ORIGINAL RESEARCH ARTICLE

Study Determining Correlation between Histopathological Diagnosis and MRI Findings of Posterior Fossa Tumors

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ABSTRACT

Introduction: The tumours that arise in the posterior fossa region are of special concern because the posterior fossa is a small enclosed space near critical brain structures, including the brain stem, the cerebellum and cranial nerves. Clinical evaluation, radiology and pathology play big role in deciding the long term prognosis. Hence, the present study was undertaken to evaluate the role of MRI in the evaluation of posterior fossa tumours and its correlation with histopathological findings.

Material and Methods: The present prospective study was conducted among 30 patients who underwent MRI, diagnosed to have posterior fossa tumours and underwent surgery over a period of 1 year were included in the present study. All patients were followed up to histopathological diagnosis. Findings on histopathological examination were noted and were compared with the MRI features. All the data will be expressed in percentages.

Results: Results of MRI evaluation of brain tumours revealed an accuracy of 100% for schwannomas, Meningiomas, Haemangiopericytoma, Epidermoid, Medulloblastomas and Haemangioblastoma and 50% for cerebellar astrocytoma, Ependymoma and Metastasis. Based on intra / extra axial location and MR signal characteristics of various types of tumours, we diagnosed posterior fossa tumours with 86.67% sensitivity.

Conclusion: The study concluded that MRI is an accurate tool in diagnosing various posterior fossa tumours. MRI is helpful for localization of tumours and also in detecting mass effect over brain stem, herniation and hydrocephalus, thus helpful for patient management / surgical planning and aid in the early diagnosis and reduction of morbidity and mortality.

Key words: Brain Tumors; Meningiomas; Metastasis; Posterior Fossa Tumors; Schwannomas

INTRODUCTION

The posterior fossa is a region near the base of the skull. The tumours that arise in this region are of special concern because the posterior fossa is a small enclosed space near critical brain structures, including the brain stem, the cerebellum and cranial nerves. Cushing probably was the first to report a large series of posterior fossa tumours. He published information about 61 patients with cerebellar medulloblastoma with mostly fatal outcome.[1]

Clinical evaluation, radiology and pathology play big role in deciding the long term prognosis. The major advantages of magnetic resonance (MR) imaging over CT scaning of the posterior fossa are lack of streak artifacts due to bone, increased sensitivity in detecting contrast differences, and ability to obtain direct sagittal views.[2] A nearly 100% sensitivity of MRI in the diagnosis of tumours has been reported, despite the fact that these images were obtained on prototype units, with relatively low field strength.[3] Hence, the present study was undertaken to evaluate the role of MRI in the evaluation of posterior fossa tumours and its correlation with histopathological findings.

MATERIAL AND METHODS

The present prospective study was conducted among 30 patients who presented to Department of Radiology, Sri Venkateswara Institute of Medical Sciences (SVIMS), Tirupati, with clinical suspicion of posterior fossa tumours and who underwent MRI. All patients who underwent MRI at our institute (SVIMS TIRUPATI) and diagnosed to have posterior fossa tumours and underwent surgery over a period of 1 year were included in the present study.

All the patients with clinical suspicion of posterior fossa tumours were evaluated clinically before sending them to radiology for MRI evaluation. The information was recorded in detail in a predesigned data collection sheet. MAGNETOM Symphony, 1.5 tesla MRI, SIEMENS machine was used for MRI. Contrast material used was 10ml Gadolinium – DTPA and technique used was T_1W, T_2W, flair, post contrast T_1W sequences and MR spectroscopy.

The procedure was briefly explained to the patients including the risks of contrast material and consent was obtained. Detailed history for contraindications of MRI was specifically taken on predesigned and pretested proforma. The patients were

provided with earplugs to minimize the noise within MRI room. All patients were followed up to histopathological diagnosis. Findings on histopathological examination were noted and would be compared with the MRI features.

STATISTICAL ANALYSIS

Microsoft office 2007 was used for the analysis. All the data were expressed in percentages and mean.

RESULTS

Figure 1 shows incidence of hydrocephalus in posterior fossa tumours. Out of the total 12 cases of schwannoma, 07cases (58.33%) showed hydrocephalus. 02 out of 03 cases of meningioma showed hydrocephalus. The only case of Haemangiopericytoma showed hydrocephalus. 50% of Cerebellar astrocytomas showed hydrocephalus. Both the cases of medulloblastoma showed hydrocephalus. Among Haemangioblastomas, hydrocephalus was seen in 3.33% of cases i.e., one out 03 cases. 01case (50%) of metastasis showed hydrocephalus.

