

UDC 616-006

DOI: 10.15587/2519-4798.2022.265313

STUDY OF HISTOPATHOLOGY OF TUMORS OF THE CENTRAL NERVOUS SYSTEM IN A TEACHING HOSPITAL

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Primary central nervous system (CNS) tumours are rare, but they are the second most common in childhood after the most common malignancy, leukaemia. They are considered the most notorious of all cancers. They represent characteristics of a unique, heterogeneous population of neoplasms with benign and malignant tumours and are reported to be less than 2 % of all malignant neoplasms.

The aim of the study: To study various tumours of the central nervous system (CNS)

Methods: A prospective study on CNS tumours was conducted in the department of Pathology, Guntur Medical College, Guntur, for two years, from June 2011 to May 2013. The data necessary for the study has been retrieved from the histopathology records at the department. 104 cases of CNS tumours were studied in detail, correlating the clinical, radiological and histopathological findings. The department of neurosurgery has provided the biopsy material. The applied nomenclature is that adopted by the 2007 WHO classification.

Results: The tumours have been encountered in all age groups, from infants to 80yr elderly persons. The highest frequency is seen in the age group of 41 to 50 years (27 %), followed by 51 to 60 years age group (19 %). The most common tumour reported was astrocytomas constituting 21.1 % (22/104), followed by schwannomas constituting 19.2 % (20/104). least reported was plasmacytoma astroblastoma 0.9 % (1/104).

Conclusion: Adequate imaging by CT/MRI is an essential aid in the diagnosis. Although H&E staining is the mainstay for histopathological diagnosis, immunohistochemistry has played a significant role in diagnostic accuracy. In addition, the judicious use of a panel of selected antibodies is helpful in diagnostically challenging cases

Keywords: gliomas, astrocytoma, schwannomas, diagnostic accuracy, immunohistochemistry, antibodies, central nervous system, malignant tumours, computerised tomography, magnetic resonance imaging (MRI)

How to cite:

Sunitha K., Akarsh M. P., Panchakarla G. V. (2022). Study of histopathology of tumors of the central nervous system in a teaching hospital. ScienceRise: Medical Science, 5 (50), 24–31. doi: <http://doi.org/10.15587/2519-4798.2022.265313>

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1. Introduction

Central nervous system (CNS) tumours include malignant and non-malignant tumours of the brain and spinal cord. Primary CNS tumours represent 2 % of the estimated cancers among adults. The incidence of primary CNS tumours in India is 2.6 per 1, 00,000 persons per year. Gliomas are the most common type of primary tumour, accounting for 35 % to 50 % [1].

Many of these tumours are so far incurable and have a high disease burden. These tumours thus represent a dreadful example of an unmet clinical need. The precise diagnosis of a brain tumour has always relied on microscopic examination of the tissue. Though MRI and CT can distinguish between various brain tumours, surgical intervention to obtain relevant tissues two types of surgery may be performed- craniotomy or a stereotactic biopsy through a burr hole. In stereotactic biopsies, if the tissue reveals a surgically treatable condition, the surgeon would like to proceed to resection by craniotomy [2, 3]. During a craniotomy, they can better plan the extent of surgery if the nature of the biopsied tissue is well known.

The role of neuroimaging in patients with CNS tumours is not simply to evaluate structural abnormality and identify tumour-related complications. The current

state of neuroimaging has evolved into a comprehensive diagnostic tool for characterising morphologic and biologic alterations to diagnose and grade brain tumours and assess treatment response and prognosis. MRI has become the primary imaging modality for brain tumours and is primarily used in the pre and post-operative evaluation of patients [4]. However, this has limitations; the findings are not specific to a tumour or lesion. In addition, some studies have demonstrated that the degree of contrast enhancement correlates poorly with the histologic grade of tumours.

CNS tumours can produce clinical manifestations either by compression of adjacent structures, local invasion, increased intracranial pressure by either a mass effect or by obstructing the cerebrospinal fluid flow, resulting in hydrocephalus. The symptoms and signs depend on the location and rate of growth of these tumours. General signs that reflect the increase in intracranial pressure include drowsiness, confusion, headache, nausea, vomiting, generalised seizures and cognitive impairment. Focal signs and symptoms reflect the pressure effect on specific structures.

