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*Original Research Article*

# The Clinical Profile and Radiological Variations of Medulloblastoma

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## ABSTRACT

**Introduction:** Medulloblastoma is a highly malignant neuroepithelial tumour of the posterior fossa that is predominantly seen in children but may also occur in adults. Medulloblastoma represents the most common pediatric posterior fossa tumour overall. The aim of the study was to study the different clinical presentation including different imaging features of medulloblastoma in different age groups and to find out a correlation of the imaging features with its clinical profile.
**Materials and Methods:** A total of 32 patients attending in the Department of Neurosurgery were included in this study. The study was performed on the spectrum of cross sectional imaging manifestations of this common tumour and a comprehensive summation of the history, pertinent clinical findings, pathologic characteristics, histogenesis and prognosis associated with this tumour.
**Results:** Among 32, children consisted of 30 (93.75%) and adult 2 (6.25%). Male and female ratio was 2.2:1. Headache and vomiting were predominant symptoms. Classical medulloblastoma mostly consisted of vermian lesion belonged to younger age group. The imaging findings were studied and tabulated.
**Conclusion:** There were some characteristic imaging features of medulloblastoma according to different site, age group and histologic variants.

***Keywords:*** medulloblastoma, neurosurgery, cross sectional studies.

## INTRODUCTION

Medulloblastoma is a highly malignant neuroepithelial tumour of the posterior fossa that is predominantly seen in children but may also occur in adults. [1,2] Although it accounts for 6%–8% of all central nervous system tumours and 12%–25% of such tumors in the pediatric age group, it constitutes only 0.4%–1% of all adult central nervous system tumours. [1,3] Medulloblastoma accounts for up to 38% of all pediatric posterior fossa tumours and represents the most common pediatric posterior fossa tumour overall. [4,5]

The term Medulloblastoma cerebelli was introduced by Bailey and Cushing in 1925 to refer a distinct, highly malignant, small cell tumour of the midline cerebellum. According to most accepted hypothesis medulloblastoma arise from remnants of undifferentiated neuroepithelial cells in the region of cerebellar vermis or inferior medullary vellum. [6,7] By far, the cerebellum is the most common location for medulloblastomas (94.4% of cases), and most (>75%) of these arise in the midline cerebellar vermis. [1,3]

CT is usually the first-line neuroimaging modality for patients with posterior fossa tumours because of its availability in an emergency setting. A typical feature of medulloblastoma seen with CT is a midline, homogeneous, contrast-enhancing cerebellar vermian mass(30- 55%). [8]

Here we are going to study the different clinical profile of Medulloblastoma and their respective radiological appearance which may help in planning optimal treatment strategies for this tumour.

## MATERIALS AND METHODS

The present study is a prospective study carried out in the Department of Neurosurgery, from January 2009 to December 2010. A total of 32 patients with mean age of 10 years, attending in the Department of Neurosurgery, were included in this study. Patients were selected by random sampling method. We studied the spectrum of cross sectional imaging manifestations of this common tumour and a comprehensive summation of the history, pertinent clinical findings, pathologic characteristics, histogenesis and prognosis associated with this tumour. The study was approved by Institute of Ethical committee of the Medical College and Hospital in which study was carried out. The written informed consents were also taken from the participants.

***Inclusion Criteria:*** Only biopsy confirmed medulloblastoma cases were included in the study.

***Exclusion Criteria:*** The cases which were not indicative of medulloblastoma, after comprehensive summation of the history, pertinent clinical findings and pathologic characteristics associated with this tumor, were excluded from the study.

***Mode of Evaluation:***

a**. History:** A detailed history was taken regarding demography of the patient, chief complaints and associated complaints. Thorough physical and neurological examination was done in all patients.

b. **Haematological Examination:** Complete haematological examinations were done in all patients.

c. **Imaging Studies:** All patients underwent CT Head and MRI Brain (plain and contrast) along with screening of whole spine. Post operative gadolinium enhanced MRI of brain and screening of spine was done within 48hrs of surgery (prior to onset of enhancing reactive gliosis, which may be interpreted as tumour)

According to imaging features we classified the site of the tumour as- Vermian, Paravermian, Lateral (cerebellar hemisphere).

d. **Cerebrospinal Fluid (CSF) test:** Lumbar puncture was done 2 weeks following surgery as lumbar puncture done shortly after surgery can have misleading results and pre-operative lumber puncture can lead to herniation.

