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Clinicopathological Study on Posterior Fossa Tumours

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Abstract: ***Aim: To find out the occurrence of posterior fossa tumours as per the age group and sex ratio, the different clinical presentations of posterior fossa tumours in different areas, the different aetio - pathological types as per the imaging &post operative histopathological findings and find out the surgical outcomes in the post - operative period. . Material and Method: The present prospective study was conducted at Department of Neurosurgery, Nilratan Sircar Medical College & Hospital, Kolkata among 30 consecutive patients admitted with tumours of posterior cranial fossa were operated upon at the Department of Neurosurgery, NRS Medical College and Hospital, Kolkata in the period of April, 2020 to October, 2021. Patients on admission deatilesd history taking and examination was done in preset format followed by radiological investigations like CT Scan, MRI Brain. Patients operated and in the post operative period detailed history taking and examination was done in preset format followed by radiological investigations like CT Scan, MRI with follow up for any post operative complication and the histopathological result of the excised specimen. The collected data was analysed to infer results and conclusions. Results: Maximum number of patients were in the age group of 0 - 10 yr (30%) followed by 41 - 50yr (20%), 31 - 40 yr and 51 - 60 yrs 16.66% each, 21 - 30 yrs 10%, 11 - 20 yrs and>60 yrs 3.33% each. Males were predominantly affected (16 cases, 60%) compared to females (12 cases, 40%). Imbalance (90%) was the predominant symptom followed by headache (83.33%), vomiting (76.66%), cranial nerve symptoms (80%), limb weakness (33.33%), bladder disturbances (6.16%), slurring of speech (13.33%). Other less common symptoms included seizures. Signs of cranial nerve involvement were found in 89.28% of cases followed by involvement of cerebellum in 82.14%, corticospinal (pyramidal) tract 60.71%, posterior column (50%) and spinothalamic tract (10.71%). Most common cranial nerve involved was CN II (63.33%) followed by CN VI (41.66%), CN VII (29.16%),, CN VIII (29.16), CN IX & X (8.33%), CN XI, CN XII. As per the imaging studies, most of the tumours were located in the cerebellum (10 cases, 33.33%) followed by fourth ventricle (8 cases, 26.66%), cerebellopontine angle (6 cases, 20%), Tentorial (4 cases, 13.33%) and brainstem (2 cases, 7.14%). As per the post - operative histopathological report, the most common tumour was by haemagioblastoma (7 cases, 23.3%) followed by, schwannoma (6 cases, 20%), low grade glioma (5 cases, 16.66%), medulloblastoma (4 cases, 13.33%), meningioma (4 cases, 13.33%), ependymoma (3 cases, 10% and metastasis (1 case, 3.33%). Low grade glioma, haemangioblastoma, schwannoma, were predominantly found in males whereas,, medulloblastoma, ependymoma, meningioma were predominantly found in females.26 patients (86.66%) having hydrocephalus underwent shunt with definitive surgery and 4 patients without hydrocephalus (13.33%) underwent definitive surgery only. Post operative complication was found in 50% (15) of cases, VII Cranial nerve palsy 33.33% (5), cerebellar hematoma 26.66% (4), CSF leak 26.66% (4), lower ccranial nerve palsy in 20% (3), meningitis 13.33% (2), pseudomeningocele in 6.66% (1). Conclusion: Chidren (0 - 10 years) are the most common group involved in posterior cranial fossa tumours. There is a male prevalence for these tumours. Cerebellum is the most common site of occurrence of these tumours. Different types of tumours have their particular age group predispositions. Symptoms of headache, vomiting, imbalance, slurring of speech, weakness are the common presentations. VII cranial nerve palsy appears here as the predominant complication and hence requires special concern intraoperatively. Complications like meningitis, pneumonia, rebleeding should be checked for at the earliest suspicion to reduce post operative mortality.***

Keywords: Intracranial Posterior fossa tumours

1. Introduction

The posterior fossa of the cranial cavity, limited by the tentorium above, also called infratentorial space. It has much smaller space than the rest of the cranial cavity. However, such a comparable small space consists of several types of motor and sensory tracts and a number of vital nuclei and reticular formation, midbrain, pons, and medulla that is further complicated by presence of cranial nerves, vascular network with large venous sinuses, changing volume of cerebrospinal fluid (CSF) in the ventricle and cisterns, and prominently visible cerebellar parenchyma with nuclei and peduncles.