Figure 2 shows incidence of mass effect in posterior fossa tumours Out of 12 cases of schwannoma, 10 cases showed mass effect. Meningioma, Haemangiopericytoma, Cerebellar astrocytoma, ependymoma, medulloblastoma, Haemangioblastoma showed mass effect in all the cases (100%). 1case of metastasis showed mass effect (50%).

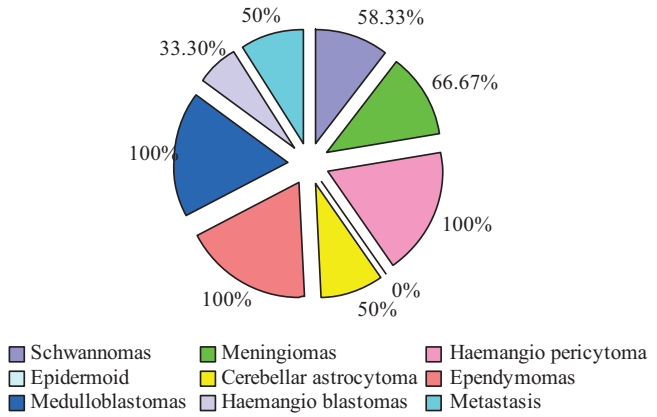

Figure-1: Incidence of hydrocephalus in posterior fossa tumours

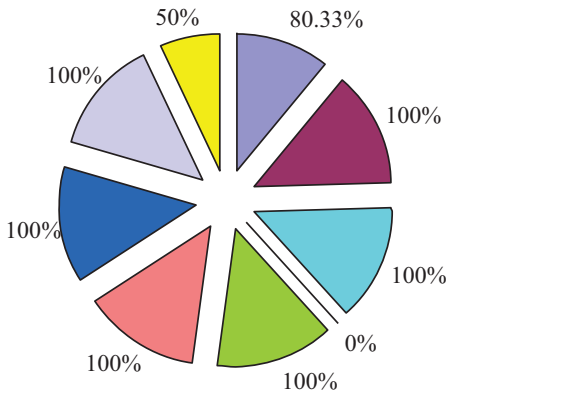

Figure-2: Incidence of mass effect in posterior fossa tumours

Sl. No.	Tumour	No.of cases	T_1W Sequence			T_2W Sequence			Flair Sequence			T_1W Contrast Enhancement	
			Iso Intense	Hypo Intense	Hyperintense	Iso Intense	Hypo Intense	Hyper intense	Hetero geneous	Supressed	not supressed	Partially supressed	Homo geneous	Hetero geneous
1.	Schwannoma	12	03 (25%)	08 (66.67%)	-	-	-	07 (58.33%)	05 (41.67%)	-	10 (83.33%)	02 (16.67%)	07 (58.33)	05 (41.67%)
2.	Meningioma	03	02 (66.67%)	01 (33.33%)	-	-	-	03 (100%)	-	-	03 (100%)	-	03 (100%)	-
3.	Haemangio pericytoma	01	01 (100%)	-	-	-	-	-	01 (100%)	-	01 (100%)	-	-	01 (100%)
4.	Epidermoid	01	-	01 (100%)	-	-	-	01 (100%)	-	-	-	01 (100%)	-	Not enhancing
5.	Cerebellar Astrocytoma	04	-	04 (100%)	-	-	-	02 (50%)	02 (50%)	-	04 (100%)	-	-	04 (100%)
6.	Ependymoma	02	-	02 (100%)	-	-	-	-	02 (100%)	-	02 (100%)	-	-	02 (100%)
7.	Medulloblastoma	02	-	01 (50%)	-	0	01 (50%)	01 (50%)	-	-	02 (100%)	-	-	02 (100%)
8.	Haemangio blastoma	03	-	03 (100%)	-	-	-	03 (100%)	-	-	03 (100%)	-	-	03 (100%)
9.	Metastasis	02	-	02 (100%)	-	-	-	02 (100%)	-	-	02 (100%)	-	00	02 (100%)

Table-1: Signal intensity of tumours on MRI

Sl. No.	Tumour	Total number of cases	No.of cases correlated with HPE	No.of cases not correlated with HPE	Percentage of accuracy
1.	Schwannoma	12	12	-	100%
2.	Meningioma	03	03	-	100%
3.	Haemangio pericytoma	01	01	-	100%
4.	Epidermoid	01	01	-	100%
5.	Cerebellar Astrocytoma	04	02	02	50%
6.	Ependymoma	02	01	01	50%
7.	Medulloblastoma	02	02	-	100%
8.	Haemangio blastoma	03	03	-	100%
9.	Metastasis	02	01	01	50%
	Total	30	26	04	86.67% sensivity

