Original Article

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Pathology Section

Histopathological Spectrum of Neoplastic and Non Neoplastic Brain Lesions at a Tertiary Care Centre in South India- A Retrospective Observational Study

VIJAYA LAKSHMI MURAM REDDY[1], SUNANDA LAKSHMI GELLI VENKATA[2], DURGA KHARIDEHAL[3], PENCHALA REDDY MURAM REDDY[4], MOHAN RAO NANDAM[5], SYAMSUNDARA RAO BYNA[6], BHAVANA GRANDHI[7]

ABSTRACT

Introduction: Brain lesions can be caused by varied etiological factors like neoplastic, infectious, inflammatory and vascular diseases. Accurate diagnosis in very important for correct neurosurgical treatment. A retrospective histopathological study of brain lesions is of utmost importance because as it can demonstrate the changes in the spectrum of brain lesions, burden of disease in the community, can reveal the possible risk factors and can suggest probable treatment methods for various neoplastic and non neoplastic brain lesions.

Aim: To evaluate the incidence, age distribution, gender distribution, and histopathological spectrum of neoplastic and non neoplastic lesions of brain.

Materials and Methods: This retrospective observational study was conducted in the Department of Pathology at Narayana Medical College, Nellore, Andhra Pradesh, India, from January 2019 to December 2021. Total 216 cases were studied. The tumours were classified under World Health Organisation (WHO) classification. To test the mean difference between the groups, Independent sample t-test was done.

Results: Out of 216 cases, 180 (83%) were neoplastic and 36 (17%) were non neoplastic lesions. The male:female ratio was 1.03:1. Non neoplastic lesions were common in males (22, 61.11%), while neoplastic lesions were common in females (92, 51.11%). The most common age group affected was 41-50 years (55, 25.46%). Astrocytoma (41, 22.77%) followed by meningioma (40, 22.22%) were the common neoplastic tumours and haematoma (7, 19.44%) was the most common non neoplastic lesion in adults. Common tumour in children (<18 years) was diffuse fibrillary astrocytoma (3/11, 27.27%) and chronic inflammatory pathology was the common non neoplastic lesion (2/11, 18.18%).

Conclusion: Majority of cases were seen in 41-50 years age group. Astrocytoma was the common neoplastic tumour and haematoma was the common non neoplastic lesion in adults. Diffuse fibrillary astrocytoma was the common tumour and chronic inflammatory pathology was the common non neoplastic lesion in children.

Keywords: Adults, Astrocytoma, Children, Haematoma

INTRODUCTION

Brain lesions can be caused by variedetiological factors like neoplastic, infectious, inflammatory and vascular diseases. Differentiating neoplastic from non neoplastic lesions is very essential so as to prevent unnecessary surgery, chemotherapy and radiotherapy to non neoplastic lesions. Many non neoplastic brain lesions resemble brain tumours both clinically and radiologically, so histopathological examination plays an important role in differentiating these lesions. Accurate diagnosis is very important for proper neurosurgical intervention [1]. Tumours of the central nervous system accounts for less than 2% of all malignancies [2,3]. In India, Central Nervous System (CNS) tumours accounts for 1.9% of all tumours [2]. Increasing incidence in CNS tumours has been reported in this particular studies between time period (2000-2012) [4] and (1990-2016) [5] China, United States of America, followed by India are the top three countries documented with highest number of new cases of CNS tumours [6].

The risk factors for the development of tumours are genetic predisposition and ionising radiation [7]. Increased incidence is also related to certain occupations, dietary factors and chemical exposure [8]. According to international agency for research on cancer, excessive exposure to low frequency non ionising electromagnetic waves from mobile phones is a risk factor for developing brain tumours [9]. Most common clinical symptom of brain lesions is head ache and least common is visual disturbances [10]. Other clinical symptoms and signs include seizures, neurological deficits, vomiting and raised intracranial pressure [11].

