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Original Research Article.

Surgical Outcome of Posterior Fossa Space Occupying Lesion: A Critical Analysis

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ABSTRACT

Background: Out of all childhood brain tumors, 54-70% arise in posterior fossa as compared to 15-20% in adults. Medulloblastoma, ependymoma, astrocytoma of cerebellum vermian and brainstem more commonly affect children. Metastatic lesion, hemangioblastoma and lymphoma are more common in adults. In India, there are more number of tuberculoma as compared to west. Primary modality of treatment in these patients is surgical without increasing the morbidity and mortality significantly and adjuvant therapy in form of radiotherapy and/or chemotherapy.

Aims: The aim of this study is to analyze patients treated with midline posterior fossa tumor in our hospital and compare their incidence, clinical presentation, radiological features and management with existing literature.

Methods and Materials: This study was conducted in Department of Neurosurgery, Tertiary Care Hospital, Ahmedabad, India. 40 consecutive cases of midline posterior fossa tumors were selected for this study from August 2007 till January 2018. All patients with primary brain tumor will be evaluated by history, clinical examination (age, sex, GCS Score, neurological deficit, seizure, hydrocephalous, Glasgow outcome score), laboratory and radiological investigations. Patients were operated by craniotomy and tumor removal.

Results and Conclusion: Medulloblastoma, cerebellar astrocytoma, ependymoma, haemangioblastoma and brainstem glioma are commonest among midline posterior fossa sol in pediatric age group. Medulloblastoma, cerebellar astrocytoma, ependymoma and brainstem glioma occur most commonly in pediatric patients. Metastasis and meningioma occur commonly in later age group. Tuberculoma, haemangioblastoma and epidermoid cyst are common in younger (11-40) age group. Intra-axial midline tumors present early with signs and symptoms of raised intracranial pressure and truncal ataxia while extra axial tumor present with other symptoms such as headache. CT scan and MRI finding in association with clinical features gives clues to probable pathological diagnosis. Most patients were i.e. 62.5% were having evidence of hydrocephalus. Pre-operative shunt should be carried out in patients with poor general condition poor consciousness level due to increased intracranial pressure with hydrocephalus. Cerebellar mutism is one of the common complication in midline posterior fossa sol and also due to approach in surgery. Post-operative CSF leak, wound infection, and size of bony defect is also more in patient with sub occipital craniectomy. Intraoperative monitoring with EMG, BERA etc. can help in decreasing incidence of cranial nerve and brainstem damage.

Keywords: Posterior Fossa; Space Occupying Lesion; Management; Surgical Outcome.

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INTRODUCTION

The posterior cranial fossa is part of the cranial cavity, located between the foramen magnum and tentorium cerebelli. It contains brainstem and cerebellum. Anteriorly, it extends to the apex of the petrous part of temporal bone. Posteriorly it is enclosed by the occipital bone. Portions of the squamous and mastoid part of the temporal bone form its lateral walls.[1]

Out of all childhood brain tumors, 54-70% arise in posterior fossa as compared to 15-20% in adults.[2] Medulloblastoma, ependymoma, astrocytoma of cerebellum vermian and brainstem more commonly affect children. Metastatic lesion, hemangioblastoma and lymphoma are more common in adults. In India, there are more number of tuberculoma as compared to west.[2]

The most common pediatric vermian space occupying is medulloblastoma, a subgroup of primitive neuroectodermal tumors. Midline cerebellar tumors including astrocytomas, are predominantly solid arising in the vermis with extension into the cerebellar peduncles, hemisphere, and recesses of the fourth

ventricle usually gives them a lateralized appearance. Brainstem is generally spared, although it may be displaced by the mass.[2]

Anatomic details such as the sloping dorsum sellae and clivus, as well as the complex vascular interrelationships, the topographically varied tentorium and calvaria, and the surgeon's concern for transtentorial and foramen magnum herniation, all must be taken into account in planning the surgical management of abnormalities of the posterior fossa.

