ORIGINAL RESEARCH ARTICLE

Clinical Pathological Profile of Supratentorial Neoplasms as Diagnosed by Computerized Tomography (CT)

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ABSTRACT

Introduction: Brain neoplasms may be classified by location of Supratentorial, infratentorial and midline tumours. Of the supratentorial neoplasm, meningiomas are the most frequent extra-axial neoplasm. CT has become the most important diagnostic procedure in evaluating patients suspected of harbouring an intracranial tumour. It is still considered the basic radiologic study since it gives specific information for the management of brain tumours and is minimally invasive. The purpose of this study was to assess the distribution, features, localization, and extent of supratentorial neoplasm.

Material and Methods: Forty cases with symptoms of intracranial pathology and on CT found to have supratentorial tumours were studied during the period from Jan 2015 to Nov 2017

Results: The CT patterns of 40 supratentorial tumours were reviewed, out of which 25 cases i.e. 62% were found to be intra-axial and 15 i.e. 38% extra-axial tumours. High-grade gliomas formed the major group of the intra axial tumours i.e. 22.5% and meningiomas formed the major extra-axial Tumours forming 27.5% of all supratentorial tumours.

Conclusion: CT proves to be a valuable modality of imaging in evaluating the distribution, features, localizing and assessing the extent of various intra and extra-axial tumours in the supratentorial region.

Key words: Supratentorial Neoplasm's, Brain Neoplasms; Tomography, X-ray Computed, Glioma, Meningioma

INTRODUCTION

Intracranial metastasis from systemic cancers, gliomas especially glioblastomas and meningiomas are the most commonly occurring intracranial tumors.[1] Brain neoplasm may be classified by location of Supratentorial, infratentorial and midline tumors. Of the supratentorial neoplasm, meningiomas are the most frequent extra-axial neoplasm.[1]

The clinical presentations of brain tumors vary because the population affected is widely heterogeneous. Broadly they are classified as generalized or focal symptoms. The clinical presentation differs in the size, type, location, and pattern of growth of the tumor. Generalized symptoms are due to the mass effect of the tumor.[2] The symptoms can be headache (52%), memory loss, cognitive dysfunction (35%), seizures (32%), personality changes (23%) nausea and vomiting (12%).[3] Headache is the most common presenting symptom occurring in 46%-58% of the patients.[4]

The focal symptoms point in the direction of the lesion. They can be a motor deficit (33%), language deficit or aphasia (32%), visual deficit (22%), sensory deficit (13%), dizziness, problems in maintaining balance or ataxia(9%).[3] The histological subtype is important to determine as it varies with its clinical presentation, the rate of growth, malignant potential, prognosis, compression of critical structures.

Cranial CT has been proved to be exceptionally specific in detecting and localizing cerebral neoplasms and defining its margins.[5,6] More recently the classification of gliomas relies on molecular features and histology to come to an integrated diagnosis which can help predict the prognosis in a better way. Imaging for initial diagnosis and histology for confirmation is the mainstay of diagnosis.[6] The most common type is glioblastoma multiforme which has a poorer prognosis. Surgery currently remains the mainstay of treatment as most of these tumors rarely spread outside the central nervous system.[6] Postoperative surgery and radiotherapy also have a role to play.[6]

The decision to perform surgery depends on the location, extension, histopathological type and co-morbid conditions. Hence it becomes essential for accurate imaging and classification of the tumors. Majority of all brain tumors occur in the supratentorial compartment. Hence initial recognition of these tumors, their exact nature – whether neoplastic or non – neoplastic or metastatic, position – intra axial and extra-axial are essential in defining the disease and accurate managing of the condition.[7]

With advances in imaging, it is possible to accurately determine tumour location and biological activity. Imaging hence plays a role in the initial workup, determine treatment effects, differentiate recurrence of tumor from the effects of radiation, and tumor progression.[6] In Supratentorial tumors, the prognostic factors in relation to computed tomography findings are not well documented.[8] With this background, this present study was planned to study the distribution of supratentorial neoplasms, the CT features associated and to localize and assess the extent of the same.

MATERIAL AND METHODS

The current study was a prospective observational study, conducted in the Department of Radiodiagnosis, Karpagam faculty of medical sciences and research, between Jan 2015 to Nov 2017.

The study population included patients, who were referred to Department of Radiodiagnosis after suspected to have brain tumors by clinicians. All the suspected patients with brain tumors, later confirmed as supratentorial tumors by Computerized Tomography (CT scan) were included in the study.

All cases with supratentorial pathology and symptomatology due to infections, congenital malformations, trauma or cerebrovascular accidents etiology were excluded.

The study was approved by the institutional human ethics committee. Informed written consent was taken from all the participants, after thoroughly explaining the risks and benefits involved in the study.