Tumours in the posterior fossa are considered some of the most critical brain lesions. This is primarily due to the limited space within the posterior fossa, as well as the potential involvement of the vital brainstem nuclei. Apart from that, it also serves the final common pathway for the outflow of cerebrospinal fluid (CSF) through the foramen magnum from the cranial to the spinal space. Hence any lesion, even though apparent to be insignificant in size, may present with a significant presentation Presence of a number of vital neurovascular structures in close vicinity to the

lesions in this region makes it a big challenge for the surgeons to remove, decompress and even approach for the pathology. Hence, the best of neurosurgical skills and clinico - radiological localisation are required.

Fewer than 5% of all adult tumours originate in the posterior fossa, whereas approximately 50% of primary central nervous system (CNS) tumours occurring in patients younger than 15 years of age arise in the fourth ventricular region[1]. Tumours of the posterior fossa (PF) occur more commonly in children than adults. Between 54% and 70% of all childhood tumours arise in the posterior fossa, compared with 15% - 20% in adults[2]. There has been a predisposition of occurrence of such tumours in males compared to females[3].

Though the pathology in this region varies from person to person, the common presentations are headache, imbalance, vomiting, visual disturbances. Sometimes, spinal drop metastasis in some tumours can produce back pain, urinary retention or leg weakness[4].

The majority of posterior fossa tumours cause marked intracranial hypertension. Children with posterior fossa tumours are predisposed to hydrocephalus. A proportion of patients will require a cerebrospinal fluid (CSF) diversion procedure at some time during the course of their illness. Removal of the tumour changes the volume parameters and the cerebrospinal fluid distribution[5]. However the management of hydrocephalus in children with resectable posterior fossa tumours is controversial[6].
Development of surgical techniques for the treatment of posterior fossa disorders is, in the terms of historical events are very recent. In looking back at the historical literature, surgeons since the time of antiquity avoided any kind of surgical intervention within the posterior fossa. Surgery of the posterior fossa really only came in being with the origins of the twentieth century. In the last 25 years, there has been a virtual explosion of techniques and equipment related to what is now called frameless surgical technology[7].

Along with these events, the improvement in the field of anaesthesia, neurophysiological monitoring and postoperative intensive care have made it possible to operate over this critical region pathologies with greater efficiencies and better results.
The pathological entities vary from astrocytoma, ependymoma, haemangioblastoma, medulloblastomas, schwannomas, metastasis and others[8, 9].

The present day approach for treatment of posterior fossa tumours is to correctly localize the tumour both clinically and radiologically and to formulate a proper plan of treatment. Surgery, radiotherapy and chemotherapy are used either alone or in combinations according to the individual tumour type.

In our observational study, we have tried to evaluate patients with posterior cranial fossa tumours clinically and radiologically, operated them and followed them up for outcome and histopathological finding. By this comprehensive approach we have made an effort to analyse the various factors associated with this entity and affecting the treatment and outcome.

2. Material and Method

The present prospective, observational study was conducted at Department of Neurosurgery, Nilratan Sircar Medical College &Hospital, Kolkataamong30consecutiveadmitted with intracranial posterior fossa tumours. From April, 2020 to October, 2021. The study population comprised of patients of both sex and all age group. The subjects were included according to the following inclusion and exclusion criteria:

Inclusion Criteria: Patients clinically and radiologically diagnosed with intracranial posterior fossa tumours operated with definite treatment by surgical excision.

Exclusion Criteria: Haemorrhagic lesions, infarcts, traumatic lesions, Infective lesions presenting as tumours, cystic lesions
Study Tool:

a) Neurological exam with tuning fork, cotton wisps, pinprick, hot – cold objects, Knee hammer, measuring tape, tongue depressor, swab stick
b) Imaging: CT Scan and MRI Brain (plain and contrast)
c) Intraoperative instruments and operating microscope

Data was collected in a proforma and subjected to statistical analysis.

Statistical analysis: Data so collected was tabulated in an excel sheet, under the guidance of statistician.