Majority of patients present with signs and symptoms of raised intracranial pressure and depending on the anatomical location with either vermian, cerebellar hemispheric or brainstem dysfunction or cranial nerve involvement. Radiological investigations like computed tomographic scan and MRI scan provide an anatomic diagnosis and clue for probable pathological diagnosis.[2]

Primary modality of treatment in these patients is surgical without increasing the morbidity and mortality significantly and adjuvant therapy in form of radiotherapy and/or chemotherapy.[1]

In present study, I have analyzed longitudinally cases of posterior fossa midline space occupying lesion retrospectively in past 10 years from 2007 to 2017.

AIMS AND OBJECTIVES

The aim of this study is to analyze patients treated with midline posterior fossa tumor in our hospital and compare their incidence, clinical presentation, radiological features and management with existing literature.

MATERIALS AND METHODS

This study was conducted in Department of Neurosurgery, Tertiary Care Hospital, Ahmedabad, India. 40 consecutive cases of midline posterior fossa tumors were selected for this study from August 2007 till January 2018

Following protocol were employed in treatment of these cases.

Inclusion Criteria

Patients with intra and extra-axial space occupying lesions arising from midline structures were included in study.

Exclusion Criterion

Patients with space occupying lesions arising from cerebellar hemisphere, spinal cord and supratentorial region extending up to midline posterior fossa were excluded from study.

METHOD

All patients with primary brain tumor will be evaluated by history, clinical examination (age, sex, GCS Score, neurological deficit, seizure, hydrocephalous, Glasgow outcome score), laboratory and radiological investigations.

All patients and relatives were explained about the disease of the patient and benefits of the surgical procedure and potential side effects and complications in detail. Written and informed consent was taken. Patients were operated by craniotomy and tumor removal.

If hydrocephalous is present that patient were treated first by VPMP shunt followed by craniotomy and tumor removal. Postoperative management was done in the ICU or ward depending on clinical condition of the patient. Postop NCCT head was done in all patients after 24 hrs of operation or earlier in case of clinical deterioration. Specimen was sent for histopathology and IHC. Grading of tumor was done according to WHO criteria.

SURGICAL PROCEDURE

Craniectomy

1. Position: (depends on location of tumor)
2. Paint and drape
3. Equipment: A. microscope; B. ultrasonic aspirator
4. Blood availability: type and cross 2 U PRBC
5. Post op: ICU
6. Consent (in lay terms for the patient- not all-inclusive):

A. procedure: surgery through the skull remove as much of the tumor as is safely possible

B. complications: (usual craniectomy complications) and inability to remove all of the tumor

Histopathology and IHC

Tumor specimen will be fixed in 10 % neutral buffered formalin and embedded in paraffin. Consecutive 4 micron meter section will be cut using rotatory microtone. Sections will be stained with hematoxylin and eosin (H and E) for histopathological examination. The IHC analysis will be performed on formalin fixed, paraffin embedded tissue sections using standard horse radish peroxidase polymer technique.

Investigations

Routine investigations like CBC, Coagulation Profile, RBS, Renal function test (RFT), Serum Electrolytes and Liver function Test (LFT) were carried out in all cases. Preoperative ECG and chest X-Ray, x-ray skull was done in all patients. Computed Tomogram (CT scan) and Magnetic resonance Imaging (MRI) with contrast was done in all cases.

Initial Medical Treatment

Dexamethasone was started to all patients with radiological evidence of posterior fossa tumor in the dose of 1-2 mg/kg/day in children and 15-25 mg/day in adults in divided doses along with an antacid. It was continued intraoperatively and tapered after surgery.

Management of Hydrocephalus

Preoperative shunt was used in patients with poor general condition and poor consciousness level due to increased intra cranial pressure. Post-operative shunt was done if patient showed signs and symptoms of increased intracranial pressure with hydrocephalus.

Definitive Surgery

Primary modality of treatment was surgery. General anesthesia was used in all cases. Midline sub-occipital craniectomy was used for surgical access. The aim of the surgery was to achieve gross total excision in all tumors while avoiding damage to cranial nerves and brain stem structures. As our policy we didn't close the dura in sub occipital craniectomy.

