Original Research

POSTERIOR FOSSA TUMORS – A STUDY ON THE CLINICOPATHOLOGICAL PROFILE AND SURGICAL OUTCOMES IN A TERTIARY NEUROSURGERY CARE CENTER IN NORTH KARNATAKA

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ABSTRACT

Background: Posterior cranial fossa (PCF) tumors account for more than 50% of brain tumors in children. Medulloblastoma and Pilocytic astrocytoma are the most common brain tumors in childhood and adolescence. In India, among these tumors, medulloblastoma has been reported as the most common, followed by astrocytoma. Cerebellopontine (CP) angle tumors were also included in our study. This study aims to evaluate the clinicopathological profile and surgical outcomes of PCF tumours across all age groups in our tertiary neurosurgical care centre in North Karnataka.

Methods: This was a combined prospective and retrospective study conducted over a period of four years at our institution. Clinical data were collected at three time points: at admission, at discharge, and at 30-day follow-up. The Karnofsky Performance Status (KPS) scale was used to assess functional outcomes, and histopathological grading of tumors was recorded. The data were compiled, analyzed, and interpreted to assess correlations between clinical, radiological, and pathological findings, as well as surgical outcomes.

Results: The most common PCF tumor observed in our study was schwannoma, with equal prevalence among males and females. In this study, more than 70% of patients underwent gross total resection. Functional outcomes improved significantly following surgical intervention, with higher KPS scores at 30-day follow-up compared to admission and discharge scores. Postoperative complications and new neurological deficits were noted but did not significantly affect overall patient outcomes. MRI proved to be a highly valuable diagnostic modality for PCF tumors, demonstrating strong correlation with histopathological findings.

Conclusion: With appropriate and individualized management strategies, posterior fossa tumors can be effectively treated, resulting in favorable surgical and functional outcomes despite their challenging anatomical location and histological diversity.

Keywords: Posterior Fossa; Brain Neoplasms; Medulloblastoma; Astrocytoma; Schwannoma; Neurosurgical Procedures; Treatment Outcome; Karnofsky Performance Status.

INTRODUCTION

The posterior fossa is the suboccipital or infratentorial compartment of cranium, extending from tentorium cerebelli superiorly to foramen magnum inferiorly, the cerebellum and brainstem (the pons and medulla).[1]

In adults, the most common expansile "mass" lesion in the posterior fossa is a subacute stroke, whereas the most common neoplastic lesion in the posterior fossa is cerebellar metastasis (intra-axial) or vestibular schwannoma (extra-axial). This category of tumors is uncommon and more frequently encountered in children, because infratentorial tumors predominate over supratentorial tumors after infancy and before adolescence.[2] Paediatric brain tumors are the leading cause of death from solid tumors in childhood. The most common posterior fossa tumors in children are medulloblastoma (MB), atypical teratoid/rhabdoid tumor (ATRT), cerebellar pilocytic astrocytoma (CPA), ependymoma, and brainstem glioma (BG).[3] There is no controversy that surgery is the mainstay of treatment in posterior fossa tumors in children. It is a time- tested modality

www.ajmrhs.com
eISSN: 2583-7761

Date of Received: 24-01-2026
Date Acceptance: 21-03-2026
Date of Publication: 26-03-2026

and is a primary approach to the treatment of posterior fossa tumors. It provides tissue diagnosis, which helps to understand the natural history and biology of the tumor. It simultaneously helps achieve surgical decompression of the tumor and alleviation of symptoms.[4] About 10% of all intracranial tumors are located in the cerebellopontine angle.