3. Results

Epidemiological Profile

Table 1: Age wise distribution of patients
Total no. of patients (n) =30

S. No.	Age group	No. (n=30)	%
1.	0 - 10 yrs	9	30
2.	11 - 20 yrs	1	3.33
3.	21 - 30 yrs	3	10
4.	31 - 40 yrs	5	16.66
5.	41 - 50 yrs	6	20
6.	51 - 60 yrs	5	16.66
7.	>60 yrs	1	3.33

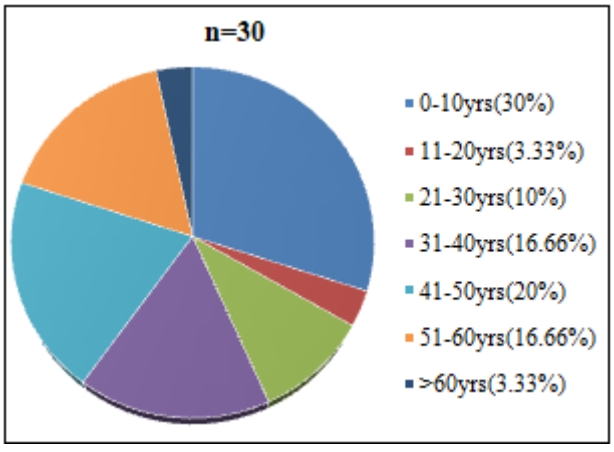


Table 2: Gender distribution of patients (n=30)

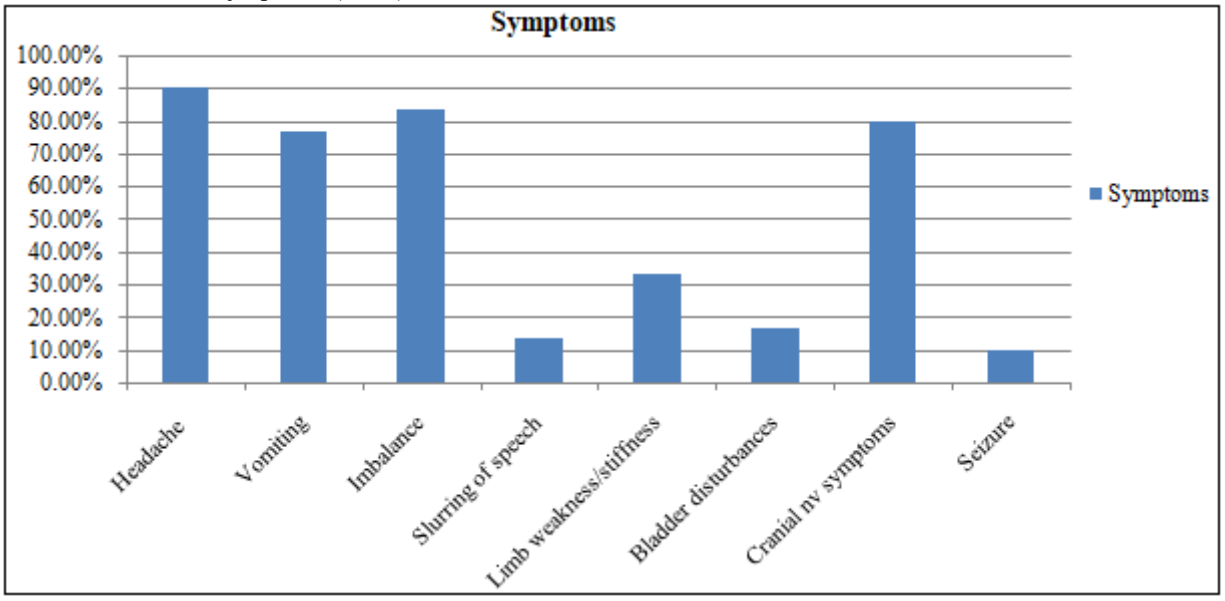
S. No.	Gender	No.	%
1.	Female	12	40
2.	Male	18	60

Males were predominantly affected (16 cases, 60%) compared to females (12 cases, 40%).

Clinical Presentation

Table 3: Symptoms (n=30)

S. No.	Symptoms	No.	%
1.	Headache	27	90
2.	Vomiting	23	76.66
3.	Imbalance	25	83.33
4.	Slurring of speech	04	13.33
5.	Limb stiffness/weakness	10	33.33
6.	Bladder disturbances	05	16.66
7.	Cranial nerve symptoms	24	80
8.	Seizures	03	10
	Dimness of vision	13	43.33



Imbalance (90%) was the predominant symptom followed by headache (83.33%), vomiting (76.66%), cranial nerve symptoms (80%), limb weakness (33.33%), bladder disturbances (6.16%), slurring of speech (13.33%). Other less common symptoms included seizures.