The histopathological spectrum of lesions of brain is vast and it varies among adults,children and also in different geographical locations [12,13]. Till date, only few studies have been conducted about the spectrum of brain lesions in south Indian population [8,14]. Meningioma and astocytoma were the common brain tumours in these studies [8,14]. The aim of the study was to evaluate the incidence, age distribution, gender distribution and histopathological spectrum of neoplastic and non neoplastic brain lesions in both adults and children, from a tertiary care centre in southern India.

MATERIALS AND METHODS

This retrospective observational study was conducted in the Department of Pathology at Narayana Medical College, Nellore, Andhra Pradesh, India, from January 2019 to December 2021. The ethical clearance was obtained from Institution Ethical Committee (IEC/NMC/16/04/2022_2). The data was analysed for a period of three months from January to March 2022.

Inclusion criteria: All of the biopsy samples with lesions located in the brain were included in the study.

Exclusion criteria: Inadequate samples and poorly preserved biopsy samples were excluded from the study.

Study Procedure

Total 216 biopsy samples were sent from the Neurosurgery Department. The slides were retrieved and biopsy reports were studied. Clinical details and radiological findings were also collected. The biopsy samples were fixed in 10% formalin, followed by processing and embedding in paraffin wax. The sections were cut with a thickness of 5 µ. Haematoxylin and Eosin (H&E) staining was done for the sections and special stains were done whenever necessary. The diagnosis of all the brain lesions was done by histopathological examination and also the tumours were classified under World Health Organisation (WHO) classification [15].

STATISTICAL ANALYSIS

Statistical analysis was done by using Statistical Package for Social Sciences (IBM SPSS) version 25.0. For continuous variables, the data values were represented by mean and standard deviation. To test the mean difference between the groups, Independent sample t-test was done.

RESULTS

Out of 216 cases, 180 (83%) were neoplastic and 36 (17%) were non neoplastic. Overall, there was a slight male preponderance. Highest number of cases were noted in 41-50 years age group (55 cases, 25.46%). Lowest number of cases were noted in children less than 10 years (seven cases, 3.2%) [Table/Fig-1].

Age group (years)	Total number of neoplastic tumours	Total number of non neoplastic tumours	Total number of brain lesions
≤10	4	3	7 (3.24%)
11-18	7	5	12 (5.55%)
19-30	15	4	19 (8.79%)
31-40	28	6	34 (15.74%)
41-50	47	8	55 (25.46%)
51-60	39	4	43 (19.90%)
61-70	32	5	37 (17.12%)
71-80	8	1	9 (4.16%)
Total	180	36	216 (100%)
Mean±SD	Males-48.43±16.40 Females-47.16±16.13	Males-35.39±19.66 Females-41.61±23.62	

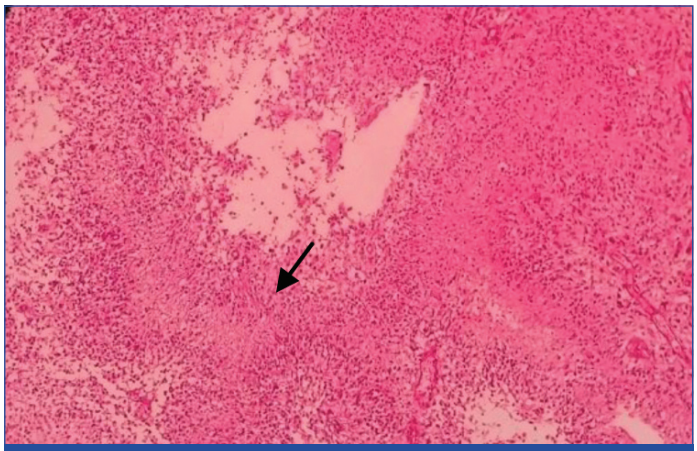
[Table/Fig-1]: Age distribution.

In neoplastic tumours, there was slight female predominance accounting for 92/180 cases (51.1%). The most common age group involved was 41-50 years (47, 26.1%). Least commonly involved was less than 10 years age group (4, 2.2%). For neoplastic lesions, the youngest age of the patient was seven years, diagnosed with medulloblastoma and oldest age of the patient was 80 years, diagnosed with pituitary adenoma.