***Treatment:***

a. **Medical Treatment:**

Indication: Pre-operative signs and symptoms of raised intra cranial pressure.

Drugs: (i) Dexamethasone: Adult:-10mg iv loading dose followed by 4-6mg iv 6hrly. Paediatrics:-0.5-1mg/kg iv loading dose followed by 0.25- 0.5mg/kg/day (Divided

6hrly). (ii) Osmotic Diuretics: Dose:-0.25-1gm/kg bolus (over<20mins) followed by 0.25gm/kg iv (over 20mins) every 6hrly.

**b. Surgical Treatment:**

1. CSF Diversion Procedure before Definitive Procedure:

*Indication:*

Patient presenting with signs and symptoms of raised intra cranial pressure with decreased consciousness level (not improved by pre-operative dexamethasone and Mannitol administration) and in moribund patients.

2. *Definitive Procedure:*

In the present study all patient underwent sub-occipital craniectomy and excision of the lesion. The extent of resection was determined intraoperatively (by surgeon's opinion) and by post –operative MRI brain.

Depending upon the extent of excision we classified the excision in four categories-

- *Gross Total:*-When no residual tumour tissue left(on the basis of intraoperative surgeon's opinion and on post op Gadolinium enhanced MRI)
- *Near Total:*-When more than 90% of tumour tissue resected
- *Subtotal:*-When less than 90% of tumour tissue resected
- *Biopsy Only:*-When less than 10% of tumour mass resected.

**c. Radiotherapy:**

Post-operatively all patients underwent fractionated external beam radiotherapy.

Protocol followed was-36Gy to craniospinal axis and 54-59.6 Gy to posterior fossa as1.50-1.80 Gy/fraction for 5 fractions per week.

**d. Chemotherapy:**

Chemotherapy was given only to high risk patients. Eight courses of adjuvant chemotherapy consisting of CCNU (lomustine), vincristine and cisplatin were given to those patients.

## RESULTS

As the sample size was small in number no comparable results were drawn statistically in this study.

**Table no.1:** showing age distribution of cases of medulloblastoma (SD is standard deviation and SEM is standard error of Mean).

| Age group (years) | No. Of patients | Percentage (%) |
|---|---|---|
| **0-<5** | 13 | 40.6 |
| **5-<10** | 13 | 40.6 |
| **10-<15** | 4 | 12.5 |
| **15-20** | 2 | 6.3 |
| **Total** | 32 | 100 |
| **Mean** | 8 | 25 |
| **SD** | ±5.831 | ±18.190 |
| **SEM** | ±2.915 | ±9.095 |

**Table no.2:** showing signs & symptoms presented by medulloblastoma cases according to different age groups.

| Symptoms And Signs | Age Groups (Years) | | | |
|---|---|---|---|---|
| | **0-<5** | **5--<10** | **10-<15** | **15-20** |
| Headache | 13 | 13 | 4 | 2 |
| Vomiting | 9 | 11 | 4 | 0 |
| Lethargy | 7 | 2 | 1 | 0 |
| Anorexia/Weighht Loss | 8 | 2 | 1 | 0 |
| Behavioural Change | 6 | 2 | 0 | 0 |
| Impaired Consciousness | 4 | 2 | 0 | 0 |
| Truncal Ataxia | 13 | 9 | 1 | 0 |
| Appendiculer Ataxia | 0 | 1 | 3 | 2 |
| Head Tilt | 6 | 4 | 0 | 0 |
| Nystagmus | 1 | 2 | 2 | 1 |
| Reduced Vision | 1 | 1 | 3 | 0 |
| Diplopia | 0 | 1 | 1 | 0 |
| Papilloedema | 4 | 5 | 2 | 0 |
| Enlargement Of Head | 0 | 0 | 0 | 0 |
| Seizure | 0 | 0 | 0 | 0 |
| Vertigo | 1 | 7 | 2 | 0 |
| Imbalance | 13 | 9 | 1 | 0 |
| Limb Weakness | 2 | 0 | 0 | 0 |
| Back Pain/Radicular Symptoms | 2 | 0 | 0 | 0 |
| Limb Spasticity | 2 | 0 | 0 | 0 |
| Cranial Nerve Palsy | 2 | 1 | 1 | 0 |