Table 4: Signs (n=30)

S. No.	Involved Structure	No.	%
1.	Cranial Nerves	24	80
2.	Pyramidal tract	11	36.66
3.	Spinothalamic tract	03	10
4.	Posterior Column	05	16.66
5.	Cerebellum	28	93.33

Signs of cranial nerve involvement were found in 89.28% of cases followed by involvement of cerebellum in 82.14%, corticospinal (pyramidal) tract 60.71%, posterior column (50%) and spinothalamic tract (10.71%).

Table 5: Cranial nerve involvement (24 cases)

Cranial nerve	No of cases involved	%
CN II	19	63.33
CN VI	10	41.66
CN VII	07	29.16
CN VIII	07	29.16
CN IX, X	02	8.33
CN XI	01	4.16
CN XII	01	4.16

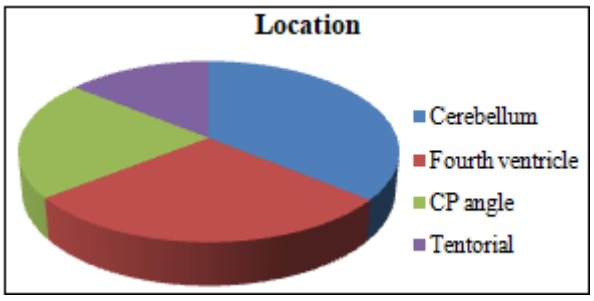
Most common cranial nerve involved was CN II (63.33%) followed by CN VI (41.66%), CN VII (29.16%),, CN VIII (29.16), CN IX & X (8.33%), CN XI, CN XII.

Investigations

CT Scan Brain with Contrast and MRI Brain with Contrast were done in all the cases while Pute Tone Audiometry was done in the 6 cases of tumours of Cerebello - Pontine angle (Schwannomas)

Table 6: Location of tumours (Imaging):

S. No.	Location	No. (n=30)	%
1.	Cerebellum	10	33.33
2.	Fourth ventricle	08	26.66
3.	CP angle	06	20
4.	Tentorial	04	13.33
5.	Brainstem	02	6.66



As per the imaging studies, most of the tumours were located in the cerebellum (10 cases, 33.33%) followed by fourth ventricle (8 cases, 26.66%), cerebellopontine angle (6 cases, 20%), Tentorial (4 cases, 13.33%) and brainstem (2 cases, 7.14%).

Table 7: Histopathological types of tumours

S. No.	Types	No. (n=30)	%

1.	Haemangioblastoma	07	23.3
2.	Schwannoma	06	20
3.	Low grade glioma	05	16.66
4.	Medulloblastoma	04	13.33
5.	Meningioma	04	13.33
6.	Ependymoma	03	10
7.	Metastasis	01	3.33

As per the post - operative histopathological report, the most common tumour was by haemagioblastoma (7 cases, 23.3%) followed by, schwannoma (6 cases, 20%), low grade glioma (5 cases, 16.66%), medulloblastoma (4 cases, 13.33%), meningioma (4 cases, 13.33%), ependymoma (3 cases, 10% and metastasis (1 case, 3.33%).

