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CT & MRI Evaluation of Brain Tumour & Tumour like Conditions

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Abstract: ***Imaging plays important role in evaluation of patients with brain tumor. CT scan, MRI and introduction of its newer imaging technique has significantly improved detection and characterization of brain neoplasms. Aim of our study was to evaluate the patients with brain tumor and characterization of tumor by studying its location, extent, involvement of key structure and complications. Our Study included 100 patients with brain tumor and tumor like conditions evaluated on CT scan and 1.5 tesla MRI machines. Results were observed and concluded. Introduction of newer techniques and advances in CT and MRI has improved the diagnostic accuracy of patients with brain tumor. CT scan can be used as screening modality, but MRI is the mainstay of diagnosis.***

Keywords: brain tumor, CT scan, MRI.

1. Introduction

The brain is the most complex part of the human body. Brain tumours are defined as a collection or mass of abnormal cells in the brain. The skull is very rigid and the brain is enclosed, so any growth inside such a restricted space can cause problems. Brain tumours can be malignant or benign. Localization of intracranial / extra cranial tumours and tumour like conditions depends primarily upon careful study of patient's symptoms with accurate and detailed neurological examination. CT and particularly MRI have been most spectacular advances in Radiology & have practically revolutionized the diagnosis of brain tumours and tumour like conditions. Benefits of MRI of brain includes non invasiveness, No ionizing radiation, Excellent soft tissue resolution, Multiplanner imaging etc. Benefits of CT scan includes low cost than MRI of Brain, Non invasive, Bone and calcified lesions are best evaluated, Less technical expertise required than MRI.

One-third of CNS tumors are metastatic lesions, one third is gliomas and one-third is of non-glial origin. Astrocytomas are most common glial tumor and meningiomas are most common non glial origin tumor. When we analyze any lesion for potential brain tumor, we need to look for the age of the patient, location of the tumor (intra-extra axial), number of the lesions (single/multiple), CT/MRI characteristics (fat, calcification, cyst, intensity) of the lesion, contrast enhancement, effect on the surrounding structures, etc. We also have to consider the possibility of a lesion that simulates a tumor - like an abscess, MS-plaque, vascular malformation, aneurysm or an infarct with luxury perfusion.(7)Brain tumors are the second most common type of childhood cancer after leukemia/lymphoma. Most common brain tumor in adult is metastasis. Diffusion weighted imaging and perfusion imaging plays important role in evaluating brain tumors. Perfusion imaging helps in determining the malignancy grade of a CNS tumor. Perfusion depends on the vascularity of a tumor. The amount of perfusion shows a better correlation with the grade of malignancy of a tumor than the amount of contrast enhancement.(2,6,7)

2. Aims and Objectives

- To evaluate patients with suspected brain tumour
- To confirm presence of brain tumour and tumour like conditions
- To study location, extent & involvement of key structure by brain tumour and tumour like conditions.
- To study radiological characteristics of different types of brain tumors.
- Assessment of presence & severity of secondary changes like edema, hemorrhage & herniation

3. Materials & Method

This study includes 100 cases of brain tumour and tumour like conditions suspected clinically & evaluated on the basis of radiological imaging modalities, mainly CT scan & MR imaging, during the study period of November 2013 to October 2015 at PDU government medical college & civil hospital, Rajkot, Gujarat. Patients were referred from various clinical departments of our institute. All the cases were first evaluated clinically and then referred to our radiology department for further diagnosis.

Method

- The detail of the procedure was explained to the patient.
- A written consent was obtained either from patient &/or his relatives.
- Whenever needed, Contrast study was done under anesthetic care after sensitivity testing.

CT scan - continuous scan with 5 mm slice thickness from base to vertex. Contrast study was done with Non-ionic

iodinated IV contrast after confirming normal renal function test & 4 hours of NBM.

MRI – serial slices in three plains. Gadolinium was given for contrast study.
In required cases CTscreening as well as advanced imaging like MR spectroscopy & MR perfusion studies were also done.

Inclusion criteria - Patients from all ages & both sexes were taken into consideration. All the cases of brain tumours and tumour like conditions were only included.

Exclusion criteria - Other than brain tumours & tumour like conditions i.e.: Infective conditions identified on contrast study, post operative or radiation induced gliosis, infarction, benign hemorrhage of brain- these cases are not to be included in the study.

