Magnetic Resonance Imaging in Evaluation of Supratentorial Tumours

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ABSTRACT

BACKGROUND
Supratentorial tumours mostly present with non-specific complaints such as headache, stroke like syndrome or seizures. Often a diagnosis is made or suggested initially by findings on imaging studies. We wanted to study the imaging findings of supratentorial tumours, so as to deliver the best possible diagnosis and treatment for the patient.

METHODS
All clinically suspected supratentorial brain tumour cases undergoing Magnetic Resonance Imaging (MRI) at GSL Medical College and General Hospital, Rajahmundry, were included in this study. All scans were performed with 1.5 Tesla MRI. Pre-contrast scanning was done using axial T1, T2 and FLAIR; coronal T2 and sagittal T1 with a slice thickness of 5 mm. Post-contrast coronal, sagittal and axial T1WI were obtained. If required, thinner sections were obtained in the region of interest wherever necessary. Special MRI sequences like FLAIR (Fluid Attenuated Inversion Recovery Sequence), and DWI (Diffusion Weighted Imaging) were obtained.

RESULTS
In this study, 53 cases were diagnosed with supratentorial tumours. Glioma was the most common diagnosis (49%). Peak incidence of neoplasms was seen in fifth decade and the lowest incidence was seen in the first decade. 29 patients were males and 24 patients were females. Headache was the commonest presenting complaint. Twenty-three tumours were homogenous, 22 were heterogenous and 7 had non-enhancing pattern.

CONCLUSIONS
Multiplanar capability of MRI is helpful in identifying the precise anatomic location and the exact extent of the tumours. Post contrast images clearly define the size, margins, and nature of the tumour and also improves the differentiation between the tumour and surrounding edema.

KEYWORDS
Magnetic Resonance Imaging, MRI, Supratentorial Tumours

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BACKGROUND

Brain tumours are one of the most dramatic forms of human illness. There are two main types of tumours, malignant and benign tumours. Malignant tumours can be divided into primary and secondary tumours. All types of brain tumours may produce symptoms that vary depending on the part of the brain involved.[1] These symptoms may include headache, seizures, problem with vision, vomiting, and mental changes.[2] The headache is classically worse in the morning and goes away with vomiting. More specific problems may include difficulty in walking, speaking and with sensation. Supratentorial tumours are those which occur in sellar, suprasellar region, meninges, pituitary gland, pineal gland and other areas of cerebrum. Supratentorial tumours mostly present with non-specific complaints such as headache, stroke like syndrome or seizures, often a diagnosis is made or suggested initially by the findings on imaging studies.[3]

Recent advances in imaging techniques have exploded into the horizon of using many different modalities such as magnetic resonance imaging (MRI), and computed tomography (CT) perfusion, positron emission tomography, and single photon emission CT. These imaging modalities have revolutionized the diagnosis and management of brain tumours.[4] MRI is an important modality, which has high sensitivity for detecting intracranial pathology. MRI has earned recognition as the optimal screening technique for the detection of the most intracranial neoplasms.

We wanted to study the imaging findings of supratentorial tumours, so as to deliver the best possible diagnosis and treatment for the patient.

METHODS

All clinically suspected supratentorial brain tumour cases undergoing MRI at GSL Medical College and General Hospital, Rajahmundry were included into this cross-sectional observational study. The study was conducted from January 2016 to June 2017. All patients having cardiac pacemakers, prosthetic heart valves or any metallic orthopaedic implants, adverse reaction to contrast agents, supratentorial pathology and symptomatology due to infections, congenital malformations and trauma or cerebrovascular accidents were excluded from study.

All the scans were performed with 1.5 Tesla MRI, manufactured by Philips with software version Acheiva. Pre-contrast scanning was done using axial T1, T2 and FLAIR; coronal T2 and sagittal T1 and slice thickness of 5 mm. Omniscan (gadodiamide) is used as contrast agent in dose of 0.1 mmol/kg (I.V.) body weight. Post-contrast coronal, sagittal and axial T1WI were obtained. If required, thinner sections were obtained in the region of interest wherever necessary. Special MRI sequences like FLAIR (Fluid Attenuated Inversion Recovery Sequence), DWI (Diffusion Weighted Imaging) were obtained. Findings during the surgery and on histopathological examination were noted and were compared with the MRI features.