Table-2: Correlation of MRI findings with histopathological examination

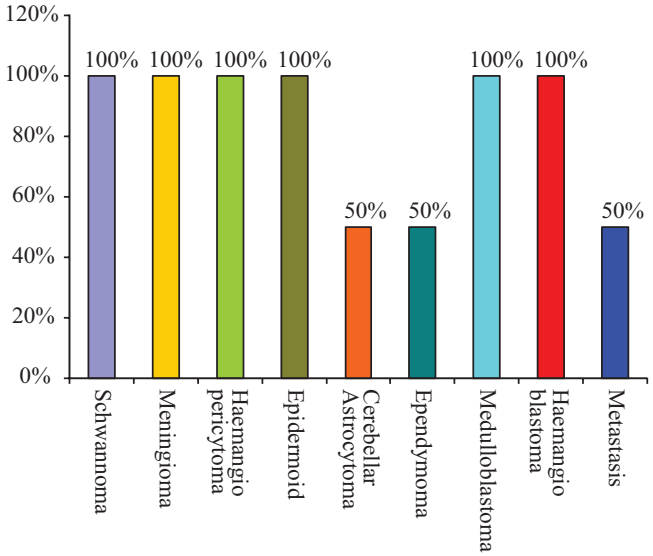

Figure-3: Percentage of correlation of MRI findings with histopathological examination

Table 1 reveals signal intensity of tumours on MRI. Schwannomas were hypointense on T_1W and hyperintense on T_2W. They were not suppressed on Flair sequence. They showed homogeneous enhancement on contrast administration. Meningiomas were either isointense (66.67%) or hypointense (33.3%) on T_1W and are hyperintense on T_2W. They were not suppressed on flair sequence and showed homogeneous enhancement on contrast administration. Haemangiopericytoma was isointense on T_1W, Heterogeneous on T_2W, and not suppressed on flair sequence. It showed heterogeneous enhancement on contrast administration. Epidermoid, showed hypointensity on T_1W, hyperintensity on T_2W and not suppressed on flair sequence. It did not showed enhancement after contrast administration. Cerebellar gliomas were hypointense on T_1W, either hyperintense or heterogeneous on T_2W and not suppressed on flair. On contrast administration, it showed heterogeneous enhancement. Ependymomas were hypointense on T_1W, heterogeneous on T_2W, not suppressed on flair. They showed heterogeneous enhancement on contrast administration. Medulloblastomas were either hypointense or heterogeneous on T_1W, hypointense or hyperintense on T_2W and not suppressed on flair sequence. On contrast administration, it showed heterogeneous enhancement. Haemangioblastomas were hypointense on T_1W, hyperintense on T_2W and not suppressed on flair sequence. They showed heterogeneous enhancement on contrast administration. Metastatic lesions were hypointense on T_1W, hyperintense on T_2W, not suppressed on flair and showing heterogeneous enhancement on contrast administration.

Results of MRI evaluation of brain tumours revealed an accuracy of 100% for schwannomas, Meningiomas, Haemangiopericytoma, Epidermoid, Medulloblastomas and Haemangioblastoma and 50% for cerebellar astrocytoma, Ependymoma and Metastasis (table 2 and Figure 3). The results proved that MRI evaluation of posterior fossa brain tumours is very accurate and aid in the early diagnosis and reduction of morbidity and mortality. MRI has got other added advantage of being safe without hazards of radiation.

DISCUSSION

8 out of 12 cases of schwannomas were hypointense on T_1w and were hyperintense or heterogeneous on T_2W sequences. Most of them were either not suppressed 10 (83.33%) or partially suppressed 02 (16.67%) on flair sequence. 07 (58.33%) cases were homogeneous and 05 (41.67%) cases were heterogeneous on contrast administration. This is in correlation with the study by Mulkens TH et al[4] where they stated that after contrast administration, all tumors showed intense enhancement, except for one small intracanalicular tumor, which did not enhance. According to them the enhancement pattern was homogeneous in 67%, inhomogeneous in 10% and heterogeneous with areas of cystic degeneration in 22%. Mass effect was noted in 10 (83.33%) out of 12 cases and Hydrocephalus in 07 cases (58.33%). The above findings were also observed by Bilanuiuk LT,[5] where he stated that the incidence of brain stem compression and obstructive hydrocephalus occur depending on tumour size and extent. Out of 12 cases of schwannomas operated, all the cases correlated with the HPE showing 100% correlation.

Meningiomas were either isointense (66.67%) or hypointense 01 (33.33%) on T_1w and all of them are hyperintense on T_2w and not suppressed on Flair sequence. On contrast administration, all of them showed intense homogeneous enhancement. This is in concordance with the study done by Fujii K et al,[6] where they stated that all meningiomas enhance rapidly and intensely following contrast administration.

