D:\Biomedica Vol. 30, Issue 3, Jul. – Sep., 2014\Bio-2.Doc Pic. 2 No. B/w P. 1 – 5 (KC) IV

ORIGINAL ARTICLE

MRI EVALUATION OF MEDULLOBLASTOMA WITH HISTOPAHTOLOGICAL CORRELATION

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ABSTRACT

Background and Objective: Medulloblastoma is the commonest tumor in children in infratentorial location that is highly malignant, fast growing neoplasm with varying degrees of histological variations. Normally the surgical resection is the common treatment followed by radiotherapy and chemotherapy. MRI can be used as primary imaging technique in such patients prior to surgery, during the follow-up and in post-operative phase. The sensitivity, specificity and diagnostic accuracy of this procedure was evaluated in this study.

Methods: One hundred and ten patients with clinical suspicion medulloblastoma were taken and magnetic resonance imaging was performed. Histopathological results were recorded and compared taking histopathology as gold standard.

Results: The mean age of the patients was 11.08 ± 4.06. Out of a total of 110 patients 65 (59.1%) were males and 45 (40.9%) were females. Fifty patients (45.45%) were labeled as having medulloblastoma on MRI while 60 patients (54.55%) were not labelled as medulloblastoma. Fifty three patients (48.18%) were diagnosed as medulloblastoma on histopathology while 57 patients (51.8%) were not labelled as medulloblastoma. The sensitivity of MRI was 86.79%, specificity 92.98%, diagnostic accuracy 90.0%, positive predictive value 90% and negative predictive value 88.33%.

Conclusion: Magnetic Resonance Imaging is a precise, non-invasive, safe and convenient imaging modality for the evaluation of medulloblastoma even for small tumor size.

Keywords: Medulloblastoma, Magnetic Resonance Imaging, Posterior Cranial Fossa.

INTRODUCTION

The Central nervous system (CNS) tumors are considered as the common tumors in children after Leukaemia.[1] Childhood neoplasms are more common in infratentorial location (56%) than supratentorial (44%). In infratentorial location, common tumors – medulloblastoma (40%) and astrocytoma (31%) are of almost equal frequency. Brain stem gliomas are 20% and ependymoma of 4th ventricle is 11%[2]. Medulloblastoma is a primitive neuroectodermal tumor typically occurring in the posterior fossa in children. This tumor is a highly malignant and fast-growing neoplasm. Histological variations include: Classic, Medulloblastoma, Desmoplastic medulloblastoma, Cerebellar neuroblastoma, Large – cell medulloblastoma, Medullomyoblastoma and Melanotic medulloblastoma.[3]

The peak age of tumor manifestation is 7 years. Over 70% of this tumor is diagnosed in children below the age of 16 years.[4] The frequent symptoms include vomiting (90%), headach (80%), psychomotor regression (58%), psychological symptoms (30%), strabismus (25%) and asthenia (20%).[5] Normally the surgical resection is the common treatment followed by radiotherapy and chemotherapy.[4] MRI can be used as primary imaging technique in such patients prior to surgery, during the follow-up and in post-operative phase providing the highest sensitivity.[6] Medulloblastomas are characterized as solid, homogeneous or heterogeneous, contrast – enhancing masses localized in the posterior fossa, either compressing or extending into the 4th ventricle. Most of the times medulloblastomas present heterogeneous signal in association with the presence of cysts, necrosis, small blood vessels and/or calcifications, presenting from isointense to hypointense signal on T_1 – weighted, and isointense to hyperintense signal on T_2 – weighted sequences[3]. In this study diagnostic accuracy of MRI was evaluated in detection of medulloblastoma in comparison to histopathology in our population, as few available international studies have shown variation in results and no local study is yet available.

Medulloblastoma is associated with Nevoid basal cell carcinoma (Gorlin Gotz syndrome), Turcot syndrome – type 2 - , Li-Fraumeni syndrome, Neuro bromatosis types 1 and 2, Rubinstein – Taybi syndrome, Fanconi anemia, Nijmegen syndrome.[9-11] Part of the

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information on the molecular pathways related to medulloblastoma comes from the study of two syndromes associated with a constitutional predisposition to medulloblastoma — Gorlin syndrome and Turcot syndrome.[9,11,13] The 2007 WHO classification of tumors recognizes medulloblastoma, primitive neuroectodermal tumor (PNET) of the CNS and ATRT as embryonic tumors; all grade four lesions.[12,13] Two new histological variants with different clinical behavior have been incorporated:

- Medulloblastoma with extensive nodularity, associated with a favorable prognosis.
- Anaplastic type with poor prognosis.