**Table no.3:** showing duration of symptoms presented by medulloblastoma cases according to different age groups.

| Age Group (Years) ( At Diagnosis) | Mean Duration Of Symptoms (Months) |
|---|---|
| 0 - <5 | 2.5 |
| 5 - <10 | 2.8 |
| 10 - <15 | 3.2 |
| 15 - 20 | 4 |

In the present study, most of the patients belonged to children group (< 15 years), consisting of 30 (93.75%). Adults account for only 2 (6.25%) cases.

There were 22 (68.75%) male and 10 (31.25%) female. Male to female ratio was 2.2:1.

**Table no.4:** showing Glassgo Coma Scale of medulloblastoma patients at the time of admission according to different age groups.

| Age Group (Years) | GCS Score | | | |
|---|---|---|---|---|
| | 15 | 12 - 14 | 10 - 12 | <10 |
| 0 - < 5 | 9 | 2 | 2 | 0 |
| 5 - <10 | 11 | 2 | 0 | 0 |
| 10 - <15 | 4 | 0 | 0 | 0 |
| 15 - 20 | 2 | 0 | 0 | 0 |

**Histological Subtypes:** In the present case series, most patients had classical medulloblastoma (CLA) that is 25 cases (78.12%). Desmoplastic/nodular (DES/NOD) constitute only 7 cases (21.88%). No cases with medulloblastoma with extensive nodularity (MBEN) and large cell/anaplastic (LC /ANA) was detected. The classical type was mostly belonged to younger age groups and desmoplastic type to older children and adult groups. In the adult group all cases had desmoplastic medulloblastoma.

## Imaging Studies:

## CT Head:

**Table no.5:** showing density of lesion in plain CT scan of head of medulloblastoma cases.

| Density (Plain CT) | No. of Cases | Percentage (%) |
|---|---|---|
| Hyper Dense | 22 | 69 |
| Isodense | 2 | 6 |
| Hypodense | 1 | 3 |
| Mixed | 7 | 22 |
| Total | 32 | 100 |
| Mean | 8 | 33.8 |
| SD | ±9.695 | ±32.935 |
| SEM | ±4.848 | ±14.729 |

Hyper density lesion in plain CT (figure no.2) was mostly found in younger age group. 13 cases (100%) in the age group of 0 - <5 years and 9 cases (69.23%) in the age group of 5 - <10 years had hyper dense lesion. Mixed density lesions (figure no.1) were found in the older children and adult group. One case (50%) in the adult group, 3 cases (75%) in the 10 - <15 years age group and another 3 cases (23.07%) in the 5 - <10 years age group had mixed density lesion. One iso-dense lesion (50%) was found in the adult group and another one (7.69%) was found in the 5 - <10 years age group. One hypo dense lesion was noted in the 10 - <15 years age group.