Although conventional haematoxylin-eosin staining is crucial for diagnosis, neuropathology has benefited in the past two decades from incorporating immuno-

histochemistry (IHC) in differential diagnosis and improving diagnostic accuracy. It combines anatomical, immunological and biochemical techniques to identify discrete tissue components by interacting target antigens with specific antibodies tagged with a visible label. IHC can be performed on formalin-fixed paraffin-embedded sections, frozen sections, smears, imprints and cytopspins. In addition, various markers of CNS pathology have been studied, among which glial fibrillary acid protein (GFAP) is considered to be specific for CNS.

Aims and Objectives

1. To study prospectively, various tumours of the central nervous system (CNS) received in the Department of Pathology.

2. Analysis of CNS tumours concerning frequency correlating with factors such as age, gender and clinical presentation.

3. Histopathological typing of the tumours that were encountered.

4. To study the immunohistochemical markers and their role in differential diagnoses and diagnostic accuracy.

2. Materials and Methods

A prospective study on CNS tumours was conducted in the department of Pathology, Guntur Medical College, Guntur, for two years, from June 2011 to May 2013. The data necessary for the study has been retrieved from the histopathology records at the department. 104 cases of CNS tumours were studied in detail, correlating the clinical, radiological and histopathological findings. The department of neurosurgery has provided the biopsy material. The applied nomenclature is that adopted by the 2007 WHO classification [3]. Ethical clearance number is Ethics committee no ECR/300/Inst/AP/2013/RR-16 dated 30 Dec 2019.

Multiple sections were studied from each tumour by the paraffin embedding technique. The tissue received has been fixed in 10 % formaldehyde and is processed in an automatic tissue processor, and later paraffin embedding has been done. Sections of 4 to 5 μ thickness were cut on a rotary microtome, and the routine stain used for all the tumours was Harris haematoxylin and eosin. A detailed microscopic examination has been carried out. In addition, immunohistochemistry was done in selected cases.

H & E staining:

- a. Deparaffinise the sections.
- b. Hydration in descending grades of alcohols.
- c. Stain in Harris hematoxylin – 10 min.
- d. Under running tap water for 5 min until the sections turn blue (blueing).
- e. Differentiation in 1 % acid alcohol.
- f. Eosin 1–2 dips.
- g. Under running tap water.
- h. Dehydration in ascending grades of alcohol.
- i. Clearing in xylol.
- j. Mounting with DPX.

Results: nucleus appears blue, and the cytoplasm appears pink.

Immunohistochemistry (IHC):

IHC combines anatomical, immunological and biochemical techniques to identify discrete tissue compo-

nents by interacting the target antigens with specific antibodies tagged with a visible label. The distribution and localisation of specific cellular components within the cells can be appropriately visualised with the help of IHC. It consists of the following steps:

- 1) The primary antibody binds to a specific antigen.
- 2) A secondary, enzyme-conjugated antibody binds the antigen-antibody complex.
- 3) The enzyme forms a coloured deposit at the sites of antigen-antibody binding in the presence of substrate and chromogen.

Methods of immunohistochemistry:

Direct method: It is a one-step staining method and involves a labelled antibody reacting directly with the antigen in tissue sections.

Indirect method: in this method, a second antibody raised to the gamma globulin of the species which produced the primary antibody is conjugated. This method involves an unlabeled primary antibody which reacts with tissue antigen, and a labelled secondary antibody reacts with the primary antibody. This method is more sensitive due to signal amplification and also economical. The second layer antibody can be labelled with a fluorescent dye such as rhodamine or labelled with an enzyme peroxidase alkaline phosphatase.

The paraffin-embedded tissues are cut as 3–4 μ thick sections, deparaffinised using three changes of xylol, each 15 min, rehydrated and subjected to antigen retrieval to unmask the antigens (which have been masked by formalin fixation due to cross-linking of amino acid groups) in a microwave, immersed in a TRIS-EDTA buffer solution (pH 9). The slides are then washed several times with phosphate buffer.