4. Results & Analysis

100 cases of brain tumours & tumour like conditions were evaluated during the period of 2 years (November 2013 to October 2015). In most of the patients diagnosis were confirmed on follow up scans &/or histopathological reports.

According to our study, the most common CNS neoplasm is glioma (24 patients). Most common malignant neoplasm is metastasis (17 patients). Least common variants are lipoma, paraganglioma, subependymoma, medulloblastoma (reported only one case).Most common condition that mimic tumour is vascular malformation.

Maximum 24 cases were encountered between age of 41 to 50 years. Most commonly affected age group in our study is 5^{th} decade(41-50) . Incidence of neoplastic CNS lesions is seen increasing gradually up to 5^{th} decade & than it decreases gradually.

Out of 100 patients 60 patients were male and 40 patients were female. Males are more frequently affected than females.
Out of 100 patients 71 presented with supratentorial mass while 29 patients had infratentoreal mass. 61 tumors were extra-axial and 39 tumors were intra-axial. Most commonly affected site was parietal lobe, followed by cerebello-pontine angle and frontal lobe.

Heterogeneous enhancement pattern was seen in most of the cases (40%). This enhancement pattern is mainly due to mixed solid & cystic content. Homogenous enhancement was mainly seen in the cases of meningioma (19%).

From total diagnosed 24 patients of glioma, 11 patients had high grade glioma (GBM), 9 patients had astrocytoma, 2 patients had pilocytic astrocytoma and 2 had pleomorphic xanthoastrocytoma. GBM is the most common type of glioma.

Complication of neoplastic brain lesions include Mass effect, edema, midline shift, hydrocephalus, hemorrhage, distant spread/metastasis, recurrent lesions, etc. mass effect is most frequently encountered complication (68 patients), followed by edeme (63 patients), midline shift (40 patients) and hemorrhage (19 patients).
CT scan is used as initial screening investigation & MRI remains the mainstay of diagnosis.

Table 1: Classification of lesions

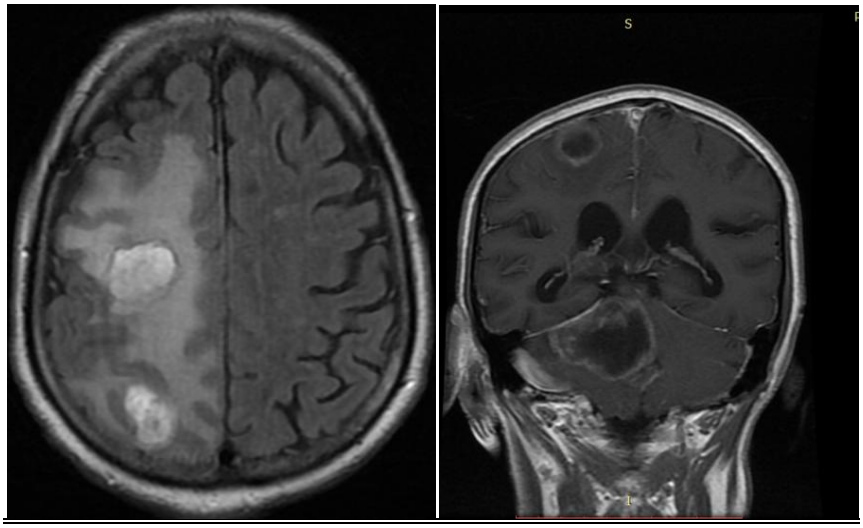
Radiological diagnosis	No. of cases (out of 100)	Percentage
Metastasis	17	17
Meningioma	19	19
Glioma	24	24
Oligodendroglioma	2	2
Pituitary macroadenoma	7	7
Schwannoma	6	6
DNET	2	2
Lipoma	1	1
Ependymoma	3	3
Epidermoid	2	2
Craniopharyngioma	3	3
Paraganglioma	1	1
Subependymoma	1	1
Medulloblastoma	1	1
Neoplastic – SOL (mixed features / without specific features of any)	6	6
Tumour like conditions	3	3

