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MRI Evaluation of Posterior Fossa Tumours in Paediatric Population- A Study at Tertiary Care Centre

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Abstract: Brain tumour in paediatric population is one of the important causes of mortality and morbidity. They may be grouped into supratentorial and infratentorial tumours. MRI with its multiplanar capability and different pulse sequences has very important role in detection, localisation & characterisation of brain tumours and for planning of treatment. The aim of study was to find out the demographic profile of paediatric patients with posterior fossa tumours, to assess the distribution, localization and extent of tumours by MRI and to correlate with histopathological examination. In the present study, 72 paediatric patients with symptoms/signs of brain tumour, who were sent for MRI evaluation, were taken for study. Those with lesions in supratentorial brain (40 in no.) were excluded from study leaving 32 patients with posterior fossa lesions. Their post operative histology diagnosis was compared with MRI study. It was found that, out of 32 cases, one was found to be pyogenic abscess and one was tuberculoma. Among total of 30 patients with histology diagnosis of having tumour, 24(80%) were males and 6 (20%) were females. Most common age group was first decade (53.3 %). Intraaxial tumors (80%) were commoner with astrocytoma (9 in no.) and medulloblastoma (9 in no.) as the commonest lesions followed by ependymoma (4 in no.), PNET (1 in no.) and choroid plexus tumor (1 in no.). Other tumors were epidermoid (1 in no.), arachnoid cyst (2 in no.). Tumors extending from adjacent areas were craniopharyngioma (1 in no.) & pinealoblastoma (1 in no.) which constituted 6.7% of tumors. Tuberculoma and pyogenic abscess mimicked tumours at imaging in 2 (6.7%) patients. MRI correctly diagnosed lesions in 29 out of 32 patients and wrongly diagnosed in 3, all those 3 lesions were intraaxial in location. MRI is very important imaging modality in accurately evaluating the morphologic distribution of various tumors in the posterior fossa. MRI is accurate for tissue characterization in 90.6% of posterior fossa tumors and 100% of extraaxial tumors in paediatric population.

Keywords: Posterior Fossa Tumours, Magnetic Resonance Imaging, Glioma, medulloblastoma.

INTRODUCTION

A brain tumor is one of the most devastating forms of human illness, especially when occurring in the posterior fossa. Brainstem compression, herniation and death are all risks in tumors which occur in this critical location because of the limited space within the posterior fossa [1]. Brain tumor is the second most common form of malignancy in children [2, 3]**.** Posterior fossa tumors are more common in children than the adults as mentioned by various researchers. Between 54% and 70% of all childhood brain tumors originate in the posterior fossa [4-6]. Certain types of posterior fossa tumors, such as, primitive neuroectodermal tumors (medulloblastoma, pineoblastoma), ependymomas and astrocytomas of the cerebellum and brain stem, occur more frequently in children [7]. Tumors can arise in the posterior fossa (brain tissue, the cranial nerves, the meninges or the skull) itself or can be invaded by neoplasms from the adjacent head and neck regions or distal tumors. Posterior fossa skull base neoplasms may be grouped into basic categories like cerebello-pontine angle lesions, petrous apex lesions and intraaxial lesions [8]. Non-neoplastic conditions that can mimic tumors in imaging: are infections (abscess, tuberculoma, encephalitis), vascular lesions (vascular malformations, aneurysms, infarction, hematoma), demyelinating disease, sarcoidosis [9].Since majority of these tumors present with nonspecific complaints such as headache, stroke like syndromes, or seizures, often a diagnosis is made or suggested initially by the findings on imaging studies [10]**.** The prognosis of these patients has

improved considerably due to recent advances in diagnostic techniques, microsurgery and radiotherapy. CT and MRI play a vital role in the diagnosis of brain lesions and should be employed as primary imaging modalities [11].

The aim of our study was to study the demographic profile, to assess the distribution, features, localization and extent of posterior fossa tumors by MRI and compare the tissue characterization by MRI with pathological examination.