Among non neoplastic lesions, there was male predominance accounting for 22/36 cases (61.1%). The most common age group involved was 41-50 years age group (8, 22.2%). Rarely involved age group was 71-80 years (1, 2.7%). For non neoplastic lesions, the youngest age of patient was 1-month-old baby diagnosed with meningocele, and the oldest age of the patient was 80 years, diagnosed with epidermoid cyst. Out of 180 cases of neoplastic tumours, the most common tumour in adults was astrocytoma constituting (41, 22.7%) followed by meningioma constituting 40 cases (22.2%) and schwannoma (24,13.3%) [Table/Fig-2]. Out of 41 cases of astrocytoma, the most common subtype was glioblastoma (16, 39%) followed by diffuse fibrillary astrocytoma (11, 26.82%) [Table/Fig-3]. There was male predominance for astrocytoma and male: female ratio was 2.15:1. The most common site for astrocytoma was frontal lobe. Astocytoma was most common in 51-60 years age group accounting for 14 cases (34.4%). The youngest patient diagnosed with glioblastoma was a 22-years-old male [Table/Fig-4].

Neoplastic tumour	Male (n)	Female (n)	n, %
Astrocytoma	28	13	41 (22.77%)
Meningioma	12	28	40 (22.22%)
Schwannoma	11	13	24 (13.33%)
Metastatic tumour	9	7	16 (8.88%)
Pituitary adenoma	7	7	14 (7.77%)
Oligodendroglioma	6	4	10 (5.55%)
Haemangioma	4	3	7 (3.88%)
Craniopharyngioma	2	3	5 (2.77%)
Oligoastrocytoma	1	3	4 (2.22%)
Medulloblastoma	1	2	3 (1.66%)
Haemangioblastoma	2	1	3 (1.66%)
Lymphoma	2	0	2 (1.11%)
Primitive neuroectodermal tumour	2	0	2 (1.11%)
Choroid plexus papilloma	2	0	2 (1.11%)
Ganglioglioma	0	1	1 (0.55%)
Pineoblastoma	1	0	1 (0.55%)
Pituitary adeno carcinoma	0	1	1 (0.55%)
Neurofibroma	0	1	1 (0.55%)
Ependymoma	1	0	1 (0.55%)
Benign fibrous histiocytoma	0	1	1 (0.55%)
Chondrosarcoma	0	1	1 (0.55%)
Total	91	89	180 (100%)

[Table/Fig-2]: Histopathological spectrum.



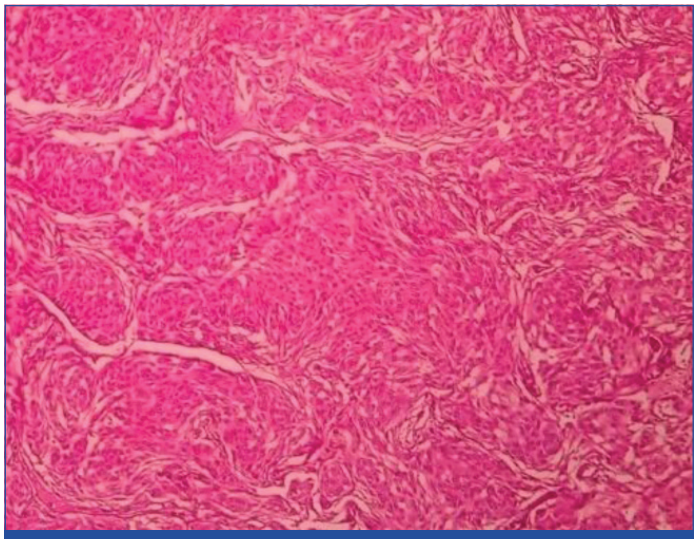
[Table/Fig-3]: Glioblastoma with foci of necrosis and pseudopalisading of tumour cells. (Haematoxylin and Eosin stain; 100X)

Out of 40 cases of meningioma, the most common subtype was Transitional meningioma (25, 62.5%) followed by Meningothelial meningioma (6, 15%) [Table/Fig-5]. Meningioma was more common in old age between 61-70 years age group (13, 32.5%). There was female predominance for meningioma with male:female ratio of 0.42:1. The most common site for the tumour was parasagittal region [Table/Fig-6].