Table 8: Age wise distribution of different tumours

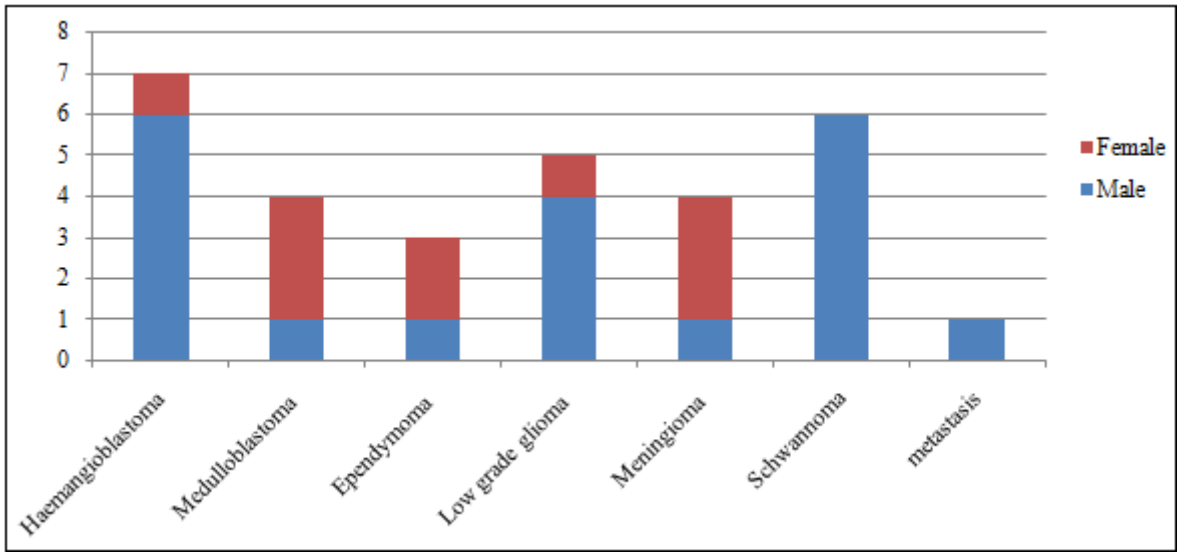
Age group	Tumour types
0 - 10 yrs	Pilocytic astrocytoma - 3, Brainstem glioma - 1, Ependymoma - 2, Medulloblastoma - 2, Hemangioblastoma - 1
11 - 20 yrs	Ependymoma - 1
21 - 30 yrs	Haemangioblastoma - 2, CP angle schwannoma - 1
31 - 40 yrs	Haemangioblastoma - 2, Meningioma 1, Medulloblastoma 2,
41 - 50 yrs	Meningioma - 2, Haemangioblastoma - 1, CP angle schwannoma - 3
51 - 60 yrs	Meningioma1, Low grade astrocytoma - 1, Haemangioblastoma - 1, CP angle schwannoma 2
>60 yrs	Metastatic adenocarcinoma - 1

Table 9: Gender distribution of different tumours

Gender	Tumour types
Female	Haemangioblastoma - 1, Medulloblastoma - 3, Ependymoma - 2, Meningioma - 3, Low grade brain stem glioma - 1, Metastatic adenocarcinoma - 1
Male	Low grade glioma - 4 (pilocytic astrocytoma - 3, brainstem glioma1), CP angle schwannoma - 6, Haemangiblastoma - 6, Meningioma - 1, Medulloblastoma - 1, Ependymoma - 1,

Table 10: Gender distribution of individual tumours

S. No.	Tumour type	Male	Female
1.	Haemangioblastoma	06	01
2.	Medulloblastoma	01	03
3.	Ependymoma	01	02
4.	Low grade glioma	04	01
5.	Meningioma	01	03
6.	Schwannoma	06	00
7.	Metastasis	01	00



Low grade glioma, haemangioblastoma, schwannoma, were predominantly found in males whereas,, medulloblastoma, ependymoma, meningioma were predominantly found in females.

Treatment

Table 11: Procedures done

S. No.	Procedure	No. (n=30)	%
1.	Shunt+ Definitive Surgery	26	86.66
2.	Definitive Surgery only	04	13.33

26 patients (86.66%) having hydrocephalus underwent shunt with definitive surgery and 4 patients without hydrocephalus (13.33%) underwent definitive surgery only.

Table 12: Complications (15 cases)

S. No.	Complications	No.	%
1.	VIIthNv palsy	05	33.33
2.	Cerebellar haematoma	04	26.66
3.	CSF leak	04	26.66
4.	Lower Cranial Nv palsy	03	20
5.	Meningitis	02	13.33
6.	Pseudomeningocele	01	6.66

Post operative complication was found in 50% (15) of cases, VII Cranial nerve palsy 33.33% (5), cerebellar hematoma 26.66% (4), CSF leak 26.66% (4), lower ccranial nerve palsy in 20% (3), meningitis 13.33% (2), pseudomeningocele in 6.66% (1).

