Research Article

Role of computed tomography scan in supratentorial mass lesions

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Received: December 05, 2016; **Accepted:** December 21, 2016

ABSTRACT

Background: The incidence of tumor, in recent years, increased due to increased longevity and better diagnostic methods. The occurrence of intracranial space occupying lesion (SOL) is relatively higher in younger age group among all tumors. Suspicion and diagnosis of an intracranial SOL amounted to death warrant for lack of knowledge regarding nature and localization. **Objectives:** The objective of this study is to study imaging characteristics of brain supratentorial lesions and to compare the radiological findings with histopathology. Furthermore, the aim was to assess the sensitivity, specificity, and positive predictive value for definitive diagnosis of computed tomography (CT) scanning in intracranial SOL. **Materials and Methods:** Patients who presented with symptoms of raised intracranial tension (ICT) of subacute onset and had lateralizing sign were investigated by imaging to determine the relative frequency of various mass lesions. The management outcome and follow-up findings were also recorded in the case record form. The imaging findings were correlated with histopathological diagnosis and also with surgical findings. The results were analyzed and studied. **Results:** Totally 100 patients with suspected or already diagnosed cases of intracranial SOL were studied by cross-sectional imaging. Children below 20 years of age constituted 40% of cases. Lesions were equally distributed in male and female, i.e., 53% were male and 47% were female. The density of mass lesions shows that 30% lesions were hypodense, 19% were isodense, 16% were hyperdense, and 35% were mixed type of lesions. In that, 32% of the lesions had inhomogeneous enhancement while 28% had homogeneous enhancement. Rim was well defined in 12% of cases and ill-defined in 15% cases. While 13% cases did not show any type of differential findings. Common intracranial masses in children below 20 years of age were glioma (11) and abscess (9). While in adults along with glioma (20) other common masses are metastasis (10) and local spread (6). **Conclusion:** In clinically suspected cases of intracranial SOLs, CT scanning have good sensitivity (100%) for picking up the lesions and mass effect. It is also exquisitely sensitive and shows localization and extent of disease process, and calcification very well. However, lack of multiplanar imaging and lack of precise tissue characterization limits its specificity of CT scanning in this study to 87%.

KEY WORDS: Supratentorial Mass Lesions; Intracranial Space Occupying Lesions; Computed Tomography

INTRODUCTION

The term "supratentorial mass lesion" is conveniently applied to the localization of intracranial lesion lying above the tentorium cerebelli whether of neoplastic, vascular or chronic/acute inflammatory origin, which by virtue of occupying space within the skull tends to raise intracranial tension (ICT). The brain is fruitful soil for tumor growth. Moreover, it is concealed in a bony cage for protection. As it has a capacity to accommodate a fixed amount of tissue, anything extra within, it will produce symptoms of raised ICT.[1]

Access this article online	
Website: http://www.ijmsph.com	**Quick** Response code
DOI: 10.5455/ijmsph.2017.1268621122016	

The incidence of tumor, in recent years, increased due to increased longevity and better diagnostic methods. The occurrence of intracranial space occupying lesion (SOL) is

relatively higher in younger age group among all tumors. As compared to pediatric age group where the majority of mass lesions occur in the posterior fossa; most of adult SOL occurs in supratentorial compartment of the brain.[2]

In former days, suspicion and diagnosis of an intracranial SOL amounted to death warrant for lack of knowledge regarding nature and localization. However, the days of invasive diagnostic procedures such as pneumoencephalography, myodil ventriculography, echoencephalography, radionuclide scanning, and contrast angiography are now over and with the introduction of computed tomography (CT) and magnetic resonance imaging (MRI) scanning, imaging of brain SOLs has acquired new dimension whereby excellent anatomical detail in axial, sagittal, and coronal planes as well as tumor tissue characterization has become possible. The advantage of MR angiography and CT angiography has helped create a virtual 3-dimensional vascular map of tumor blood supply noninvasively.[3,4]

MR spectroscopy, positron emission tomography scan, single photon emission CT, heralds phenomenal scope in future for functional brain imaging. All these modalities have helped in the early diagnosis and localization of the SOL and in complement to advanced neurosurgical techniques, have brightened the prognosis of mass lesions.

The aim of the study was to study imaging characteristics of brain SOL and to compare the radiological findings with histopathology. Furthermore, the aim was to assess the sensitivity, specificity, and positive predictive value for the definitive diagnosis of CT scanning in intracranial SOL.