Schwannoma constituted for 24 cases (13.3%). The most common age group for schwannoma was 41-50 years, accounting for seven cases (29.1%) [Table/Fig-7]. There was female predominance and male:female ratio was 1:1.18. The most common site for schwannoma was cerebellopontine angle. Metastatic tumour was the fourth common tumour, accounting for 16 cases (8.88%). Metastatic tumours were more common in males and male:female ratio was 1.2:1 and they were more common in 41-50 years age group. Metastatic tumours were more common in males and male:female ratio was 1.2:1 and they were more common in 41-50 years age group [Table/Fig-8]. The common tumour in children was diffuse fibrillary astrocytoma (27.27%, 3/11). The next common was medulloblastoma and craniopharyngioma in equal proportions (18.18%, 2/11 each) [Table/Fig-9].

Subtype of astrocytoma	<18 years		19-30 years		31-40 years		41-50 years		51-60 years		61-70 years		71-80 years		Total (n, %)
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
Glioblastoma	-	-	1	-	-	-	3	-	5	3	2	-	-	2	16 (39.02%)
Diffuse fibrillary astrocytoma	2	1	1	1	-	-	-	-	4	-	-	1	1	-	11 (26.82%)
Pilocytic astrocytoma	-	-	3	-	-	1	2	-	-	-	-	-	-	-	6 (14.63%)
Anaplastic astrocytoma	-	-	-	-	-	-	1	-	2	-	-	-	-	-	3 (7.31%)
Pleomorphic xanthoastrocytoma	-	-	-	-	-	1	-	-	-	-	-	1	-	-	2 (4.87%)
Gliosarcoma	-	-	-	-	-	-	-	1	-	-	-	1	-	-	2 4.87%)
Gemistocytic astrocytoma	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1 (2.43%)

[Table/Fig-4]: Histological subtypes of astrocytoma.
M: Male; F: Female



[Table/Fig-5]: Meningothelial meningioma with tumour cells arranged in syncytial pattern (Haematoxylin and Eosin stain; 100X).

DISCUSSION

Tumours of the brain cause significant morbidity and mortality to the patients [16]. Inflammatory and benign neoplasms also cause serious and life threatening complications because of their presence in a confined space and proximity to the vital structures [1]. Unlike other cancers, simple, population wide screening tests are not available for diagnosing CNS cancers. The most important global health challenge is requirement of highly specialised medical and surgical care for the diagnosis and long-term management of CNS cancers. However, because of unavailability of neuroimaging, neurosurgeons and oncologists in many locations will affect the diagnostic accuracy, incidence rates and also the registry of various brain lesions [5]. In this context, tertiary hospital based studies will be useful and can provide baseline data about various CNS lesions.

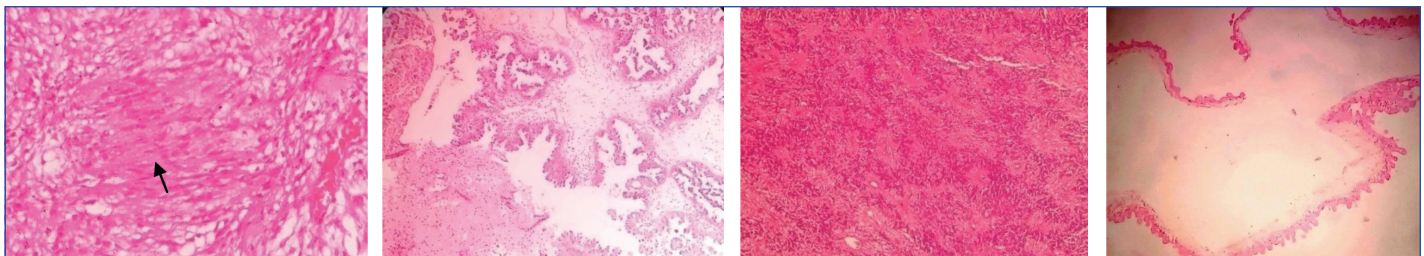
In the present study, there was slight male predominance similar to the other studies [7,17-20]. However, Shihora NV et al., reported female predominance in their study [Table/Fig-13] [21]. Common