Staining:

a) Blocking endogenous peroxidase: The sections are treated with hydrogen peroxide for 15min and later washed with the phosphate buffer several times.

b) The power block is then added to enhance antigen retrieval further.

c) Primary antibody: Polyclonal antibodies are produced against several epitopes on single antigens. The antibodies are stored in the refrigerator at 4 °C. Then, the primary antibody is added to the sections and is left for one hour.

d) They were washed with phosphate buffer repeatedly.

e) Secondary antibody: The secondary antibody is produced against the immunoglobulin of the species from which the primary antibody is derived. It consists of individual steps, adding a super-enhancer and SS label and further washing with phosphate buffer.

f) Chromogen is added to the sections and retained for 15 min.

g) The sections are now washed repeatedly with distilled water.

h) They are counterstaining with hematoxylin.

i) They were cleared with xylol and mounted with DPX.

True and false positive stains:

An actual positive shows chromogen deposition in cells or structures containing antigens of interest. A false

positive stain is where chromogen is localised to cells or structures that lack the antigen in reality.

Controls:

This is the most crucial step in quality control in IHC, including the positive and negative controls.

Negative control: A section of the tissue block being studied is taken as the negative control and treated identically without the primary antibody and replaced with wash buffer.

3. Results

The present study includes 104 CNS neoplasms, of which 91 cases (86.66 %) were primary neoplasms, and 14 (13.33 %) were metastatic tumours to the CNS. Intracranial tumours were 92 (87.61 %), and spinal cord tumours were 13 (12.38 %). Of the 92 intracranial tumours, 76 (82.6 %) cases are located supratentorial, whereas the infratentorial tumours account for 16 (17.39 %) (Table 1).

Table 1

Age	0–10 years	11–20 years	21–30 years	31–40 years	41–50 years	51–60 years	61–70 years	71–80 years
Tumours								
Astrocytomas	–	2 (1.9 %)	5 (4.8 %)	3 (2.8 %)	4 (3.8 %)	5 (4.8 %)	–	–
Glioblastomas	–	1 (0.9 %)	–	1 (0.9 %)	3 (2.8 %)	5 (4.8 %)	3 (2.8 %)	–
Meningiomas	–	1 (0.9 %)			1 (0.9 %) 2 (1.9 %) 8 (7.6 %)	3 (2.8 %)	–	–
Metastases	–	–	–	1 (0.9 %)	4 (3.8 %)	3 (2.8 %)	2 (1.9 %)	5 (4.8 %)
Medulloblastomas	3 (2.8 %)		2 (1.9 %) 1 (0.9 %)	–	–	–	–	–
Schwannomas	–	2 (1.9 %)						5 (4.8 %) 2 (1.9 %) 5 (4.8 %) 2 (1.9 %) 2 (1.9 %) 1 (0.9 %)
Lymphomas	–	–	–	–	–	1 (0.9 %)	–	–
Pituitary adenoma	–	–	1 (0.9 %)	1 (0.9 %)	–	–	–	–

Table 2

S.no	Histological type	No. of cases	Percentage
1	Astrocytomas	22	21.1
2	Schwannomas	20	19.2
3	Meningiomas	15	15.38
4	Metastases	14	13.4
5	Glioblastomas	13	12.5
6	Medulloblastomas	6	5.7
7	Oligodendrogliomas	2	1.9
8	Ependymomas	2	1.9
9	Pituitary adenomas	2	1.9
10	PNET	2	1.9
11	Lymphoma	2	1.9
12	Plasmacytoma	1	0.9
13	Astroblastoma	1	0.9
14	Neurocytoma	2	1.9
Total		104	100

The tumours have been encountered in all age groups, from infants to 80-year elderly persons. However, the highest frequency is seen in the age group of 41 to 50 years (27 %), followed by the 51 to 60 age group (19 %).

Among all the tumours, the majority were more common in males, comprising 67 cases (64.4 %) compared to females with 37 cases (35.6 %).

Most patients presented with headaches constituting 62 %; next common were convulsions occupying 30 %, vomiting 29 %, visual disturbances 27 %, gait disturbances 21 %, and loss of consciousness 14 %.

According to the site of distribution of CNS tumours majority were located in the Supratentorial region occupying 72.1 % (75/104), Infratentorial 16.3 % (17/106). Spinal cord 11.5 % (12/104).

The most common tumour reported was Astrocytomas constituting 21.1 % (22/104), followed by Schwannomas, constituting 19.2 % (20/104) least reported was plasmacytoma Astroblastoma 0.9 % (1/104) (Table 2).