All the patients were evaluated by thorough clinical history and clinical examination, followed by CT examination. The type and location of the tumor were noted. All the cases were studied on a PHILIPS Mx 8000 Dual Computed Tomography system which is a modified Third generation machine. Factors of 130Kv and 70MA were a constant for all cases.

Routing axial scans were performed in all cases, taking the orbitomeatal line as the baseline, 5mm slice thickness with 500 table increment for the posterior fossa and 10mm slice thickness with 10mm table increment for the supratentorial region were employed routinely, with a scan time of 3 seconds per slice. Thin contiguous slices of 2 mm or 3 mm were done wherever necessary.

Multiple coronal and sagittal reformatted images were frequently used to further analyze the lesions detected on axial scans. Direct prone coronal sections at 90° orbito-meatal line were obtained in cases where axial and reformatted images could not be conclusive in localization and extent of the tumour.For contrast enhancement, a bolus injection of Diatrizoate meglumine and Diatrizoate sodium(Trazograf 76% or Urografin76%) in a dose of 300mg of iodine/kg body was used and given just before the contrast-enhanced CT was to be performed.

The magnification mode was commonly employed, and the scans were reviewed a direct display console at multiple window levels and width to examine the wide variety of tissue density in the forebrain and also to look for osseous involvement.The pre and post contrast attenuation values, the size, location of the lesions were reviewed by a panel of radiologists.

STATISTICAL ANALYSIS

No statistical test was done to the Descriptive analysis: Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency, and proportion for categorical variables. Data was also represented using appropriate diagrams like bar diagram, pie diagram, and box plots. IBM SPSS version 22 was used for statistical analysis.[9]

RESULTS

A total of 40 subjects were included in the analysis. The mean age of study population was 46.33 ± 21.89 with the range between 4 to 85 years.

Among the study population, 6 (15%) participants were aged less than 20 years, 10 (25%) were aged 21 to 40 years, 12 (302%) were aged 41 to 60 years and 12 (30%) were 61 and above years. Among the study population male participants were 23 (57.50%) remaining 17 (42.50%) were female participants. Among the study population, the most common clinical presentation was a head ache seen in 25(72.5%) patients. The number of people with convulsions, hemiplegia, ataxia, blurring of vision and tinnitus/vertigo was 22(56.4%), 10(25.6%), 6(16.7%), 7(17.5%) and 5(13.2%) respectively. The majority of clinical diagnosis, 11 (27.5%) people had a head ache, 6 (15%) people had a seizure, 5 (12.5%) people had a cerebrovascular accident, 4 (10%) people had papilledema, 5(12.5%) people were diagnosed with ICSOL. (table 1)

Among the study population, the most common site of tumor was parietal in 10(25%) subjects. The proportion of tumors located in frontal, lateral ventricle, occipital, seller, ventricle, pineal region, suprasellar, multiple, sphenoid wing and temporal was,8 (20%), 6(15%), 4(10%), 3(7.5%), 2(5%), 2(5%), 2(5%), 1(2.5%), 1(2.5%) and 1(2.5%) respectively. Among the study population, 24(60%) people had isodense. The number of hypodense, hyperdense, heterodense, perilesional oedema, calcification, multiplicity, bone erosion, and necrosis were 11(27.5%), 8(20%), 7(17.5%), 5(12.5%), 6(15%), 3(7.5%), 2(5%) and 12(30%) respectively. Among the study population, 2(5%) people had bone erosion. Among the study population, 12(30%) people had necrosis. Among the study population,

Age group	Frequency	Percentage
Less than 20	6	15%
21 to 40	10	25%
41 to 60	12	30%
61 and above	12	30%
Gender		
Male	23	57.50%
Female	17	42.50%
Presenting features		
Headache	25	72.5%
convulsions	22	56.4%
Hemiplegia/ Hemiparesis	10	25.6%
Ataxia	6	16.7%
Blurring of vision	7	17.5%
Tinnitus/vertigo	5	13.2%
Clinical diagnosis		
headache	11	27.5%
Seizure	6	15%
Cerebrovascular accident (CVA)	5	12.5%
Papilledema (raised ICT)	4	10%
Intracranial space occupying lesions (ICSOL)	5	12.5%
Other miscellaneous	11	27.5%

Table-1: Descriptive analysis of demographic parameter in the study population (N=40)

CT examination	Frequency	Percentage
Site		
Parietal	10	25%
Frontal	8	20.%
Lateral ventricle	6	15%
Occipital	4	10%
Sellar	3	7.5%
Ventricle	2	5%
Pineal region	2	5%
Suprasellar	2	5%
Multiple	1	2.5%
sphenoid wing	1	2.5%
Temporal	1	2.5%
Density		
Isodense	11	27.5%
Hypodense	8	20%
Hyperdense	7	17.5%
Hetero dense	5	12.5%
Calcification	6	15%
Multiplicity	3	7.5%
Bone erosion	2	5%
Necrosis	12	30%
Contrast enhancement (N=30)		
Slight	4	10%
Moderate	12	30%
Intense	14	35%
Not done	10	25%
Pattern		
No pattern	5	12.5%
Heterogeneously	26	65%
Homogenously	9	22.5%
Hydrocephalus		
present	7	17.5%
absent	33	82.5%