4. Discussion

A study by D Kalyani et al[10]and Walker Ml and Petronio J et

al[2] showed that children are the more commonly affected group (55.76%) compared to the adults (44.24%). In the present study on 30 cases, the most common age group involved was 0 - 10 years (9 cases, 32.14%) followed by the age group of 41 - 50 years (6 cases, 20%). Considering 0 - 20 years, number of cases was 10 (appx 33%), which was nearly one third of the total number of cases.

Previous studiesDKalyani et al.1[0], Santos de Oliveira R et. al[11]and Zakrzewski K et al[12] showed a male prevalence regarding gender distribution of posterior fossa tumours. In the present study also, male cases (18) were more compared to the female cases (12) with a male: female ratio of 1.5: 1.

A systematic review by Wilne S et al.1[3] of literature and meta analysis of posterior fossa tumours in children showed clinical presentation of nausea and vomiting (76%), headache (90%), abnormal gait and coordination (83.33%), and dimness of vision (43%) for posterior fossa tumours. A retrospective analysis by Victor Kwasi et al[14] of children treated for posterior fossa tumours between 2009 and 2012 Cerebellar symptoms in the form of imbalance and coordination were the most common mode of presentation (32%) followed by headaches and vomiting, 30% of the patients were blind at presentation probably due to chronic effects of raised intracranial pressure. A retrospective study by Marie F et al[107] over 501 patients with posterior fossa lesions showed that Status epilepticus could be a potential complication in patients with posterior fossa cranial lesions and could be seen in up to 2.6% of such patients.1[07]. Reports of cases of cerebellar tumours with seizures have been found in studies by Honda H et al [15]

In our present study we evaluated the patients categorically by their symptoms and signs. Most common symptoms found were imbalance (25cases, 83.33%), headache (27cases, 90%), vomiting (23cases, 76.66%) and cranial nerve symptoms (24 cases, 80%). Limb stiffness/weakness was found in 10 cases (33.33%), slurring of speech was found in 4 cases (13.33%) and bladder disturbances in 5 cases (16.66%). One patient of cerebellar tumour presented with seizure which is a rare presentation considering cerebellar pathology. All the cases of brainstem gliomas and schwannomas had multiple cranial nerve symptoms.
Signs of cerebellum involvement were found in 28 (93%) cases. This was followed by involvement of Cranial nerve involvement (80%), pyramidal tract (36%) and posterior column (05%). Lesser involvement of posterior column compared to the pyraminal tract was not clearly explainable for most of the compressive lesions. One possible explanation may be inability to properly assess posterior column by imbalance as there was gross imbalance in cases along with cerebellar involvement.

In the present study, the most common cranial nerve that was been found to be involved was the 2nd nerve in 63.33% of cases. Next in frequency was the 6th nerve and all of them being bilaterally involved (41.66%). Cause for the involvement of the two nerves may be raised intracranial pressure due to obstruction to the CSF pathway.7th and 8th nerve were involved in (29.16%) and (29.16%) cases respectively. Among the cases of lower cranial nerve involvement, IX, X were involved in (8.33%), XI in 1 (4%), XII in 1 (4%).

In the study by A. James Barkovichet al[11], in children the most common primary posterior fossa tumour is cerebellar astrocytoma, whereas in adults vestibular schwannoma occurring in the cerebellopontine angle is the most common primary one as shown by Laurie A. Loevneret al in their study[15]. . Cerebellar metastasis is the most common intra - axial mass of posterior fossa in adults[15]. In our study, the major number of cases were children (0 - 10 years) and the most common tumour in that age group was cerebellar astrocytoma. Apart from that, there were cases of medulloblastomas, haemangioblastomas of cerebellum in other groups also. Hence, cerebellum obviously becomes the most common site (10 cases, 33.33%) of occurrence in the posterior fossa followed by fourth ventricle (8 cases, 26.66%), cerebellopontine angle (6 cases, 20%), tentorial (4 caes 13.33) and brainstem (2 cases, 6.66%).

In our study, the number of individual histopathological types of tumours were small. Yet, 7 cases of Hemangioblastomas comprised the major bulk. Schwannomas were the next common group (6 cases, 20%) followed by low grade glioma 5 cases compromising 16.66% compromising the major bulk in children. Cases of medulloblastoma was detected in 4 cases comprising 13.33 of cases. Meningioma contributes to 4 cases (13.33%) and ependymoma 3 cases (10%). Metastasis was been found in only one case.