Gliomas were the most common tumours encountered in our study among all the CNS tumours. They account for 38 % of all tumours. They were most frequent among the 41–60 years age group. Astrocytomas were the most frequent histological type accounting for up to 57 % of the total gliomas. The other subtypes encountered were glioblastomas (33 %), ependymomas (5 %), and oligodendrogliomas (5 %).

Meningiomas These were the second most common tumours encountered, next to gliomas. They account for 14.4 % of all CNS tumours. Akin to gliomas, these were also more common in the age group of 41–60. Of all the histological types, the transitional variant was our study's most frequently encountered subtype. The other subtypes were fibroblastic, atypical, papillary, angio-

tous, clear cell, meningothelial and psammomatous in decreasing frequency.

In our study grade 1 constituted 32.6 %, grade II 25 %, grade III 5.7 %, grade IV 18.2 %, respectively (Table 3).

Unipolar cytoplasmic processes of neoplastic cells help anchor the stromal blood vessels. Immunostaining with GFAP, EMA, CD 99 and Vimentin came out positive, which helped to arrive at a confirmatory diagnosis (Table 4). Diffuse fibrillary astrocytomas (grade II) were most common in our study, with 18 out of 22 cases. In addition, there were three cases of anaplastic astrocytoma

(grade III), and we have also encountered a case of gemistocytes astrocytoma (Fig. 1).

Table 3

Frequency distribution of histological grades of CNS tumours

S.no	Histological grade	No. Of cases
1	Grade I	34 (32.6 %)
2	Grade II	26 (25 %)
3	Grade III	6 (5.7 %)
4	Grade IV	19 (18.2 %)

Table 4

Immunohistochemical analysis of CNS tumours

S.no	Clinical details	Differential diagnosis	IHC	Final diagnosis
1.	F/60 yr Rt. frontal ICSOL	Non-Hodgkin's lymphoma	CD 45 positive	Non-Hodgkins lymphoma
2.	F /75yr Rt. temporal ICSOL	Metastasis	ER-negative PR negative Pan CK positive	Secondary deposit from poorly differentiated adenocarcinoma
3.	F /67yr Lt. temporal ICSOL	Clear cell meningioma, Glioblastoma	GFAP-strong positive EMA-focal positive	Glioblastoma
4.	M /55yr Lt. temporal ICSOL	Glioblastoma	GFAP-diffuse positive	Glioblastoma
5.	F /80yr Lt. corpus callosum	Malignant melanoma deposit, Pigmented ependymoma.	HMB 45-positive GFAP-negative	Secondary deposit from malignant melanoma.
6.	F /21yr Lateral ventricle	Central neurocytoma, Oligodendroglioma	Synaptophysin-positive GFAP-positive in trapped astrocytes	Central neurocytoma
7.	M /55yr Rt. frontal	Benign nerve sheath tumour, Solitary fibrous tumour	S100-positive CD 34-negative	Benign nerve sheath tumour.
8.	M /45yr Rt. frontal lobe mass	Malignant lymphoma, Secondary from blue round cell tumour	CD 45-positive PanCK-negative	Lymphoma
9.	M /17yr Foramen magnum mass	PNET, Anaplastic ependymoma	CD99-positive GFAP-positive	PNET
10.	M / 55yr Rt. frontoparietal mass	Glioblastoma	GFAP-positive	Glioblastoma
11.	F /11yr Lt. frontoparietal mass	Anaplastic astrocytoma	GFAP-positive Synaptophysin-negative	Anaplastic astrocytoma
12.	M /46yr D11-D12 mass lesion	Cellular schwannoma	S100-positive	Cellular schwannoma
13.	M /21yr Lt. frontal mass	PNET, Ependymoma, Papillary meningioma	GFAP-positive EMA-positive CD99-positive Vimentin-positive	Astroblastoma
14.	F /12yr Rt. frontal mass	PNET, Malignant lymphoma, Diffuse fibrillary astrocytoma	GFAP-focal positive CD45-negative Synaptophysin-negative	Diffuse fibrillary astrocytoma
15.	F /21yr Intramedullary mass	Nerve sheath tumour	EMA-negative	Nerve sheath tumour
16.	M /65yr Rt. frontotemporal	Secondary deposit from small cell carcinoma, Malignant lymphoma	CD45-positive PanCK-negative	Primary CNS lymphoma.
17.	Fch /8yr D10-L3 extramedullary intradural mass	Cellular schwannoma	S100-positive	Cellular schwannoma.

