, and 8 (15%) were between 11-15 years. The mean age was 7 ± 3.421 years (Table 1).

Table 1: Age Distribution.

Age (Group)	N	%
1 – 3 years	14	25%
4 – 10 years	32	60%
11 – 15 years	8	15%
Total	54	100%

Mean age was 7 ± 3.421 years

Gender Distribution

33 (62%) children were male and 21 (38%) children were female.

Tumor Type

15(27%) children had ependymoma, 10(19%) children had medulloblastoma, and 29(54%) children had pilocytic astrocytoma (Table 2).

Table 2: Type of Tumor.

Type of Tumor	N	%
Ependymoma	15	27%
Medulloblastoma	10	19%
Pilocytic astrocytoma	29	54%
Total	54	100%

Per Operative EVD

36 (67%) children had weaned off and 18 (33%) children had converted to VP shunt (Table 3).

Table 3: Per Operative EVD.

Per Operative EVD	N	%
Weaned Off	36	67%
Converted to VP shunt	18	33%
Total	54	100%

Stratification Results

Stratification of per operative EVD with respect to age, gender, and tumor type is given in Tables 4 –

6. There existed an insignificant difference in the outcome (yes/no) with respect to age groups, gender, and tumor type.

DISCUSSION

According to our findings, the average age was 7 years, with a standard deviation of 3.421. Sixty-two percent of the children were male, while 38 percent were female. Twenty-seven children were diagnosed with ependymoma, 19% with medulloblastoma, and 54% with pilocytic astrocytoma. More than 67 percent of the children had been weaned, and 33 percent were switched to VP shunt. Similar findings were reported by Ghani et al. 124, who performed preoperative emergency EVD insertion in 38 patients with juvenile posterior fossa tumors. There were two groups of patients. Group A includes individuals who have preoperative EVD for 7 days or fewer. Group B covers individuals who had preoperative EVD for more than 7 days. Group A comprises 16 patients, but Group B has 22. Only symptoms and indications of elevated intracranial pressure (ICP) were present as the major clinical characteristic. Seven individuals had EVD-related infections. The overall shunt rate was 23.68%.

Ghani et al.⁸ observed similar findings after performing preoperative emergency EVD insertion in 38 patients with juvenile posterior fossa tumors. Individuals in Group A have had preoperative EVD for 7 days or less. Individuals in Group B experienced preoperative EVD for more than 7 days. As the primary clinical feature, only symptoms and indicators of high intracranial pressure (ICP) were observed. Seven people got EVD-related illnesses. The total shunt rate was

Table 4: Per Operative EVD with Respect to Age.

Outcome	Age Ranges in Years			Total	P value
	1 – 3	4 – 10	11 – 15		
Yes	9	22	5	36	0.9228 (insignificant result)
No	5	10	3	18	
Total	14	32	8	54	

Table 5: Outcome with Respect to Gender.

Outcome	Male	Female	Total	P value
Yes	22	14	36	1.0000 (insignificant result)
No	11	7	18	
Total	33	21	54	

Table 6: Outcome with Respect to Type of Tumor.

Outcome	Ependymoma	Medulloblastoma	Pilocytic Astrocytoma	Total	P value
Yes	10	7	19	36	0.9669 (insignificant result)
No	5	3	10	18	
Total	15	10	29	54	

23.68%. In one research, 95.2 percent of patients had symptomatic hydrocephalus, although 29.8 percent required a postoperative VP shunt. These were either handled with intraoperative EVD or without CSF diversion. Most surgeons anticipate that one-third of patients will eventually require postoperative CSF diversion. In several investigations, the rate of VP shunt implantation ranged from 30% to 38%. Riva-Cambrin et al. created a pre-operative clinical grading system to help determine if post-operative CSF diversion is necessary. To forecast the likelihood of hydrocephalus after 6 months, this grading system evaluates children based on their age (2 years), initial degree of hydrocephalus, tumor histological characteristics, and the existence of metastasis.⁹⁻¹¹ During the surgical operation, an occipital or 'Frazier' burr hole can now be placed. This is for emergency lateral ventricle decompression if post-operative edema causes

occlusion of the fourth ventricle and acute hydrocephalus.¹²

The treatment of hydrocephalus caused by a tumor in the posterior fossa remains debatable. Some writers highlight the benefits of rapid tumor excision, which may regulate cerebrospinal fluid (CSF) dynamics.¹³ In clinical practice, however, simple excision of the lesion is associated with persistent hydrocephalus in around one-third of the cases. Endoscopic third ventriculostomy (ETV) before surgery has various advantages.¹⁴ It may manage intracranial pressure (ICP), reduce the need for emergency treatment, allow for proper timing of the tumor removal operation, and eliminate the hazards associated with the existence of external drainage. The technique also lowers the likelihood of postoperative hydrocephalus. A final benefit, which is more difficult to quantify but clear to the neurosurgeon, is the ability to remove the lesion while the brain is calm and the ICP is normal. In the postoperative phase, ETV can be utilized to treat patients with persistent hydrocephalus, both those who had merely the tumor removed and those whose preoperative ETV failed due to intraventricular hemorrhage with subsequent stoma closure (redoETV). The fundamental benefit of postoperative ETV is that it is performed only in cases with persistent hydrocephalus; as a result, its usage is more selective than preoperative ETV. The drawback is the typical usage of external CSF draining in the first few postoperative days, which is required to manage the pressure and rule out cases of spontaneous hydrocephalus cure.¹⁵ For a cerebellar posterior fossa lesion, patients are normally put in the prone position; if the lesion involves a lateral extension, a modest head rotation may be used. Because blood does not pool in the operating field, some surgeons prefer the sitting position for cerebellar lesions. The park-bench posture is frequently employed for lesions that primarily affect the CPA. The midline suboccipital craniotomy has been the workhorse for fourth ventricle tumor removal. Improvements

to the midline technique have been created, such as the telovelar approach with cerebellomedullary fissure dissection to reach the fourth ventricle without splitting the vermis.¹⁶