Table-2: Descriptive analysis of the site in the study population (N=40)

Supratentorial tumors	Frequency	Percentages
Intraaxial	25	62.5%
Extra-axial	15	37.5%

Table-3: Descriptive analysis of supratentorial tumours in the study population (N=40)

Intraaxial tumours	Frequency	Percentages
Intraaxial		
Astrocytomas	13	52%
Other intra axial tumors	9	36%
Choroid plexus	2	8%
Oligodendroglioma	1	4%
Extra-axial		
Meningioma	11	73.3%
Pituitary adenoma	2	13.3%
Craniopharyngioma	2	13.3%

Table-4: Descriptive analysis of Intraaxial tumours in the study population (N=25)

Intra axial	Frequency	Percentages
High-grade glioma	9	36%
Low-grade gliomas	4	16%
Metastasis	3	12%
Central neurocytoma	2	8%
Colloid cyst	2	8%
Oligodendroglioma	1	4%
Choroid plexus papilloma	1	4%
Choroid plexus carcinoma	1	4%
Germinoma	1	4%
Pineal cyst	1	4%

Table-5: Descriptive analysis of Intra axial tumors in study population (N=25)

CT diagnosis	Frequency	Percentages
Falx meningioma	4	26.66%
Convexity meningioma	2	13.33%
Craniopharyngioma	2	13.33%
Pituitary macroadenoma	2	13.33%
Sphenoid meningioma	1	6.67%
Central neurocytoma	1	6.67%
Pineal meningioma	1	6.67%
Intraventricular meningioma	1	6.67%
Pituitary microadenoma	1	6.67%

Table-6: Descriptive analysis of extra-axial tumours in the study population (N=15)

4(10%) people had slight contrast enhancement. The number of moderate and intense was 12(30%) and 14(35%) respectively. Among the study population, 5(12.5%) people had no pattern. The number of HET expansion, HOM expansion, and the sharp margin was 26(65%) and 9(22.5%) respectively. Among the study population, 7(17.5%) people had present and 20(50%) had absent

Among the study population, 25(62.5%) people had intra axial tumors and 15(37.5%) had extra-axial tumors. (Table 3) Among the study population, 13(52%)people had astrocytomas. The number of other intra tumors, choroid plexus, and oligodendroglioma was 9(36%), 2(8%) and 1(4%), respectively. Among the study population, 11(73.3%) people had meningioma. The number of pituitary adenoma and Craniopharyngioma was 2(13.3%) and 2(13.3%) respectively (Table 4).

Among the intra axial tumors, 9 (36%)people had high-grade glioma. The number low grade gliomas, metastasis, central neurocytoma, colloid cyst,Oligodendroglioma, choroid plexus papilloma, choroid plexus carcinoma, germinoma and pineal cyst was 4(16%), 3(12%), 2(8%), 2(8%), 1(4%), 1(4%), 1(4%), 1(4%) and 1(4%) respectively (Table 5).

Among extra-axial tumors, 4 (26.66%) had falx meningioma. The number of subjects with convexity meningioma, Craniopharyngioma, and pituitary macroadenoma, were 2 (13.33%) each. One subject each had a sphenoid meningioma, central neurocytoma, pineal meningioma, intraventricular meningioma and pituitary microadenoma was 1(6.67%), 1(6.67%), 1(6.67%), 1(6.67%) and 1(6.67%) respectively. (Table 6)

DISCUSSION

A total of 40 subjects were included in the analysis. The mean age of study population was 46.33 ± 21.89 with the range between 4 to 85 years. A similar study done among 111 subjects showed the median age to 44 years.[10] Another study to assess the factors in supratentorial gangliogliomas showed a median age of 26 years.[11] The present study showed male participants were 23 (57.50%) remaining 17 (42.50%) were female participants.Similarly, a study among patients with supratentorial gangliogliomas showed a gender distribution of 57% males and 43% females.[11]

In the present study, majority of CT diagnosis, 9 (36%) people had HGG, 4 (16%) people had LGG, 4 (26.66%) people had falx meningiomas, 3 (12%) people had metastasis. 2(13.33%) people had convexity meningioma, pituitary macroadenoma and craniopharyngioma each. 2(8%) people had central neurocytoma and colloid cyst each. And 1(6.67%) each had pituitary micro and sphenoid meningioma. A study of 229 patients with malignant gliomas showed that glial tumors were the most frequently diagnosed (i.e., 46.3%), followed by meningiomas (21.9%), metastases (17.1%), and others miscellaneous (14.7%).