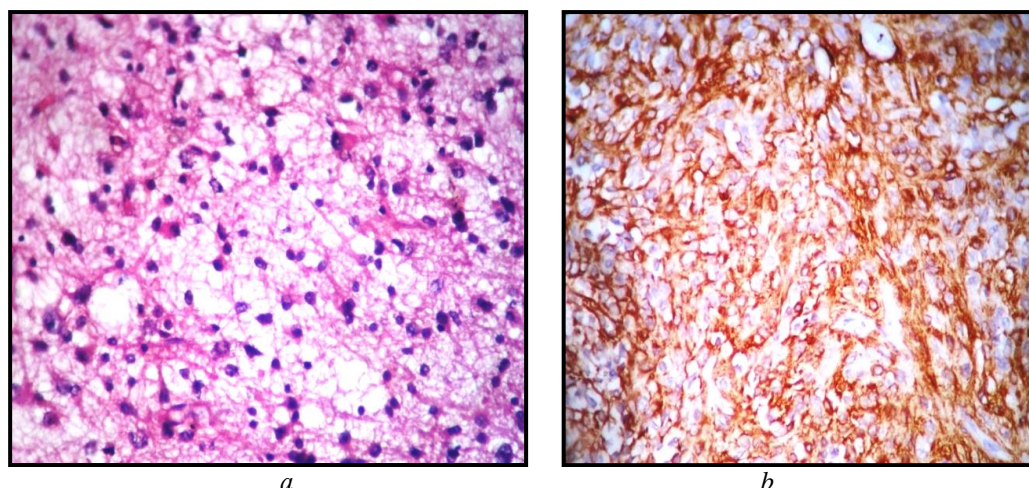


Fig. 1. Diffuse fibrillary Astrocytoma IHC -GFAP positive. $\times 40$, H/E: *a* – H/e: tumour with increased cellularity, fibrillary processes against a fibrillary background; *b* – GFAP: diffuse positivity in astrocytes

4. Discussion

In our study, the most common symptom encountered was headache (62 %), followed by convulsions (30 %), vomiting (29 %) and visual disturbances (27 %). The predominance of headaches in intracranial tumours follows other studies by Nelson S et al. [4].

The most common site for the tumours in our study was the cerebral lobes accounting for 56.7 %. Among these, the frontal lobe was most frequently involved, followed by parietal, temporal and occipital lobes, either singly or in association with other lobes. The percentage of tumours in frontal, parietal, temporal and occipital lobes is 38.9 %, 22 %, 1.3.5 % and 3.3 %, respectively. The study by Prasad K. S. V. [5] et al. has shown similar findings with frontal lobes as the most common site, followed by the temporoparietal region.

The most common age group affected in our study was 41–50 years, followed by 51–60 years; in both males and females. This concurred with a study by Ardhini, Rahmi et al. [6]. In a study conducted at Tata Memorial Hospital, the highest incidence was noted in the 19–40 year age group. In a study conducted by Shivraj Nag-nath Kanthikar et al. [7], the maximum number of CNS tumours were found beyond 40 years of age; among them, 41–50 years age groups people mostly had the lesions. The lowest age group where tumours were noted was 11–20, in that one case was found with glioblastoma multiforme in a male patient at the age of 17 years. Out of 40 cases, CNS tumours and meningioma were most commonly found, followed by astrocytoma and schwannoma, in which a slight tendency for females compared to males was noted. The female to Male ratio was 1.22:0.81.

Males are more frequently affected (61.5 %), and male to female ratio is 1.6:1. Our findings were similar to the study of Ostrom QT et al., which showed an M:F ratio of 1.7:1 [8]. However, in contrast to other studies, there was a subtle variation in the frequency of meningiomas with a male predominance (7.6 %) compared to females (6.7 %). Data from the Central Brain Tumor Registry of the US (CBTRUS) revealed a male/female incidence ratio of 1.38 [9].