Subtype of meningioma	<18 years		19-30 years		31-40 years		41-50 years		51-60 years		61-70 years		71-80 years		Total cases (n, %)
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
Transitional meningioma	-	-	-	-	-	3	3	6	1	5	4	2	1	-	25 (62.5%)
Meningothelial meningioma	-	-	-	-	-	1	1	1	1	1	-	1	-	-	6 (15%)
Psammomatous meningioma	-	-	-	-	-	-	-	-	-	1	-	1	-	1	3 (7.5%)
Angiomatous meningioma	-	-	-	-	-	-	-	-	-	1	-	2	-	-	3 (7.5%)
Fibroblastic meningioma	-	-	-	-	-	-	-	-	-	-	1	1	-	-	2 (5%)
Atypical meningioma	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1 (2.5%)

[Table/Fig-6]: Histological subtypes of meningioma.
M: Male; F: Female

Out of 36 cases of non neoplastic lesions, the common lesion in adults was haematoma (7, 19.4%). The next common were chronic inflammatory pathology and tuberculosis (4, 11.11% each). In children the first common was chronic inflammatory pathology (2, 5.55%) [Table/Fig-10,11]. The top three clinical symptoms were headache (48.7%) followed by neurological deficits (31.6%), seizures (22.9%) [Table/Fig-12].

age group affected was 41-50 years which was different from other studies [16-18]. They reported 31-40 years age group as commonly affected age group, slightly younger age group when compared to the present study. Neoplastic tumours were common in females similar to the studies [8,16]. Non neoplastic tumours were common in males similar to the study done by Joshi H et al., [7]. Headache was the common symptom similar to the study done by Shihora



[Table/Fig-7]: Schwannoma showing Verocay body (Haematoxylin and Eosin stain; 400X). **[Table/Fig-8]:** Papillary carcinoma of thyroid metastastic deposit in brain showing tumour cells arranged in papillary pattern (Haematoxylin and Eosin stain; 100X). **[Table/Fig-9]:** Medulloblastoma showing tumour cells arranged in Homer Wright rosettes (Haematoxylin and Eosin stain; 100X). **[Table/Fig-10]:** Cysticercosis in brain showing cystic appearance with microvilli. (Haematoxylin and Eosin stain; 00X). (Images from left to right)

Non neoplastic brain lesions	n, %
Haematoma	7 (19.44%)
Chronic inflammatory pathology	4 (11.11%)
Tuberculosis	4 (11.11%)
Epidermoid cyst	3 (8.33%)
Arachnoid cyst	3 (8.33%)
Arterio venous malformation	3 (8.33%)
Reactive gliosis	3 (8.33%)
Abscess	2 (5.55%)
Fungal infection	2 (5.55%)
Meningocele	1 (2.77%)
Encephalocele	1 (2.77%)
Demyelinating disease	1 (2.77%)
Cysticercosis	1 (2.77%)
Colloid cyst	1 (2.77%)
Total	36 (100%)

[Table/Fig-11]: Histopathological spectrum of non neoplastic brain lesions.

Clinical symptom	n, %
Headache	105 (48.7%)
Neurological deficits	68 (31.6%)
Seizures	49 (22.9%)
Vomiting	39 (18.1%)
Visual impairment	16 (7.6%)
Fever	8 (3.8%)
Loss of consciousness	6 (2.7%)
Occipital swelling	5 (2.2%)
Neck rigidity	3 (1.2%)

[Table/Fig-12]: Clinical symptoms in brain lesions.

tissue [23]. In the present study, the common tumour in children was diffuse fibrillary astocytoma. In other studies, pilocytic astrocytoma was the common tumour which was different from the present study [24,25].