METHODS

It was a retrospective analytical study conducted in the Department of Radio-diagnosis, Neuro-Surgery and Pathology, S.C.B. Medical College and KIMS, Patia, Bhubaneswar, from January 2014 to December 2016. A total of 72 pediatric patients with symptoms/signs of brain tumor, those sent for MRI evaluation were considered for study initially, out of which 40 cases of supratentorial lesions were excluded, so that only 32 of patients with infratentorial lesions were included in study. History was taken and the patients were clinically examined. Those patients diagnosed as having infratentorial tumors were followed up till surgery for confirmatory Histo-pathological/Cytological diagnosis. Their post operative histology diagnosis was compared with MRI study.

All the MRI scans in this study were performed using GE Signa HDX MR Machine with 1.5 tesla field strength. Precontrast images were taken followed by postcontrast images with intravenous administration of 0.1 mmol/kg of body weight of gadolinium. The MRI imaging protocol used are as below (Table 1).

Table-1: A combination of following MRI protocol was applied

Sequence	TR	TE	FOV (in cm)	Slice thickness (in mm)	Inter slice gap (in mm)	Imaging Matrix	No. Of excitation (NEX)
T2	5400	122.2	24 X 24	5	2.5	352 x 352	2
FLAIR	8002	87.7	24 x 24	5	2.5	256 x 224	2
T1	1806	17.2	24 x 18	5	2.5	320 x 192	2
DWI	4650	78.8	24 x 24	5	2.5	96 x 128	2
GRE	720	20	24 x 24	5	2.5	256 x 192	1
T1 SAG	480	11	24 x 24	5	2.5	320 x 160	1
T2 COR	5200	92	24 x 18	5	2.5	320 x 224	2
T1 AX CON	560	20	24 x 18	5	2.5	320 x 192	1
T1 SG CON	1906	9.7	24 x 24	5	1	320 x 192	2
T1 CR CON	580	20	24 x 18	5	2.5	320 x 192	1

Statistical Analysis

The obtained data were analyzed by using a software statistical package for the social science (SPSS version 20). Frequency and descriptive analyses were used to describe the data. Also paired samples t-test was used to differentiate between two numerical data sets. Any difference or correlation was considered significant if p value less than 0.05.

RESULTS

In the present study there were 32 cases with infratentorial location, out of 72 pediatric patients initially taken for MRI study, hence comprising of 44.4% of total brain lesions.

Then, out of the 32 patients, one case was found to be pyogenic abscess and one was tuberculoma by histopathological examination.

Among total of 30 patients with histology diagnosis of havung tumor, 24 (80%) were males and 6 (20%) were females. Common age group was the first decade (16 out of 30, 53.3 %) - (Table 2).

All of the tumors of posterior fossa showed male predominance except one case of epidermoid which was found in a female child (Table 3).

Table 2: Age and gender distribution of patients

Age group (in years)	Male		Female		Total	
	Number of cases	Percentage	Number of cases	Percentage	Number of cases	Percentage
0-5	6	20	2	6.7	8	26.7
6-10	6	20	2	6.7	8	26.7
11-15	11	36.7	2	6.7	13	43.3
15-18	1	3.3	0	0	1	3.3
Total	24	80	6	20	30	100

Table-3: Age and gender distribution of individual tumors

	Type of tumors with no of cases	% (n=30)	Sex		Age group(in years)			
			M	F	1-5	6-10	11-15	16-18
1	Astrocytoma (9)	30	8	1	-	3	6	-
2	Medulloblastoma (9)	30	7	2	3	3	3	-
3	Ependymoma (4)	13.2	3	1	2	1	1	-
4	Arachnoid cyst (2)	6.7	2		-	-	1	1
5	Epidermoid (1)	3.3	-	1	-	1	-	-
6	Schwannoma (1)	3.3	1		-	-	1	-
7	Craniopharyngioma (1)	3.3	-	1	-	-	1	-
8	CPP (1)	3.3	1	-	1	-	-	-
9	PNET(1)	3.3	1	-	1	-	-	-
10	Pinealoblastoma (1)	3.3	1	-	1	-	-	-

CPP- Choroid plexus papillaoma, PNET- Primitive neuroendocrine tumour

Among the posterior fossa tumors, intraaaxial lesions (80%) were more common (Table 4).

