Original Article

The Satisfactory Surgical Outcome of Posterior Fossa Brain Tumors in Children at Civil Hospital, Karachi

Jahanzeb Kakar, Junaid Ashraf, Atiq Ahmed Khan, Muhammad Imran, Muhammad Asim Rehmani, Shiraz Ahmed Ghori, Mohammad Faaiq Ali

Dow University of Health Sciences, Civil Hospital, Karachi, Pakistan

Abstract

Introduction: Posterior fossa brain tumor is the most devastating forms of human illness, primarily because of the limited space within the posterior fossa, the potential involvement of vital brain stem nuclei, and the mass effect causes obstructive hydrocephalus. Posterior fossa tumors are more common in children than adults. **The Objective of the Study:** To find out the satisfactory surgical outcome of posterior fossa brain tumors in children at Civil hospital, Karachi. **Materials and Methods and Duration of Study Setting:** This prospective observational, case series study was conducted from February 2015 to February 2105 in the Department of neurosurgery, Dow University of Health Sciences, Civil Hospital, Karachi, Karachi. Postoperative patients with the diagnosis of posterior fossa tumor were enrolled in the study. Detailed history, physical examination, anthropometrics, and biochemical measurements were recorded. Magnetic resonance imaging was done to determine the satisfactory surgical outcome. Patients were followed up at the third postoperative month to determine the satisfactory surgical outcome. **Results:** Seventy-one patients fulfilling the inclusion criteria, the mean ± standard deviation age of the study population was 6.63 ± 3.181 years. 29 (40.8%) were <7 years of age and 42 (59.2%) were of age 7 years and above. 50 (70.4%) were males and 21 (29.6%) were females. 49 (69%) patients presented with vomiting. 34 (47.9%) presented with seizures. (40.8%) had papilledema. (25.4%) presented with hemiparesis. 8 (11.3%) had meningismus. On analysis of the frequency of outcome variables (80.3%) achieved the satisfactory surgical outcome. **Conclusions:** There has been no major study to determine satisfactory surgical outcome in postoperative patients with posterior fossa brain tumor in our population. The study was to provide local data in our population and compare it to the international data. This may help in proper patient management. Majority of the patients had satisfactory surgical outcome. The absence of papilledema, hemiparesis, and meningismus had more chances of satisfactory surgical outcome.

Keywords: *Magnetic resonance imaging, posterior fossa, seizures, tumor*

Introduction

Posterior fossa brain tumor is the most devastating forms of human illness, primarily because of the limited space within the posterior fossa, potential involvement of vital brain stem nuclei, and the mass effect causes obstructive hydrocephalus. Posterior fossa tumors are more common in children than adults. A retrospective review of 313 histopathologically-proven brain tumors over a period of 11 years has been performed at the Children's Hospital Westmead, New South Wales, Australia, to determine the proportion and location of different tumors, age distribution, survival rates, and usage of various treatment modalities. Pilocytic astrocytoma was the most common tumor (29%), followed by medulloblastoma (12%) and ependymoma (6%), teratomas are very rare intracranial tumors, and cytogenetic information on this group remains rare.[1,2] We report a case of a mature teratoma with abnormal + 21 trisomy in tumor karyotype occurring in a nonDown syndrome infant. Patients who present with posterior fossa tumors undergo surgery for three reasons; (1) decompress the posterior fossa; (2) to diagnose the tumor based on histopathology, (3) to determine the further plan of management depending on the nature of the tumor. Cushing probably was the first to report a large series of posterior fossa tumor. He published information about 61 patients with cerebeller medulloblastoma with mostly

How to cite this article: Kakar J, Ashraf J, Khan AA, Imran M, Rehmani MA, Ghori SA, *et al*. The satisfactory surgical outcome of posterior fossa brain tumors in children at civil hospital, karachi. Asian J Neurosurg 2020;15:377-81.