MATERIALS AND METHODS

A prospective study carried out over a period of two and half year at Government Medical College, Surat, Gujarat. Permission from Institutional Ethics Committee was taken before starting the study.

Totally, 100 patients recruited in the study. Patients who presented with symptoms of raised ICT of subacute onset and had lateralizing sign were investigated by imaging to determine the relative frequency of various mass lesions. Furthermore, patients acutely ill with raised ICT and fever who were suspected of having intracranial abscess was studied. The patients with nasopharyngeal carcinoma and neoplasms near the brain which were suspected to invade the brain were studied. Patients with symptoms or signs pertaining to the posterior fossa lesions were excluded from the study.

CT scan was done in all 100 participants. The CT scans were taken in an axial plane with a 15° angulation of the gantry to the canthomeatal line. Slices were taken without overlapping cuts. Coronal sections were taken in cases in which it was difficult to determine the anatomical location and lesion extent on axial planes alone. The CT scan was perform by Tomoscan EG, a third generation rotate-rotate type of whole body CT scanner from Philips Medical System. Plain and contrast study were performed in all patients. A volume of 20 ml of urografin 76% was given intravenously for contrast enhancement. MRI scan could be done in only in some patients because of cost restraints.

The imaging characteristics were recorded in all patients. The management outcome and follow-up findings were also recorded in the case record form. The imaging findings were correlated with histopathological diagnosis and also with surgical findings. The results were analyzed and studied.

RESULTS

Totally, 100 patients either having suspected or already diagnosed cases of intracranial SOL were studied by cross-sectional imaging. The age incidences of lesions are given in Table 1. Children below 20 years of age constituted 40% of cases. Lesions were nearly equally distributed in male and female, i.e., 53% were male and 47% were female. The most common presenting symptom was a headache, found in 87%. Other common symptoms were vomiting (50%), convulsion (44%), limb weakness (34%), cranial nerve involvement (30%), visual disturbance (29%), and giddiness (26%), behavioral changes (13%), and others. The papilledema was the most common presenting sign with frequency was 61% with others are altered reflexes (39%) and dysphasia (13%) (Table 2).

Radiological examination was done in all patients. The CT scan finding shows that 50% cases had intraaxial lesions and 40% had extraaxial lesions, while 10% had both (Figure 1). Table 3 shows the location of mass lesion with respect to lobes of the brain. According to that frontal and temporal lobes are common sites for the lesion. The density of mass lesions shows that 30% lesions were hypodense, 19% were isodense, 16% were hyperdense, and 35% were

Table 1: Age-wise distribution of all participants

Age (years)	Number of cases (%)
0-5	6 (6)
6-10	14 (14)
11-15	8 (8)
16-20	12 (12)
21-30	11 (11)
31-40	16 (16)
41-50	9 (9)
51-60	12 (12)
61-70	11 (11)
71-80	1 (1)
Total	100 (100)

Table 2: Incidence of sign and symptoms

Clinical features	Number of cases (%)
Symptoms	
Headache	87 (87)
Vomiting	50 (50)
Convulsion	44 (44)
Limb weakness	34 (34)
Cranial nerve involvement	30 (30)
Visual disturbance	29 (29)
Giddiness	26 (26)
Behavioral changes	13 (13)
Difficulty in walking	12 (12)
Loss of sphincter control	8 (8)
Tingling/numbness	3 (3)
Nystagmus	2 (2)
Signs	
Papilledema	61 (61)
Altered reflexes	39 (39)
Dysphasia	13 (13)

Table 3: Location of mass with respect to the lobes of brain

Location of mass	Number of cases (%)
Frontal	21 (21)
Temporal	15 (15)
Sellar, suprasellar	17 (17)
Ventricular	13 (13)
Frontotemporal	11 (11)
Temporoparietal	11 (11)
Frontoparietal	6 (6)
Parietal	3 (3)
Parietooccipital	1 (1)
Posterior parietal	1 (1)
Pineal	2 (2)
Multiple sites	9 (9)
Total	100 (100)

mixed type of lesions. Calcification was found in 29% of lesions (Figure 2). Postcontrast study was done in all patients. In that, 32% of the lesions had inhomogeneous enhancement while 28% had homogeneous enhancement. Rim was well define in 12% of cases and ill-defined in 15% cases. While 13% cases did not show any type of differential findings. Various perilesional effects are seen in Figure 3.

Table 4 shows the radiological diagnosis of all patients. Common intracranial masses in children below 20 years of age were glioma (11) (Figure 4) and abscess (9). While in adults along with glioma (20) other common masses are metastasis (10) and local spread (6).