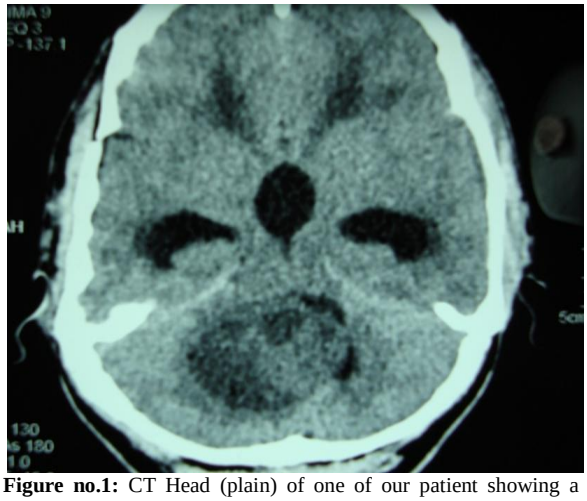

**Figure no.1:** CT Head (plain) of one of our patient showing a mixed density vermian lesion with gross hydrocephalous.

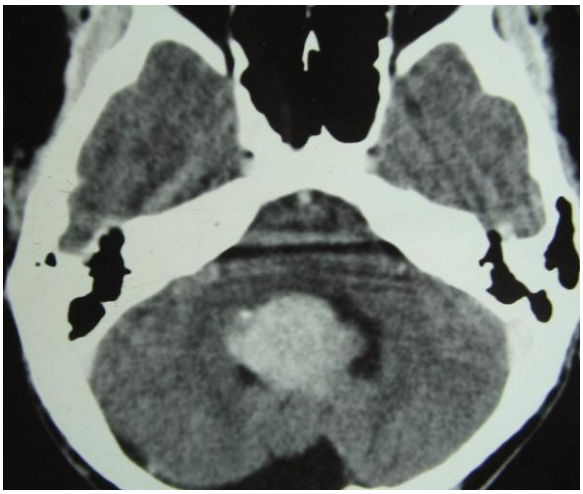

**Figure no.2:** CT head (plain) of one of our patient showing a hyperdense vermian lesion.

**Table no.6:** showing location of lesions of medulloblastoma patients according to different age groups.

| Location of Lesion | Age Group (Years) | | | |
|---|---|---|---|---|
| | 0 - < 5 | 5 - <10 | 10 - <15 | 15 – 20 |
| Vermian | 13 | 9 | 1 | 0 |
| Paravermian | 0 | 4 | 2 | 0 |
| Lateral | 0 | 0 | 1 | 2 |

**CT Scan of HEAD (CONTRAST):** All patients showed enhancement. Homogenous enhancements were found in 21 (64%) cases. Heterogenous enhancements were found in 11 (34%) cases. Homogenous enhancements were mostly seen in the younger children. In the age group of 0 - <5 years all(100%,n=13) patients enhanced homogenously. In the age group of 5 - <10 years only 7 (53.84%) and in the age group of 10 - <15 years only one (25%) patient showed homogenous enhancements. On the other hand heterogenous enhancements were seen in the adult group and in the older children. All adult patients enhanced heterogeneously. Three patients (75%) in the age group of 10 - <15 years age group and six patients (46.15%) in the age group of 5 - <10 years were enhanced heterogenously.

**Table no.7:** showing enhancement pattern in CT scan of head of medulloblastoma cases according to location of lesion.

| Enhancement Pattern in CT scan of head (contrast) | Location of the Lesion | | |
|---|---|---|---|
| | Vermian | Paravermian | Lateral |
| Homogenous | 20 | 1 | 0 |
| Heterogenous | 3 | 5 | 3 |
| No Enhancements | 0 | 0 | 0 |

**Oedema:** Oedema was present in 30 cases (93.75%). Marked oedema was found in 5 cases (15.63%), moderate in 15 cases (46.88%) and slight in 10 cases (31.25%). In the adult group one patient (50%) had no oedema and another one (50%) had only slight oedema. In the 0 - <5 years group and 5 - <10 years group, each group had two patients (15.38%) with marked oedema. Out of the total 6 patients with impaired consciousness on clinical examination 5 had marked Oedema and one had moderate Oedema on CT scan and they were mostly seen in the younger age group.

**Margin:** Margin was well defined in 24 (75%) cases and poorly defined in 8 (25%) cases. Margins were well defined in the younger age group and were poorly defined in adult age group and the older children. Twelve (92.30%) patients in the age group of 0 - <5 years and 11 (84.61%) patients in the age group of 5 - <10 years had well defined margin. All patients in the adult group and 3 patients (75%) in the 10 - <15 years age group had poorly defined margin. 22 patients (95.65%) of vermian lesions had well defined margin. All lateral lesions and 4 (66.66%) paravermian lesions had poorly defined margin.

**Hydrocephalous, Haemorrhage, Cyst/ necrosis, Calcification**

Hydrocephalous was present in 26 (81.25%) cases and haemorrhage was present in two cases (6.25%). While cyst/necrosis was present in 3 cases (9.38%) and calcification was present in 3 cases (9.38%).