Submitted: 04-Mar-2019 **Accepted:** 08-Aug-2019
Published: 29-May-2020

Address for correspondence:
Dr. Jahanzeb Kakar, Bolan Medical College, Quetta, Pakistan.
E-mail: jahanzebkakar194@gmail.com

Access this article online

Website: www.asianjns.org

DOI: 10.4103/ajns.AJNS_56_19

Quick Response Code:

fatal outcome.[3,4] Gross total resection is appropriate surgical treatment in all posterior fossa tumors.[5] Modern neurosurgical techniques permit complete or near-complete resection with little or no significant increase in morbidity and mortality rates compared with more conservative surgery.[6] As many as 40% of patients have some degree of new neurological dysfunction postoperatively. One ill-defined syndrome is posterior fossa tumor syndrome, characterized by mutism, cerebellar dysfunction, supranuclear cranial nerve palsy, and hemiparesis that occurs 12–48 h after surgery.[7] As many as 50% of patients have residual deficits. With aggressive surgery, craniospinal radiotherapy and chemotherapy, more than 50% of children with medulloblastoma can be expected to be free of disease 5 years later.[6] Using current treatments, 80%–90% of those without disseminated disease can be cured; however, treatment for this disease often results in significant endocrinology and intellectual sequelae. Local data are not available. The 5-years survival rates exceed 60% for all patients and 80% for certain good-risk individuals with posterior fossa tumors. In the cases of pilocytic cerebeller astrocytoma, the 25-year survival rate exceeds 94%.[8,9] According to one recent study, about 90% of the patients had satisfactory surgical outcome after surgical removal.[10]

Materials and Methods

In our case series, study was conducted in the Neurosurgery Department of DUHS civil hospital, Karachi. Seventy-one patients were taking the prevalence of the satisfactory surgical outcome in postoperative patient with posterior fossa tumor. Nonprobability connective technique was used. Under 14 years old children and both gender (male and female), presenting with any one of (vomiting, seizures, papilledema, meningismus, hemiparesis, posterior fossa tumor). Recurrent and operated cases, brain stem tumors were excluded from the study. Thorough central nervous system (CNS) examination, physical examination was performed to assess the preoperative status of the patient and were performed all Clinical investigations. Patients meeting the inclusion criteria were included in the study. Informed and written consent were taken and preoperative assessment was done. Consultant postfellow neurosurgeon operated all patients. All patients were assessed for satisfactory surgical outcome by consultant postfellow consultant at 3rd months postdischarge. Collected data were collected on pro forma, and results were compiled. Confounding variables were controlled by stratification.

Data were analyzed using the SPSS® Statistics GradPack, SPSS, Version 21 (IBM). Mean and standard deviation was calculated for age. Frequency and percentage were computed for qualitative variables such as gender, vomiting, seizures, hemiparesis, meningismus, papilledema, and final outcome, i.e., satisfactory surgical outcome. Effect modifiers were controlled through the stratification of age, sex vomiting, seizures, hemiparesis, meningismus, and papilledema. Chi-square/Fisher's exact test was applied to see the effect of these on outcome variables. $P \leq 0.05$ was considered as statistically significant.

Results

Seventy-one patients fulfilling the inclusion criteria were included in this study. The mean ± standard deviation age of the study population was 6.63 ± 3.181 years.

On analysis of demographics data, it was observed 29 (40.8%) were <7 years of age and 42 (59.2%) were of age 7 years and above. 50 (70.4%) were males and 21 (29.6%) were females. 49 (69%) patients presented with vomiting 34 (47.9%) presented with seizures. 29 (40.8%) had papilledema. 18 (25.4%) presented with hemiparesis. 8 (11.3%) had meningismus. On analysis of the frequency of outcome variables, 57 (80.3%) achieved the satisfactory surgical outcome [Table 1].

On analysis of the association of age with satisfactory surgical outcome, it was observed that out of 29 patients <7 years 22 (75.86%) and out of 42 of age 7 years and >35 (83.33%) had satisfactory surgical outcome [Table 2].

On analysis of association of gender with satisfactory surgical outcome, it was observed that out of 50 male patients 43 (86%) and out of 21 female patients, 14 (66.66%) had satisfactory surgical outcome [Table 2].