Statistical Analysis

All the statistical analysis was performed by using SPSS and MS Excel 2013. Data analysis are done by using rates, ratios and percentages of differential diagnosis and outcomes made by MRI brain, which are be computed and compiled.

RESULTS

The present study was conducted in the Department of Radio-diagnosis, GSL Medical College, Rajahmundry over a period of 18 months. A total of 53 patients were studied and the observations and findings were noted.

Supratentorial Tumours	Age in Years							
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80
Glioma	-	2	3	3	5	8	5	-
Benign tumours	-	-	-	1	-	-	-	-
Pituitary adenoma	-	1	1	-	1	1	-	-
Meningioma	-	1	1	1	5	4	2	2
Pineal region tumours	1	-	-	-	-	-	-	-
Metastasis	-	-	-	1	-	3	1	-
Total	1	4	5	6	11	16	8	2

Table 1. Age Distribution

Supratentorial Tumours	Males	Females	Total
Gliomas	12	14	26
Benign tumours	1	-	1
Pituitary adenoma	2	2	4
Meningioma	10	6	16
Pineal region tumours	1	-	1
Metastases	3	2	5

Table 2. Sex Wise Distribution

Supratentorial Tumours	No. of Cases	Percentage
Gliomas	26	49%
Benign tumours	1	2%
Pituitary adenomas	4	8%
Meningiomas	16	30%
Pineal region tumours	1	2%
Metastases	5	9%
Total	53	100%

Table 3. Overall Incidence of Supratentorial Tumours

Subgroups of Gliomas	Number of Patients	Percentage
Low grade Gliomas	7	26.92%
High grade Gliomas	9	34.61%
Glioblastoma multiforme	5	19.23%
Oligodendrogliomas	2	7.69%
Ependymomas	2	7.69%
Astrocytomas	1	3.8%

Table 4. Distribution of Subgroups among Patients with Gliomas

Symptoms	Number of Cases	Percentage
Headache	36	72%
Vomiting	30	60%
Giddiness	8	16%
Visual disturbances	10	20%
Seizures	8	16%
Altered sensorium	12	24%
Behavioural disturbances	10	20%
Weakness	14	28%
Excess hormonal secretions	3	0.6%

Table 5. Symptoms of Patients with Supratentorial Tumours

Tumours	Homogenous	Heterogenous	Non-Enhancing
Gliomas	6	16	4
Benign tumours	1	-	-
Pituitary adenomas	2	-	2
Meningiomas	12	4	-
Pineal region tumours	-	1	-
Metastases	2	1	1
Total	23	22	7

Table 6. Enhancement Pattern of Tumours

Figure 1. Axial T2WI Showing Relatively Well-Defined High-Grade Glioma in Left Frontal Lobe with Disproportionate Perilesional Oedema and Significant Mass Effect

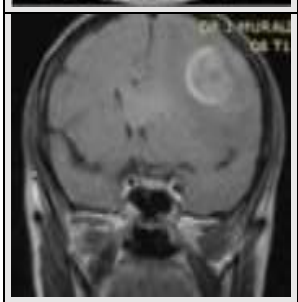

Figure 2. Coronal Post Contrast T1WI Showing Relatively Well-Defined Contrast Enhancing High-Grade Glioma in Left Frontal Lobe with Significant Mass Effect

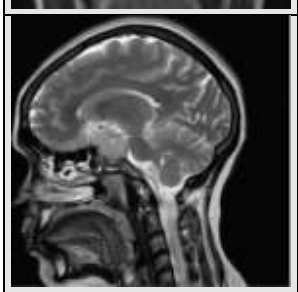

Figure 3. Sagittal T2 Showing a Heterogenous Pituitary Macroadenoma of Varying Signal Which is Isointense to Gray Matter

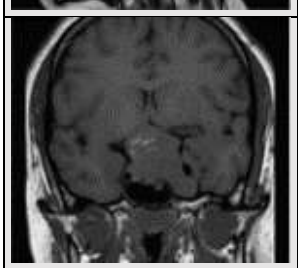

Figure 4. Coronal T2WI Showing Well Defined Heterogenous Soft Tissue Intensity Pituitary Macroadenoma in the Sellar Region