The most common tumors of CP angle are vestibular schwannoma, meningioma, and epidermoid tumors. Vestibular schwannoma accounts for 75 to 85% of all CPA tumors; meningiomas account up to 10 to 15%, whereas epidermoid make up 7 to 8% of all CPA tumors.[5]

Childhood posterior fossa tumors commonly obstruct spinal fluid path- ways with resultant hydrocephalus. Neurosurgical opinions on management of that hydrocephalus vary greatly; various authors advocate direct tumor removal, preoperative external ventricular drainage (EVD), or placement of a shunt before tumor removal.[5,6] Resection of posterior fossa tumors traditionally entails permanent bone removal. Suboccipital craniectomy gives an excellent exposure of posterior fossa structures, but it could lead to several complications. Posterior fossa surgery in children remains challenging, especially for tumors primarily involving or secondarily infiltrating the brainstem. The CSF leak ranges from 4 to 17 % across different craniectomy series, while pseudomeningocoele has been reported to occur more frequently after craniectomy rather than after craniotomy.[7]

Intraoperative neurophysiology has contributed over the past two decades to enhance the safety of these surgical procedures using mapping and monitoring technique.[8]

Aims and Objectives

Aim

The aim is to study various clinicopathological aspects of space occupying lesions of Posterior fossa and to determine the factors affecting the surgical outcome.

Objectives

1. To describe the clinical presentation of patients with posterior fossa tumor.
2. To discern the different histopathological tumor types and the most common type encountered in our centre.
3. To enumerate the factors affecting the surgical outcome in early post operative period and enumerate the complications following surgery.

MATERIALS AND METHODS

Study Design- Retrospective study done from March 2018 till July 2019 and prospective study done for patients operated between July 2019 to February 2022.

Both adult and paediatric patients were included in this study, operated in our institute for posterior fossa intra axial tumors between March 2018 to February 2022

Inclusion Criteria- All patients with clinically and radiologically confirmed diagnosis of posterior fossa tumor.

Exclusion Criteria- All patients who had recurrent posterior fossa tumor Patient whose records are not available.

RESULTS AND OBSERVATIONS

The total number of patients included in the study was 45. Data on general information Patient details

Age- The mean age of the patients included in our study was 33.02(SD – 13.52). Most of our patients were in middle age group – 31 to 40 years (28.9%)

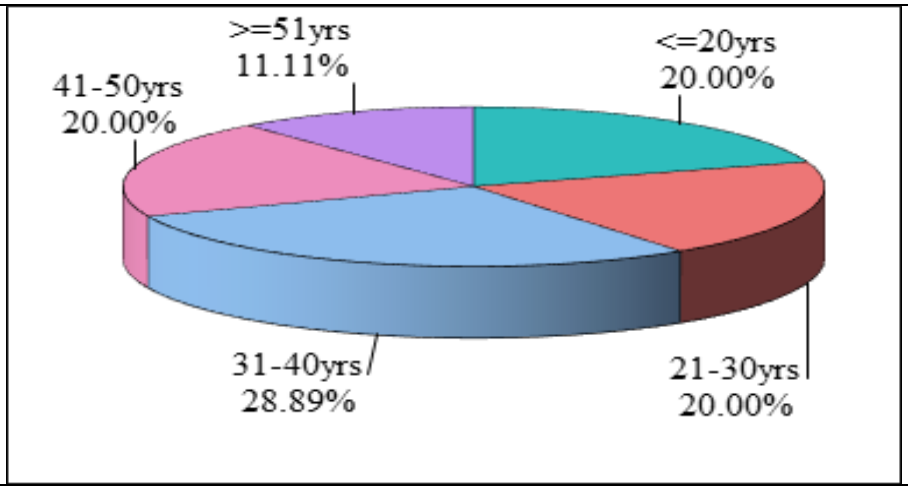

Figure 1: Age Wise Distribution

Gender - Male: Female ratio was 1.3, with a male preponderance of 57.7%

Clinical Details- Signs and Symptoms of Raised ICP. Patients who presented with either symptom/ signs of raised ICP was about 93% while others had no signs/normal presentation.