On analysis of the association of vomiting with satisfactory surgical outcome, it was observed that out of 49 patients

Table 1: Demographics analysis

	Frequency (%)
Age (years)	
<7	29 (40.8)
7 and above	42 (59.2)
Gender	
Male	50 (70.4)
Female	21 (29.6)
Vomiting	
Vomiting	49 (69)
No vomiting	22 (31)
Seizures	
Seizures	34 (47.9)
No seizures	37 (52.1)
Pappiledema	
Pappiledema	29 (40.8)
No pappiledema	42 (59.2)
Hemiparesis	
Heiparesis	18 (25.4)
No heiparesis	53 (74.6)
Meningismus	
Meningismus	8 (11.3)
No meningismus	63 (88.7)
Satisfactory surgical outcome	
Satisfied	57 (80.3)
Not satisfied	14 (19.7)

Table 2: Satisfactory surgical outcome

	Satisfactory surgical outcome		*P*
	Yes	No	
Age (years)			
Below 7	22	7	0.315
7 and above	35	7	
Gender with satisfactory surgical outcome			
Males	43	7	0.065
Females	14	7	
Vomiting with satisfactory surgical outcome			
Yes	41	8	0.224
No	16	6	
Seizures with satisfactory surgical outcome			
Yes	27	7	0.547
No	30	7	
Papilledema with satisfactory surgical outcome			
Yes	19	10	0.011
No	38	4	
Hemiparesis with satisfactory surgical outcome			
Yes	10	8	0.005
No	47	6	
Meningismus with satisfactory surgical outcome			
Yes	4	4	0.043
No	53	10	

with vomiting 41 (83.67%) and out of 22 patients without vomiting, 16 (72.72%) had satisfactory surgical outcome [Table 2]. On analysis of the association of seizures with satisfactory surgical outcome,

it was observed that out of 34 patients with seizures 27 (79.41%) and out of 37 patients without seizures, 30 (81.08%) had satisfactory surgical outcome [Table 2].

On analysis of the association of papilledema with the satisfactory surgical outcome, it was observed that out of 29 patients with papilledema 19 (65.51%) and out of 42 patients without papilledema, 38 (90.47%) had satisfactory surgical outcome [Table 2].

On analysis of association of hemiparesis with satisfactory surgical outcome, it was observed that out of 18 patients with hemiparesis 10 (55.55%) and out of 53 patients without hemiparesis 47 (88.67%) had satisfactory surgical outcome [Table 2].

On analysis of the association of meningismus with satisfactory surgical outcome, it was observed that out of 08 patients with meningismus 4 (50%) and out of 63 patients without meningismus 53 (84.12%) had satisfactory surgical outcome [Table 2].

Discussion

CNS tumors are the second-most common cancer among children and the main solid tumor in childhood in the United States. It affects about 21.3% of all children with malignant diseases,[11] and its annual incidence is 2.5 cases/100,000.2 In the whole world, about 8%–15% of the pediatric tumors are estimated to be in this group, and it is the most frequent pediatric solid tumor.[12,13] In developing countries, CNS cancers have the third highest incidence rate among children.[3] In the city of Fortaleza, Brazil, age-adjusted incidence from 1998 to 2002 was 1.3 cases/100,000 children younger than 18 years, which corresponds to an annual incidence of 0.26 cases/100,000 children. It accounts for 11% of all pediatric cancer diagnoses and is the third-most frequent type of childhood cancer, after only leukemia (30%) and lymphoma (15%).[14]

One-third of CNS tumors are diagnosed before 3 years of age. More boys than girls are affected depending on tumor type and patient age.[5] The incidence of this type of tumor has been growing progressively.[5] Although CNS tumors are the second-most common childhood cancer, they are the most common cause (30%) of death due to cancer in adolescence, and one of the most common causes of death of children after the first year of life, second only to accidents.[15] There was a 1.1% decrease in annual mortality associated with CNS tumors from 1975 to 1995 in the US.2 Brazilian authors have found no reduction in mortality among children with a diagnosis of brain tumor from 1980 to 1998.[6] In Fortaleza, Brazil, there was a slight reduction in the number of deaths due to brain tumors among children younger than 15 years from 1.3 in 1980 to 1982–1.1/1,00,000 inhabitants in 1995–1997.[16]

