Original Research Article

Clinicoradiological profile of extra axial intracranial tumors

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Abstract

Background: Extra-axial tumors are the most common adult intracranial neoplasms. Meningiomas are the most common Extra-axial tumors. Their Clinical presentation, survival rates, and prognosis vary depending on the site and specific type of tumor, hence necessitating a detailed clinical and radiological evaluation.

Materials and methods: A prospective observational study on 15 symptomatic subjects who presented to a tertiary care hospital with Supratentorial intracranial tumors confirmed by CT was done. After getting a detailed history, clinical examination and CT (including contrast) were done.

Results: In the study population, 73% had meningioma. 13% had a Pituitary Adenoma. 13% had craniopharyngioma. A headache was the most commonly reported symptom (73%). Majority of meningiomas were located in convexity of the brain (36.4%) and parasagittal areas (36.4 %).

Conclusions: Neuroradiology plays a key role in the identification of supratentorial extra-axial tumors with CT allowing accurate anatomical description which can go a long way in management and defining prognosis.

Key words

Extra-axial tumors, Intracranial tumors, Supratentorial neoplasm, Meningioma, Headache.

Introduction

Tumors of the central nervous system (CNS) are relatively rare but serious health burden. Primary malignant tumors of the brain account for 2 % of all cancers[1] in the United States (U.S.). According to the SEER (Surveillance, Epidemiology, and End Results) cancer statistics review [1], Primary intracranial tumors arising from the meninges, neuroepithelial tissues, pituitary and related structures, cranial nerves, germ cells, blood-forming organs, or a distant

subclinical primary tumor are relatively rare occurring tumors in adults with an estimated incidence of 23,380 cases in 2014 in U.S. , but with higher number of deaths (14,320) .Intracranial neoplasms can be divided into extra-axial and intra axial tumors. Extra-axial tumors are the most common adult intracranial neoplasms [2]. Meningiomas are the most common extra-axial brain tumor [2-4] amounting to almost one-third of all intracranial neoplasms. They usually present as dural-based masses which are slow growing. The most frequently reported histology overall [5] in all primary brain and CNS tumors is meningioma (36.4%), followed by tumors of the pituitary (15.5%) and glioblastoma (15.1%). The most common of all malignant brain and CNS tumors is glioblastoma (46.1%) while it was meningioma (53.4%) in case of non-malignant tumors [5]. Although benign meningiomas are common, there may be difficulty in distinguishing it from malignant types or other dural based tumors. Neoplasms involving brain parenchyma may also present with extra-axial involvement such as gliomas. In subjects with large masses and parenchymal involvement with edema, localization can be very difficult. Neuroradiology plays a key role here with Computed tomography (CT) allowing accurate anatomic description of lesions [4]. The Clinical presentation of extra-axial neoplasms is very varied. The presenting symptoms and signs can be focal or generalized. Headache [6-8] is the most frequently reported symptom of intracranial neoplasms. The five-year survival rates and prognostic factors of intracranial neoplasms vary depending on the site and specific type of tumor [1]. Aggressive tumors require extensive surgery and may also require aggressive treatment including radiotherapy after the surgery [9-11]. Hence, it is essential to have a clear understanding of Extra-axial tumors and their radiological patterns to be able to diagnose them effectively and differentiate them. Available literature is also limited with regards to extra-axial tumors present intracranially. So we documented the clinical and radiological profile of extra-axial neoplasms with CT in a tertiary care teaching hospital

Objectives

- To document the clinical and radiological profile of extra-axial neoplasms with the help of computerized tomography in a tertiary care teaching hospital.

Materials and methods

The current study was a prospective observational study, conducted in the Department of Radiodiagnosis, Karpagam Faculty of Medical Sciences and Research, from January 2015 to September 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^{o} orbito-meatal line were obtained in cases where axial and reformatted images could not be conclusive in localization and extent of a tumour. For contrast enhancement, a bolus injection of Diatrizoate meglumine and Diatrizoate sodium (Trazograf 76% or Urografin 76%) 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. Data were analyzed by mean and standard deviation for quantitative variables, frequency, and proportion for categorical variables.

Results

Among the study population, 11 (73%) had meningioma. The pituitary adenoma and craniopharyngioma were 2 (13%) for each (**Table – 1**).

Table - 1: Descriptive analysis of extra axial tumors (N=15).