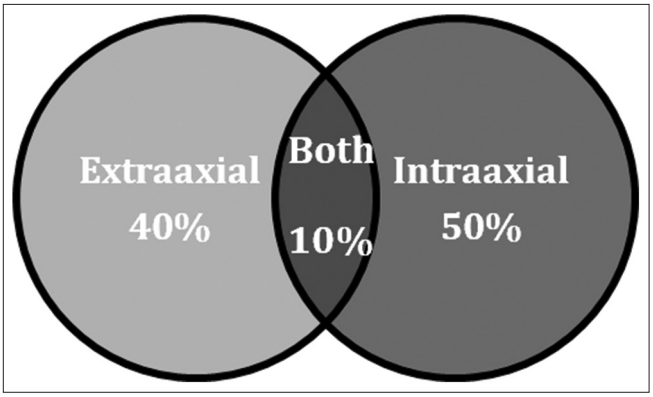

Figure 1: Localization of mass lesions

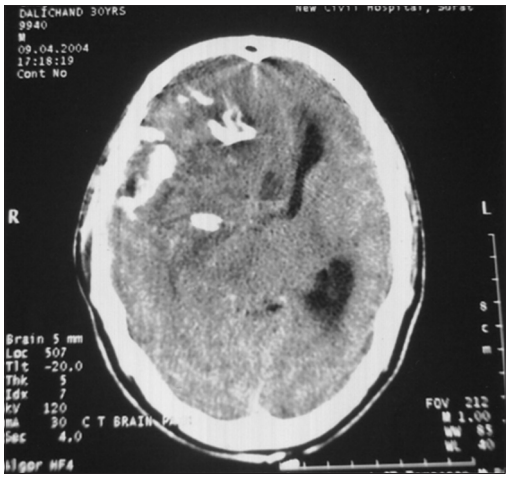

Figure 2: Computed tomography shows solid mass with calcification

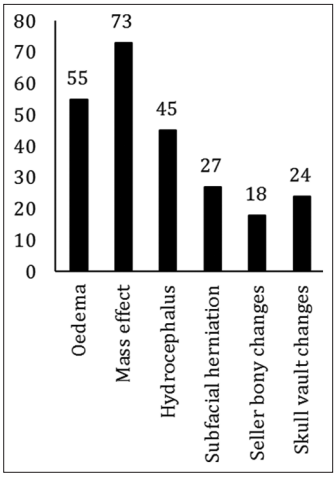

Figure 3: Perilesional status of intracranial mass

Of 100 patients, 62 were operated and the diagnosis was confirmed by histopathological examination. Comparison of radiological diagnosis with histopathological diagnosis was done in those cases. It was found that 54 out of 62 patients had true positive diagnosis by radiological examination. Hence, positive predictive value for the radiological diagnosis for this study was 87%.

Table 4: Incidence of various types of mass in adults and pediatric patients

Lesions	Adult (≥20 years)	Pediatric (0-20 years)
Meningioma	11	0
Metastasis	10	2
Abscess	2	9
GBM	8	0
Oligodendroglioma	5	2
Low-grade astrocytoma	2	3
High-grade astrocytoma	4	0
Ependymoma	1	2
Pituitary adenoma	4	2
Local spread	6	0
Epidermoid cyst	4	2
Lymphoma	1	0
Colloid cyst	1	0
Osteosarcoma	1	0
Pilocytic astrocytoma	0	2
CPP	0	2
Craniopharyngioma	0	4
Germinoma	0	2
Pineal region tumor	0	2
Arachnoid cyst	0	2
PNET	0	1
Ganglioglioma	0	1
Hydatid cyst	0	1
Tuberous sclerosis	0	1
Total	60	40

GBM: Glioblastoma multiforme, CPP: Choroid plexus papilloma, PNET: Primitive neuroectodermal tumors

DISCUSSION

In the present study, 100 patients of either clinically suspected or already diagnosed cases of intracranial SOLs were studied radiologically. Among them, 62 patients were undergone surgery and subsequent histopathological examination.