The most common non neoplastic lesion which encountered in the present study was haematoma. On the contrary, it was abscess and congenital lesions in a few other studies [7,21]. Chronic inflammatory pathology and tuberculosis were the second most common lesions. The reason for haematoma being more common may be related to more patients reporting with hypertension. The present study reflected the diversity of CNS lesions in different age groups, gender and also the distribution of various brain tumours and non neoplastic brain lesions.

Also, there is a need for future epidemiological studies and in depth multricentric studies should be done as it can reveal the changes in the spectrum of brain lesions among different population, so that probable risk factors can be assessed and treatment methods can be planned [14].

Limitation(s)

This was a hospital-based single-centre retrospective study and hence the data does not represent the actual incidence of disease burden in the community. Another limitation is that the classification of tumours was not based on molecular cytogenetics (because of lack of resources in the study hospital).

CONCLUSION(S)

The present study enlightened the changing trends in the incidence of both neoplastic and non neoplastic lesions of brain and also it is helpful for further medical research. Varied histological diversity was seen in different age groups and also in both genders. Majority of cases were seen in 41-50 years age group. Neoplastic tumours were common in females, where as non neoplastic lesions were common in males. Astrocytoma was the common neoplastic tumour and haematoma was the common non neoplastic lesion in adults. Diffuse fibrillary astrocytoma was the common tumour in children. Clinically and radiologically many non neoplastic lesions will resemble like brain tumours. Pathologist plays an important role in differentiating neoplastic from non neoplastic lesions. Further, the treatment and prognosis of neoplastic tumours will depend on histological type and grade of tumour. So, histopathological examination is the gold standard for accurate diagnosis and also plays an important role for proper neurosurgical intervention.

Variables	Present study	Jazayeri SB et al., [17]	Ghanghoria S et al., [18]	Krishnatreya M et al., [19]	Kakshapati T et al., [16]	Joshi H et al., [7]	Shihora NV et al., [21]
Geographical location	Andhra Pradesh	Iran	Madhya Pradesh	North East India	Nepal	Uttar Pradesh	Gujarat
Type of study	Hospital-based study	National cancer registry based study	Hospital-based study	Hospital-based study	Hospital-based study	Hospital-based study	Hospital-based study
Sample size	216	10,868	65	231	221	96	65
Common age group (years)	41-50 years	30-40 years	31-40 years	20-60 years	21-40 years	Not Available (NA)	31-40 years
Male:Female ratio	1.03:1	1.48:1	1:0.86	2.3:1	1:1.3	1.67:1	1:1.4
Common neoplastic lesions	Astrocytoma (22.77%) Meningioma (22.22%)	Astrocytoma (29%) Meningioma (27.8%)	Meningioma (41.5%) Astrocytoma (24.61%)	Diffusefibrillary Astrocytoma (37.2%) Glioblastoma (21.2%)	Meningioma (30.3%) Astrocytoma (25.7%)	Astrocytoma (27.4%) Schwannoma (22.58%)	Astrocytoma (33.3%) Meningioma (25.9%)
Common non neoplastic lesions	Haematoma (19.44%) Chronic inflammatory pathology (11.11%)	NA	NA	NA	NA	Abscess and non specific inflammation (23.5%) Cysticlesions (20.5%)	Congenital (57.14%) Infective (28.57%)
Common symptoms	Head ache (48.7%) Neurological deficits (31.6%)	NA	NA	NA	NA	Head ache vomiting	Headache (47.70%) Body/ Limb weakness (10.78%)

[Table/Fig-13]: Comparision between present study with other studies [7,16-19,21].

NV et al., [21]. Common neoplastic tumour in the present study was astrocytoma similar to other studies [7,17,19]. In a few others studies meningioma was the common tumour [16,18,22]. There was male predominance for astrocytoma in the present study similar to the study by Thambi R et al., [8].

Meningioma showed a female predominance in the present study, similar to others [1,8]. The reason for meningioma being more common in females is because of the hormonal influence and presence of oestrogen, progesterone receptors in the meningioma

REFERENCES

[1] Khonglah Y, Shangpliang D, Mishra J, Mustafa A, Kakoti A, Phukan P, et al. Histological spectrum of central nervous system lesions at a tertiary care center in India. Clin cancer Investing J. 2020;9:175-81. Doi: 10.4103/ccij. ccij_39_20.