Post-operative Management

Extubation was tried in all cases. Patients who were suspected to have poor respiratory compromise from loss of central drive or peripheral muscle weakness and/or protective airway reflex. Patient who didn't maintain adequate saturation of oxygen were kept on ventilator. Early follow-up scans were not done routinely. CT scan was done in patients who deteriorated post-operatively and/or didn't show expected improvement.

Adjuvant Therapy

Most of the patients of medulloblastoma, ependymoma, metastasis, and astrocytoma were referred for further consideration of radio and chemotherapy.

Table I: Tumor incidence

Tumor Type	N= 40	
	Number of patients	Percentage
Medulloblastoma	10	25%
Astrocytoma	6	15%
Ependymoma	5	12.5%
Hemangioblastoma	4	10%
Metastasis	3	7.5%
Epidermoid Cyst	3	7.5%
Brainstem glioma	3	7.5%
Meningioma	2	5%
Tuberculoma	2	5%
Choroid Plexus Papilloma	2	5%

Table II: Incidence in various age group

Age	Medulloblastoma	Cerebellar Astrocytoma	Ependymoma	Haemangioblastoma	Metastasis	Epidermoid Cyst	Brainstem glioma	Tuberculoma	Meningioma	Choroid plexus papilloma
1-10	7	4	2	0	0	0	1	0	0	1
11-20	2	1	1	0	0	0	2	1	0	1
21-30	1	0	2	2	0	2	0	1	0	0
31-40	0	1	0	2	0	1	0	0	1	0
41-50	0	0	0	0	1	0	0	0	0	0
51-60	0	0	0	0	2	0	0	0	1	0
61-70	0	0	0	0	0	0	0	0	0	0

Table III: Incidence according to sex

Tumor Type	Number Of Patients	
	Male	Female
Medulloblastoma	6 (60%)	4 (40%)
Astrocytoma	3 (50%)	3 (50%)
Ependymoma	3 (60%)	2(40%)
Haemangioblastoma	3(75%)	1(25%)
Metastasis	2 (66.7%)	1 (33.3%)
Epidermoid Cyst	1 (33.7%)	2 (66.7%)
Brainstem glioma	2 (66.7%)	1 (33.3%)
Meningioma	1 (50%)	1 (50%)
Tuberculoma	1 (50%)	1 (50%)
Choroid plexus papilloma	1(50%)	1(50%)

RESULTS

Tumor Incidence

In Present study of 40 cases of posterior fossa tumors, 10 cases were Medulloblastoma (25%), 6 Cerebellar Astrocytoma (15%), 5 Ependymoma (12.5%), 4 haemangioblastoma(10%), 3 Metastasis (7.5%), 3 Epidermoid cyst (7.5%), 3 Brainstem glioma (7.5%), 2 Meningioma (5%) and 2 Tuberculoma (5%), 2 choroid plexus papilloma (5%).

Incidence According to Age

Most of the patients of medulloblastoma, cerebellar astrocytoma were in first decade of age group. Ependymoma was more common in young and adolescent age group, while metastasis was more common after 40 years of age. Epidermoid cyst and haemangioblastoma were common in adults (21-40 years) age group. Brain stem glioma and tuberculoma were present in younger age groups. There were two cases of meningioma in present study, both were in late age groups. In present study, choroid plexus papilloma was present in younger age.

Incidence According to Sex

Out of 40 patients, 23 were male (57.5%) and 17 were female (42.5%). For medulloblastoma, there was slight male preponderance with 54.5 %. Astrocytoma and ependymoma were also more common in males involving 57.1% male patients. Metastatic lesions and brainstem gliomas were more common in male patients accounting 75% and 66.7% in their respective category. Epidermoid cysts, meningioma and tuberculoma were having equal sex distribution.

Sign and Symptoms

Features of raised intracranial pressure such as visual disturbances and papilledema were also present in significant

number of patients accounting approximately 55 and 65% respectively. Nystagmus and gait disturbance were also present in significant number of patients i.e. 52.5 and 57.5% of patients respectively.