Age incidence shows that 40% patients were below 20 years of age. Moreover, among children, 6-10 years of age was common age group with the youngest patient was 22 days old. Comparison with other studies like Kriks[5] and Osborn[6] shows that the age of diagnosis of intracranial SOL is decrease. It might be because of easy availability of CT scan, and so lesions can be easily picked early in the life. The male:female ratio in the present study was 1.13:1 with slightly male predominance. The findings in the study by Tadmor et al. and Bagchi et al. also shows male predominance, but

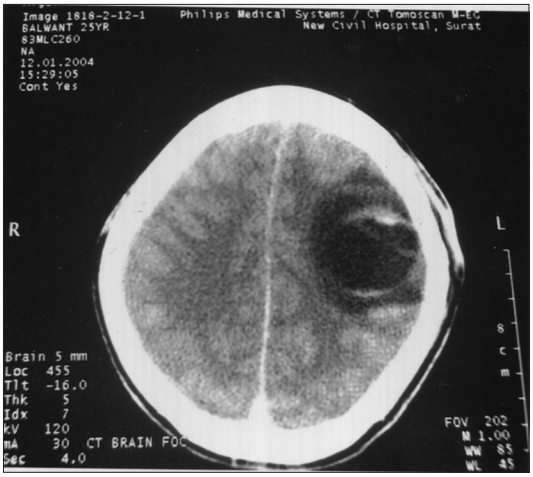

Figure 4: Hypodense lesion with rim enhancement in cystic glioma

the incidence of male involvement is a slightly higher side in those studies.[7]

The common presenting complaints are a headache and vomiting which is the result of raised ICT. Other complaint like weakness in the extremities was due to hemispheric mass. Moreover, a visual disturbance was due to the affection of optic pathway or due to chronic raised ICT.[8] Giddiness and level of consciousness correlates well with the lateral displacement of the brain in patients with acute hemispheric mass.[9] Papilledema, a non-inflammatory swelling of optic disc, is one of the common finding of raised ICT. It was found in 61% of cases. While in Yashodhara and Reddy study, it was present in 52.4% of participants.[10]

The frontal and temporal lobes were commonly involved in the present study. While study done by neurological institute of New York shows the most common lobe was frontal followed by parietal. 29% of SOLs showed intratumoral calcification. However, MRI is a poor predictor of calcification.[11] As one case which shows no calcification in MRI shows calcification in CT scan.

In clinically suspected cases of intracranial SOL, CT scanning is good for picking up the lesions and mass effect. It is exquisitely sensitive and shows localization and extent of disease process very well. However, lack of multiplanar imaging and lack of precise tissue characterization limits the specificity of CT scanning in the present study to 87%. However, MRI is helpful by virtue of its excellent tissue characterization and multiplanar imaging. Hence, CT and MRI should be used as complementary imaging modality rather than as a substitute to each other.

The glioma was the most common type of lesion in the present study. Other common lesions were metastases and abscess. In addition, the frequency lesions resemble the study done at CMC Vellore.[12] However, in pediatric age group frequency of abscesses was also more after glioma. It

is because in developing countries like India, poor hygiene and prevalence of tuberculosis, abscesses are common in childhood. Among glioma, glioblastoma multiforme, oligodendroglioma, and benign astrocytoma were commonly seen in the present study. However, a study by Osborn along with glioblastoma multiforme, other common lesions were anaplastic astrocytoma and other malignant tumors. The discrepancy between the two data might be because of small sample size and only supratentorial study. The metastases to the brain were seen in 12% of cases. Moreover, the hypodense lesions were usually from carcinoma lungs, carcinoma breast, lymphoma while hyperdense lesions were secondaries from melanoma and choriocarcinoma.[13,14] Out of 11 cases of meningioma 6 were in cerebral convexities, 2 in sphenoidal ridge, 2 were falcine, and 1 parasagittal. All cases of meningioma showed mass effect and white matter buckling compared to 74% in other study.[15]

In clinically suspected cases of intracranial SOLs, CT scanning have good sensitivity (100%) for picking up the lesions and mass effect. It is also exquisitely sensitive and shows localization and extent of disease process, and calcification very well. However, lack of multiplanar imaging and lack of precise tissue characterization limits its specificity of CT scanning in this study to 87%.

CONCLUSION

In clinically suspected cases of intracranial SOLs, CT scanning have good sensitivity (100%) for picking up the lesions and mass effect. It is also exquisitely sensitive and shows localization and extent of disease process, and calcification very well. However, lack of multiplanar imaging and lack of precise tissue characterization limits its specificity of CT scanning in this study to 87%.

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How to cite this article: Patidar N, Shah N, Sastri M, Desai E, Patel D, Chitara MH, et al. Role of computed tomography scan in supratentorial mass lesions. Int J Med Sci Public Health 2017;6(5):888-892.

Source of Support: Nil, **Conflict of Interest:** None declared.