Table 2: According to complications

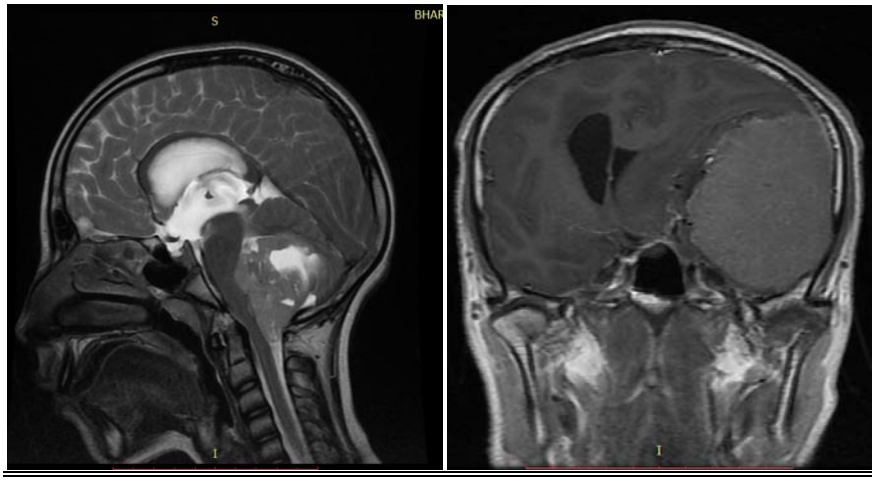
Complication	*No. of cases (out of 100)*	*Percentage*
Mass effect	68	68
Edema	63	63
Midline shift	40	40
Hydrocephalus	13	13
Hemorrhage	19	19
Distant spread / metastasis	14	14
Recurrent lesion	10	10

Table 3: According to diagnostic imaging modality

Imaging modality	*No. of cases (out of 100)*	*Percentage*
CT scan	15	15
MRI	78	78
CT scan & MRI	1	1
Non-diagnostic on imaging (pathological diagnosis advised)	6	6

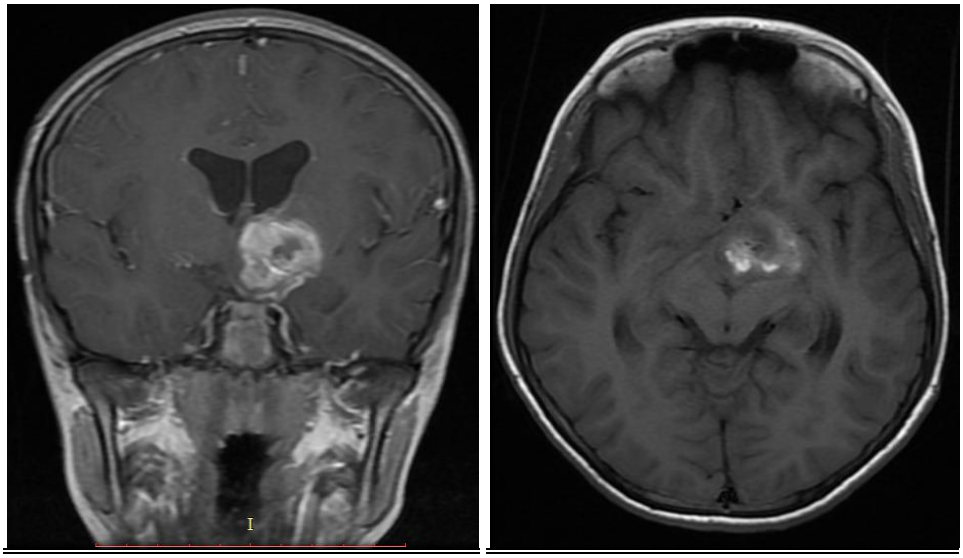


(a) (b)



(c) (d)

Figure 1: (a) and (b) Axial FLAIR and coronal post contrast T1 weighted images showing Multiple lesions with adjacent edema & peripheral enhancement in different patients with Metastasis. (c) Saggital T2 weighted image showing large mixed solid-cystic mass within fourth ventricle in patient with Ependymoma. (d) Coronal T1W post contrast image showing Extra axial lesion with intense post contrast enhancement in a patient with Meningioma.



