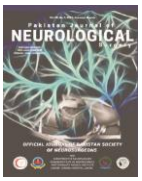

PAKISTAN JOURNAL OF NEUROLOGICAL SURGERY (QUARTERLY) – OFFICIAL JOURNAL OF PAKISTAN SOCIETY OF NEUROSURGEONS

Original Article (BRAIN)

Pediatric Posterior Fossa Brain Tumor Surgical Outcome

Mian Awais[1], Akhtar Muner[1], Laeeq-ur-Rehman[1], Syed Misbah[1], Rimla Ayesha[2]
[1]Pediatric Neurosurgery Department, Lahore Medical City, Lahore, Pakistan
[2]Murshid Hospital, Faisalabad, Pakistan

ABSTRACT

Objective: The study analyzed the complications and satisfactory surgical outcomes of posterior fossa brain tumor surgery in Lahore Medical City Lahore.

Materials and Methods: A prospective study was conducted and included 40 children who were diagnosed with posterior fossa brain tumors by history, physical examination, and later radiologically were admitted and operated on at the Pediatric Neurosurgery Department in Lahore medical City Lahore between the period of March 2021 and March 2022.

Results: There were 26 (65%) male and 14 (35% females) individuals among the 40 patients. The average age was 12.5 years. This study found that great surgical outcomes were observed in 10 instances (25 percent), good outcomes in 20 cases (50%), and bad outcomes in 10 cases (25%). The most frequent clinical manifestations were headache (38%), vomiting (30%), ataxia (10%), blurred vision (10%), and cranial nerve palsy (12.5%). The best prognosis is shown in children with Pilocytic astrocytoma, followed by ependymoma, while the poorest outcome is seen in children with medulloblastoma.

Conclusion: Pediatric neurosurgeons continue to face particular difficulty in the surgical treatment of posterior fossa brain tumors. Our study compares the outcomes, complications, and surgical outcomes to prior clinical investigations.

Keywords: Posterior fossa tumors, Surgical outcome, Ventriculoperitoneal Shunts, Pilocytic astrocytoma, Medulloblastoma.

Corresponding Author: Mian Awais
Pediatric Neurosurgery Department, Lahore Medical City, Lahore, Pakistan
Email: Mian.awais00@gmail.com

Date of Submission: 25-04-2022
Date of Revision: 28-05-2022
Date of Acceptance: 02-06-2022
Date of Online Publishing: 30-06-2022
Date of Print: 30-06-2022

DOI: 10.36552/pjns.v26i2.686

INTRODUCTION

Posterior fossa tumors account for around 54%–70% of all brain tumors in children. Posterior fossa brain tumors are the most frequent solid tumors in children and are more fatal than leukemias and other cancers. Tumors in this vital site pose the dangers of obstructive hydrocephalus, herniation, brainstem compression, and death. Surgical removal is typically the preferred treatment approach with

adjuvant treatments used in selected patients.[1-2] Brain tumors in the infratentorial area, such as the posterior fossa, are among the most deadly types of tumors that affect children. Tumors in the posterior fossa cause obstructive hydrocephalus, brainstem compression, herniation, and, eventually, death. Cushing, the pioneer of neurosurgery, has operated on a considerable number of posterior fossa brain tumors. He developed a list of 61 people who had the poorest results from cerebellar medulloblastoma.[3] Posterior fossa tumors are more prevalent in youngsters than in adults. In children, the posterior fossa contains around 54 percent to 70 percent of all brain tumors, but in adults, it's just about 15 percent to 20 percent[4]. Pilocytic astrocytomas, Medulloblastomas, and ependymomas are more prevalent in children, whereas metastatic lesions, hemangioblastomas, and lymphomas are more common in adulthood.[5] Clinical manifestations differ depending on the location of the tumor. These tumors can cause a variety of indications and symptoms. The most common presenting symptom is headache, which is followed by any evidence of elevated ICP, such as nausea and vomiting. The clinical presentation differs depending on the location of the tumor. Symptoms might be caused by local compression on the brain stem or by elevated ICP.[6-8] The current study focused to report the concerns and successful surgical outcomes of posterior fossa brain tumor surgery at Lahore Medical City.