Other subtypes previously described are Classic and Desmoplastic / Nodular and Large cells.[11,12] Medulloblastoma with extensive nodularity is related to the desmoplastic / nodular subtype. Former has better prognosis, appears earlier, whereas the latter occurs in older children. Both tumors are prognostically more favorable than the other variants. The anaplastic subtype shows the highest degree of atypia. Large cell variant also carries poor prognosis and shows similar cytological features as the anaplastic form.[8,14,15] The objective of study is to determine the diagnostic accuracy of Magnetic Resonance Imaging (MRI).

MATERIALS AND METHODS

This cross sectional study was carried out at Department of Radiology, PGMI Lahore from November 2012 to February 2014. One hundred and ten (110) patients, referred from Neurosurgery department of Lahore General Hospital, were included in this study**.** All patients presenting with clinical suspicion of posterior fossa tumor referred by neurosurgeons from outdoor of Lahore General Hospital, Lahore meeting the inclusion criteria was inducted for the study after informed consent. Patients with residual, recurrent or metastatic medulloblastoma were excluded from the study to avoid confounding variables. All the patients were recorded for their demographic features i.e. age, gender and address. Magnetic resonance imaging on a 1.5-T Philips whole body MR system using standard imaging coil was carried out. T_2 – weighted and both unenhanced and contrast – enhanced T_1 – weighted images in the axial, sagittal and coronal projections were obtained. Magnetic resonance imaging diagnosis i.e. presence or absence of medulloblastoma, was recorded by same observer. The cases (with posterior fossa tumor) were followed and their histopathological results were recorded. The results of magnetic resonance imaging and histopathology were compared taking histopathology as gold standard. All this information was collected through a specially designed proforma and the data was analyzed with SPSS version 10.

RESULTS

Among the 110 patients with clinical suspicion of medulloblastoma 65 patients (59.1%) were males and 45 patients (40.9%) were females. The age of patients ranged from 03 to 16 years with mean age 11.08 ± 4.06 years. The highest number of patients were aged between 13 – 16 years i.e. 55 (50%), 23 patients (20.9%) were aged between 03 – 07 years and 32 patients (29.1%) were aged between 08 – 12 years.