[2] Naik S, Sahoo N, Mohanty B, Lenka A, Mohapatra AS, Das P, et al. Histopathological spectrum of central nervous system lesions in a tertiary care hospital in eastern India. J Evid Based Med Health C. 2021;8(18):1038-41. Doi: 10.18410/jebmh/2021/000.

[3] Sen D, Sarkar P, Banerjee A, Datta A. Histopathological spectrum of CNS tumors: An observational study in a tertiary care centre of north east india. International Journal of Medical Reviews and Case Reports. 2022;6(3):01-06. Doi: 10.5455/IJMRCR.Histopathological spectrum of CNS tumors.

[4] Pouchieu C, Gruber A, Berteaud E, Menegon P, Monteil P, Huchet A, et al. Increasing incidence of central nervous system tumors (2000-2012): Findings from a population based registry in Gironde (France). BMC Cancer. 2018;18:653. Doi: doi/org/10.1186/s 12885-018-4545-9.

[5] Fitzmaurice C, Patel AP, Fisher JL, Nichols E, Abdallah F, Abdela, et al. Global, regional, and national burden of brain and other CNS cancer, 1990-2016: A systematic analysis for the Global burden of disease study 2016. Lancet Neurol. 2019;18:376-93. Doi: dx.doi.org/10.1016/s1474-4422(18)30468-X.

[6] Global burden of disease cancer collaboration, Fitzmaurice C, Allen C, Barber RM, Barregard L, Bhutta ZA, et al. Global, regional and national cancer incidence, mortality, years of life lost, years lived with disability and disability adjusted life years for 32 cancer groups, 1990 to 2015: A systemic analysis for the global burden of disease study. JAMA Oncol. 2017;3(4):524-28. Doi: 10.1001/jamaoncol.2016.5688.

[7] Joshi H, Awasthi S, Dutta S, Bharadwaj R. Histopathological spectrum of central nervous system lesions. Trop J Path Micro. 2019;5(11):844-49. Doi: 10.17511/jopm. 2019. i11.02.

[8] Thambi R, Kandamuthan S, Sainulabdeen S, Vilasiniamma L, Abraham TR, Balakrishnan PK, et al. Histopathological analysis of brain tumours-A seven year study from a tertiary care centre in south India. J Clin Diagn Res. 2017;11(6);EC05-EC08. Doi: 10.7860/JCDR/2017/25623.9990.

[9] Hamdani SM, Dar NQ, Reshi R. Histopathological spectrum of brain tumors: A 4 year retrospective study from a single tertiary care facility: Int J Med Sci Public Health. 2019;8(8):673-76. Doi: 10.5455/ijmsph.2019.0616504062019.

[10] Gore CR, Mishra P, Rashmi R, Chugh A. Piecing together a puzzle of exceptional lesions: A retrospective study of a potpourri of 160 space- occupying lesions of the central nervous system. Cureus. 2022;14(3):e23585. Doi: 10.7759/ cureus.23585.

[11] Garg RK, Sinha MK. Multiple ring enhancing lesions of the brain. J Post Grad Med. 2010;56(4):307-16. Doi: 10.4103/0022-3859.70939.

[12] Miller KD, Ostrom QT, Patil N, Cioffi G, Waite KA, Siegel RL, et al. Brain and other central nervous system tumor statistics. CA: A Caner Journal for Clinicians. 2021;71(5):381-406. Doi: doi.org/10.3322/caac.21693.

[13] Wanner M, Rohrmann S, Korol D, Shenglia N, Gigineishvili T, Gigineishvili D, et al. Geographical variation in malignant and benign/borderline brain and CNS tumor incidence: A comparision between a high income and a middle income country. J Neurooncol. 2020;149(2):273-82. Doi: 10.1007/s 11060-020-03595-5.

[14] Sahitya KA. Spectrum of central nervous system tumours–histopathological study of 80 cases at a single centre. Int J Contemp Med Res. 2020;7(8):H13-H15. Doi: http:/dx.doi.org/10.21276/ijcmr.2020.7.8.22.