Up to the 1990s, the use of chemotherapy for brain tumors was controversial, but a growing number of patients has benefited from this treatment. Currently, chemotherapy is well established for pediatric patients with medulloblastoma and low-grade astrocytomas.[17]

Brain tumors are relatively common in children, affecting 3983 children age 1–14 years out of a population counting 4.4 million children in a Nordic study during the 1985–2006 period.[18] According to a Danish Cancer Registry report from 2009, the prevalence was 130 boys and 126 girls. As approximately 20% of children live in the Southern Danish region, the expected prevalence was 51. We identified 55 children with BTs, and hence, the prevalence was slightly higher than expected. Localization with ataxia, cerebral nerve deficits, and gait abnormalities presents in infratentorial tumors along with motor dysfunctions, seizures, visual dysfunctions, and endocrinological abnormalities as the most frequently seen supratentorial localizations. Symptoms of increased intracranial pressure with headache and vomiting, together with papilledema, develop more rapidly in infratentorial tumors than at other localizations due to their proximity to the fourth ventricle. We found a roughly equal range of symptoms compared with those reported in other studies.[19,20] In this study, vomiting, seizures, and hemiparesis were the most common symptoms.

It was somewhat lower than rates reported in the literature for astrocytomas (73% in surveillance, epidemiology and end results (SEER) versus 59% in our series) and much lower for ependymomas (56% in SEER versus 33%). We believe that such differences may reflect a reduced number, probably due to under referral, of low-grade astrocytomas (only 18% of the total number of tumors in our series). In an epidemiological series of 1195 pediatric patients with brain tumors operated on in Hospital de Clínicas of São Paulo from 1974 to 2003, 24.4% of the diagnoses were low-grade astrocytomas.[21] The results for ependymomas are similar to the SEER findings up to 1984 (39% versus 33%). A comparison between SEER and European Population-based Data (EUROCARE) show that children with ependymomas in Europe was closer to our series and the same was seen in comparison with a population series in England and Wales (43% versus 33% in our series).[22,23] However, the small number of ependymomas in our study (n = 12) does not warrant definitive conclusions.

Brain tumors when occurring in the posterior fossa have stormy course. In this anatomical location brainstem compression occurs and it also results in herniation leading o death if not treated in time. The pulmonary function tests (PFT) can be broadly divided into intra- and extra-axial locations. Common tumors include cerebellar astrocytoma, primary neuroectodermal tumors, medulloblastoma, ependymoma, etc. PFT are more common in children than adults.[24] For good risk individuals, it is nearly 80%.[25] A gross total resection should be attempted to achieve a better clinical outcome.[26] Skull base surgery confers the advantages of improved line of sight, a wider operative corridor, and reduced brain retraction.[27] Same was practiced in this group of patients. The study by Charles and Morgan focused on a series of patients of brain and spinal cord tumors, considered inoperable by specialized multidisciplinary teams, operated in a single setting.[28] The results showed that there was a single case of surgical mortality. We, in this study, had 23% of patients.

Another study results also found that 38/121 (31%) patients had an uneventful postoperative period and only 23 (19%) had neurological complications at long term which is in line with the results of our study.[28,29] Reported high morbidity following gross resection of tumor.[30] Although, we did not measure pre/post-surgical symptoms; the strong predictors of good outcomes in our study were age >10 years and morphological type of tumors. Staging parameters expected to predict for poor prognosis do not significantly influence the outcome.[31]

A study one of the complications of PFT resection is the PF syndrome that consisted of transient cerebellar mutism, cognitive symptoms, and neurobehavioral abnormalities.[32-34] Although the pathophysiological substrate of the syndrome remains unclear, studies have shown that >50% of the patients with this syndrome develop a variety of clinically relevant nonmotor language symptoms associated with cognitive and behavioral disturbances after PFT resection. Fortunately, this syndrome is not common and thus, the poor outcome after PFT resection is low as also reflected in our series of patients.