The most common tumours in the present study are gliomas (35.5 %), among which astrocytomas formed

the bulk (59.4 %). A cross-sectional study conducted in Kolkata, India, has also shown gliomas as the most frequent tumour [10]. In a similar study conducted at Tata Memorial Hospital, Mumbai, astrocytomas were the most common amounting to 38.7 % of the tumours. However, another similar study by CBTRUS showed a 33.7 % incidence of neuroepithelial tumours, among which glioblastomas were the most common (17 %), followed by astrocytomas (2.1 %) in the case of adults [9].

In paediatric cases, astrocytomas were the most common (29.2 %), followed by medulloblastomas (12.3 %). In contrast to all these studies, one study by Dho Y. S. et al. [10] in Korea reported meningiomas as the most common tumour (31.2 %), followed by glioblastomas (30.7 %). A nationwide database in France also showed glioma as the most frequent tumour (49.6 %). The present study reaffirms the findings of other studies [11].

Our study's second most common tumours were schwannomas (18 %), followed by meningiomas (14 %). Similar findings were also reported in other studies conducted in France and Kolkata, in which meningiomas were the second most common tumours that made up 30.9 % and 11.6 %, respectively. However, in our study, meningiomas were the third most common tumours. Following meningiomas were the other medulloblastomas, ependymomas, pituitary adenomas, lymphomas, PNET, and neurocytomas. We have also encountered astroblastoma and plasmacytoma, one case each [12].

In the present study, gliomas are the most common tumours, among which astrocytomas were predominant (59.4 %), followed by glioblastomas (35.1 %) and oligodendrogliomas (5.4 %). The grading system adopted is according to the WHO system [4]. Most astrocytomas are seen in males compared to females, and the highest frequency has been noted in the 4th and 5th decades of life. Diffuse fibrillary astrocytomas (grade II) were most common in our study, with 18 out of 22 cases (Table 3, Fig. 1). There were three cases of anaplastic astrocytoma (grade III), and we also encountered a case of gemistocytes astrocytoma. Cellular tumours composed predominantly of fibrillary neoplastic astrocytes with nuclear atypia were diagnosed as fibrillary astrocytomas. The tumour dominated by gemistocytes (more than 20 %) has been diagnosed as gemistocytes astrocytoma. The ana-

plastic astrocytomas were highly cellular with distinct nuclear atypia and mitotic activity [13].

The number of glioblastomas was 13, with a frequency of 12 % of all CNS tumours and 35.13 % of gliomas. Some of the studies have reported the highest frequency of glioblastomas [13]. Like astrocytomas, the highest frequency is seen in the 5th decade and in males. The diagnosis is based on pleomorphic astrocytes with marked nuclear atypia, mitotic activity, microvascular proliferation and necrosis. The diagnosis has been confirmed by positive expression of GFAP in epithelial structures.

In our study, a case 65-year-old man presented with a solid and cystic lesion in the left frontoparietal region. Histopathology revealed glioblastoma features with foci showing foamy cytoplasm (lipidated cells) (Tab. 4). Another case has been reported in a female, 37-year-old with a tumour in the left temporal lobe. Histology revealed bizarre multinucleated giant cells with prominent nucleoli, atypical mitoses, and necrosis, and it has been diagnosed as a giant cell glioblastoma. Literature shows immunopositivity of giant cells with S-100, Vimentin, class III β tubulin, p53 and EGFR but with variable GFAP expression [14].

Our study reported two cases of oligodendrogliomas, accounting for 2 % of all tumours. One case was a female aged 25 years with an extradural SOL in the right frontal lobe. Histology showed diffusely infiltrating tumour cells with round nuclei, perinuclear halos and few cellular processes. Histology of another case of a 50yr old male with right frontoparietal mass showed features of prominent branching capillaries and calcification, which aided in diagnosing anaplastic oligodendroglioma (grade III).

In the present study, two cases of anaplastic ependymoma (grade III) have been reported. Interestingly both the cases were 4-year-old boys, among which one presented with right frontotemporal mass and the other with right parietooccipital mass. Histology revealed monomorphic cells arranged in perivascular pseudorosettes along with mitotic activity, microvascular proliferation and necrosis. Literature shows that parenchymal ependymomas may occur outside the ventricular system, particularly in children [15].

