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Research Article

Beyond Glial: A Retrospective Histopathological Review Of Non-Glial CNS And PNS Tumors

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ABSTRACT

Background: Non-glial tumors of the central nervous system (CNS) and peripheral nervous system (PNS) constitute a diverse group of neoplasms with distinct clinicopathological features and prognostic implications. Accurate histopathological classification is essential for management and therapeutic decisions.

Aim: To analyze the spectrum, clinicopathological features, and distribution of non-glial CNS and PNS tumors with emphasis on histological subtypes and their correlation with clinical and radiological findings.

Methods: A retrospective study of **30 cases** of non-glial CNS and PNS tumors diagnosed in the Department of Pathology, MGM Medical College & Hospital, between January 2023 and May 2025. Clinical history, radiological findings, and histopathological features were reviewed. Tumors were classified and graded according to the WHO Classification of CNS Tumors, 2021.

Results: Among the 30 cases, **meningiomas** were most frequent (**18 cases, 60%**), followed by **schwannomas** (**8 cases, 26.7%**), **neurofibromas** (**3 cases, 10%**), and **metastasis** (**1 case, 3.3%**). The majority were **benign tumors (26 cases, 86.7%)**, while **4 cases (13.3%)** were malignant, including atypical meningiomas (Grade II) and metastasis. Patients ranged from **23–75 years** (mean 49.2 years), with a **male-to-female ratio of CNS and PNS tumor** (calculated from dataset). Headache was the most common presenting complaint.

Conclusion: Non-glial CNS and PNS tumors display significant histological diversity, with meningiomas and schwannomas comprising the majority. Histopathology remains crucial for definitive diagnosis and grading, directly influencing treatment and prognosis.

Keywords*: Non - glial tumors, Meningioma, Schwannoma, Neurofibroma, CNS tumors, Histopathology.*

INTRODUCTION

Primary tumors of the central nervous system (CNS) represent a heterogeneous group of neoplasms, with gliomas being the most common. However, a considerable proportion of CNS tumors arise from non-glial elements, including the meninges, cranial nerves, sellar region, embryonal remnants, lymphoid tissue, and germ cells. These tumors, collectively termed non-glial CNS tumors, differ significantly in their anatomical distribution, clinical behaviour, prognosis, and therapeutic strategies compared to their glial counterparts [1,2].

Neoplasms of the peripheral nervous system (PNS), such as schwannomas and neurofibromas, also contribute to the spectrum of non-glial tumors. They display a wide range of biological potential—from benign and curable lesions to locally aggressive tumors, and rarely, highly malignant variants such as malignant peripheral nerve sheath tumors (MPNSTs) [2,3].

Among non-glial CNS tumors, meningiomas account for nearly one-third of primary intracranial tumors, with a higher

incidence in middle-aged women [4,5]. Vestibular schwannomas, pituitary adenomas, craniopharyngiomas, medulloblastomas, and primary CNS lymphomas are other important entities within this group [6]. Histopathological examination remains the gold standard for their diagnosis, often supplemented by immunohistochemistry (IHC) and molecular studies for accurate classification and grading [1].

With advances in neuroimaging and surgical techniques, the detection of non-glial tumors has increased, necessitating a deeper understanding of their clinicopathological spectrum [7]. Since management and prognosis vary widely across these tumor types, accurate histological classification is crucial.

The present study was undertaken to evaluate the spectrum, frequency distribution, histomorphological features, and clinico-radiological correlation of non-glial CNS and PNS tumors in a tertiary care centre. The findings aim to enrich existing literature and provide insights into better recognition and classification of these tumors in routine practice.

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Among non-glial CNS tumors, **meningiomas** account for nearly one-third of primary intracranial tumors, with a higher incidence in middle-aged women. **Vestibular schwannomas**, **pituitary adenomas**, **craniopharyngiomas**, **medulloblastomas**, and **primary CNS lymphomas** are other important entities within this group. Histopathological examination remains the gold standard for their diagnosis, often supplemented by immunohistochemistry (IHC) and molecular studies for accurate classification and grading.

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MATERIALS AND METHODS

Study Design and Setting:

This was a retrospective cross-sectional study conducted in the Department of Pathology, MGM Medical College & Hospital, Navi Mumbai, between January 2023 and May 2025.

Sample Size:

A total of 30 histopathologically diagnosed cases of non-glial CNS and PNS tumors were included in the study.