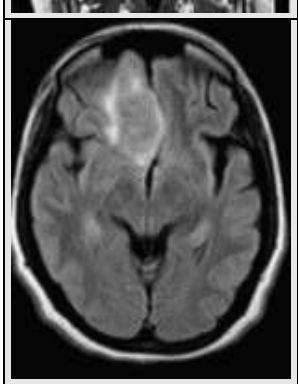

Figure 5. Meningioma: T1WI Axial Image Showing an Isointense Gray Matter Lesion with Positive CSF Cleft Sign

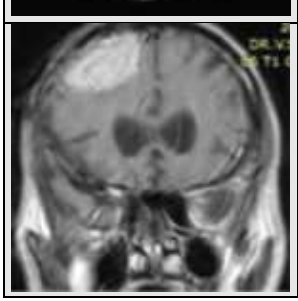

Figure 6. Coronal Post Contrast T1WI Showing Well Defined Extra-Axial Mass Lesion with Intense Homogeneous Enhancement Localized in Right Parafalcine Frontal Convexity

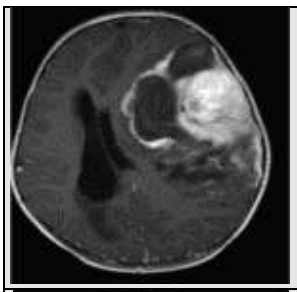

Figure 7. PNET- Axial T1W1 Showing Highly Variable Intensity Lesion with Low Extent of Peritumoral Oedema with Hyperintensity in Left Leptomeningeal Fronto-Parietal Region

Figure 8. Axial T2W1 Showing High Signal Solid and Cystic Components and Significant Mass Effect in Left Fronto-Parietal Region

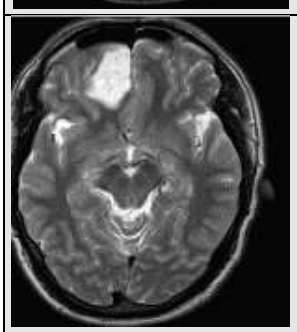

Figure 9. Axial T2W1 Showing Hyperintense Signal in Right Parafalcine Frontal Lobe with High Signal Bubbly Appearance

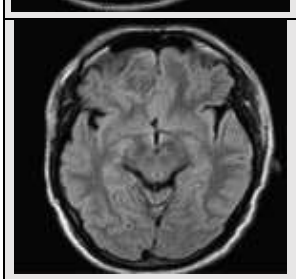

Figure 10. Axial Flair Sequence Mixed Signal Intensity with Bright Rim Sign

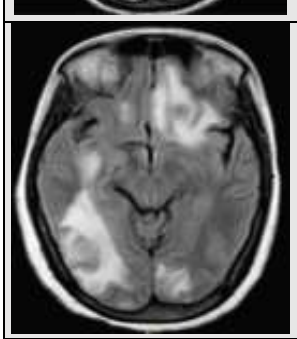

Figure 11. Axial Flair Showing Two Well Defined Ring Enhancing Lesions with Significant Perilesional Oedema

Figure 12. Axial Flair Showing Mass Like Hyperintense Signal Causing Expansion of Cortex and Following White Matter Distribution with Moderate Perilesional Oedema and Mass Effect

DISCUSSION

MRI is a non-invasive, reproducible and highly accurate method, which demonstrates size, location configuration, extent and relationship of the lesion to the adjacent structures. In this study of 53 cases with supratentorial tumours, glioma was the most common diagnosis. Others include pituitary adenoma, meningioma, pineal region tumours, benign tumours such as dysembryoplastic neuroepithelial tumour (DNET) and metastasis. In this study higher incidence of gliomas were noted compared to studies by J Ambrose and MR Gooding and Baker et al.[5,6]

