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Original Article

Comparison between MRI Findings and Histopathological Diagnosis in the Evaluation of Posterior Fossa Tumors in Pediatric Patients

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Abstract:

Background: *Conventional radiography and CT scan failed to reveal the posterior fossa tumors which not accurately show tumors behind bone. MRI is currently recognized as the optimal screening technique for detection of posterior fossa tumors. We tried to compare the MRI findings with the histopathological findings of different types of posterior fossa tumors in pediatric patients. Histopathological reports were regarded as the gold standard.*

Objective: *To assess the diagnostic effectiveness of MRI in detection of posterior cranial fossa tumors in pediatric patients.*

Methods: *This cross sectional study was carried out in the department of Neurosurgery, DMCH, NINS and some private hospitals in Dhaka from March, 2012 to November, 2013. Purposive sampling technique was applied and 34 cases were included in the study. Data were collected by specially designed questionnaire and analysed by SPSS.*

Results: *Out of 34 cases, MRI failed to match with the histopathological diagnosis only in 2 cases. One case was diagnosed as cerebellar astrocytoma by MRI, histopathology proved it brain abscess. In another case, MRI diagnosed as ependymoma but histopathology revealed medulloblastoma.*

Conclusion: *It can be concluded That MRI is accepted as the most effective imaging modality in the diagnosis of paediatric posterior fossa tumors. T1WI, T2WI, FLAIR, axial, sagittal, coronal and T1WI post contrast sequences permit confident diagnosis and localization of the pediatric posterior fossa tumor.*

Key words: *Magnetic Resonance Imaging (MRI), Pediatric, Posterior fossa tumor.*

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Introduction:

During the early period, attempts of posterior fossa tumor surgery failed so frequently that surgeons became reluctant to do the operation in this area.[1,2] One of the causes behind that was CT failed to reveal the tumors behind bone. MRI ignores bones, provides a clear picture of tumors near and behind bones, produces a wide variety of image angles and soft tissue contrast is much better[3]. Till now histopathological reports are considered as gold standard regarding tumor diagnosis[4]. So we tried to compare the MRI findings with the histopathological findings of different types of posterior fossa tumors in pediatric patients. Our primary aim was to assess the diagnostic effectiveness of MRI in detection of posterior cranial fossa tumors in pediatric patients.

Materials and Methods:

This cross sectional study was carried out in the Department of Neurosurgery, Dhaka Medical College

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Hospital, National Institute of Neuro Sciences and Hospital (NINS) and some private hospitals in Dhaka from March, 2012 to November, 2013. Clinically suspected and MRI diagnosed cases of posterior fossa tumors in pediatric age group (18 years or less)[6] were included in the study. 34 cases were selected by Purposive sampling technique.

Results:

Table-I

Age distribution of patients

Age (Year)	Number (N=34)
1-5	5(15%)
6-10	16(47%)
11-15	8(23%)
16-20	5(15%)

Most of the patients were in between 6-10 years (47%) followed by 11-15 years (23%).

Table-II

Sex distribution of patients

Sex	Number (N=34)
Male	24(71%)
Female	10(29%)

Males were approximately 2.5 times more than females; M:F:: 24:10 (2.4:1)

Table-III

Distribution of duration of symptoms

Duration of symptoms (months)	Number (N=34)
1-3	24(71%)
4-6	5(15%)
>6	5(15%)

Most of the patients (71%) came to hospital within 3 months of appearance of first symptom, 15% came in between 3-6 months and 15% came after 6 months of their first clinical presentation.

Table-IV

Distribution of location of tumors

Location of tumors	Number (N=34)
Cerebellar hemisphere	13(38%)
Vermis	12(35%)
Ventricle	5(15%)
Pons	3(12%)
Midbrain	1(3%)

38% tumors were located in cerebellar hemispheres, 35% were in vermis, 15% in ventricles, 12% in pons and 3% in midbrain.

Table-V

Distribution of state of ventricles

Ventricles	Number (N=34)
Dilated	30(88%)
Non dilated	4(12%)

Most of the patients (88%) came to hospital with triventriculomegaly.