Conclusions

The majority of the patients had satisfactory surgical outcome, and elder patients had comparatively better chances of satisfactory surgical outcome, the absence of papilledema, hemiparesis, and meningismus had more chances of satisfactory surgical outcome.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Ramanan M, Chaseling R. Paediatric brain tumours treated at a single, tertiary paediatric neurosurgical referral centre from 1999 to 2010 in Australia. J Clin Neurosci 2012;19:1387-91.
2. Bakhtiar Y, Yonezawa H, Bohara M, Hanaya R, Okamoto Y, Sugiyama K, *et al.* Posterior fossa immature teratoma in an infant with trisomy 21: A case report and review of the literature. Surg Neurol Int 2012;3:100.
3. Frontera WR, Silver JK, Rizzo TD. Essentials of Physical Medicine and Rehabilitation E-Book: Musculoskeletal Disorders, Pain, and Rehabilitation. Elsevier Health Sciences; 2014.
4. Witt H, Mack SC, Ryzhova M, Bender S, Sill M, Isserlin R, *et al.* Delineation of two clinically and molecularly distinct subgroups of posterior fossa ependymoma. Cancer Cell 2011;20:143-57.
5. Mpairamidis E, Alexiou GA, Stefanaki K, Manolakos I, Sfakianos G, Prodromou N. Posterior fossa tumor in a 12 year-old boy. Brain Pathol 2009;19:341-2.
6. MacDonald T. Medulloblastoma. eMedicine; 2009 Available from: http://emedicine.medscape.com/article/987886-print. [Last accessed on 2014 Nov 11].
7. Soffietti R, Baumert BG, Bello L, von Deimling A, Duffau H, Frénay M, *et al.* Guidelines on management of low-grade gliomas: Report of an EFNS-EANO task force. Eur J Neurol 2010;17:1124-33.
8. Stupp R, Brada M, van den Bent MJ, Tonn JC, Pentheroudakis G. ESMO Guidelines Working Group. High-grade glioma: ESMO clinical practice guidelines for diagnosis, treatment and follow-up. Ann Oncol 2014;25 Suppl 3:iii93-101.
9. Wright KD, Gajjar A. Current treatment options for pediatric and adult patients with ependymoma. Curr Treat Options Oncol 2012;13:465-77.
10. Steinbok P, Mangat JS, Kerr JM, Sargent M, Suryaningtyas W, Singhal A, *et al.* Neurological morbidity of surgical resection of pediatric cerebellar astrocytomas. Childs Nerv Syst 2013;29:1269-75.
11. American Cancer Society. Cancer Facts and Figures 2010. Atlanta: American Cancer Society; 2010.
12. Ries LA, Smith MA, Gurney JG, Linet M, Tamra T, Young JL, *et al*., editors. Cancer Incidence and Survival Among Children and Adolescents: United States SEER Program 1975-1995.