The age group from 2 to 75 years, peak incidence of neoplasms was seen in fifth decade and the least incidence was seen in the first decade. Thus, the age range was variable. In this study a slightly male predominance was noted as 29 patients were males and 24 patients were females. Headache was the most common presenting complaint. In our study, 60% of patients came with headache especially, which is persistent and not relieved by routine analgesics. Vomiting, giddiness, seizures, visual disturbances were the other common symptoms. In a study by Baker et al report headache, altered consciousness, personality change, cognitive disabilities, seizures, visual and gait disturbances as the common presenting complaints of the patients with brain tumour.[6]

Among the gliomas, astrocytic tumours are most common. On MRI, astrocytoma's were relatively well defined, hypo to iso intense on T1 and hyper intense on T2. These findings correlated with the findings reported in literature.[5] Anaplastic astrocytoma cases showed heterogeneous appearance on both T1 and T2 weighted images. The case was correlated with reported literature.[5]

In the present study, 5 cases of glioblastoma multiforme were studied which constituted 20% of gliomas. Heterogeneous appearance on both T1 and T2 was noted in all the case. In the present study, two cases of oligodendrogliomas were studied. They were heterogenous on both T1 and T2. The above findings correlated with literature.[5,7] In this study, there are two cases of ependymoma, which correlates with the reported literature.[8,9] The tumour was hypointense on T2 and hyperintense on T2, not enhancing on contrast with no evidence of calcification or haemorrhage. In this study, 4 cases of pituitary adenomas were evaluated by MRI, out of which three cases were macroadenomas (>10 mm) and one case of microadenoma (<10 mm). In this study, on MR, 75% of the adenomas were hypointense on T1 and isointense on T2W1. A study by Walter Kucharczyck et al reports hypointense signal intensity on T1 in 82% of cases.[10] In this study, on post-contrast studies 50% of the adenomas were non-enhancing, 25% showed early enhancement and the remaining 25% of cases did not enhance on early studies but enhanced on delayed scans.

In this study, 80% of meningioma cases were hypointense on T1 and 60% were hyperintense on T2W1 and 20% of cases are isointense on T1. Forty cases of meningiomas were studied by Allen D Elster et al, they report isointense signal intensity on T1 in 62% of cases.[11] A study by Marie V Spagnoli et al report that on T1 56% were isointense and 36% were hypointense, on T2WI 52% were isointense while 44% were hyperintense.[12] Contrast enhancement was demonstrated in all our cases. PNETs were found to be the second most common intra-axial tumours accounting for 20% intra-axial tumours and 13.8% of all the supratentorial tumours. 40% of the tumours were found in 2-5 years age group. In all the cases, the lesions were hyperdense on NECT. 80% cases showed intense heterogenous post contrast enhancement with ill-defined margins in 20% of cases. Cysts were evident in 66% of the cases and heterogenous enhancement was noted in all cases in the study by Dai et al (2003).[13]

In our study, a single case of DNET was evaluated, which was located at temporal lobe. J.G. Burneo et al studied 23 patients with intractable epilepsy, out of which DNETs were located in temporal region in 17 patients (74%), in the frontal lobe in 3 patients (13%), in the parieto-occipital region in 2 patients (7%) and in 1 patient the DNET overlapped frontal and temporal areas. No lesion demonstrated enhancement on MRI, and three has a cystic component. Our study also correlated with the literature. Five cases of intracranial metastasis are reported in our study. As most of the intracranial metastasis were detected by CT scan, MRI is less frequently requested for detecting metastasis. Two patients were known cases of lung carcinoma, who had multiple metastasis both in the supra and infratentorial regions with surrounding oedema and mass effect. A female patient of a known carcinoma breast has supratentorial metastases with significant oedema and mass effect. In the reported literature carcinoma lung was the first most common malignancy to metastasize to brain. In our patient, multiple metastasis was detected in T1 and T2 weighed images.

Out of 46 operated cases, 42 cases are histopathologically correlated and 4 case are not correlated out of which 2 cases are given as low-grade astrocytoma are turned up into high grade, one case which was given as high grade turned up into low grade and one case which was given as metastasis turned up into primary brain tumour.[14,15]

CONCLUSIONS

Multiplanar capability of MRI is helpful in identifying the precise anatomic location and the exact extent of the tumours. Post contrast images clearly define the size, margins, and nature of the tumour and also improves the differentiation between the tumour and surrounding edema.

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