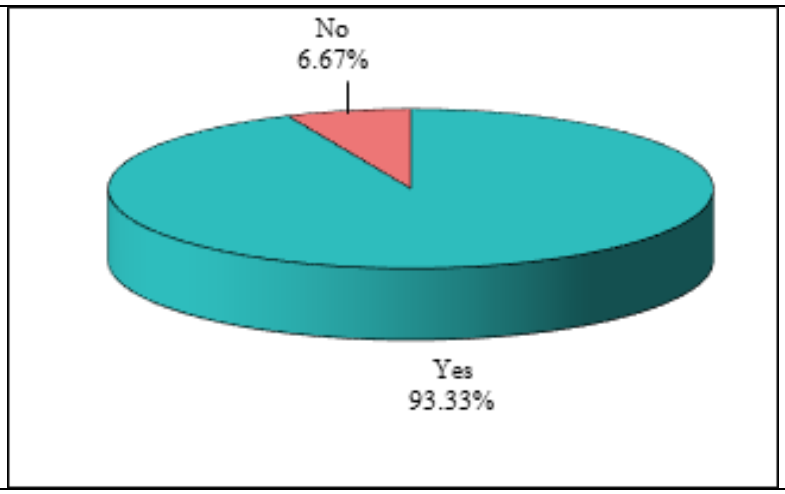

Figure 2: Sign of Raised ICP Wise Distribution of Patients

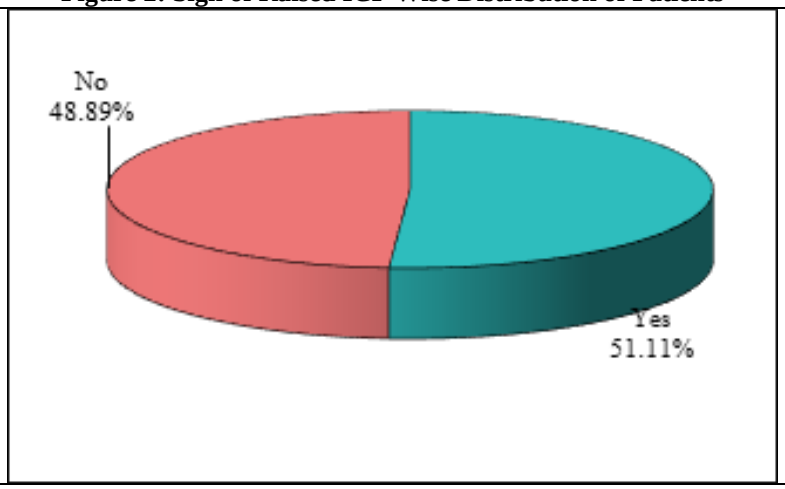

Figure 3: Cranial Nerve Involvement

Motor Involvement- Patients showing motor involvement constituted about 13%; while the rest had normal motor examination.

Cranial Nerve Involvement- About half of the patients had cranial nerve involvement in our study (23 patients ~51%)

Hydrocephalus- 17 patients had hydrocephalus while 28 were normal. CSF diversion procedures were done for all 17 patients with HCP.

Radiological Findings

MRI and Diagnosis- MRI brain was the IOC and was performed in all patients included in our study; most common finding on MRI was Schwannoma.

MRI Brain Findings	No of Patients	% of Patients
Ependymoma	5	11.11
Epidermoid	2	4.44
Glioma	6	13.33
Hemangioblastoma	1	2.22
Medulloblastoma	3	6.67
Meningioma	4	8.89
Pilocytic astrocytoma	2	4.44
Schwannoma	21	46.67
Sub ependymoma grade I	1	2.22
Total	45	100.00

Table 1: MRI Brain Findings Wise Distribution of Patients

Surgical Intervention- Out of 45 patients, 6 patients underwent stereotactic biopsy, left Retro mastoid sigmoid craniectomy was done for 16 patients (35%)

Surgical Approach	No of Patients	% of Patients
Left RMSO craniectomy	16	35.56
Midline SO craniectomy	4	8.89
Right RMSO craniectomy	13	28.89
Right suboccipital craniectomy	4	8.89
Stereotactic biopsy	6	13.33
Suboccipital craniotomy	2	4.44
Total	45	100.00

Table 2: Surgical Approach Wise Distribution of Patients

Extent of Surgical Resection- While operating the surgical resection of tumor was decided based on a number of different factors; in many of the patients (71%), Gross total excision was performed whereas in about 6 patients (13%) debulking was performed.