Bethesda: National Cancer Institute, SEER Program; 1999.
13. Little J, editor. Introduction. In: Epidemiology of Childhood Cancer. Lyon: International Agency for Research on Cancer, World Health Organization; 1999.
14. Mendonça VG, Lorenzato FR, Mendonça JG, Menezes TC, Guimarães MJ. Uterus cervix cancer mortality: socio-demographic characteristics of women living in the city of Recife, Pernambuco, Brazil. RBdGO 2008;30:248-55.
15. Gurney JG, Smith MA, Bunin GR. CNS and miscellaneous intracranial and intraspinal neoplasms. In: Ries LA, Smith MA, Gurney JG, Linet M, Tamra T, Young JL, *et al*., editors. Cancer Incidence and Survival Among Children and Adolescents: United States SEER Program 1975-1995. Bethesda: National Cancer Institute, SEER Program; 1999.
16. Costa EF, Andrade DR, Garcia LM, Ribeiro EH, Miyajima F. Genetic Investigation of Neurotransmitter and Related Genes With Cognitive Ability and Personality. The University of Manchester (United Kingdom); 2007.
17. Blaney SM, Kun LE, Hunter J, Rorke-Adams LB, Lau C, Strother D, *et al*. Tumors of the central nervous system. In: Pizzo PA, Poplack DG, editors. Principles and Practice of Pediatric Oncology. 5th ed. Philadelphia: Lippincot Williams and Wilkins; 2006.
18. Schmidt LS, Kamper-Jørgensen M, Schmiegelow K, Johansen C, Lähteenmäki P, Träger C, *et al.* Infectious exposure in the first years of life and risk of central nervous system tumours in children: Analysis of birth order, childcare attendance and seasonality of birth. Br J Cancer 2010;102:1670-5.
19. Reulecke BC, Erker CG, Fiedler BJ, Niederstadt TU, Kurlemann G. Brain tumors in children: Initial symptoms and their influence on the time span between symptom onset and diagnosis. J Child Neurol 2008;23:178-83.
20. Wilne SH, Ferris RC, Nathwani A, Kennedy CR. The presenting features of brain tumours: A review of 200 cases. Arch Dis Child 2006;91:502-6.
21. Hayashi N, Kidokoro H, Miyajima Y, Fukazawa T, Natsume J, Kubota T, *et al.* How do the clinical features of brain tumours in childhood progress before diagnosis? Brain Dev 2010;32:636-41.
22. Rosemberg S, Fujiwara D. Epidemiology of pediatric tumors of the nervous system according to the WHO 2000 classification: A report of 1,195 cases from a single institution. Childs Nerv Syst 2005;21:940-4.
23. Gatta G, Capocaccia R, Coleman MP, Ries LA, Berrino F. Childhood cancer survival in europe and the United States. Cancer 2002;95:1767-72.
24. Tseng JH, Tseng MY. Survival analysis of children with primary malignant brain tumors in England and Wales: A population-based study. Pediatr Neurosurg 2006;42:67-73.
25. Kameda-Smith MM, White MA, St. 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.
26. Shah SH, Soomro IN, Hussainy AS, Hassan SH. Clinico-morphological pattern of intracranial tumors in children. J Pak Med Assoc 1999;49:63-5.
27. Muzumdar D, Ventureyra EC. Treatment of posterior fossa tumors in children. Expert Rev Neurother 2010;10:525-46.
28. Klimo P Jr., Browd SR, Pravdenkova S, Couldwell WT, Walker ML, Al-Mefty O. The posterior petrosal approach: Technique and applications in pediatric neurosurgery. J Neurosurg Pediatr 2009;4:353-62.
29. Teo C, Broggi M. Surgical outcome of patients considered to have "inoperable" tumors by specialized pediatric neuro-oncological multidisciplinary teams. Childs Nerv Syst 2010;26:1219-25.
30. Neervoort FW, Van Ouwerkerk WJ, Folkersma H, Kaspers GJ, Vandertop WP. Surgical morbidity and mortality of pediatric brain tumors: A single center audit. Childs Nerv Syst 2010;26:1583-92.
31. Cochrane DD, Gustavsson B, Poskitt KP, Steinbok P, Kestle JR. The surgical and natural morbidity of aggressive resection for posterior fossa tumors in childhood. Pediatr Neurosurg 1994;20:19-29.
32. Di Rocco C, Chieffo D, Pettorini BL, Massimi L, Caldarelli M, Tamburrini G. Preoperative and postoperative neurological, neuropsychological and behavioral impairment in children with posterior cranial fossa astrocytomas and medulloblastomas: The role of the tumor and the impact of the surgical treatment. Childs Nerv Syst 2010;26:1173-88.
33. Rieken S, Gaiser T, Mohr A, Welzel T, Witt O, Kulozik AE, *et al.* Outcome and prognostic factors of desmoplastic medulloblastoma treated within a multidisciplinary treatment concept. BMC Cancer 2010;10:450.
34. De Smet HJ, Baillieux H, Wackenier P, De Praeter M, Engelborghs S, Paquier PF, *et al.* Long-term cognitive deficits following posterior fossa tumor resection: A neuropsychological and functional neuroimaging follow-up study. Neuropsychology 2009;23:694-704.