MATERIALS AND METHODS

Study Design and Setting

A prospective study was conducted and included 40 children who were diagnosed with posterior fossa brain tumors by history, physical examination, and later radiologically were admitted and operated on at the Pediatric Neurosurgery Department in Lahore medical City Lahore between the period of March 2021 and March 2022. The study was conducted after the approval of the ethical technical committee. Informed consent was taken from the parents of every patient.

Inclusion Criteria

All children and adolescents up to the age of 18 years who were diagnosed with posterior fossa tumor were admitted to the Pediatric Neurosurgery Department after a physical examination and later radiological examination.

Exclusion Criteria

All children and adolescents above the age of 18 years and below 2 years who were diagnosed with posterior fossa tumor were excluded from our study furthermore children with GCS below 8 were also excluded.

Data Collection

All patients had a regular physical examination as well as a complete neurological evaluation. To cover all suspects, a customized neuro-surgical sheet was used in all cases included in the research. All patients were subjected to CT and MRI scans, both with and without contrast enhancement, before surgery.

Evaluation of Outcome

Postoperative (after 3 – 6 months) CT/MRI scans were conducted to identify any initial issue. Pediatric patients were observed in our Neurosurgery department for up to 6 months. All intraoperative and postoperative problems were examined. Three months following the procedure, the ultimate surgical result was evaluated and classified as excellent, good, or bad [9]. The term "excellent result" refers to entire tumor excision with no neurological damage; "good" refers to subtotal excision with no or reversible neurological deficit, and "bad" refers to subtotal or total excision with irreversible neurological deficit.

Data Analysis

SPSS version 26 was utilized in for descriptive and statistical evaluations. The Chi-Square test was applied to find the significant/insignificant association of the outcome groups for each pathological category of tumors.

RESULTS

Age and Gender Distribution

The children varied in age from two to eighteen years old, with 40 patients, 26 (65%) of whom were boys and 14 (35%) of whom were females. The average age at the time of entrance was 12.5 years (minimum 2 years, maximum 18 years). The majority of patients (55%) were aged 10 to 18. 30% were between the ages of 5 and 10, and 15% were between the ages of 2 and 5. See Table 1.

Table 1: Background information: pediatric patients (n = 40).

Gender	Frequency and Percentage
Male	26 (65%)
Female	14 (35%
Age Groups (Years)	
2 – 5	6 (15%)
5 – 10	12 (30%)
10 – 18	22 (55%)
Median age = 12.5 years; Range: 2 – 18 years	

Clinical Presentation

Table 2 shows that the most common clinical presentations were headache 38 (95%), vomiting 30 (75%), ataxia 10(25%), blurring of vision 10 (25%), and cranial nerve palsy 5 (12.5%).

Table 2: The clinical manifestations of a posterior fossa tumor.

Clinical Presentation	Frequency	Percentage
Headache	38	95%
Vomiting	30	75%
Ataxia	10	25%
Blurring of Vision	10	25%
Cranial nerve Palsy	05	12.5%

Status of Ventriculoperitoneal Shunts

A VP shunt was implanted in 30 patients (75%), with 22 and 8 cases pre-and after tumor removal, respectively. See Table 3.

Table 3: VP Shunting.

Shunting Status	Frequency (%)
VP Shunting	30 (75%)
No VP Shunt	1 0(25%)
Pre-op shunting	22 (73.3%)
Post-op shunting	8 (26.7%)

Tumor Pathology

The most common presentation was astrocytoma in 13 cases (32.5%), then medulloblastoma in 13 cases (32.5%), ependymoma in 10 cases (25%), and metastatic tumor in 4 cases (10%). See Table 4.

Table 4: Tumour Pathology.

Tumour Pathology	Frequency (%)
Pilocytic astrocytoma	13 (32.5%)
Medulloblastoma	13 (32.5%)
Ependymoma	10 (25%)
Metastatic	4 (10%)

Complications

All intraoperative and postoperative problems were studied and reviewed, and the following are the most prevalent complications: shunt blockage in 10 instances (25%), bleeding in 6 cases (15%), cerebrospinal fluid leaking pseudomeningocele in 6 cases (15%), wound infection in 5 cases (12.5%), mutism in 3 cases (7.5%), cranial nerve palsy in 3 cases (7.5%), and death in 2 cases (5%) of the total. See Table 5.