Extent of Surgery	No of Patients	% of Patients
Gross Total excision	32	71.11
near total excision	1	2.22
Stereotactic biopsy	6	13.33
Tumor debulking	6	13.33
Total	45	100.00

Table 3: Extent of Surgery Wise Distribution of Patients

Post-Surgery Events

1. Complications- The most encountered complication post-surgery was CSF leak, noted in 5 patients whereas infection and Post OP hydrocephalus were relatively less common, occurring in 3 and 2 patients respectively.
2. New Deficits

New Deficit	No of Patients	% of Patients
Hearing loss	1	2.22
Left facial palsy	1	2.22
Left facial weakness	1	2.22
Left hemiparesis	1	2.22
Lower cranial nerves involved	1	2.22
Right facial palsy	4	8.89
Right hemiparesis	2	4.44
Right hemiplegia with aphasia	1	2.22
Nil	33	73.33
Total	45	100.00

Table 4: New Deficit Wise Distribution of Patients

Radiology vs Histology- Comparison of MRI brain findings and Histology of tumor findings MRI was used for diagnosing all patients, even those who had undergone CT scan first. And the findings on MRI were found to be corelating to the histological type of tumor in almost 90% of the cases. 2 cases of ependymoma were interpreted as schwannomas in the MRI.

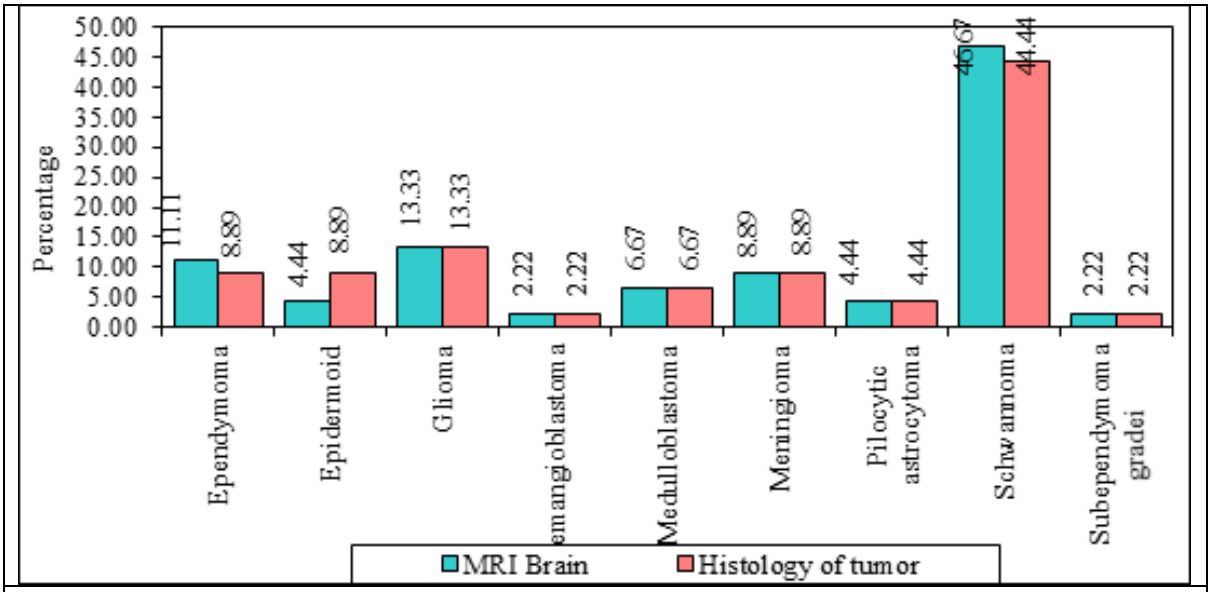

Figure 4: Comparison of MRI Brain Findings and Histology of Tumor Findings

Prognostication using KPS- KPS scores were used to prognosticate the study participants and comparisons were made between KPS scores at admission and upon discharge and 30-day follow up.

The significant correlation between admission and discharge with 30-day follow-up show that with proper management strategies, PCF tumors can be successfully managed, and patients can have better quality of life after surgery.

Association between Histology of Tumor and Age Groups

Histology of tumor	<=20 years	%	21-30 years	%	31-40 years	%	41-50 years	%	>=51 years	%
Ependymoma	2	22.22	2	22.22	0	0.00	0	0.00	0	0.00
Epidermoid	0	0.00	1	11.11	2	15.38	1	7.69	0	0.00
Glioma	0	0.00	3	33.33	3	23.08	0	0.00	0	0.00
Hemangioblastoma	0	0.00	0	0.00	0	0.00	0	0.00	1	20.00
Medulloblastoma	1	11.11	2	22.22	0	0.00	0	0.00	0	0.00
Meningioma	1	11.11	1	11.11	1	7.69	1	7.69	0	0.00
Pilocytic astrocytoma	2	22.22	0	0.00	0	0.00	0	0.00	0	0.00
Schwannoma	2	22.22	0	0.00	7	53.85	7	53.85	4	80.00
Sub ependymoma grade	1	11.11	0	0.00	0	0.00	0	0.00	0	0.00
Total	9	100.0	9	100.0	13	100.0	9	69.23	5	100.0