[15] Louis DN, Ohagaki 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):97-09. Doi: 10.007/S00401-007-0243-4.

[16] Kakshapati T, Basnet RB, Pant B, Gautam D. Histopathological analysis of central nervous system tumors; an observational study. J Pathol Nep. 2018;8:1393-98. Doi: 110.3126/jpn.v%vi%i.20892.

[17] Jazayeri SB, Rahimi-Movaghar V, Shokraneh F, Saadat S, Ramezani R. Epidemiology of primary CNS tumours in Iran: A systemic review. Asian Pacific J Cancer Prev. 2013;14(6):3979-85. Doi: 10.7314/apjcp.2013.14.6.3979.

[18] Ghanghoria S, Mehar R, Kulkarni CV, Mittal M, Yadav A, Patidar H, et al. Retrospective histological analysis of CNS tumors-A 5 year study. Int J Med Sci Public Health. 2014;3(10):1205-07. Doi: 10.5455/ijmsph. 2014.080720141.

[19] Krishnatreya M, Kataki AC, Sharma JD, Bhattacharyya M, Nanda P, Hazarika M, et al. Brief descriptive epidemiology of primary malignant brain tumors from north-east India. Asian Pac J Cancer Prev. 2014;15(22):9871-73. Doi: 10.7314/apjcp.2014.15.22.9871.

[20] Gandhi MB, Patel HL, Shah A. Histopathological evaluation of cerebral lesions. Indian J pathol oncol. 2018;5(1):87-91. Doi: 10.18231/2394-6792.2018.0016.

[21] Shihora NV, Patel HU, Patel HM, Ramani PR, Nandasana BN. A study of histopathological spectrum of central nervous system lesions at a tertiary health care center of south Gujarat, India. Int J Res Med Sci. 2020;8:1451-57. Doi: http://dx.doi.org/10.18203/2320-6012.ijrms20201341.

[22] Jaiswal J, Shastry AH, Ramesh A, Chickabasaviah YT, Arimappamagan A, Santosh V, et al. Spectrum of primary intracranial tumors at a tertiary care neurological institute: A hospital based brain tumour registry. Neurol India. 2016;64:494-01. Doi: 10.4103/0028-3886.181535.

[23] Maiuri F, Mariniello G, Somma T, Guadagno E, Corvino S, Pagano S, et al. Meningiomas in premenopausal women: Role of the hormone related conditions. Front Oncol. 2020;10:556701. Doi: 10.3389/fonc.2020.556701.

[24] Gupta R, Puri H, Malhotra V. Pathological spectrum of CNS tumors: Five year study in a tertiary care hospital. J Evol Med Dent Sci. 2014:3(16):4397-07. Doi: 10.14260/jemds/2014/2450.

[25] Udayagiri DS, Chowhan AK, Nandhyala R, Prayaga AK, Lakshmi AY, Venkata PB, et al. Primary paediatric CNS tumours: A 25 year analysis at a tertiary referral centre in southern India. J Clin Diagn Res. 2020:14(5):EC01-EC05. Doi: 10.7860/JCDR/2020/40989.13672.

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Pathology, Narayana Medical College, Nellore, Andhra Pradesh, India.
2. Assistant Professor, Department of Pathology, Narayana Medical College, Nellore, Andhra Pradesh, India.
3. Professor and Head, Department of Pathology, Narayana Medical College, Nellore, Andhra Pradesh, India.
4. Associate Professor, Department of Pathology, Narayana Medical College, Nellore, Andhra Pradesh, India.
5. Professor, Department of Pathology, Narayana Medical College, Nellore, Andhra Pradesh, India.
6. Professor, Department of Pathology, Narayana Medical College, Nellore, Andhra Pradesh, India.
7. Professor, Department of Pathology, Narayana Medical College, Nellore, Andhra Pradesh, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Vijayalakshmi Muram Reddy,
Associate Professor, Department of Pathology, Narayana Medical College,
Nellore, Andhra Pradesh, India.
E-mail: vishmireddy@gmail.com

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