A rare case of astroblastoma has been reported in the present study—a 21-year-old male presented with diplopia and progressive headache. CT scan revealed a lesion in the left frontal region with iso to hyperdense solid and cystic components. Histology showed a tumour with pseudorosette arrangement and open textured areas appearing as pseudo papillary processes. Unipolar cytoplasmic processes of neoplastic cells help anchor the stromal blood vessels. Immunostaining with GFAP, EMA, CD 99 and Vimentin came out positive, which helped to arrive at a confirmatory diagnosis [16].

Three uncommon cases of neuronal and mixed neuronal-glioma tumours have been reported in our study. A 16-year-old female presented with a left paracellular lesion, and the histology revealed multinucleated neurons admixed with lymphocytes, and it has been diagnosed as ganglioglioma (grade I). Ganglions are differentiated from neoplastic neurons by the expression of GFAP [17]. Another case was seen in a 21-year-old female who pre-

sented with an intraventricular mass. Histology showed monomorphic cells with round nuclei and speckled chromatin against a fibrillary background. The differential diagnoses were oligodendroglioma and central neurocytoma. Immunohistochemistry showed S-100 positivity for the fibrillary matrix, GFAP positivity in trapped reactive astrocytes and the diagnosis of central neurocytoma (grade II) was evident. Another similar case is seen in a 51-year-old male in the right frontal region, which has been reported as an extraventricular neurocytoma.

In the present study, we have encountered eight cases of embryonal tumours accounting for 7.6 % of all CNS tumours. Six cases were medulloblastomas (grade IV), and two cases were primitive neuroectodermal tumours (grade IV). There was a male predominance with seven out of eight cases (M: F=7:1). Six out of eight were presented in the first decade of life, and the other two were in the second and third decades each. Out of six medulloblastomas, three cases had intraventricular locations; two were in the cerebellum and one in the cerebral hemispheres. Tumours of cells arranged in sheets with a round to oval hyperchromatic nuclei and scant cytoplasm were reported as classic medulloblastoma. A 12-year-old female child presented with an intraventricular mass, and the histology showed pale nodular areas surrounded by densely packed cellular areas. This was designated as a desmoplastic/nodular medulloblastoma. Histology of another case in a 1½-year-old male child showed cells with marked nuclear pleomorphism, nuclear moulding, cell-cell wrapping and high mitotic activity. It has been diagnosed as an anaplastic medulloblastoma.

A 17-year-old male patient presented with an intradural mass extending 1 cm above and 2 cm below the foramen magnum, anterior to the cervicomedullary junction and extending through the C1-C2 lateral foramina into the left paraspinous region. Histology of the mass revealed a tumour composed of blue round cells with regular round nuclei, vesicular chromatin, mitotic activity and pseudorosettes. The differential diagnoses were PNET and anaplastic ependymoma. In addition, IHC showed positivity for GFAP and CD 99, which has been reported as PNET [18].

Comparative studies based on Nerve sheath tumours:

Schwannomas (grade I) comprised 18 % of our study's CNS tumours. Most of the tumours were located at the cerebellopontine angle besides the brain stem and spinal cord. We encountered a case of 50yr old male with a mass in the right frontal region for which the differential diagnoses were schwannoma and solitary fibrous tumour. Immunohistochemistry revealed S-100 positive and CD 34 negative, hence the schwannoma diagnosis. Schwannomas show diffuse cytoplasmic S-100 protein expression. Few instances occur when the schwannomas have to be differentiated from meningiomas with the help of IHC, where meningiomas display EMA positivity, unlike the schwannomas.

Comparative studies based on Meningeal tumours:

In the present study, 15 cases of meningeal tumours were reported with a frequency of 15.38 %. In contrast to other studies, there was a slight male predominance in our study, with eight out of 15 cases. The most common variant

encountered was the transitional variant, followed by fibroblastic and atypical variants and a single case of meningothelial, papillary, angiomatous, clear cell and psammomatous variants. The histological features include tumour cells arranged in concentric whorls and clear nuclei with pseudo inclusions. Transitional meningiomas showed both syncytial and fibroblastic components. Prominent whorls and psammoma bodies were also seen.