Table 5: Association between Histology of Tumor and Age Groups

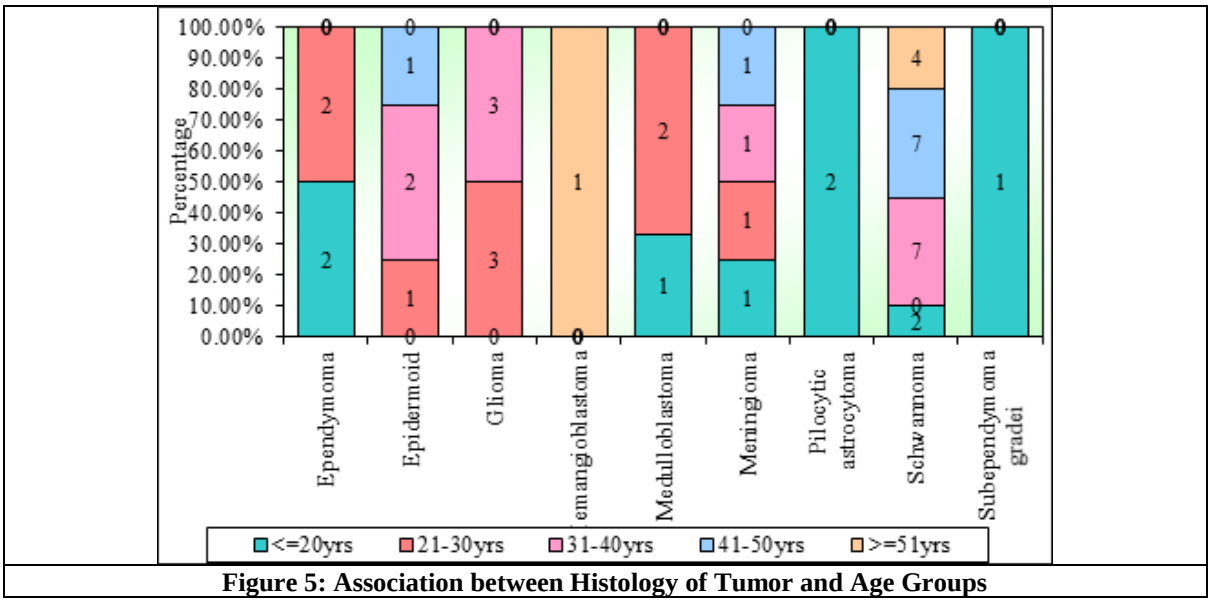

Figure 5: Association between Histology of Tumor and Age Groups

According to our study, Ependymoma was observed in less than 30 years age group. Gliomas are observed in third and fourth decades. Schwannomas are the most common tumors observed across all age groups.

DISCUSSION

PCF tumors account for 54 – 70% of brain tumors in children worldwide, thus contributing significantly to cancer related deaths among children. In Kenya, studies have shown an occurrence of 34 to 50%.

Brain tumors are the most common solid tumors of the children and occur at a rate of 2.4/1.00,000 children at risk per year. Approximately half of the brain tumors of childhood occur in the posterior fossa.

The mean age of the patients in our study was 33.02 ± 13.52 and most of the patients (i.e.) 13(28.9%) were in the age group of 31 – 40 years. This was close to the findings in the study done by Abu SU et al[9] where the mean age was 41.86±21.75 years. Our study included more male patients than female patients which is in accordance with the study done by Dubey A et al.[10] In our study 42 (93%), 6 (13.33%), 28 (62.2%), 23 (51.1%), patients were presented with either symptoms or signs of raised ICP, motor signs or symptoms, cerebellar signs or symptoms, cranial nerve involvement respectively. This finding is like the study done by Prasad K S et al.[11]

In our study 21(46.67%), 6 (13.33%), 5(11.11%), 4 (8.89%), 3 (6.67%), 2 (4.44%), 2(4.44%) 1 (2.22%), 1 (2.22%) were diagnosed as schwannoma, glioma, ependymoma, meningioma, medulloblastoma, pilocytic astrocytoma, epidermoid, sub ependymoma grade I, and hemangioblastoma based on MRI findings respectively which is not in consistent with the study findings done by Emara M et al. In Emara M et