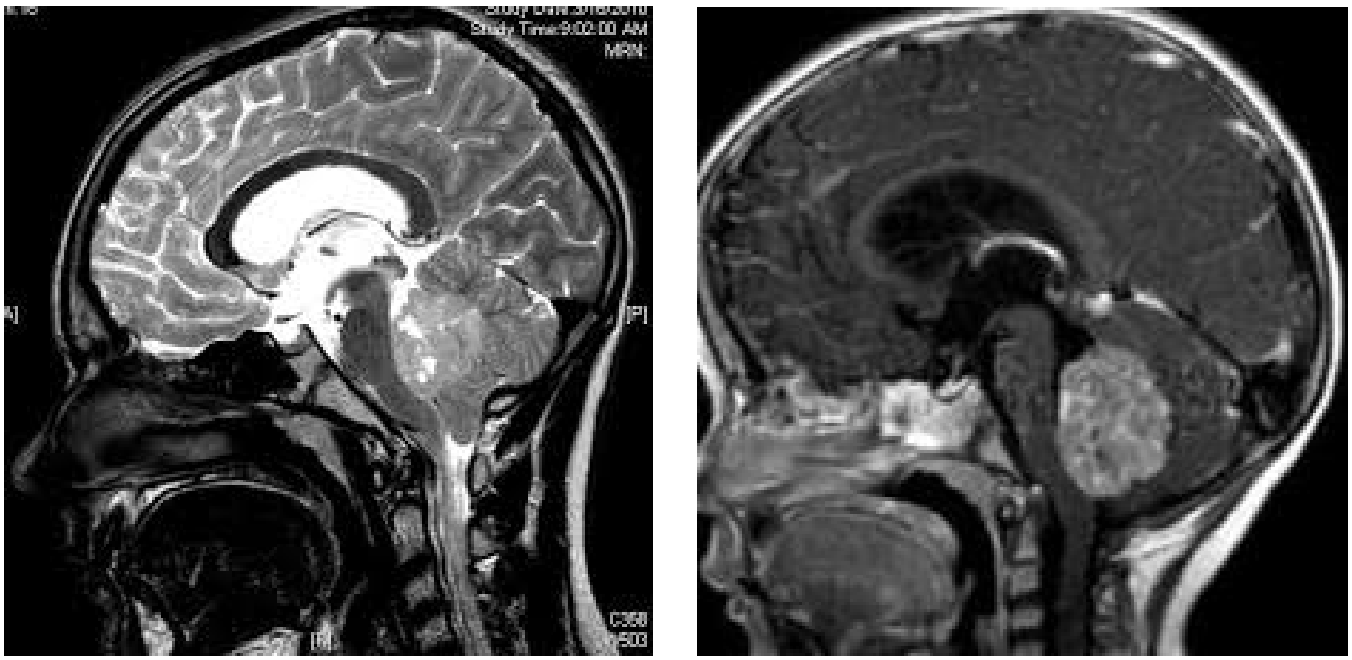

Fig. 1: *T_2 weighted and post contrast T_1 weighted sagittal images of medulloblastoma.*

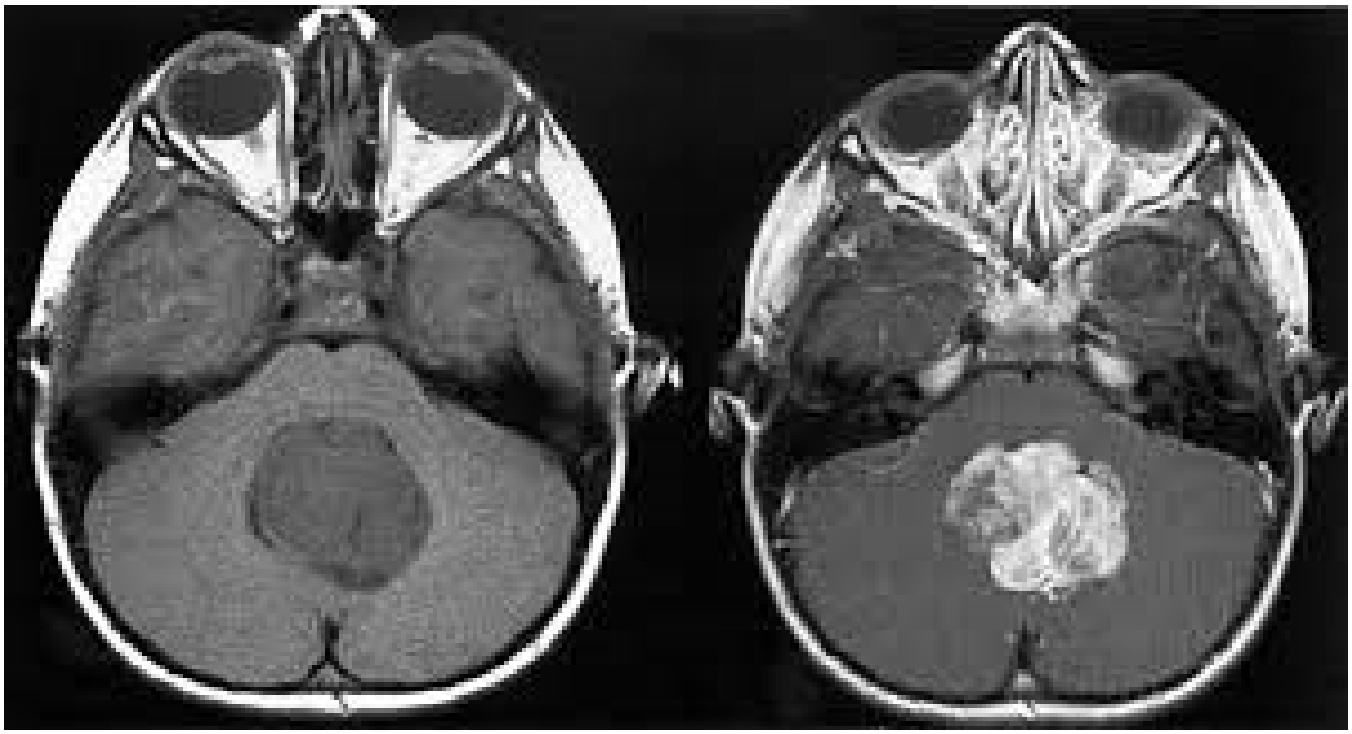

Fig. 2: *Pre and post gadolinum ehhanced T1 weighted axial images of medulloblastoma.*