Most common pediatric posterior fossa lesions were astrocytoma and medulloblastoma (Table 5).

Table-4: Compartmental distribution of pediatric posterior fossa tumors

Extraaxial	Number of case	Intraaxial	Number of case	Extension from adjacent areas	Number of case
Schwannoma	1	Medulloblastoma	9	Craniopharyngioma	1
Epidermoid	1	Astrocytoma	9	Pinealoblastoma	1
Arachnoid cyst	2	Ependymoma	4	-	-
-	-	PNET	1	-	-
-	-	CPP	1	-	-
Total	4		24	-	2

Table-5: Distribution of intraaxial lesions in pediatric age group

Intraaxial lesions	Number of case	Percentage of pediatric intraaxial lesions (n=24)	Percentage of pediatric posterior fossa neoplasms(n=30)
Astrocytoma	9	37.5	30
Medulloblastoma	9	37.5	30
Ependymoma	4	16.67	13.3
PNET	1	4.16	3.3
CPP	1	4.16	3.3

MRI correctly diagnosed lesions in 29 out of 32 (90.6%) patients and wrongly diagnosed in 3 cases, all those 3 lesions were intraaxial. Hence MRI was accurate in diagnosing 100% of extraaxial tumors and over all 90.6% of pediatric posterior fossa tumors. Among intraaxial tumors MRI accurately characterized the tissue nature in (21 out of 24) 87.5%of cases (Table 6).

Table-6: Pathology and MRI comparision

	Tumour	Pathology diagnosis	MRI diagnosis
1.	Astrocytoma	9	12
2.	Medulloblastoma	9	9
3.	Ependymoma	4	4
4.	Arachnoid cyst	2	2
5.	Epidermoid	1	1
6.	PNET	1	0
7.	Schwannoma	1	1
8.	Craniopharyngioma	1	1
9.	CPP	1	1
10.	Pinealoblastoma	1	1
11.	Abscess	1	0
12.	Tuberculoma	1	0

MRI wrongly diagnosed 3 lesions as glioma which was found to be tuberculoma, abscess & PNET, one each, by pathology examination (Table 7).

Table-7: Cases misdiagnosed by MRI

Sl.no	Age in years/sex	Pathology diagnosis	MRI diagnosis
1.	4/Male	PNET	Glioma
2.	2/Male	Abscess	Glioma
3.	16/Male	Tuberculoma	Glioma

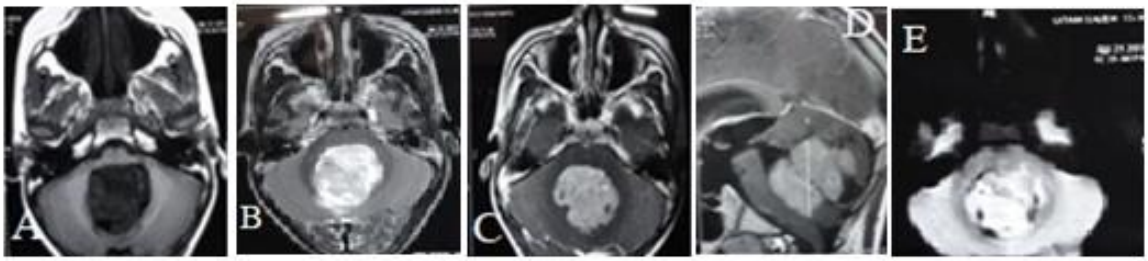

Fig-1: Axial (A-C&E) and sagittal (D) MRI images in a 13 yr male child showing a T1W (image A) hypo, T2W (image B) hyper intense, and post contrast (image C) strongly enhancing vermian mass with restricted diffusion (image E), biopsy diagnosis was medulloblastoma