CT/MRI Findings

Majority of the intraaxial tumor were arising from midline and some extending laterally from midline. Majority of medulloblastoma were hyperdense while cerebellar astrocytoma and brainstem glioma were hypodense. Calcification was most commonly seen in ependymoma. Fourth ventricle is pushed anteriorly in most of the medulloblastoma while anterolaterally in cerebellar astrocytoma, metastasis, tuberculoma and backwardly in brainstem glioma. On contrast injection of all tumors show enhancement of varying degree. MRI was done showing better delineation of normal anatomy, extent of space occupying lesion and displacement of anatomical structures.

Table IV: Sign and symptoms

Symptoms & Sign	Medulloblastoma	Cerebellar Astrocytoma	Ependymoma	Haemangioblastoma	Metastasis	Epidermoid Cyst	Brainstem glioma	Tuberculoma	Meningioma	Choroid Plexus Papilloma	Total %
Vomiting	9	5	5	3	3	2	2	1	1	2	33(82.5)
Headache	7	5	5	4	3	2	2	1	1	2	32(80)
Altered Sensorium	3	1	2	0	1	0	1	0	1	0	9(22.5)
Visual Disturbance	6	3	3	1	2	1	2	1	1	2	22(55)
Enlarged Head	1	0	0	0	0	0	0	0	0	0	1(2.5)
Papilledema	9	4	4	1	2	1	2	1	1	1	26(65)
FND	1	0	0	1	0	0	2	0	0	0	4(10)
Gait Dist.	7	3	2	2	2	2	2	1	1	1	23(57.5)
Truncal Ataxia	7	3	2	2	3	1	1	1	0	1	21(52.5)
Nystagmus	7	3	3	2	2	1	2	0	1	0	21(52.5)
Other Cerebellar Sign	5	4	2	2	2	1	0	0	1	1	18(45)
LCN Involvement	1	1	0	0	0	0	2	0	0	0	4(10)
Other CN Involvement	3	0	0	0	1	0	0	0	0	0	4(10)

Table V: CT/MRI scan findings

CT SCAN FINDINGS	Medulloblastoma	Cerebellar Astrocytoma	Ependymoma	Haemangioblastoma	Metastasis	Epidermoid Cyst	Brainstem glioma	Tuberculoma	Meningioma	Choroid plexus papilloma
LOCATION										
Midline	9	3	5	3	3	3	2	2	2	2
Extending to cerebellar hemisphere	1	3	0	0	1	0	0	0	1	0
Hydrocephalus	8	3	5	2	1	1	0	1	2	2
DENSITY										
Hypodense	0	3	0	3	0	0	0	0	3	0
Isodense	1	0	0	0	0	1	0	0	0	0
Hyperdense	7	0	2	0	0	2	2	0	0	2
Mixed Density	2	3	3	0	4	0	0	2	0	0
Calcification	2	0	3	0	0	0	0	0	0	0
CONDITION OF IV VENTRICLE										
Not Visualized	3	0	0	0	0	0	0	0	0	0
Pushed Anteriorly	6	3	0	0	2	0	0	0	0	0
Antero-laterally	1	3	0	0	0	2	0	2	0	0
Backward	0	0	2	3	0	0	0	0	0	1
Backward Laterally	0	0	3	0	0	0	0	0	0	1
Laterally	0	0	0	0	0	0	0	0	0	0
EVIDENCE OF BRAINSTEM INFILTRATION	2	0	0	0	0	0	0	0	0	0
ENHANCEMENT										
No Enhancement	0	0	0	0	0	0	0	0	2	0
Slight	2	3	0	2	0	1	0	1	1	0
Moderate	5	3	3	1	0	2	2	0	0	0
Marked	3	0	2	0	4	0	0	1	0	2
Focal Lucencies in Tumor	2	3	3	0	0	0	0	1	0	0

Table VI: Management of Hydrocephalus

Shunt Surgery	Pre. Op.	Post-Op.	Drainage at time Of surgery	Not Done
Tuberculoma	1	0	0	1
Meningioma	0	0	0	2
Metastasis	0	0	0	3
Ependymoma	2	1	2	0
Brainstem Glioma	2	0	0	0
Cerebellar Astrocytoma	1	1	1	3
Medulloblastoma	2	1	2	5
Epidermoid Cyst	0	2	0	1
Haemangioblastoma	0	1	0	3
Choroid plexus papilloma	0	0	0	2