Table 5: Tumour Pathology.

Sr. #	Complication reported	Percentage
1.	Shunt Obstruction	25%
2.	Hemorrhage	15%
3.	CSF leakage and Pseudomeningocele	15%
4.	Wound Infection	12.5%
5.	Mutism	7.5%
6.	Cranial Nerve Palsy	7.5%
7.	Death	5%

Surgical Outcome

The surgical outcome in this study is great in 10 instances (25%) and good in 20 cases (50%), with a bad outcome recorded in 10 cases (25 percent). See Table 6.

Table 6: Outcome.

Outcome	Percentage
Excellent	25%
Good	50%
Poor	25%

The Prognosis of Various Posterior Fossa Tumors

Astrocytoma had the best result of all posterior fossa tumors (excellent: 61.55% and good: 30.7 %), followed by ependymoma (excellent: 10% and good: 70%), and the worst outcome was medulloblastoma (poor: 46.1 percent) followed by metastatic (poor: 25%). An insignificant association was found between 'good' and 'poor' outcome categories for Astrocytoma, Medulloblastoma, Ependymoma, and Metastatic cases. See Table 7.

Follow-up

Recurrence occurred in 4 patients over the follow-up period (10 percent, 3 medulloblastomas, and one ependymoma). After 4 – 6 months of the operation, two patients (5%) died, among them, one was with metastatic tumors and one from recurrent medulloblastoma with abrupt death.

Table 7: The prognosis of various forms of posterior fossa brain tumors (n = 40).

Category of Outcome	I	II	III	IV	Chi-square p-value
Excellent	8 (61.5%)	1 (7.69%)	1 (10%)	0 (0%)	
Good	4 (30.7%)	6 (46.1%)	7 (70%)	3 (75%)	Chi-Sq: 2.52
Poor	1 (7.69%)	6 (46.1%)	2 (20%)	1 (25%)	p-value: 0.47 < 0.050
Total	13	13	10	4	Insignificant result

Key: I: astrocytoma; II: medulloblastoma; III: ependymoma; IV: metastatic.

DISCUSSION

The most prevalent type of primary brain tumor in children is a posterior fossa tumor.[4] We reported that headache and vomiting were the common symptoms. Robert et al. (2016) included 45 patients in their research. The most prevalent symptoms were headache, nausea, vomiting, vision disturbance, and gait disruption.[10] Another study, which included 67 patients in 2016, revealed that raised ICP symptoms such as headache, and cerebellar dysfunction such as ataxia and diplopia were all associated with elevated ICP.[11] Our study also found that VP shunting was performed in nearly 30 patients (75 percent) either pre or post-surgery and shunt correction was performed in 10 cases (25 percent). According to Bartlett et al.[2] VP shunting was required in 53% of patients for CSF fluid diversion[1]. Another study found that VP shunting was performed in 33% of individuals. Another complication noted in our study was postoperative hemorrhage (15%), and lower

cranial nerve palsy (7.5%).

CSF leakage and pseudomeningocele were similarly shown to be the most prevalent postoperative complications in our study, accounting for about 15% of patients. Islam et al.[12] reported that CSF leak was the commonest complication (26%), followed by pseudomeningocele (23%). Shaikh et al.[13] researched 66 patients and found that medulloblastoma (29.26 percent) and pilocytic astrocytoma (29.26 percent) were the most prevalent posterior fossa brain tumors, which is very same as our study, which included 13 (32.5 percent) medulloblastoma and astrocytoma (32.5 percent). They also found that surgical outcomes were good in 77% of children and bad in 23% of children, whereas, in our study, excellent outcomes were seen in 25% of children, good in 50% of children, and poor in 25% of children.