Tumors	No	Extra Axial
Meningioma	11	73%
Pituitary adenoma	2	13%
Craniopharyngioma	2	13%

Among the meningioma group, the majority of the proportion 72.72% had a headache and 27.27% had convulsions and hemiplegia. Among the pituitary tumor group, (150%) had a headache and convulsions for each. 2 (100%) had blindness. Among the Craniopharyngiomas group, 2 (100%) had a headache and blindness for each (**Table – 2**).

Among the meningioma group, the majority of the proportion, 45.45% were aged between 41 to 50 years. The proportion of 27.27% was more than 60 years. Among a pituitary tumour, 1 (50%) were less than 20 years and 21 to 40 years for each. Among the Craniopharyngiomas group, all of them 2 (100%) were less than 20 years. Among the meningioma group, 5 (45.45%) participants were male and 6 (54.54%) were female. Among the pituitary tumour group, 1 (50%) participants were male and 1 (50%) were female. Among the Craniopharyngiomas group, 1 (50%) participants were male and 1 (50%) were female (**Table – 3**).

Among the meningioma group, the majority of the proportion, 36.4% had Convexity site and parasagittal site for each. Among the pituitary tumour group, all of the 100% has a sellar site. Among the Craniopharyngiomas group, all of the 100% had a sellar and suprasellar site. Among the meningioma group, the majority of the proportion, 63.6% had intensely and homogeneously and 18.1% had moderately and homogenously. Among the pituitary tumour group, all of the 100% had intensely and homogenously. Among the Craniopharyngiomas group, all of the 100% had intensely and heterogeneously (**Table – 4**).

Discussion

Extra-axial brain tumors refer to lesions which are external to the brain parenchyma, as compared to lesions within the brain substance (intra-axial). Intracranial extra-axial pathologies arise from tissues other than brain parenchyma, such as meninges, dura, calvarium, ventricles, choroid plexus, pineal gland, or pituitary gland. We did a prospective observational study on 15 subjects with Supratentorial intracranial tumors confirmed by CT in a tertiary care hospital. Intracranial brain tumors can be classified as Supratentorial, infratentorial and midline tumors based on their location. The supratentorial region

is the area located above the tentorium cerebelli. The cerebrum is situated above it while cerebellum is below it. Our study population included 7 males and 8 females. The majority (33.33%) of our study population were in the age group of 41 to 50 years. After getting a detailed history, thorough clinical examination and Contrast-enhanced CT was done.

Table - 2: Presenting symptoms.

Symptoms	Meningioma(n=11)	Pituitary Tumor (n=2)	Craniopharyngiomas (n=2)
Headache	8(72.72%)	1(50%)	2(100%)
Convulsions	3(27.27%)	1(50%)	0(0%)
Deafness	0(0%)	0(0%)	0(0%)
Vertigo	1(9.09%)	0(0%)	1(50%)
Ataxia	2(18.18%)	0(0%)	0(0%)
Tinnitus	1(9.09%)	0(0%)	0(0%)
Hemiplegia	3(27.27%)	0(0%)	0(0%)
Blindness	1(9.09%)	2(100%)	2(100%)

Table - 3: Age and gender-wise distribution of extracranial tumours in the study population.

Parameter	Meningioma (n=11)	Pituitary Tumor (n=2)	Craniopharyngiomas (n=2)
Age group (Years)			
Less than 20	0 (0%)	1 (50%)	2(100%)
21-40	1 (9.09%)	1 (50%)	0 (0%)
41-50	5 (45.45%)	0 (0%)	0 (0%)
51-60	2 (18.18%)	0 (0%)	0 (0%)
>60	3 (27.27%)	0 (0%)	0 (0%)
Gender			
Male	5 (45.45%)	1 (50%)	1 (50%)
Female	6 (54.54%)	1 (50%)	1 (50%)

Table - 4: The site and pattern of enhancement of different types of tumours on CT examination.