Table VII: Position and approach of Surgery

Type of Tumor	Position		
	Prone	Sitting	Supine
Medulloblastoma	10	0	0
Astrocytoma	5	1	0
Brain stem Glioma	3	0	0
Ependymoma	5	0	0
Metastasis	3	0	0
Meningioma	1	1	0
Tuberculoma	2	0	0
Epidermoid cyst	3	0	0
Haemangioblastoma	4	0	0
Choroid plexus papilloma	2	0	0

Table VIII: Extent of excision

Tumor	Total / Near Total Excision	Subtotal Excision	Biopsy
Medulloblastoma	8	2	0
Astrocytoma	4	2	0
B.S. Glioma	0	0	3
Ependymoma	3	2	0
Metastasis	3	0	0
Meningioma	2	0	0
Tuberculoma	2	0	0
Haemangioblastoma	4	0	0
Epidermoid Cyst	3	0	0
Choroid plexus papilloma	1	1	0

Management of Hydrocephalus

Out of 25 patients with radiological evidence of hydrocephalus, pre-operative VP shunt was carried out in 8 patients, while external ventricular drainage at the time of surgery was carried out in 5 patients. Post-operative shunt surgery was required in 6 patients. Pre-operative shunt surgery was carried out in patients who presented with altered sensorium and brain stem glioma, post-operative shunt was required in whom post-operative deterioration occurred due to hydrocephalus mostly in patients with partial removal of tumor.

Position and Approach of Surgery in Various Tumors

Midline suboccipital craniectomy with excision of total or near total excision was done in all patients and position used for these 40 cases of midline posterior fossa tumors are given below in tabulated form.

Extent of Excision

Total excision decreases chances of recurrence in patients of posterior fossa lesions.

Near total excision: 30; Subtotal excision: 7; Biopsy: 3.

Subtotal, partial excision and biopsy was done in patients with lesions involving vital structures such as cerebellar peduncles, brain stem or floor of fourth ventricle.

1. Gross total excision (100% of tumor is removed)
2. Near total excision (more than 80% of tumor volume is removed)
3. Subtotal excision (less than 80% of tumor volume is removed)

Complications

The commonest complication noted in present series was cerebellar mutism present in 6 cases.

After that wound related complications such as CSF leak (was treated by lumber puncture) and wound infections were common. Operative site hematoma was present in 3 patients. Temporary (Up to 1 month from surgery) lower cranial nerve and facial nerve paresis was present in 2 and 3 patients, which tend to improve with time and residual facial paresis remained only in 2 patients in follow-up.

Outcome of Surgery

Good Outcome: improved and returned to their normal daily and professional activity.

Fair Outcome: return to their daily routine activity but no other professional activity which they were doing previously

Poor Outcome: not able to do their daily routine activity

In present study, 1 patient had poor outcome, 11 had fair outcome, while rest had good outcome.

Table IX: Complications

COMP.	Med	Ast	B.S Glioma	Epen	Met	Men	Tub	Haem	Epid	C. P. papilloma
CSF Leak	2	0	0	1	0	0	1	0	1	0
Shunt Infection	0	1	0	0	0	0	0	0	1	0
Meningitis	1	1	0	0	0	0	0	1	0	0
Haematoma	0	0	0	1	1	0	0	1	0	0
Hemi paresis	0	1	2	0	0	0	0	0	0	0
Cerebellar Mutism	3	1	0	2	0	0	0	0	0	0
Lower cranial nerve paresis	0	0	0	0	0	0	0	2	0	0
Wound infection	1	0	0	0	0	0	0	2	0	0
Facial Nerve Paresis	0	0	1	1	0	0	0	0	0	1
Broncho Pneumonia	0	0	0	0	1	0	0	0	0	0
Mortality	0	0	0	0	0	0	0	0	0	0