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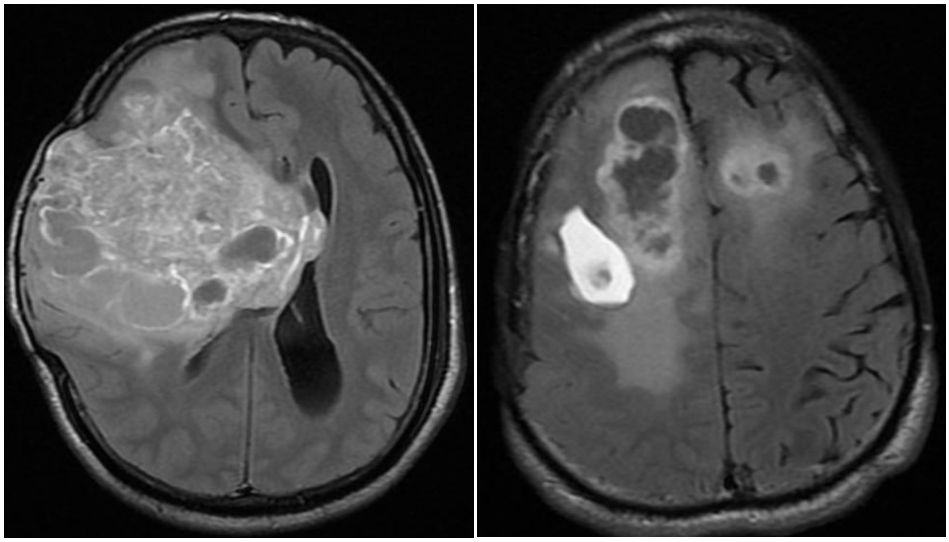

(c) (d)

Figure 2: (a) and (b) Coronal T1W post contrast and axial T1W images showing hyperintense Suprasellar mass with enhancement on post contrast study in a patient with Craniopharyngioma. (c) and (d) T2W FLAIR post contrast images showing large masses with intense heterogenous enhancement, midline shift & edema- High grade glioma

5. Discussion

We studied 100 cases; out of which glioma was the most common tumour followed by meningioma. Other brain tumours & tumour like condition were metastasis, oligodendroglioma, pituitary macroadenoma, schwannoma, DNET, lipoma, ependymoma, epidermoid, craniopharyngioma, paraganglioma, subependymoma, medulloblastoma, arterio-venous malformation & cavernoma formation. Most common malignant brain lesion was metastasis. Most common primary brain malignancy was high grade glioma. Primary brain neoplasm was seen in 75%. Out of which glioma was seen in 24 cases (32%). According to our study 10% of brain neoplasm seen in children. In children most common neoplasm was glioma. Other lesions were ependymoma, craniopharyngioma, vascular malformations. In our study males were involved more frequently (60% cases), as compare to females.

Children were having the same cases of supra & infratentorial lesions. While in adults supratentorial lesions were far more common. Supratentorial lesions were seen in 71% cases. Tumour like conditions was almost all in supratentorial location. In our study 61% patients were having extra axial lesions. Extra axial lesions were more common in infratentorial location. Consideration of lobar anatomy of brain, most common location was parietal lobe for single lesion. 13% of brain lesions were located at cerebello-pontine angle & all were extra axial at this location. Most common tumour at CP angle was schwannoma followed by meningioma. Most common intraventricular lesion was ependymoma. Tumours involving sellar & supra seller regions were pituitary macroadenoma in adults & craniopharyngioma in children.

Contrast studies were very useful for detection of tumours from tumour like conditions. Approximately 40% lesions show heterogeneous enhancement due to mixed internal solid & cystic contents as well as internal hemorrhagic content & calcification. Most common lesion showing homogenous enhancement was meningeoma. Peripheral enhancement was seen in 12% cases most common cause was cystic metastasis. Tumour like conditions- vascular malformation and low grade neoplasm did not show contrast enhancement. Most common cause of hemorrhagic brain tumour was high grade glioma. Internal calcification was seen in also 19% cases. Which was better evaluated on CT scan as hyperdense areas & hypointense on all sequences with GRE blooming foci. Most common lesion with internal calcification was meningioma. Associated complications were better evaluated on MRI. Multiple lesions were seen in 26 cases. Most common cause was metastasis. Vascular malformations- cavernomas were seen in some cases. In one case multiple schwannomas & meningiomas were noted (NF2).

MRI has better diagnostic accuracy than CT scan. In our study 78 cases were diagnosed by MRI & 13 cases were diagnosed by CT. In one case both studies were done, so overall CT scan is good for initial screening & MRI is accurate diagnostic imaging modality. Advances like spectroscopy done in 5 cases & perfusion images in 10 cases. All cases showed choline peak on MR spectroscopy due to high cellularity of tumour. Almost all cases show increased perfusion while one lesion showed hypoperfusion & absent perfusion was seen in one case. These sequences were very useful for grading of glioma, differentiating primary from secondary, exact extent, margins of lesion, metabolic activity & angiogenesis, differentiating tumours from tumour like conditions.

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