In our study, astrocytoma had the best prognosis, followed by ependymoma, whereas medulloblastoma had the lowest outcome (poor 46.1 percent). In another study, ependymoma had a better prognosis than astrocytoma. The poorest result, as in our study, was in medulloblastoma.[13] Recurrence occurred in four patients over the follow-up period (10 percent, 3 medulloblastomas, and one ependymoma). Two patients (5%) died, one from metastatic tumors and one from recurrent medulloblastoma with sudden death 05 months after surgery. In previous research, the recurrence occurred in 8.33 percent of patients, with two cases of medulloblastoma.[14] Two instances (4.87 percent) died. Another investigation found just one occurrence of fatality, at 0.83 percent.[12] According to the most recent study, the mortality rate was 6.7 percent.[8]

CONCLUSION

Pediatric neurosurgeons continue to face particular difficulty in the surgical treatment of posterior fossa brain tumors. Our study compares the outcomes, complications, and surgical outcomes to prior clinical investigations.

REFERENCES

1. Pollack IF. Brain tumors in children. New England Journal of Medicine, 1994; 331 (22): 1500-7.
2. Bartlett F, Kortmann R, Saran F: Medulloblastoma. Clin Oncol (R Coll Radiol); 2013; 25 (1): 36-45.
3. Rehman AU, Lodhi S, Murad S. Morphological pattern of posterior cranial fossa tumors. Ann King Edward Med Uni. 2009; 15 (2): 57–9.
4. Ostrom QT, Gittleman H, Liao P, Rouse C, Chen Y, Dowling J, Wolinsky Y, Kruchko C, Barnholtz-Sloan J. CBTRUS statistical report: primary brain and central nervous system tumors diagnosed in the United States in 2007-2011. Neuro Oncol. 2014; 16 (S4): 1–63.
5. Santos de Oliveira R, Jucá CEB, Valera ET, Machado HR: Hydrocephalus in posterior fossa tumors in children. Are there factors that determine a need for permanent cerebrospinal fluid diversion? Child´s Nervous System, 2008; 24: 1397-1403.
6. Nagatani K, Waga S, Nakagawa Y. Mutism after removal of a vermian medulloblastoma: cerebellar mutism. Surgical Neurology, 1991; 36 (4): 307-9.
7. Kamil MA, Yusuf I, Alper B, Cem A, Erol K, Erdener T. Surgical outcomes of cerebellar tumors in children. Pdiatr Neurosurg. 2004; 40: 220–2.
8. Kameda-Smith MM, White MA, George EJ, Brown JI. Time to diagnosis of paediatric posterior fossa tumours: an 11-year West of Scotland experience 2000-2011. Br J Neurosurg. 2013; 27: 364–9.
9. Kamil MA, Yusuf I, Alper B, Cem A, Erol K, Erdener T. Surgical outcomes of cerebellar tumors in children. Pdiatr Neurosurg. 2004; 40: 220–2.
10. Robert YS, James GS. Posterior fossa tumors in adult patients. Neuroimag Clin N Am. 2016; 26: 493–510.
11. Jiang T, Zhang Y, Wang J, Du J, Ma Z, Li C, Liu R, Zhang Y. Impact of tumor location and fourth ventricle infiltration in medulloblastoma. Acta Neurochirurgica. 2016; 158 (6): 1187–95.
12. Islam MR, Islam KMT, Hossain M, Rashid MH, Dhakhal S, Khair A, Barua KK, Hossain S. Clinical outcome of posterior fossa tumor surgery without

preoperative ventriculoperitoneal shunt. Bangladesh Medical Journal, 2011; 40 (1): 43–7.
13. Shaikh HA, Bokhari I, Rehman L, Babar A, Siddiqui S, Hashim A. Surgical outcome of posterior fossa brain tumors. Journal of Surgery Pakistan (International), 2014; 19 (1): 26–30.

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. No.	Author's Full Name	Intellectual Contribution to Paper in Terms of
1.	Mian Awais	Study design, methodology, and paper writing.
2.	Akhtar Muner	Data calculation and data analysis.
3.	Laeeq-ur-Rehman	Interpretation of results.
4.	Syed Misbah	Statistical analysis.
5.	Rimla Ayesha	Literature review.