Table X: Surgical Outcome

Tumor	Results			
	Good	Fair	Poor	Died
Medulloblastoma	6	4	0	0
Cerebellar Astrocytoma	4	2	0	0
Brainstem Glioma	1	1	1	0
Ependymoma	3	2	0	0
Metastasis	3	0	0	0
Tuberculoma	1	1	0	0
Haemangioblastoma	4	0	0	0
Epidermoid Cyst	3	0	0	0
Meningioma	2	0	0	0
Choroid plexus papilloma	1	1	0	0

DISCUSSION

Medulloblastoma was the commonest tumor in our study and it is one of most common tumor in the posterior fossa and account for 4 to 10 % of primary brain tumors.[3,4] In patients under the age of 20, they account for 15-20% of CNS tumors. In the present study, 10 patients i.e. 25% of total patients were having medulloblastoma. According to literature, medulloblastoma affects boys more often than girls with ratio of 4:3 and 2:1 as compared to our study with male: female ratio of 3:2.[4,5] Medulloblastoma was most common below age of 10 years accounting for 70% of cases. Similar results were documented in literature with 70% of cases less than 8 years of age. Desmoplastic medulloblastoma, a subtype of medulloblastoma is more common in older age and located laterally in cerebellar hemispheres.[6,7]

Cerebellar astrocytoma constitute 10-20% of childhood brain tumor with peak incidence in middle of the first decade and present in equal frequency in male and female.[8,9] In present study, midline astrocytomas were 2nd most common tumor present i.e. 15% and also common in 1st decade of life accounting approximately 67% of total cases with equal distribution in both sex. Ependymomas has an incidence of 5% in primary intracranial tumor with half presenting during first two decades of life and having slight male predominance.[10-14] In present study ependymoma accounted for 12.5% of total cases with 2/3rd cases were in 1st two decades and with slight male predominance i.e.3:2. Haemangioblastoma accounts for 7-12% of posterior fossa tumors with slight male predominance 1.3:1 and peak incidence in 3rd decade.[15-17] In present study, there were 10% cases of midline haemangioblastoma with 75% of male patients. Haemangioblastoma was common in 3rd and 4th decade in present study. Brainstem glioma accounts for 10-25% of all intracranial childhood neoplasms with predominance in childhood and adolescence. There is no sex predilection.[18] In present study, there was incidence of 7.5% with all cases below age of 20 years and slight male preponderance (2:1).[19-21] Choroid plexus papilloma usually presents in younger age group as in present study (with 5% of total cases).[22] Midline posterior fossa meningioma usually arising from fourth ventricle accounts for 1.5% of all intracranial meningiomas with equal male to female ratio and mean age of diagnosis 25 years while in present study there were 2 cases of meningioma i.e. 5% with equal distribution in both sex and slight late age of presentation.[23] In a study by Kalyani and others, epidermoid cyst usually present between 2nd and 5th decade and accounting for 8% of posterior fossa sol in a study by with equal sex distribution.[24] In present study there was incidence of 7.5% with slight female predominance with all cases between 2nd and 4th decade.[70] Metastasis was more common after 40 years of age.[25-27]

CLINICAL FEATURES

As noticed in observation patient with midline posterior fossa tumor presented with headache, vomiting and visual blurring as common presenting symptoms. Headache was present in 80% patient, vomiting in 82.5 %, cerebellar signs in 45% patients. Papilledema and visual disturbance were also present in 65 and 55% patients respectively. Lower cranial nerve palsies and focal

neurological deficit were present in two patients of brainstem glioma. Gait disturbance and truncal ataxia were among the common symptoms accounting for 57.5 and 52.5%. While Walker et al also demonstrated predominance of headache, vomiting and Papilledema in his series.[22] Chang et al also reported headache, vomiting and gait disturbance as commonest symptoms among patients of medulloblastoma, cerebellar astrocytoma and ependymoma.[28]