**Table no.8:** showing different CT head findings according to age groups of medulloblastoma cases.

| CT Head | | Age Group (Years) | | | |
|---|---|---|---|---|---|
| | | 0-<5 | 5-<10 | 10-<15 | 15-20 |
| **Hydrocephalous** | Present | 12 | 12 | 2 | 0 |
| | Absent | 1 | 1 | 2 | 2 |
| **Haemorrhage** | Present | 0 | 0 | 1 | 1 |
| | Absent | 13 | 13 | 3 | 1 |
| **Cyst** | Present | 0 | 0 | 1 | 2 |
| | Absent | 13 | 13 | 3 | 0 |
| **Calcification** | Present | 0 | 0 | 1 | 2 |
| | Absent | 13 | 13 | 3 | 0 |

**MRI:**

**Location of the lesion:** In MRI, the location was exactly the same as CT scan findings. 23 cases (73%) were vermian, 6 cases (18%) were paravermian and three cases (9%) were lateral. The relation of the lesion location with age was same as CT scan findings, with most of the vermian lesions were found in

the younger age group and lateral lesions were found in the adult group and in the older children group (10 - <15 years). Out of 6 paravermian lesions 4 were found in the 5 - <10 years age group and 2 were in the 10 - <15 years age group.

**SIGNAL INTENSITY:** On T1 weighted images hypo signal intensity (figure no. 3) was seen 28 patients (87.5%). Iso intense signal intensity was seen in 4 (12.5%) cases. No patient with hyper signal intensity was seen. While, on T2 weighted images hyper signal intensity (figure no.4) was found in 25 (78.12%) cases and iso signal intensity was found in 7 (21.88%) cases. No patient with hypo signal intensity was found on T2 weighted images.

**Table no.9:** showing signal intensity of MRI of medulloblastoma cases according to different age groups.

| Signal Intensity | | Age Group (Years) | | | |
|---|---|---|---|---|---|
| | | 0 - < 5 | 5 - <10 | 10 - <15 | 15 - 20 |
| T1 | HYPO | 12 | 11 | 3 | 2 |
| | ISO | 1 | 2 | 1 | 0 |
| | HYPER | 0 | 0 | 0 | 0 |
| T2 | HYPO | 0 | 0 | 0 | 0 |
| | ISO | 0 | 2 | 3 | 2 |
| | HYPER | 13 | 11 | 1 | 0 |

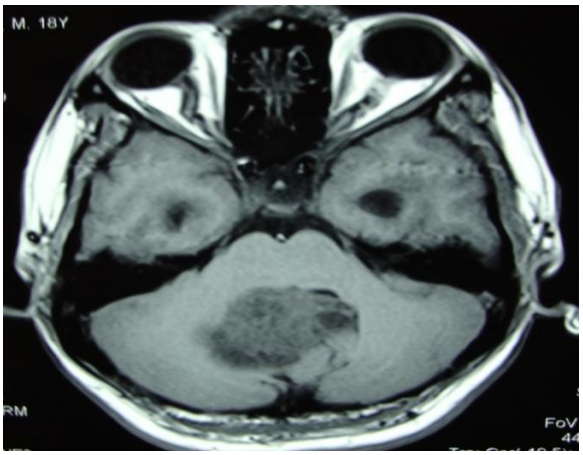


**Figure no.3:** T1 weighted image of one of our patient showing a vermian lesion with hyposignal intensity.

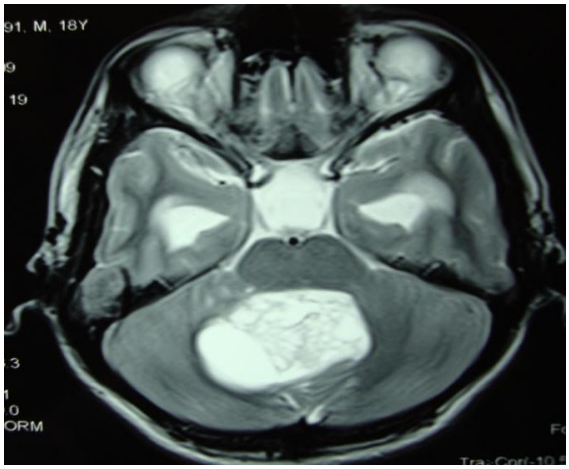


**Figure no.4:** T2 weighted image of one of our patient showing a vermian lesion with hypersignal intensity.

**Enhancement:** After contrast administration homogenous enhancements were seen in 12 (37.5%) patients and heterogenous enhancements were seen in 20 (62.5%) patients. In the present series, in MRI, heterogeneous enhancements were found more than CT scan. Homogenous enhancements were mostly found in the younger age group – 10 (76.92%) out of 13 in the age group of 0 - <5 years, 2 (15.38%) out of 13 in the age group of 5 - <10 years. Heterogenous enhancements were mostly found in the adult group and older children – all (n=2,100%) patients in the adult group, all (n=4,100%) patients in the 10 - <15 years age group, 11 (84.61%) out of 13 patients of 5 - <10 years age group.