In this study, with regard to the clinical presentation 25(72.5%), people had a headache. The number of persons with convulsions, hemiplegia, ataxia, blurring of vision and tinnitus/vertigo was 22(56.4%), 10(25.6%), 6(16.7%), 7(17.5%) and 5(13.2%) respectively. This is in accordance with previous studies which shows that headache is the most common presenting symptom (46%-58%).[4] Headaches can be global or localized in nature. The intensity and rate of progress of a headache will give a clue to the type of lesion. The classic tumor headache is global radiating to the vertex, orbital region associated with nausea and vomiting.[4] A study by Comelli et al. showed that the clinical presentation distributed as follows focal signs (59.5%), mental status alteration (24.9%), headache (14.6%), seizures (14.1), trauma (7.8%), nausea/vomiting (4.4%). Most patients had more than one presenting symptom at the time.[12]

Another study to determine clinical presentation in intracranial tumors showed headaches were present in 48% and the distribution of types was similar to tension-type in 77%, migraine-type in 9%, and other types in 14%.[10]

The second most common presentation was seizures in around 56.4% in the study. A study by Cordelia Luyken et al., showed that seizures were the major preoperative symptom in 97% patients.[11]

The pattern of seizures may provide insight into the location of tumors. Primary brain tumors are more likely to present with seizures as compared to metastasis. low-grade gliomas are more commonly associated with seizures (85%).[4] Seizures are due to secondary irritation of the cortex by the tumor itself or due to surrounding edema. Larger lesions affecting the majority of the brain lead to generalized tonic-clonic seizures. The frequency, intensity, and severity of seizures due to brain neoplasms increase if left untreated unlike in other epileptic patients.[4]

In the present study it was found that among the study population, 13(52%)people had astrocytomas. The number of Oligodendroglioma, choroid plexus and other intra tumors was 1(4%),2(8%)and 9(36%) respectively. Among the study population, 11(73.3%) people had meningioma. The number of pituitary adenoma and craniopharyngioma was 2(13.3%) and 2(13.3%) respectively.In a study by Comelli et al., glial tumors were the most frequently diagnosed (i.e., 46.3%), followed by meningiomas (21.9%), metastases (17.1%), and other miscellaneous (14.7%).[12]

In the present study, 10(25%) people had parietal. The number of base bone falx, frontal, lateral ventricle, occipital, sellar, ventricle, pineal region, suprasellar, multiple, sphenoid wing and temporal was 10(25%), 8(20%), 6(15%), 4(10%), 3(7.5%), 2(5%), 2(5%), 2(5%), 1(2.5%), 1(2.5%) and 1(2.5%) respectively. Previous studies show that the most common site for gliomas is the temporal lobe. Other common sites are the cerebellum, brainstem and optic nerves.[13] A study Cordelia Luyken by et al, on supratentorial gangliogliomas, showed that tumor was temporal in 78% and frontal in 12%.[11]

Among the study population, 24(60%) people had isodense. The number of hypodense, hyperdense, heterodense, perilesional edema, calcification, bone erosion and necrosis was 11(27.5%), 8(20%), 7(17.5%), 5(12.5%), 6(15%), 3(7.5%) and 12(30%) respectively. Among the study population, 2(5%) people had bone erosion. Among the study population,12(30%) people had necrosis. Among the study population, 4(10%) people had slight. A study was done to describe the CT findings of supratentorial ependymomas showed that they were periventricular (nine), intraventricular (one), or both (one) and averaged 4 cm in diameter. Four of nine ependymomas examined by CT were calcified. Eight ependymomas had a cystic component.[14]

The present study showed 4(10%) people had slight contrast enhancement, the number of moderate and intense was 12(30%) and 14(35%) respectively. A study by Chamberlain MC et al., non - enhancing tumors were identified in 4% with glioblastoma multiforme, 30% with gemistocytic astrocytoma, 31% with highly anaplastic astrocytoma, and 54% with moderately anaplastic astrocytoma. The study shows that it is important to obtain histologic confirmation in supratentorial gliomas regardless of the presence or absence of contrast enhancement of the tumor on CT because neither of these characteristics correlates with the tumor histology.[15]

CONCLUSION

The study was done among 40 patients to study the distribution of supratentorial neoplasms, the CT features associated and to localize and assess the extent of the same. From the study, it is evident that the mean age was 46 years and the most commonly found histopathological subtype was meningiomas. In this study as in previous studies, the headache was the most common clinical presentation, 14% had intense contrast enhancement. This is in accordance with existing literature, more studies have to be undertaken to further correlate the extent and type of supratentorial tumors with prognostic indicators.

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