Table-VI

Distribution of tumors according to signal intensity

Types of tumor	Imaging sequence	Hypo intense	Hyper intense	Iso intense	Total
Cerebellar	T1WI	13	0	0	13
astrocytoma	T2WI	0	13	0	13
Medulloblastoma	T1WI	6	1	2	9
	T2WI	0	9	0	9
Brainstem glioma	T1WI	3	0	1	4
	T2WI	0	4	0	4
Ependymoma	T1WI	4	2	2	8
	T2WI	1	7	0	8

All of the cerebellar astrocytomas were hypointense in T1WI and hyperintense in T2WI. Most of the medulloblastomas, ependymomas and brainstem gliomas were hypointense in T1WI and hyperintense in T2WI.

Table VII

Distribution of tumors according to contrast enhancement

Types of tumor	Contrast of Enhancement				
	Mild	Modeate	Strong	Hetero-genous	Total
Cerebellar astrocytoma	0	3	9	1	13
Medulloblastoma	1	1	2	5	09
Ependymoma	1	2	1	4	08
Brainstem glioma	4	0	0	0	4
Total	6	6	12	10	34

Most of the cerebellar astrocytomas enhanced strongly with gadolinium, most of the medulloblastomas and ependymomas were heterogeneously enhancing and all of the brainstem gliomas were mild contrast enhancing.

Table-VIII

Distribution of tumors by MRI diagnosis

MRI diagnosis	Number (N=34)
Cerebellar astrocytoma	13(38%)
Medulloblastoma	09(26%)
Ependymoma	08(24%)
Brain stem glioma	04(12%)

Out of 34 cases of different tumors, MRI diagnosed as cerebellar astrocytoma 13, medulloblastoma 09, ependymoma 08 and brain stem glioma 04.

Table-IX

Distribution of tumors by histopathological diagnosis

Histopathological diagnosis	Number (N=34)
Cerebellar astrocytoma	12(35%)
Medulloblastoma	10(29%)
Ependymoma	07(21%)
Brain stem glioma	04(12%)
Brain abscess	01(3%)

Out of 34 cases of different tumors, histopathology diagnosed as cerebellar astrocytoma 12, medulloblastoma 10, ependymoma 07 and brain stem glioma 04 and brain abscess 01 cases.

Table-X

Misdiagnoses by MRI

No of misdiagnosed cases	MRI diagnosis	Histopathological diagnosis
01	Cerebellar astrocytoma	Brain abscess
01	Ependymoma	Medulloblastoma

Above table shows that MRI failed to accurately diagnose the histopathological variety of posterior fossa tumors in pediatric patients in 2 out of 34 cases.

Table-XI

Comparison between MRI diagnosis and histopathological diagnosis

	MRI diagnosis	Histopathological diagnosis (Gold standard)
Correct	32 (94%) $_{(P1)}$	34 (100%) $_{(P2)}$
Incorrect	02 (6 %) $_{(q1)}$	00 (0 %) $_{(q2)}$
Total	34 $_{(n1)}$	34 $_{(n2)}$

$$Z = \frac{p_1 p_2}{\frac{p_1 q_1}{} + \frac{p_2 q_2}{}}$$ where…

$_{P1}$ = Proportion of correct diagnosis for MRI = 94%

$_{q1}$ = Proportion of incorrect diagnosis for MRI=100-p1 = 06%

$_{P2}$ = Proportion of correct diagnosis for Histopathological diagnosis = 100 %

$_{q2}$ = Proportion of incorrect diagnosis for Histopathological diagnosis = 100 " P_2 = 0 %

Z = 1.47

In Z – distribution table, table Z value at 5% level is 1.96. So, P > 0.05. Null hypothesis (H_0) retained.

Discussion

In our study, the mean age of the patients at presentation was 9.91 years with SD 1.94, the maximum number of patients was between 6-10 years (47%, 16 patients) followed by 11 -15 years (23%, 8 patients). Wilne et al.[7] have shown a review of 200 cases of brain tumors where mean age at presentation was 7.4 years.