Inclusion Criteria:

- All histopathologically diagnosed cases of non-glial CNS tumors and PNS tumors received in the department during the study period.
- Patients of all ages and both genders.

Exclusion Criteria:

- All cases of glial tumors were excluded. Data Collection:
  Relevant clinical data, including patient demographics, clinical presentation, and radiological findings, were retrieved from medical records and histopathology requisition forms.

Histopathological Processing:

All surgical specimens received were fixed in 10% buffered formalin. Following gross examination, representative tissue samples were processed using standard histopathological techniques. Sections were stained with haematoxylin and eosin (H&E) and examined under light microscopy.

Classification and Grading:
Tumors were classified and graded according to the **World Health Organization (WHO) Classification of Tumors of the Central Nervous System, 5th Edition (2021)**.

Statistical Analysis:
Data were compiled in Microsoft Excel. Descriptive statistics were used, and results were expressed as frequency and percentages. Graphical representations (bar charts and pie charts) were prepared for distribution patterns.

Ethical Clearance:
The study protocol was approved by the Institutional Ethics Committee (IEC), MGM Medical College, Navi Mumbai (Approval No: DHR-EC/2025/07/70). Patient confidentiality was maintained throughout the study.

RESULTS
A total of **30 cases** of non-glial CNS and PNS tumors were studied during the period from January 2023 to May 2025.

Age and Gender Distribution
The patients' ages ranged from **23 to 75 years**, with a **mean age of 49.2 years**. The majority of cases occurred in the **fifth to sixth decades of life**.

There were **17 females (56.7%)** and **13 males (43.3%)**, yielding a **male-to-female ratio of 1:2.3**.

Gender	Number of Cases	Minimum Age	Maximum Age	Mean Age
F	21	18	76	51.857
M	9	5	58	42.111

Table 1: Age and Gender Distribution

Tumor Distribution
Among the 30 cases, the most common tumors were:

- **Meningiomas – 18 cases (60%)**
- **Schwannomas – 8 cases (26.7%)**
- **Neurofibromas – 3 cases (10%)**
- **Metastasis – 1 case (3.3%)**

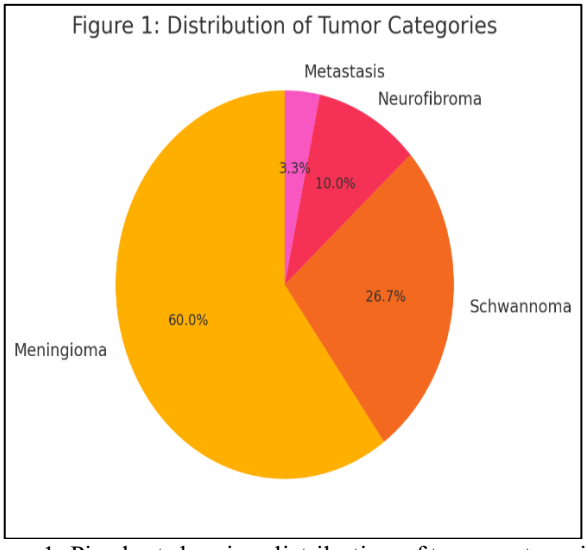


Figure 1: Pie chart showing distribution of tumor categories.

Histopathological Subtypes

- Meningiomas included meningothelial, fibroblastic, transitional, angiomatous, and atypical variants.
- Schwannomas were classical type in most cases.
- Neurofibromas included plexiform and cellular variants.
- One case of metastatic carcinoma was noted.

Benign vs Malignant Tumors

Of the total cases, **26 (86.7%)** were benign, while **4 cases (13.3%)** were malignant. Malignant cases comprised **atypical meningiomas (WHO Grade II)** and one case of **metastatic carcinoma**.

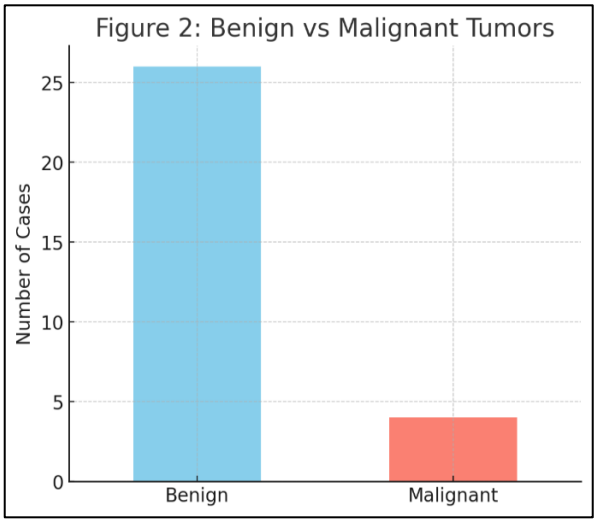


Figure 2: Bar chart showing benign vs malignant tumor distribution.