While focal neurological deficit was the commonest feature among brainstem glioma, he also reported 8% cases who presented with altered sensorium while in our series 22.5% of patients presented with altered sensorium, this may be due to late presentation of patients in our series. Kalyani and others has incidence of headache and vomiting of 70.3% while in present series it was 80 and 82.5% respectively.[29] Motor deficit and cranial nerve palsy was more common in series presented by Kalyani and others as compared to our study.[24] Cerebellar signs and papilledema were comparable in present study to Kalyani and others.[24] In a study by Refaat et al. 21 of our 25 cases (84%) presented to us with manifestations of hydrocephalus and increased intracranial pressure. Among these 21 cases; 7 cases presented with persistent headache only. 9 cases had the classic persistent vomiting, headache, nausea, with blurring of vision, in 2 of these cases this classic picture was associated with sixth nerve palsy. 3 cases presented with physical growth retardation and persistent vomiting. While 2 cases presented with disturbed conscious level. The remaining 4 cases (16%) presented with tumor mass effect. 2 cases presented with ataxia and hypotonia, while 2 other cases presented with facial and lower cranial nerve palsies. Headache was the most common presenting symptom, it was found in all 25 cases in variable degrees. Results were comparable to present study.

Table XI: Comparison of various sign and symptoms

Sign and Symptoms	Kalyani et al	Present series
Headache	70.30%	80%
Vomiting	70.30%	82.5%
Motor deficit	37.5%	10%
Cranial nerve palsy	56.5%	20%
Cerebellar signs	59%	45%
Papilledema	52%	65%

Table XII: CT scan finding

CT SCAN FINDINGS	Medulloblastoma	Chang Series	Cerebellar Astrocytoma	Chang Series	Brainstem Glioma	Chang Series	Ependymoma	Change Series
LOCATION								
Midline	90%	92%	50%	74%	100%	100%	100%	79%
Midline extending laterally	10%	8%	50%	26%	0	0	0	21%
Calcification	20%	29%	0	17%	0	8%	50%	70%
HYDROCEPHALUS	80%	64%	50%	77%	70%	29%	100%	57%

Majority of medulloblastoma in Chang's series were located midline, only 8% were extending laterally from midline whereas 26% cerebellar astrocytoma and 21 % of ependymoma were seen extending laterally from midline in Chang's series, while in our series 10% of medulloblastoma, 50% of astrocytoma were extending laterally.[28]

Kingsley's et al reported calcification to be present in 44% ependymoma, 12% medulloblastoma, 12% brainstem glioma and 9% cerebellar astrocytoma while Chang reported a frequency of 70% for ependymoma, 29% for medulloblastoma, enhancement. In present series, calcification was present in 20% of medulloblastoma and 50% of ependymoma.[28,30] Hydrocephalus was present in 80% of medulloblastoma, 100% of ependymoma, 70% of brainstem glioma and 50 % in patients of cerebellar astrocytoma.

SHUNT SURGERY

Shunt was done in 3 patient with medulloblastoma, 2 patients with Cerebellar astrocytoma, 2 patients with Brainstem glioma, 3 patients with ependymoma, 2 patients with epidermoid cyst, one with haemangioblastoma and 1 patient with tuberculoma. Pre-operative VP shunt was carried out in 8 patients, while external ventricular drainage at the time of surgery was carried out in 5 patients. Post-operative shunt surgery was required in 6 patients.

Schmidt reported series of 61 patients (38 adult and 23 children) with midline posterior fossa tumor and hydrocephalus where steroids and EVD were used as management.[31,32] 93% of patients were shunt free. Shunt was required in 7% of patients, all were children.[33,34] Higher number of patients in our series required shunt. This may be due to late presentation of patients. In study by Kalyani et al. 40 patients out of 52 required drainage of CSF i.e. 77% as compared to 47.5% of patients in present study.[24]

DEFINITIVE SURGERY

Out of ten cases of Medulloblastoma, near total excision was achieved in 80% (8) of medulloblastoma while subtotal excision was achieved in 20% (2). In cerebellar astrocytoma total/near total excision was achieved in 4 (67%), while subtotal excision was achieved in 1(33%). In brainstem glioma, biopsy was taken in all three patients. In ependymoma near total excision was achieved in 3(60%) while subtotal excision was achieved in 2 (40%). In one patient of choroid plexus papilloma subtotal excision was done whereas near total excision was done in one patient. In all patients with metastasis, meningioma, haemangioblastoma,

epidermoid cyst and tuberculoma near total excision was achieved.