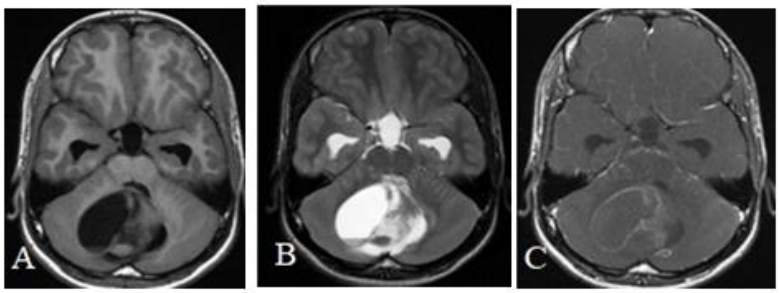

Fig-2: Axial T1W (image A) ,T2W (image B) and postcontrast image (C) of a 8 yr male child showing a cystic right cerebellar tumor with thin peripheral and a nodular enhancement. Pilocytic astrocytoma was diagnosed by pathological study

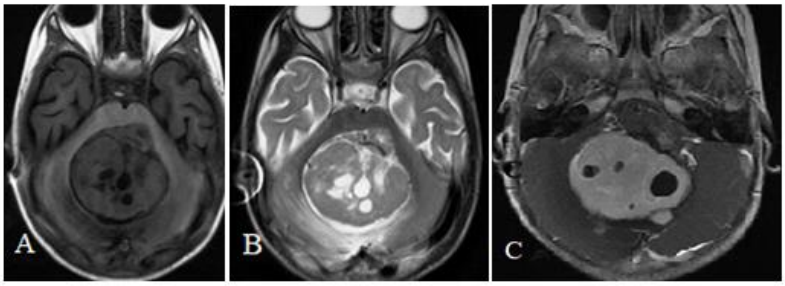

Fig-3: Axial T1W (image A) ,T2W (image B) and postcontrast image (C) of a 7 yr female child showing an intraventricular posterior fossa tumor with small cystic areas and good enhancement. It was found to be ependymoma after pathological study

DISCUSSION

In the present study, there were 32 cases with infratentorial location out of 72 pediatric cases having brain lesions, hence comprising about 44%. But according to study conducted by Rehman A.U *et al*. about 54 to 70% of childhood brain tumors were located in the posterior fossa [12]. However, according to Pollack IF, infratentorial tumors accounted for 45–60% of brain tumors [13].

Male to female ratio was 4:1 in our study. According to Stiller CA et al, male-to-female ratio was 1.2:1 [14]. Rehman A.U. *et al*. mentions about male predominance of posterior fossa tumors [12]. But, in a study by Rath et al male to female ratio was 0.9:1 implying a slight female predominance [15]. Common age group was the first decade in our study which is similar to study by Rath *et al*. [15].

In our study, common pediatric posterior fossa lesions were medulloblastoma (Fig 1) and astrocytoma (Fig 2). Similar to this, Maher CO et al state that the three most common pediatric brain tumors of the cerebellum in decreasing order of frequency are medulloblastoma, astrocytoma and ependymoma (Fig 3) [16]. Similarly, Stiller CA et al state that among pediatric brain tumors, tumors of astrocytic origin comprise 40% to 55% of the total, primitive neuroectodermal tumors (including medulloblastoma) 20% to 30%, and ependymomas 10% to 15% [14].

According to our study, among the posterior fossa tumors, intraaaxial lesions (80%) were more common. Similarly Smirniotopoulos JG mention that, in adults extraaxial lesios are more common, whereas in children intraaxial lesions are more common [17].

MRI was accurate in diagnosing 100% of extraaxial tumors and over all 90.6% of pediatric posterior fossa tumors. Among intraaxial tumors MRI accurately characterized the tissue nature in 87.5% of cases. Similarly, accuracy of MRI was 87% in a study conducted by Taghipour Zahir SH *et al*. [18].

Treatment of posterior fossa tumors

The main stay of treatment whenever possible is complete surgical excision. Adjuvant therapy includes chemotherapy and radiotherapy. The drug temozolomide is used for recurrent glioma, anaplastic oligodendroglioma and is undergoing clinical testing as neoadjuvant chemotherapy or with concomitant radiotherapy in patients with newly diagnosed glioma [19].

CONCLUSSION

MRI is very important imaging modality in accurately evaluating the morphologic distribution of various tumors in the posterior fossa.

MRI is accurate for tissue characterization in 90.6% of posterior fossa tumors and 100% of posterior fossa extraaxial tumors in pediatric population.

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