**Oedema:** The findings of the oedema were same as the CT scan findings. Oedema was present in 30 cases (93.75%). Marked oedema was found in 5 cases (15.63%), moderate in 15 cases (46.88%) and slight in 10 cases (31.25%).

**Margin:** The findings of the margin were same as the CT scan findings. Margin was well defined in 24 (75%) cases and poorly defined in 8 (25%) cases.

**Hydrocephalous, Haemorrhage, Cyst/ necrosis, Calcification**

The findings of the hydrocephalous were same as the CT scan findings. Hydrocephalous was present in 26 (81.25%) cases. Also, the findings of the haemorrhage were same as the CT scan findings and haemorrhage was present in two cases (6.25%). Whereas, cysts and necrosis were more evident in MRI than CT scan and was present in 7 cases (21.87%).

**Table no.10:** showing different MRI findings according to age groups of medulloblastoma cases.

| CT Head | | Age Group (Years) | | | |
|---|---|---|---|---|---|
| | | **0 - < 5** | **5 - <10** | **10 - <15** | **15 - 20** |
| **Hydrocephalous** | Present | 12 | 12 | 2 | 0 |
| | Absent | 1 | 1 | 2 | 2 |
| **Haemorrhage** | Present | 0 | 0 | 1 | 1 |
| | Absent | 13 | 13 | 3 | 1 |
| **Cyst** | Present | 0 | 2 | 3 | 2 |
| | Absent | 13 | 11 | 1 | 0 |

**Metastasis:** At the time of admission spinal metastasis was detected in two cases (6.25%). No patient with cerebral metastasis was detected in our study.

**Extension:**Extension to 4th ventricle was found in 26 (81.25%) cases and to brain stem was found in 2 (6.25%) cases. No patient with extension of the lesion to brain stem, Luschka's foramina, Magendie's foramina, C-P angle and to other sites was detected.

**Post-op MRI Brain and Spine (within 48 hrs):** Post-operative MRI brain showed residual tumour volume more than 1.5 cm2 in 4 (12.5%) patients. All were belong to 0 - <5 years age group.

**Cerebrospinal Fluid (CSF) Study:** CSF collected by lumbar puncture 2 weeks following surgery had not detected any malignant cells in any patients in our series.

**Treatment:** All patients underwent surgical resection followed by radiotherapy. Adjuvant chemotherapy was given to high risk patients only (four in our series). EVD was given to two patients only (6.25%) which were admitted with altered consciousness level (GCS<12). These two patients were belong to the 0 – 5 years age group.No V-P shunt was given to any one of our patients.

**Excision:** Gross total excision was done in 28 (87.5%) patients. Near total excision was done in 4 (12.5%) patients. Out of four near total excision patients two had extension to the brainstem. All these four patients were belongs to the 0 - <5 years age group.

**Post-Operative Complications:** One patient (3.33%) was expired within 48 hours of surgery. The pre-operative status of the patient was also very poor. Cerebellar ataxia and nystagmus were found in 10 cases (31.25% each). Cranial nerve palsy (facial and abducens) were found in 2 (6.25%) of cases. Cerebellar mutism was found in 4 (12.5%) 0f cases.

**Staging:** All patients were staged according to current staging system [9] into average and high risk category. All four high risk patients were belong to 0 - <5 years age group. After excision they underwent radiotherapy and chemotherapy.

**Follow Up:** Follow up was done from one month to one year. Recurrence was found in 4 patients (12.5%). All four patients belonged to the 0 – 5 years age group.

## DISCUSSION

Rengachary SS et al, 2003 [10] like the present study also reported that majority of medulloblastoma occurred in children and 50% occurred in the first decade of life. Chang AW et al, 2000 [11] reported that 15% of their patients belonged to <1 year and

30% belonged to children and adults aged >10 years.