In a study by Refaat et al, near total excision was achieved in 92% in patients of medulloblastoma as compared to 80% of patients in present study. Whereas near total excision was achieved in 80 % of ependymoma and 100% of choroid plexus papilloma.[29]

Piere Khan et al reported a study at 75 patients of brainstem glioma who were operated, 57.5% underwent partial excision 29.3%·underwent subtotal excision while total excision was done in 13.3 %. Edward et al in his study of medulloblastoma preferred removal of CI arch to maximize exposure as most medulloblastoma extend caudally. Our experience confirmed this. Bright el al achieved total excision in 37%, near total in 43%, subtotal in 14%, partial in 6% and biopsy was done in 4% of patients with medulloblastoma based on estimation of neurosurgeons. In our study 80% underwent near total excision, while subtotal excision was seen in 20%.

Sutton reported series of 59 patient with cerebellar astrocytoma in which 73% underwent total resection and 27% underwent subtotal resection while in our series 67% of patient had total resection while 33% had subtotal resection.[4]

COMPLICATIONS

In our series, 5 patients had CSF leak in post-operative period. They were managed with either additional stitch or repeated LP or lumber drainage. Shunt infection was noted in 1 patient of cerebellar astrocytoma and 1 patient of epidermoid cyst. Meningitis occurred in 1 case of medulloblastoma, 1 case of Cerebellar astrocytoma, 1 case of haemangioblastoma. Extradural hematoma was noted in 1 patient of ependymoma due to sugita pin, 2 patients had operative site hematoma. Cerebellar mutism was present in 6 patients i.e. 3 patients of medulloblastoma, 2 of ependymoma, one with astrocytoma. LCN palsy was observed in 2 patients and facial nerve palsy in 3 patients of present series.

In a study by Refaat et al, There were no intraoperative mortalities in 25 cases. 7 cases (28%) experienced 4 new postoperative neurological findings including: 2 cases had cerebellar mutism; one postoperative hypotonia, 2 cases had facial palsy, 2 cases had bulbar palsy and 1 case had both. One of the 2 cases with cerebellar mutism improved after 2 months, while the other remained till the end of the follow up period. None of our cases had postoperative truncal ataxia.[35]

Standefer et al reported 6% incidence of air embolism for patients operated in sitting position while in our series only two patients were operated in sitting position with no air embolism. For medulloblastoma, Cushing reported operative mortality of 33%, Park et al of 11.1% Choux of 11.3%, Bloom of 10%, Verma et al of 12.5%, while in our series there was no immediate post-operative mortality.[36-40]

CONCLUSION

- Medulloblastoma, cerebellar astrocytoma, ependymoma, haemangioblastoma and brainstem glioma are commonest among midline posterior fossa sol in pediatric age group.
- Medulloblastoma, cerebellar astrocytoma, ependymoma and brainstem glioma occur most commonly in pediatric patients. Metastasis and meningioma occur commonly in later age group. Tuberculoma, haemangioblastoma and epidermoid cyst are common in younger (11-40) age group.
- There was slight male preponderance in patients of midline posterior fossa sol.
- Intra-axial midline tumors present early with signs and symptoms of raised intracranial pressure and truncal ataxia while extra axial tumor present with other symptoms such as headache.
- CT scan and MRI finding in association with clinical features gives clues to probable pathological diagnosis.
- Most patients were i.e. 62.5% were having evidence of hydrocephalus. Pre-operative shunt should be carried out in patients with poor general condition poor consciousness level due to increased intracranial pressure with hydrocephalus. Despite having large incidence of hydrocephalus, shunt is required in nearly 1/3rd patients.
- Subtotal removal is done in patient with brainstem glioma and tumor invading brainstem or other important neuro-vascular structure.
- Cerebellar mutism is one of the common complication in midline posterior fossa sol and also due to approach in surgery. Post-operative CSF leak, wound infection, and size of bony defect is also more in patient with sub occipital craniectomy.
- Intraoperative monitoring with EMG, BERA etc. can help in decreasing incidence of cranial nerve and brainstem damage.

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