CONCLUSION

Our findings show that in pediatrics with posterior fossa tumors and hydrocephalus, external ventricular drainage may be weaned off (67%) and switched to a VP shunt (33%).

REFERENCES

1. D'Arco F, Khan F, Mankad K, Ganau M, Caro-Dominguez P, Bisdas S. Differential diagnosis of posterior fossa tumours in children: new insights. *Pediatr Radiol.* 2018; 48 (13): 1955-63.
2. Bateman GA, Fiorentino M. Childhood hydrocephalus secondary to posterior fossa tumor is both an intra- and extraaxial process. *J Neurosurg Pediatr.* 2016; 18 (1): 21-8.
3. Lin CT, Riva-Cambrin JK. Management of posterior fossa tumors and hydrocephalus in children: a review. *Childs Nerv Syst.* 2015; 31 (10): 1781-9.
4. Le Fournier L, Delion M, Esvan M, De Carli E, Chappé C, Mercier P, et al. Management of hydrocephalus in pediatric metastatic tumors of the posterior fossa at presentation. *Childs Nerv Syst.* 2017; 33 (9): 1473-80.
5. El-Gaidi MA, El-Nasr AH, Eissa EM. Infratentorial complications following preresection CSF diversion in children with posterior fossa tumors. *J Neurosurg Pediatr.* 2015; 15 (1): 4-11.
6. Shbeeb MI, O'Duffy JD, Michet CJ Jr, O'Fallon WM, Matteson EL. Evaluation of glucocorticosteroid injection for the treatment of trochanteric bursitis. *J Rheumatol.* 1996 Dec. 23 (12): 2104-6.
7. Rasul FT, Marcus HJ, Toma AK, Thorne L, Watkins LD. Is endoscopic third ventriculostomy superior to shunts in patients with non-communicating hydrocephalus? A systematic review and meta-analysis of the evidence. *Acta Neurochir (Wien)*, 2013 May; 155 (5): 883-9.
8. Ghani E, AlBanyan A, Sabbagh A, Ahmad M. Duration of Preoperative External Ventricular Drain in Pediatric Posterior Fossa Tumors—Does It

- Matter? *Open Journal of Pediatrics*, 2017; 7: 86-97.
9. Serlo W, Fernell E, Heikkinen E, Anderson H, Wendt L. Functions and Complications of Shunts in Different Etiologies of Childhood Hydrocephalus. *Child's Nervous System*, 1990; 6: 92-94.
 10. Riva-Cambrin J, Detsky AS, Lamberti-Pasculli, M, Sargent MA., Armstrong D, Moineddin R. Predicting Postresection Hydrocephalus in Pediatric Patients with Posterior Fossa Tumors. *Journal of Neurosurgery: Pediatrics*, 2009; 3: 378-85.
 11. Ghani E, Zaidi GI, Nadeem M, Rehman L, Noman M. Role of Cerebrospinal Fluid Diversion in Posterior Fossa Tumor Surgery. *Journal of the College of Physicians and Surgeons*, 2003; 13: 333-36.
 12. Bronstein KS. Epidemiology and classification of brain tumors. *Crit Care Nurs Clin North Am*. 1995; 7 (1): 79-89.
 13. du Plessis AJ. Posthemorrhagic hydrocephalus and brain injury in the preterm infant: dilemmas in diagnosis and management. *Semin Pediatr Neurol*. 1998 Sep. 5 (3): 161-79.
 14. Lassman LP, Arjona VE. Pontine gliomas of childhood. *Lancet*. 1967; 1 (7496): 913-5.
 15. Reigel DH, Scarff TB, Woodford JE. Biopsy of pediatric brain stem tumors. *Childs Brain*, 1979; 5 (3): 329-40.
 16. Griwan MS, Sharma BS, Mahajan RK, Kak VK. Value of precraniotomy shunts in children with posterior fossa tumours. *Childs Nerv Syst*. 1993; (8): 462-5.

Additional Information

Disclosures: Authors report no conflict of interest.

Ethical Review Board Approval: The study was conformed to the ethical review board requirements.

Human Subjects: Consent was obtained by all patients/participants in this study.

Conflicts of Interest:

In compliance with the ICMJE uniform disclosure form, all authors declare the following:

Financial Relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

Other Relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

AUTHORS CONTRIBUTIONS

Sr.#	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Abdul Mannan Aftab	1. Study design and methodology.
2.	Abdul Aziz Khan	2. Paper writing, referencing, and data calculations.
3.	Khalid Zadran	3. Data collection and calculations.
4.	Aamir Zaman	4. Analysis of data and interpretation of results