Fibrous Meningiomas show spindle-shaped cells forming parallel and interlacing bundles against a collagen-rich matrix. A case 32-year-old male with a right parietal region mass showed histological features of meningioma with numerous thin-walled blood vessels and has been diagnosed as an angiomatous meningioma. A parasagittal mass in a 45-year-old male revealed meningioma with polygonal cells with clear cytoplasm. Literature shows that intracranial clear cell meningiomas mainly display high grades (grade II) [18].

Another similar case was encountered in two male patients aged 45 and 59, and the histology showed atypical meningioma (grade II) features with high cellularity, >4 mitoses/10 hpf, and small pleomorphic cells. Another rare variant of a papillary meningioma has been noted in a 49-year-old male in the suprasellar and clinoidal region with papillary patterns. Immunohistochemistry revealed S-100 positivity. In some studies, it has been reported that 39 % of meningiomas show S-100 positivity.

In our study, two cases of primary CNS lymphomas have been reported with a frequency of 1.9 %. One case was a 60-year-old female with a frontal mass, and the other was a 45 year male with a frontal mass. The histology of both tumours revealed an angiocentric growth pattern. CD 45 and 20 were upbeat, confirming the diagnosis of primary malignant lymphoma of B cell origin. Nearly 60 % of the primary CNS lymphomas occupy the supratentorial space.

One case of plasmacytoma has been reported in a male aged 50 who presented with a mass in the left paraspinous extramedullary region at the D6-D7 level, causing destruction of the D7 vertebra and displacing the cord.

Two cases of pituitary adenomas were reported in our study. Both cases were male patients in the fourth decade of life. Histology shows monomorphic cells with uniform round nuclei, stippled chromatin, and moderate cytoplasm.

In our study, 14 cases of metastatic tumours were reported with a frequency of 13.4 %. The age distribution ranged from the fourth to seventh decades. Adenocarcinoma was the most common metastatic deposit in our study. Also, there was a metastasis from melanoma and follicular carcinoma of the thyroid. Of 14 cases, 13 were located in the cerebral hemispheres and the other in the spinal cord. Brain metastases originate from the respiratory tract and breast, followed by skin and colorectal adenocarcinomas.

Grossly the metastatic nodules form discrete round, well-circumscribed grey white or tan masses and simulate the primary tumour histologically. The diagnosis was straightforward in most cases. Immunohistochemistry was helpful in other cases. One of the cases was an 80yr old female with a mass lesion in the corpus callosum. The differential diagnoses were pigmented ependymoma and malignant melanoma deposit. IHC revealed strong HMB 45 positivity and negative GFAP, thus diagnosing metastasis from malignant melanoma.

Limitations of the study. This study may not represent an accurate incidence of CNS tumours at our centre due to the limited number of cases. Furthermore, the study was based on a single-centre analysis.

Prospects for further research. CNS tumour classification constantly explores new horizons daily. Most of our research is based on old classifications and literature. We need to expand and involve molecular studies, which can be more useful in diagnosis and treatment approaches.

5. Conclusion

In the present study, the most common cases are intracranial tumours. The tumours have been encountered in all age groups, from infants to 80-year elderly persons, with the highest frequency in the age group of 41 to 50. Astrocytomas were the most frequent histological type accounting for up to 57 % of the total gliomas. Among all the tumours, the majority were more common in males. Unipolar cytoplasmic processes of neoplastic cells help anchor the stromal blood vessels. Immunostaining with GFAP, EMA, CD 99 and Vimentin came out positive, which helped to arrive at a confirmatory diagnosis. Diffuse fibrillary astrocytomas (grade II) were most common in our study, with 18 out of 22 cases. In addition, there were three cases of anaplastic astrocytoma (grade III), and we have also encountered a case of gemistocytes astrocytoma.

Rare cases like astroblastoma were encountered in this study. Adequate imaging by CT/MRI is an essential aid in the diagnosis. Although H&E staining is the mainstay for histopathological diagnosis, immunohistochemistry has played a significant role in diagnostic accuracy. The judicious use of a panel of selected antibodies is helpful in diagnostically challenging cases.

Conflicts of interest

The authors declare that they have no conflict of interest concerning this research, whether financial, personal, authorship or otherwise, that could affect the research and its results presented in this article.

Financing

The study was performed without financial support.

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Received date 17.05.2022

Accepted date 26.06.2022

Published date 30.09.2022

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