	Meningioma (n=11)	Pituitary Tumor (n=2)	Craniopharyngiomas (n=2)
Site			
Convexity	4 (36.4%)	0(0%)	0(0%)
Parasagittal	4 (36.4%)	0(0%)	0(0%)
Sphenoid ridge	1 (9%)	0(0%)	0(0%)
Pineal	1 (9%)	0(0%)	0(0%)
Intraventricular	1 (9%)	0(0%)	0(0%)
Sellar	0(0%)	2 (100%)	0(0%)
Sellar and suprasellar	0(0%)	0(0%)	2 (100%)
Pattern of enhancement			
No enhancement	-		
Intensely and homogenously	7 (63.6%)	2 (100%)	0(0%)
Moderately and homogenously	2 (18.1%)	0(0%)	0(0%)
Intensely and heterogeneously	1 (9%)	0(0%)	2 (100%)
Moderately and heterogeneously	1 (9%)	0(0%)	0(0%)
Mild and heterogeneously	0(0%)	0(0%)	0(0%)

In our study 73% of our subjects had meningioma. The diagnosis was Pituitary adenoma and craniopharyngioma in the remaining subjects (13% each). Similar to our study, Meningiomas have been reported as the most common extra-axial intracranial tumor [2-4] by several authors amounting to almost one third of all intracranial neoplasms as reported by Rapalino O, et al. [2]. Similar to our study, the most frequently reported histology overall[5] in all primary brain and CNS tumors in CBTRUS Statistical Report of Primary Brain and Central Nervous System Tumors Diagnosed in the United States in 2008-2012 was meningioma (36.4%), followed by tumors of the pituitary (15.5%) and glioblastoma (15.1%). Drevelegas A [3] reported that meningiomas form the majority of extra-axial brain tumors and McFaline-Figueroa JR, et al. [12] also reported that the most prevalent brain tumors are intracranial metastases from systemic cancers, meningiomas, and gliomas, specifically, glioblastoma. The World Health Organization classifies primary brain tumors based on histopathologic criteria and immunohistochemical data and malignancy grading is done based on morphological features, growth patterns, and molecular profile [13, 14]. Nonmalignant tumors of the meninges (Meningiomas) and tumors of the pituitary gland account for nearly 50% of all primary brain tumors [5, 13]. The average annual age-adjusted incidence of meningioma was 7.61 per 100,000 in the U.S. [5]. In our study 54.54% of subjects in Meningioma group were females. Similar to our study, the incidence rate of tumors of meninges in literature was also reported to be higher in females (10.87 per 100,000 population) than in males (4.98 per 100,000 population) [5]. Meningiomas arising in the first two decades of life are uncommon and our study also reports the same with none identified in this age group similar to that observed by Germano IM, et al. [15]. The Clinical presentation of intracranial neoplasms is very varied. They may present with generalized or focal symptoms. Generalized symptoms, such as headache and seizures may occur due to the mass effect or increased intracranial pressure or due to erosion of the calvarium or involvement of extra-axial structures [16, 17]. But they are not useful for localization of the lesion. Focal symptoms, such as motor deficit, visual deficit, ataxia may be due to tissue destruction or compression of specialized regions [17]. Initially symptoms are often focal in low grade disease, progressing to generalized symptoms with increases in size and spreads. In our study, the most frequently reported symptom was Headache. Headache was the most frequently reported symptom seen in about 73% of subjects with meningioma (8 out of 11 subjects). Out of the 2 subjects in each group, both (100%) had headache in Craniopharyngioma group while only one (50%) had headache in Pituitary tumor group. Forsyth PA, et al. [18] in their study also reported Headaches as the major symptom in about 48% of their subjects. Similar to our study, the prevalence of headache was 71% in brain tumor patients, as reported by Suwanwela N, et al. [7]. Headaches can be either localized or global in nature with varied intensity depending on the lesion growth. Primary brain tumors often have less mass effect due to their infiltrative growth as compared with extra-axial tumors which have more mass effect due to their expansive growth. Lesions with a long history of slowly worsening symptoms over years tend to be more slow growing and benign whereas acute onset headaches with a rapid crescendo pattern are worrisome for a more ominous course [17,19]. The classic brain tumor headache is one of a global headache often radiating to the vertex or periorbital region which is associated with nausea and vomiting due to secondary CO_2 retention and subsequent vasodilation during sleep [6.7]. In our study, both subjects in Craniopharyngioma and Pituitary tumor group had visual deficits (100%). Among the meningioma group, the majority of the study population (72.72%) had headache while 27.27% respectively had convulsions and hemiplegia. Comelli I, et al. [20] in their study reported that seizures was present in 14.1% of the subjects, slightly lower than our study, but their study population included adult subjects with brain

tumors firstly diagnosed in the Emergency Department. But they reported Focal signs were most commonly observed in about 59.5% of subjects with headache present only in 14.6% of subjects. Grant R [21] in his review reported that headache was present in 23.5%, generalized seizures in 21.3%, unilateral weakness in 7.1%, unsteadiness in 6.1%, diplopia in 0.3% and other symptoms in 24.2% of subjects with Brain tumors.