Mass effect was noted in all the 3 cases (100%) and 02 cases (66.67%) showed the incidence of hydrocephalus. All the 3 cases of meningiomas were confirmed by HPE i.e., 100% correlation.

Haemangiopericytomas was isointense as T_1w, not suppressed on flair sequence. It showed heterogeneous enhancement on contrast study. The same characteristic signal intensities were also observed by Cosentino CM et al,[7] in which they found that Haemangiopericytomas mostly are isointense with cortex on T_1w and slightly hyperintense on PD sequences and heterogeneous on T_2w. Strong but inhomogeneous enhancement occured following contrast administration. Prominent vascular channels were frequently identified. The MRI diagnosis of Haemangiopericytoma was correlated with the HPE.

Epidermoid showed hypointense signal on T_1w and hyperintense on T_2w, partially suppressed on flair sequence and showed no enhancement on contrast administration. This was in concordance with the study conducted by Tampieri D et al.[8] In their study of nine patients with epidermoid cysts, five of them pathologically proved, were evaluated with MR imaging. Six patients also had CT. The cases were reviewed to evaluate the MR appearance of epidermoid cysts and to compare the MR findings with those of CT. The epidermoid cysts demonstrated low- signal intensity on T1- weighted MR images and hyperintensity on T2-weighted images. In five cases the cysts appeared heterogeneously iso-to hyperintense on the intermediate echo, and were surrounded by a thin rim of high signal intensity, which was caused by encased CSF. The CT scans showed the cysts as low-density, well-demarcated lesions that do not enhance after infusion with contrast material. The study concluded that MR is superior to CT in the evaluation of epidermoid cysts and is particularly useful in surgical planning. This does not show either mass effect or incidence of hydrocephalus. This was in correlation with the study conducted by Dubois PJ et al,[9] in which they observed that hydrocephalus occurs very rarely or lately in case of epidermoids due to their slow growth. The single case of epidermoid was correlated with the HPE.

Cerebellar astrocytomas were hypointense on T_1w, either hyperintense (50%) or heterogeneous (50%) on T_2w and not suppressed on Flair sequences. These tumours showed heterogeneous enhancement on contrast study. This observation was made by Dean BL et al.[10] Of the 04 cases, 02 cases (50%) showed the incidence of hydrocephalus and all the 04 cases showed mass effect (100%). Out of 04 cases of cerebellar astrocytoma, 02 cases (50%) were correlated with HPE.

Ependymomas were hypointense (02 cases (100%)) on T_1w and Heterogeneous (02 cases (100%)) on T_2w and not suppressed on flair sequence. They showed heterogeneous enhancement on contrast administration. A study by Healey EA et al[11] found irregular contrast enhancement in 03 out of 04 cases which was similar in our study. Both the cases showed mass effect and incidence of hydrocephalus (100%). Out of 02 cases of ependymoma, one case was correlated with HPE and the other not correlated making it 50%.

Medulloblastomas were either hypointense 01 (50%) or heterogeneous 01(50%) on T_1w and either hypointense 01(50%) or hyperintense 01(50%) on T_2w and not suppressed (02 (100%)) on flair sequence. These tumours showed heterogeneous enhancement on contrast administration. These findings were in correlation with the study done by Meyers SP et al.[12] Both the cases showed mass effect and the incidence of hydrocephalus. These two cases of Medulloblastomas are correlated with HPE (100% correlation).

Haemangioblastomas were hypointense on T_1w and hyperintense on T_2w, not suppressed on flair sequences. They showed heterogeneous enhancement on contrast administration. These similar characteristic imaging features were also observed by Elster AD et al[13] in their study. Mural nodule enhanced strongly and uniformly which was also observed by Elster AD et al[13] in their study where 75% of cases showed enhancement of mural nodule on contrast administration. In all the 03 cases which were operated, an MRI finding correlated well with the HPE.

The cases of metastasis were hypointense on T_1w and hyperintense on T_2w, and enhance heterogeneously following contrast administration. These lesions were not suppressed on flair sequence. All the cases showed uniform ring like enhancement on contrast administration. Marked enhancement is fairly uniform within viable positions of the neoplasm. One out of two cases of metastasis showed the incidence of hydrocephalus and mass effect. 1 case out of 2 cases was confirmed by the HPE.

CONCLUSION

The study concludeded that MRI is an accurate tool in diagnosing various posterior fossa tumours. Based on intra / extra axial location and MR signal characteristics of various types of tumours, we diagnosed posterior fossa tumours with 86.67% sensitivity. MRI is helpful for localization of tumours and also in detecting mass effect over brain stem, herniation and hydrocephalus, and thus helpful for patient management / surgical planning. The MRI is also useful in achieving a nearest histological diagnosis as particular MRI features will nearly point to particular histopathological diagnosis and thus helpful in correlating histopathological features.

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