Out of 110 patients, 50 patients *(45.45%)* had medulloblastoma on MRI while 60 patients *(54.55%)* had no medulloblastoma on MRI while 53 patients *(48.18%)* had medulloblastoma on histopathology and 57 patients *(51.8%)* had no medulloblastoma on histopathology. Out of the 110 patients, 50 patients *(45.45%)* had medulloblastoma; 38 patients *(34.54%)* had astrocytoma; 19 patients *(17.2%)* had ependymoma; 03 patients *(2.1%)* had ATRT on MRI. Out of the 110 patients, 53 patients (48.18%) had medulloblastoma, 36 patients *(32.7%)* had astrocytoma, 19 patients *(17.2%)* had ependymoma, 02 patients *(1.81%)* had ATRT on histopathology.

Table 1: *Comparison of MRI and histopathology n = 110.*

MRI	*Histopathology (Gold Standard)*		*Total*
	Positive	*Negative*	
Positive	46 (TP)	04 (FP)	50
Negative	07 (FN)	53 (TN)	60
Total	53	57	110

On comparison of results of MRI with histopathology, out of 110 patients, 46 patients were true positive, 53 patients, true negative; 04 patient, false positive and 07 patient, false negative (Table 1). The sensitivity of MRI was 86.79%, specificity 92.98%, diagnostic accuracy 90.0%, positive predictive value 90% and negative predictive value 88.33% (Table 1).

DISCUSSION

Magnetic resonance imaging is a non-invasive and safe imaging modality, in current clinical practice MR imaging is the first – line investigation for the identification of suspected medulloblastoma in appropriately selected patients. At present the definitive examination is a gadolinium enhanced magnetic resonance scan. This can detect lesions of 2 mm in diameter and probably smaller.[16] The MRI findings of the medulloblastoma are well known and specific, but unusual features may also be encountered.[10] Medulloblastomas are isointense relative to the pons on MR T_1 – weighted images, mildly hyperintense on MR T_2 – weighted images, and enhance intensely after i.v. administration of gadolinium – DTPA.

In our study we found that MRI examination and its positive predicted value of 90% is comparable to gold standard histopathology as also reported in the studies done by Mahmud et al.[7] Most of the patients were in the late childhood which may be due to late presentation and delay in seeking medical advice and treatment. Sensitivity of the MRI for the detection of the medulloblastoma was 87.6%, specificity 93% whereas diagnostic accuracy was 90%. Yuksal and colleagues found sensitivity of 94% but the specificity was low (64%) in their studies during scintigraphy for medulloblastoma although the positive predictive values

are comparable.[17]

Mahmud and colleagues found the specificity and sensitivity of 94 and 95% respectively that is comparable with our results. It was seen that MRS and DWI sequences can improve the diagnostic accuracy of MB.[18] Many researchers used taurine and lipid levels assessment by the DWI and improved the diagnostic accuracy.[19-21] Riffaud et al. reported a recurrences rate of 41 percent, with a median time to first recurrence of 4.2 years (range 0.7 – 18 years).[22] Similarly, in the only prospective study published to date, Brandes et al. reported that the risk of recurrence increased markedly after seven years of follow-up for low – risk adult patients, and after ten years for high – risk adult patients.[23] Though the recurrence rate was beyond the scope of this study and our institute lack the facility of chemotherapy and radiation but the recurrence can also be detected by MRI as confidently as in the new cases.

It is ***concluded*** that magnetic resonance imaging is a highly accurate, non-invasive, safe and convenient imaging modality for the evaluation of medulloblastoma and is valuable for guiding surgical biopsies thereby decreasing unnecessary intervention. It allows detection of small tumors which is very useful in tumor characterization and plays an integral role in early detection, planning management and estimating patient's prognosis.

ACKNOWLEDGMENT

We acknowledge the support of HoD and staff of Radiology Department Lahore General Hospital, Lahore for collection and use of patient's data to carry out this research project. The statistical assistance of Prof. Muhammad Ibrahim and valuable contributions by Mr. Abubakar Imran are also thankfully acknowledged.

AUTHOR'S CONTRIBUTION

Dr. Tanweer Ahmad has contributed in selection of topic, discussion and final write-up, whereas Dr. Madiha planned the study, collected the data and wrote the results.

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