Clinical Presentation

The most common clinical symptom was **headache**, followed by **seizures**, **vomiting**, and **visual disturbances**. Rare symptoms included giddiness and dizziness.

Radiological Findings

Most patients had radiological findings consistent with a **neoplastic etiology**. Meningiomas and schwannomas were often suspected radiologically and confirmed on histopathology.

Tumor Type	Number of Cases	Percentage (%)
Meningioma	18	60.0
Schwannoma	8	26.7
Neurofibroma	3	10.0
Metastasis	1	3.3

Table 2: Tumor Category Distribution

Nature	Number of Cases	Percentage (%)
Benign	26	86.7
Malignant	4	13.3

Table 3: Benign vs Malignant Distribution

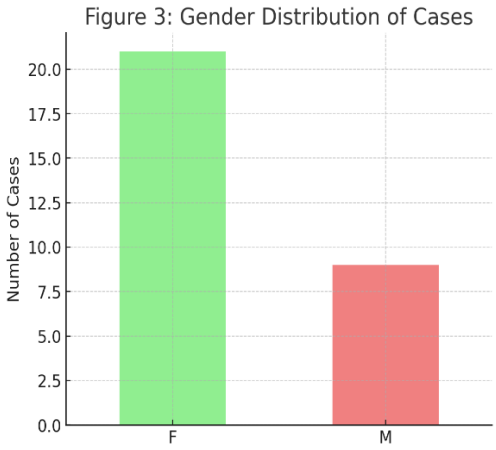
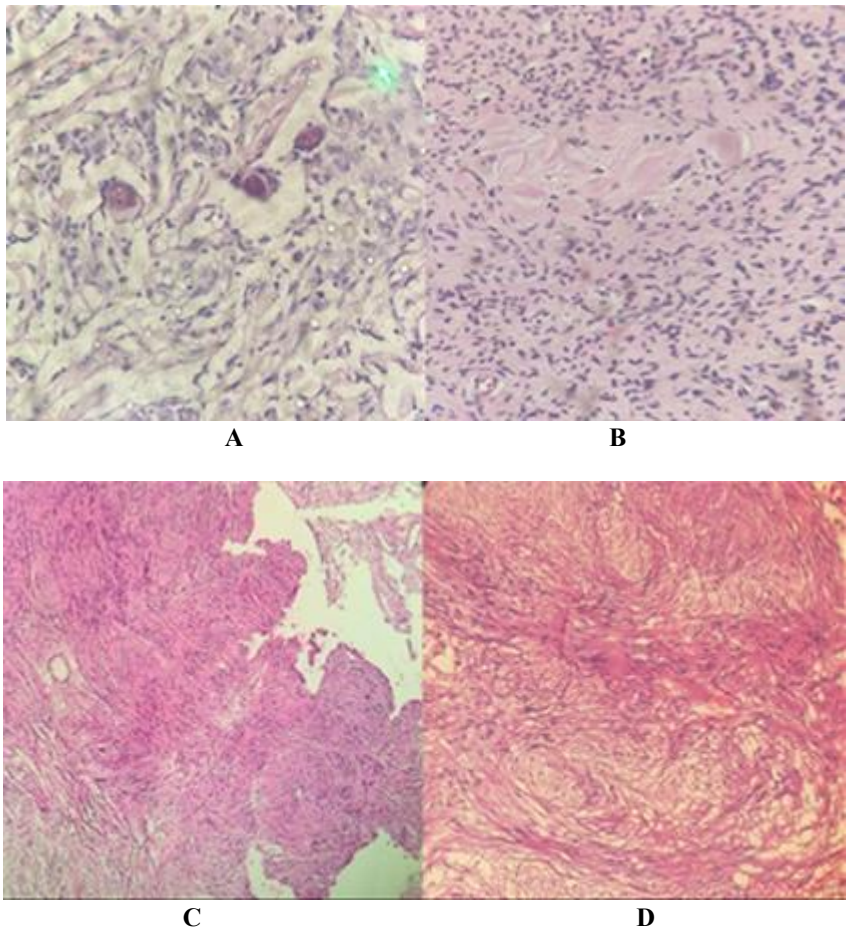