al the most diagnosed posterior cranial tumor among 44 patients is astrocytoma in 16 cases (36.3%) which its variants are pilocytic and anaplastic in 14 and 2 cases of them respectively, then medulloblastoma 12 cases (27.3%), ependymoma 10 cases (22.7%), metastatic tumour 4 cases (9.1%), ganglioglioma one case (2.3%) and dermoid tumour one case (2.3%).[12]

In our study most encountered post-surgery complication was CSF leak 5(11.11%) followed by that 3 (6.67%) were presented with infections. This finding was in accordance with the finding of the study done by Khan MM et al.[13] In our study the mean duration of stay in ICU was 8.62 ± 3.73 and post op hospital stay was 20.11 ± 5.91 days which is accordance with the study done by Njeru PK et al.[14]

Hydrocephalus with signs of raised ICP are most found in patients with posterior fossa tumors. In our study 17 patients had Hydrocephalus and they all underwent Pre resection shunting, with VP shunt procedure.

Our findings corelate with the findings from other literature as Albright et al have shown in their study, 27 of their study participants had cerebrospinal fluid (CSF) shunts before they underwent suboccipital craniectomy and that children with shunts had better post op recovery and decreased morbidity and mortality rates after tumor removal.[15]

Recurrence is a major in CNS tumors and total resection has been found to be useful in reducing recurrence rates. Won et al. suggested total resection of CNS tumors as a protective factor for CSF drainage and may be helpful in preventing post-operative hydrocephalus.[16,17,18] But the resection – GTR or STR, depends on various factors like location of tumor, histological type, vascularity, infiltration of nearby sinuses and increased difficulty is noted when the tumors have unclear margins and/or have a rich blood supply.