In our series, 71% (24) patients were male and 29% (10) were female; male to female ratio was 2.4: 1. Walker and Petronio[8] found the ratio 1-3: 1. Zakrzewski et al.[9] found 1.35: 1 and Kadria et al.[10] found 1.5: 1.

In this study, majority i.e. 70% (24) of patients presented to the hospital within 3 months of the appearance of their first symptom. 15% (5) patients presented within 4-6 months. 15% (5) patients presented after 6 months. This indicates that posterior fossa tumors cause rapid progression of symptoms, as it causes obstruction to the CSF pathways and develop hydrocephalus earlier. Koellar and Rushing[11] showed that most (75%) have had symptoms for less than 3 months.

This study showed that 38% (13) tumors were located in cerebellar hemisphere, 35% (12) in vermis, 15%(5) in ventricles, 12%(3) in pons and 3%(1) in midbrain. Likasitwattanakul et al.[12] found that overall brain tumors were located in the infratentorial region in about 50% cases. In the infratentorial regions, medulloblastoma and cerebellar astrocytoma were the most common tumors.

The most common tumor of our study was cerebellar astrocytoma 35%(12), medulloblastoma 29%(10), ependymoma 21% (7) and brain stem glioma 12% (4). Al-Shatoury, Galhom and Engelhard[13] mentioned that in children, cerebellar astrocytomas comprises about one third, medulloblastomas about one quarter, brainstem gliomas about one quarter & ependymomas about one eighth. But they differ from Chang et al.[14] They described the most common tumor found in

childhood was medulloblastoma (27.5%) followed by astrocytoma (25.8%). Our third most common tumor was ependymoma. Spoto et al.[15] found that ependymomas were the 3rd most common tumors in children after medulloblastoma and astrocytoma and 50% of ependymomas demonstrate signal heterogenicity which may indicate calcification, necrosis, and tumour vascularity.

Most of our cerebellar astrocytomas strongly enhanced with contrast. Previous studies show that in cerebellar astrocytoma, nodule usually strongly enhance with contrast, cystic wall may or may not enhance[16,17]. Most of the cases of medulloblastomas of our series showed heterogeneous enhancement. Blaster and Harwood-Nash[18] showed that in medulloblastoma, necrosis, hemorrhage and cavitations are common features, giving these tumors a heterogeneous appearance on MRI. Most of our brain stem gliomas showed mild enhancement and none showed heterogenicity. According to Hesselink and Healy[19], brain stem gliomas are relatively homogeneous masses without much cystic change, necrosis, vascularity or calcification. Vezina et al.[20] told that about 50% of brainstem gliomas will show mild enhancement.

In this series, MRI failed to predict the histopathological variety of tumors in only 2 cases out of 34 cases. Among them one was diagnosed as cerebellar astrocytoma by MRI. That was a well-defined, round, cystic lesion with a solid mural nodule in the right cerebellar hemisphere with minimum edema and intense homogenous enhancement of the solid portion. But it was confirmed as brain abscess by histopathology. Another case was diagnosed as ependymoma by MRI. The mass was fairly large, strong heterogeneously enhancing, having cystic and solid component with mild perilesional edema. It was in the posterior fossa at fourth ventricular region causing marked dilatation of third and both lateral ventricles. It was confirmed as medulloblastoma by histopathology.

To compare between the MRI diagnosis and Histopathological diagnosis, two sample Z proportion test was done. Z value was 1.47. In Z distribution table, Z value at 5% level is 1.96. So P > 0.05 and null hypothesis (Ho) retained. i.e. the difference between MRI diagnosis and Histopathological diagnosis is not significant.

Conclusion:

It can be concluded that MRI is accepted as the most effective imaging modality in the diagnosis of pediatric posterior fossa tumors. T1WI, T2WI, FLAIR, axial, sagittal, coronal and T1WI post contrast sequences permit confident diagnosis and localization of the pediatric posterior fossa tumor. So if a lesion is suspected in posterior fossa specially in pediatric patients, neither CT nor any other investigation but MRI should be the choice of investigation.

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