Figure 3: Panel showing representative histopathology of non-glial CNS and PNS tumors



A **B**

C **D**

A: Meningioma (H&E, ×40) showing characteristic whorled pattern with psammoma bodies.
B: Neurofibroma (H&E, ×40) with spindle cells in a myxoid background.
C: Schwannoma (H&E, ×20) showing Antoni A areas with nuclear palisading.
D: Schwannoma (H&E, ×20) showing Antoni B areas with loose, hypocellular regions.

DISCUSSION

In the present study of 30 cases of non-glial CNS and PNS tumors, meningiomas were the most common entity, accounting for 60% of cases. This finding is consistent with the CBTRUS statistical report and WHO classification, which describe meningiomas as the most frequent primary intracranial non-glial tumors, representing nearly one-third of all CNS tumors [1,8].

Our study demonstrated a female predominance (M:F = 1:2.3), aligning with previous reports that highlight the hormonal influence and genetic predisposition in meningioma pathogenesis. The mean age for meningioma cases in this study was in the fifth to sixth decades, similar to findings by Backer-Grøndahl et al. and Raza et al., who noted peak incidence in middle-aged females [4,5].

Schwannomas represented 26.7% of our cases, most commonly located in the cranial and peripheral nerves. This is in agreement with Patil et al. and Costa et al., who reported schwannomas as the second most common non-glial tumors, typically arising in the head and neck region with a slight male predominance [7,9]. The clinicopathological features in our study—including seizures, giddiness, and localized neurological deficits—were comparable to their observations. Neurofibromas constituted 10% of our cases, including plexiform and cellular variants. This is consistent with Friedrich et al., who emphasized their association with neurofibromatosis type 1 (NF1) and their potential for malignant transformation into malignant peripheral nerve sheath tumors (MPNSTs) [3].

One case of metastatic carcinoma was noted in our series (3.3%), highlighting the fact that metastases remain the most frequent intracranial neoplasms overall, often originating from lung, breast, and renal primaries. Although rare in our small sample, this finding underscores the importance of histopathology in differentiating metastases from primary CNS tumors [10].

Regarding biological behaviour, the majority of our cases (86.7%) were benign, while 13.3% were malignant, including atypical meningiomas (WHO Grade II) and metastasis. This distribution reflects the general consensus that most non-glial CNS and PNS tumors are benign but may demonstrate recurrence or progression in certain histological subtypes [1,6].

The clinical presentation in our study was dominated by headache and seizures, in line with previous studies [8,11]. Symptoms such as visual disturbances and giddiness were also observed, reflecting tumor location and local mass effect. Radiological findings were largely supportive, but histopathology remained the definitive diagnostic tool, particularly in grading meningiomas and identifying rare subtypes [6].

In the present study of **30 cases** of non-glial CNS and PNS tumors, **meningiomas** were the most common entity, accounting for **60%** of cases. This finding is consistent with the CBTRUS statistical report and WHO classification, which describe meningiomas as the most frequent primary intracranial non-glial tumors, representing nearly one-third of all CNS tumors.

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Limitations
The limitations of this study include the **small sample size (30 cases)** and the **retrospective design**, which limited the availability of complete clinical and follow-up data. Immunohistochemistry and molecular markers were not performed in all cases, which may have provided additional diagnostic precision.

CONCLUSION
Non-glial tumors of the CNS and PNS constitute a diverse spectrum of neoplasms, most commonly represented by meningiomas and schwannomas. In the present study, the majority were benign, with only a small proportion showing malignant potential. Clinical presentation was predominantly with headache and seizures, while radiological findings were largely suggestive but not definitive.

Histopathology remained the cornerstone for accurate diagnosis and grading, particularly for distinguishing benign from atypical or malignant variants. The findings reinforce the importance of routine histopathological evaluation in all suspected cases of non-glial CNS and PNS tumors, as management and prognosis vary considerably among subtypes. Further studies with larger cohorts and incorporation of immunohistochemistry and molecular techniques are recommended to enhance diagnostic precision and prognostic stratification.

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