Diagnosis of a suspected intracranial tumor is dependent on appropriate imaging and histopathology. The location of extra-axial brain tumors also affects treatment planning and predicts their prognosis. CT scans also play a major role in the follow up of these tumors [22, 23]. Often it is trivially easy to distinguish an intra-axial from an extra-axial mass. In many cases, especially when the mass is large and associated with parenchymal changes, such as oedema, localization can be more difficult. A number of features such as CSF cleft sign in subarachnoid space, erosion or invasion of bone can be useful in differential extra-axial lesions [24]. In our study, the location of the majority of meningiomas was convexity of the brain (36.4%) and parasagittal areas (36.4 %). One each was present in Sphenoid ridge, Pineal, Intra ventricular sites (9% each). Dural based meningiomas over the convexity of the brain can be asymptomatic and incidentally discovered. These are often slow growing and do not require resection unless symptomatic. CT is inferior to MRI in delineating soft tissue details of meningioma and surrounding brain, but superior in defining the extent of bony hyperostosis which is a key point in the consideration of basal and convexity meningiomas with hyperostosis [25]. In our study, all meningioma subjects (100%) had enhancement on CT contrast. With iodinated contrast, they usually enhance homogenously and intensely. On non-contrast CT imaging, meningiomas appear isodense to slightly hyperdense. In our study, there was an intense and homogenous enhancement in 63.6% of meningiomas while 18.1% had moderate and homogenous enhancement. Heterogeneous enhancement was seen in 18% of subjects with meningioma. Chamberlain MC, et al. [26] in their study observed that extra axial tumors were also non enhancing from 4% to 54% depending on the type of tumor. The “dural tail” seen with MRI is not well visualized with CT as it is thinly opposed to the underlying bone. Meningiomas can occur anywhere along the course of the intracranial arachnoid and dura but tend to cluster along sites where arachnoid granulations return cerebrospinal fluid to the venous system, that is, the convexity and basal venous sinuses. The three most common locations reported in literature [27-29] for intracranial meningiomas are all supratentorial: parasagittal, convexity and sphenoid wing, similar to our study. Germano, et al. [15] in their study also observed that 67% of meningiomas were supratentorial.

In our study, the various types of extra-axial tumors were differentiated based on CT findings. Neuroradiology played a key role in Computed tomography (CT) allowing accurate anatomic description which can go a long way in management and the prognosis.

Conclusion

Extra-axial brain tumors are the most common adult intracranial neoplasms. Diagnosis of a suspected intracranial tumor is dependent on appropriate imaging and histopathology. Their Clinical presentation, survival rates, and prognosis vary depending on the site, extent and type of tumor, identified by CT. In meningiomas, Complete surgical resection is often curative. Hence, accurate anatomic description and identification are essential. This study is a small descriptive study taken in the right direction which emphasizes the need for further large-scale studies to be undertaken to differentiate and correlate the various intracranial supratentorial tumors with their prognosis.