Cerebellar astrocytomas account for upto 35% of posterior fossa lesions in children in the study by Kenneth J. Cohen et. al[16].75% of the tumous occur in the first two decades of life[16]. Here also, 3 cases have been diagnosed to be pilocyticastrocytomas all in first decade of life. Medulloblastomas are primarily a tumour of childhood but can also occur in adults (20%) as shown by study in Sharma BS et al[17]. Here, we have found two case in each groups of 0 - 10yrs, and 31 - 40 yrs. The most common ages of presentation of haemangioblastomas are third and fourth decades Andrew Slatera et. al [18.] In the present study, such case was most of the cases in second and third decade. Brainstem gliomas are common tumours of childhood comprising approximately 20% of all paediatric brain tumours in stydy by Eric Bouffetet al[19]. Here, all the 1 case of brainstem gliomas were found in the children. In a study by Duffner PK et al[20]ependymoma is also a tumour of childhood and over 50% of cases of posterior fossa ependymomas occur in children under 5 years of age. Here, out of 3 case of ependymoma, two were found in children. Childrens have an increased incidence of meningiomas in the posterior fossa compared to the adults[21]. But, all the three cases of meningiomas in our study were found in the adult age group.6 cases of schwannomas in the adult group in our study also corroborated with the literature[22]. One case of posterior fossa metastasis in the age group of 50 - 70 yrs in this study was also corroborative to the literature SahaAet al[23].

For haemangioblastomas, sex distribution is equal, though some authors have reported a prevalence of males[24]. We have found a male (6cases) preponderance compared to females (1 case). Males have a predilection for

medulloblastomas[25], which is also reverse in our study. A male preponderance has been found in cases of cerebellarastrocytomas is [26]and brain stem gliomas[27]which has been found in our study also. Posterior fossa meningiomas have been more common in females[28] and our study also supports this. Literature shows a male: female ratio of 1: 2 for vestibular schwannomas[29] but all the 6 cases were males in our study. We found one case of posterior fossa metastasis in a male though no definite gender predilection of such metastasis is found in the literature.

While going for treatment in the cases, we performed ventriculoperitoneal shunt before the definitive surgery in those who presented with hydrocephalus on imaging.26 cases underwent shunt with definitive surgery and 04 cases underwent definitive surgery

In the study of MR Islam et al[30] the major complications in both the groups were cerebrospinal fluid leakage (23.5% in Group A, 26.7% in Group B), pseudomeningocele formation (23.5% in Group A, 26.7% in Group B), meningitis (17.6% in Group A, 26.7% in Group B), seizure (11.6% in Group A, 6.7% in Group B) in order of frequency.3 (17.6%) cases of shunt blockade was found in Group A. A 10 - year (1992 - 2002) retrospective study[31] of all posterior fossa surgery performed over a total of 500 patients showed that Cerebrospinal fluid leaks were the most frequently encountered, presenting in 13%patients followed by meningitis in 9.2%patients, wound infection in 7% patients, and CN palsies in 4.8% patients. Other complications that were observed to develop almost exclusively in patients undergoing cerebellar parenchymal tumor resection included cerebellar edema in 5% patients, hydrocephalus in 4.6% patients, cerebellar hematoma in 3% patients, and cerebellar mutism in 1.2% patients. In our study, VII nerve alsy was the most common complication (5 cases, 16. %). Next to follow was cerebellar haematoma (3 cases, 26%) and CSF leak (4 cases, 26.66%). Other complications being meningitis (2 cases), lower cranial nerve palsy (3 cases, 20%), pseudomeningocele (1 case, 6.66) No complications were found in 15 patients (46.42%).

5. Conclusion

Considering our results we can conclude with the followings:

- Children (0 - 10 years) are the most common group involved in posterior cranial fossa tumours.
- There is a male prevalence for these tumours.
- Cerebellum is the most common site of occurrence of these tumours.
- Different types of tumours have their particular age group predispositions.
- Symptoms of headache, vomiting, imbalance, slurring of speech, weakness are the common presentations.
- Papilloedema must be excluded as this sign is very commonly present in these cases and is related with the management protocol and prognosis.
- VII cranial nerve palsy appears here as the predominant complication and hence requires special concern intraoperatively.
- Complications like meningitis, pneumonia, rebleeding should be checked for at the earliest suspicion to reduce post operative mortality.

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