Agerlin N et al, 1999 [12] and Alston RD et al, 2003 [13] also reported the male predominance with male and female ratio 2:1 and 1.7:1 respectively.

Sarkar C et al, 2003 [14] had reported that the mean duration of symptoms between the children and adult group were 5 and 7 months respectively. Park TS et al, 1983; [15] Al-Mefty O et al, 1985 [16] have reported that brief clinical history reflect the aggressive biologic behaviour of the tumour. In the present case series, four patients which were staged as high risk patients were in the age group of 0 – 5 years and presented with very brief clinical history.

Alston RD et al, 2003 [13] have made a study regarding clinical presentation of meulloblastoma according to age. They have reported that the older the child is, the more likely is the presentation to show pressure features of headache, vomiting, and ophthalmic signs. Younger children present with non-specific features such as lethargy, behavioural disturbance, or increasing head size. Ataxia is seen in about 75% of children across the age range.

Mc Manamy CS et al, 2007 [17] had reported only 2 – 4% in large cell, 10 – 22% in combined ANA/LC, 3 – 7% desmoplastic/nodular and MBEN and remaining constitute the classical histology. According to different literatures the age distribution of desmoplastic variety is still disputed. Rubeinstein LJ et al, 1964, [18] Provias JP et al, 1996 [19] had found it in older children and adult. Sarkar C et al, 2002 [14] had reported that childhood tumours were more commonly of classical histology and midline location while desmoplastic variant and lateral location occurred more frequently in adults. However, Mc Manamy CS et al, 2007, [17] Rutkowshi S et al, 2005 [20] had reported that desmoplastic variant occurred at an earlier age than classic and about half occurring in infancy.

Bourgouin PM et al, [21] 1992, Hubbard JL et al, 1989, [22] have reported that vermian medulloblastoma are mostly prevalent in the children group which appear as a hyper-dense mass on plain CT, and with intense homogenous enhancements with contrast; in adult population, lateral lesion is more common which appears as mixed density lesion on plain CT, and with heterogenous enhancements with contrast. According to Bourgouin PM et al, [21] medulloblastoma has a variable MRI appearance in both children and adults; in children on T1 weighted images they appear as hypo to iso signal intensity and on T2 weighted images they are mostly iso to hyper signal intensity; in adults, on T1 weighted images, they are hypo to iso and on T2 hypo to iso (predominantly iso) signal intensity with heterogenous enhancements; heterogeneity is more common in the adult group and it is more prominent in MRI than CT. According to them iso signal intensity on T2 weighted images and more heterogeneity in adult might be related to desmoplastic histology.

Sandhu A et al, 1987 [23] had reported oedema in 90% cases and marked oedema in 1% cases; they had not reported any specific age/site distribution in their series.

Bourgouin PM et al, 1992 [21] had reported that the vermian lesions which were predominant in younger age group had well defined margins and in lateral lesions which were predominant in adults had poorly defined margins.

Sandhu A et al, 1987 [23] reported haemorrhage in 1% cases only in adults. Sandhu A et al, 1987; [23] Tortori DP et al, 1996 [24] had reported the presence of cyst in medulloblastoma with prevalence ranging from 47% - 87%. Bourgouin PM et al, 1992 [21] had reported that cysts were more

common in adult (82%) than children and these were more obvious in MRI than CT scan.

Segall HD et al, 1982; [25] Kingsley DPE et al, 1979 [26] had labelled calcification as a common atypical features and was present in 10 – 15.4% in their series mostly prevalent in the adult group.

Meyers SP et al, [27] had reported dissemination in 33% of cases. All these patients had spinal dissemination and only in 67.56% of these patients had intracranial metastasis as well.

According to Kumar V et al, 1996 [28] only 25% - 30% children with hydrocephalous might require permanent V-P shunt after tumour resection. According to Albright et al, 1989 [29] the most common complications after surgical resections were cerebellar ataxia and nystagmus found in 26% of cases in their series; less common complications are facial nerve palsy, abducen nerve palsy and lower cranial nerve dysfunction.

## CONCLUSION

After carrying out the study with 32 medulloblastoma cases, it can be concluded that, medulloblastoma is more common in children than adult. There are some characteristic imaging features of medulloblastoma according to different site, age group and histologic variants and different age groups might have different clinical presentation.

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