References

1. Howlader N, Noone A, Krapcho M, Garshell J, Miller D, Altekruse S, et al. SEER Cancer Statistics Review, 1975–

2013. National Cancer Institute Bethesda Journal, 2015. http://seer.cancer.gov/csr/1975_2013/
2. Rapalino O, Smirniotopoulos JG. Extra-axial brain tumors. Handb Clin Neurol., 2016; 135: 275-91.
3. Drevelegas A. Extra-axial brain tumors. Eur Radiol., 2005; 15(3): 453-67.
4. Papanagiotou P, Ketter R, Reith W. Extra-axial brain tumors. Radiologe., 2012; 52(12): 1129-46.
5. Ostrom QT, Gittleman H, Fulop J, Liu M, Blanda R, Kromer C, et al. CBTRUS Statistical Report: Primary Brain and Central Nervous System Tumors Diagnosed in the United States in 2008-2012. Neuro Oncol., 2015; 17 Suppl 4: iv1-iv62.
6. Adams C, Sullivan J, Vitaz TW. Clinical Presentation of Brain Tumors. In: Lichtor T, editor. Molecular Considerations and Evolving Surgical Management Issues in the Treatment of Patients with a Brain Tumor. Rijeka: InTech; 2015. p. Ch. 14.
7. Suwanwela N, Phanthumchinda K, Kaoropthum S. Headache in brain tumor: a cross-sectional study. Headache, 1994; 34(7): 435-8.
8. Chandana SR, Movva S, Arora M, Singh T. Primary brain tumors in adults. Am Fam Physician, 2008; 77(10): 1423-30.
9. Zheng YC, Jung SM, Lee ST, Chang CN, Wei KC, Hsu YH, et al. Adult supratentorial extra-pineal primitive neuro-ectodermal tumors. J Clin Neurosci., 2014; 21(5): 803-9.
10. Wang M, Zhang R, Liu X, Li D, Qiu C, Zhao P, et al. Supratentorial extraventricular ependymomas: A retrospective study focused on long-term outcomes and prognostic factors. Clin Neurol Neurosurg., 2018; 165: 1-6
11. Werner MH, Phuphanich S, Lyman GH. The increasing incidence of malignant gliomas and primary central nervous system lymphoma in the elderly. Cancer, 1995; 76(9): 1634-42.
12. McFaline-Figueroa JR, Lee EQ. Brain Tumors. Am J Med., 2018 Jan 31.
13. Louis DN, Perry A, Reifenberger G, von Deimling A, Figarella-Branger D, Cavenee WK, et al. The 2016 World Health Organization Classification of Tumors of the Central Nervous System: a summary. Acta Neuropathol., 2016; 131(6): 803-20.
14. Louis DN, Ohgaki H, Wiestler OD, Cavenee WK, Burger PC, Jouvet A, et al. The 2007 WHO classification of tumours of the central nervous system. Acta Neuropathol., 2007; 114(2): 97-109.
15. Germano IM, Edwards MS, Davis RL, Schiffer D. Intracranial meningiomas of the first two decades of life. J Neurosurg., 1994; 80(3): 447-53.
16. Buckner JC, Brown PD, O'Neill BP, Meyer FB, Wetmore CJ, Uhm JH. Central nervous system tumors. Mayo Clin Proc., 2007; 82(10): 1271-86.
17. Taylor LP. Mechanism of brain tumor headache. Headache, 2014; 54(4): 772-5.
18. Forsyth PA, Posner JB. Headaches in patients with brain tumors: a study of 111 patients. Neurology, 1993; 43(9): 1678-83.
19. Nelson S, Taylor LP. Headaches in brain tumor patients: primary or secondary? Headache, 2014; 54(4): 776-85.
20. Comelli I, Lippi G, Campana V, Servadei F, Cervellin G. Clinical presentation and epidemiology of brain tumors firstly diagnosed in adults in the Emergency Department: a 10-year, single center retrospective study. Annals of Translational Medicine, 2017; 5(13): 269.
21. Grant R. Overview: Brain tumour diagnosis and management/Royal College of Physicians guidelines. J Neurol Neurosurg Psychiatry, 2004; 75 Suppl 2: ii18-23.
22. Peet AC, Arvanitis TN, Leach MO, Waldman AD. Functional imaging in

adult and paediatric brain tumours. Nat Rev Clin Oncol., 2012; 9(12): 700-11.
23. Murovic J, Turowski K, Wilson CB, Hoshino T, Levin V. Computerized tomography in the prognosis of malignant cerebral gliomas. J Neurosurg., 1986; 65(6): 799-806.
24. Arbizu J, Dominguez PD, Diez-Valle R, Vigil C, Garcia-Eulate R, Zubieta JL, et al. Neuroimaging in brain tumors. Rev Esp Med Nucl., 2011; 30(1): 47-65.
25. O'Connor JP, Tofts PS, Miles KA, Parkes LM, Thompson G, Jackson A. Dynamic contrast-enhanced imaging techniques: CT and MRI. Br J Radiol., 2011; 84 Spec No 2: S112-20.
26. Chamberlain MC, Murovic JA, Levin VA. Absence of contrast enhancement on CT brain scans of patients with supratentorial malignant gliomas. Neurology, 1988; 38(9): 1371-4.
27. Marosi C, Hassler M, Roessler K, Reni M, Sant M, Mazza E, et al. Meningioma. Crit Rev Oncol Hematol., 2008; 67(2): 153-71.
28. Gelabert-Gonzalez M, Serramito-Garcia R. Intracranial meningiomas: I. Epidemiology, aetiology, pathogenesis and prognostic factors. Rev Neurol., 2011; 53(3): 165-72.
29. Menon G, Nair S, Sudhir J, Rao BR, Mathew A, Bahuleyan B. Childhood and adolescent meningiomas: a report of 38 cases and review of literature. Acta Neurochir (Wien)., 2009; 151(3): 239-44.