In our institute, for many of the patients (71%), Gross total excision was performed whereas in about 6 patients (13%) debulking was performed. But when the tumor has infiltration of any venous sinuses subtotal resection is suggested[19] and in our study one patient underwent sub/near total excision and 6 patients had tumor debulking and 6 patients underwent stereotactic biopsy. The patients who had inoperable tumor and underwent biopsy were referred for further treatment with chemo or radiotherapy.

It was found in our study that the patient's ICU stay was for an average duration of 6 to 10 days. The ICU stay was dependent on many factors like general condition of the patient, age and comorbidities. As mentioned in a study by Neuman et al, there is no rigorous definition of what types of events are relevant for a patient's outcome and how they should be handled and so, the reported rates of postoperative events requiring an ICU stay after neurosurgical procedures vary widely in the literature.[20]

According to Durai et al, MRI was found to be a valuable modality of imaging to accurately evaluate the morphologic distribution of various intra- and extra-axial tumours of the posterior fossa. From the results of their study, MRI can correctly diagnose 100% of extra-axial tumours and 85% of intra- axial lesions.[21]

In lieu of our findings, we determine that MRI is a very useful modality in assessing the type of posterior fossa tumor as there was significant correlation between MRI findings and the histology of the tumor; 2 tumors of CP angle origin were interpreted as Schwannomas, but the histology was reported as Epidermoid tumors. Though these tumors have distinct radiological features there are some instances where they have been reported to be similar, like in this case described in 1991.[22]

The assessment of patient status was made using KPS scale. In our study it was found that there was a significant improvement in patient status at 30 day follow up as assessed using KPS scale, this correlation was made with KPS score on admission and at the time of discharge vs KPS at 30-day follow up.

Patients scored >80 on KPS scale at 30 day follow up – as seen with 50% of patients enrolled in our study. This shows though posterior fossa tumors have an impact on daily life and patient performance it can improve with appropriate management strategies.

GCS has been widely accepted as the mode of assessing the consciousness of the patients in Neurosurgery. Though PCF tumors do not usually change GCS much we observed that the GCS improved at time of discharge in up to 88% of patients, recorded as 15.[23]

Preop deficits were noticed as described in the results section. Post operatively, the frequently encountered deficits were facial palsy and hemiparesis in about 8 and 4% of study participants. The definitive relationship of age and occurrence of posterior fossa tumors have been studied since a long time and paediatric PCF tumors are much common. In our study tumors like medulloblastoma and ependymoma were seen among younger patients (age less than 20 yrs.). The tumors like schwannoma were found to be more frequent in ages above 40 yrs.[21,23]

Male preponderance was noted in our study with more than 50% of study population affected while tumors like schwannoma had equivocal distribution, medulloblastoma and glioma had affected more male than females. The opposite was found true for ependymomas, with females being affected more than males in this condition.

CONCLUSION

Surgical treatment of posterior fossa tumours still represents a challenge for neurosurgeons. As a result of clinical trials, the survival and outcome for patients with posterior fossa tumours have improved considerably over the last 20 years.

Our study shows the accepted results, complications and surgical outcome in relation to previous clinical studies. We conclude that with proper management strategy, tailored to the condition of the patient, the posterior fossa tumors can be well treated and thereby produce good outcomes in patients despite the challenging location and distinct histological variations.

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How to cite this article: Dr. Kranthi Kiran, Dr. Akhilesh joshi, Dr. Iti Singh Parmar, Dr. Abhayambigai J., POSTERIOR FOSSA TUMORS – A STUDY ON THE CLINICOPATHOLOGICAL PROFILE AND SURGICAL OUTCOMES IN A TERTIARY NEUROSURGERY CARE CENTER IN NORTH KARNATAKA, Asian J. Med. Res. Health Sci., 2026; 4 (1):1-8.
Source of Support: Nil, Conflicts of Interest: None declared.