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Edited by Yogesh Singh Bisht & Ruby Singh
E-mail: yogeshbishttech@gmail.com & bioinformationruby@gmail.com
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Adult intracranial lesions: A prospective observational study in India

Mrigank Sinha[1,*], Priya Yadav[2], Sneha Shukla[1] & Sanjay Totade[3]

[1]Department of Pathology, Chhindwara Institute of Medical Sciences, Chhindwara, Madhya Pradesh, India; [2]Department of Family Medicine, Family health care center, New Delhi, India; [3]Department of Pathology, Netaji Subhash Chandra Bose Medical College Jabalpur, Madhya Pradesh, India; *Corresponding author

Affiliation URL:
https://www.govtmedicalcollegechhindwara.ac.in/
https://www.familyhealthcarecenter.com/
https://www.nscbmc.ac.in/home

Author contact:

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Mrigank Sinha - E-mail: drmdsinha@outlook.com
Priya Yadav - E-mail: y.priya3107@gmail.com
Sneha Shukla - E-mail: snehashukla9475@gmail.com
Sanjay Totade - E-mail: drrjdoc@gmail.com

Abstract:
Adult intracranial lesions comprise diverse neoplastic and non-neoplastic conditions requiring accurate histopathological diagnosis. This prospective observational study evaluated 79 adult intracranial lesions at a tertiary care center in Central India over 18 months. Neoplastic lesions constituted 86.1% of cases, with gliomas (40.5%) and meningiomas (25.3%) being the most common diagnose. Most lesions occurred in patients aged 30–50 years and predominantly involved the supratentorial compartment. Thus, histopathological evaluation remains essential for accurate classification and appropriate management of adult intracranial lesions.

Keywords: Adult intracranial lesions, histopathology, glioma, meningioma, central nervous system (CNS), WHO classification

Background:
Intracranial lesions include diverse neoplastic and non-neoplastic disorders with variable clinical and pathological features **[1]**. Although neuroimaging aids lesion detection and localization, overlapping findings may limit definitive diagnosis **[2].** Histopathology remains essential for tumor classification, grading, prognosis and treatment planning under the WHO CNS tumor classification **[3, 4]**. The distribution of intracranial lesions varies across populations, with gliomas, meningiomas, schwannomas, pituitary tumors and metastases commonly reported in adults **[5, 6]**. Therefore, it is of interest to evaluate the histopathological spectrum and demographic, clinical, anatomical and pathological characteristics of adult intracranial lesions in a tertiary care center in Central India using the latest WHO classification.

Materials and Methods:
This hospital-based prospective study was conducted to evaluate the histopathological spectrum of adult intracranial lesions and their distribution according to age, sex, anatomical location, radiological findings and histopathological diagnosis. The study was carried out over a period of 18 months, from August 2023 to January 2025, in the Department of Pathology, Netaji Subhash Chandra Bose Medical College and Hospital, Jabalpur, Madhya Pradesh, in collaboration with the Department of Neurosurgery. Adult patients who were clinically and radiologically diagnosed with intracranial lesions and subsequently underwent neurosurgical biopsy or excision were enrolled consecutively. Relevant demographic details, clinical history, radiological findings, operative details and histopathological diagnosis were recorded in a predesigned study proforma. A total of 79 adult patients with histopathologically confirmed intracranial lesions were included in the final analysis.

Inclusion criteria:
[1] Adult patients aged 18 years or above.
[2] Patients with clinically and radiologically diagnosed intracranial lesions who underwent biopsy or surgical excision.
[3] Adequately preserved biopsy specimens received in the Department of Pathology during the study period.
[4] Histopathologically confirmed intracranial lesions.

Exclusion criteria:
[1] Patients younger than 18 years.
[2] Previously diagnosed cases.
[3] Inadequate or poorly preserved biopsy specimens unsuitable for histopathological examination.

Histopathological evaluation:
All biopsy specimens were fixed in 10% neutral buffered formalin, processed using standard histopathological techniques, embedded in paraffin, sectioned at 4–5 µm and stained with hematoxylin and eosin (H&E). Histopathological diagnosis was established by microscopic examination and neoplastic lesions were classified according to the 2021 World Health Organization (WHO) Classification of Tumours of the Central Nervous System. Immunohistochemistry was performed in selected cases whenever required for diagnostic confirmation.

Statistical analysis:
Data were compiled and analyzed using IBM SPSS Statistics version 27.0. Continuous variables were expressed as mean ± standard deviation, whereas categorical variables were summarized as frequencies and percentages.

Ethical approval:
The study was approved by the Institutional Ethics Committee of Netaji Subhash Chandra Bose Medical College, Jabalpur.

Results:
A total of 79 adult patients with histopathologically confirmed intracranial lesions were included in the final analysis. Gliomas constituted the largest proportion of intracranial lesions (40.5%), followed by meningiomas (25.3%). Infective lesions, schwannomas, metastatic tumors, mesenchymal tumors, CNS cysts, sellar region tumors and embryonal tumors were comparatively less frequent **(Table 1)**. Among the 79 study subjects, the highest proportion of intracranial lesions was observed in the 30–50 years age group (33 cases, 41.8%), followed by the 50–70 years age group (26 cases, 32.9%). The 18–30 years age group accounted for 18 cases (22.8%), while the lowest frequency was observed in the 70–100 years age group (2 cases, 2.5%) **(Table 2)**. The frontal lobe was the commonest site

of involvement (31.7%), followed by the parietal lobe (24.1%). Lesions involving the cerebellopontine angle and temporal lobe were less frequent, whereas occipital lobe lesions were rare **(Table 3)**. WHO Grade I lesions were the most common (35.4%), followed by Grade IV tumors (21.5%). Grade II and Grade III tumors constituted a smaller proportion of the study population. Grade 0 represented lesions that were not assigned a WHO tumor grade **(Table 4)**. Of the 79 patients, 41 (51.9%) were males and 38 (48.1%) were females, indicating an almost equal gender distribution with a slight male predominance**.** Neoplastic lesions accounted for 68 (86.1%) cases, whereas 11 (13.9%) were non-neoplastic lesions, demonstrating a marked predominance of neoplastic pathology among surgically managed adult intracranial lesions**.** Supratentorial lesions constituted 63 (79.7%) cases, while 16 (20.3%) lesions were located in the infratentorial compartment**.**

Table 1: Frequency distribution of histopathological diagnosis

Histopathological diagnosis	Frequency (n)	Percentage (%)
Glioma	32	40.5%
Meningioma	20	25.3%
Infective lesions	6	7.6%
Schwannoma	5	6.3%
Metastatic tumors	4	5.1%
Mesenchymal tumors	4	5.1%
CNS Cysts	3	3.8%
Sellar region tumors	3	3.8%
Embryonal tumors	2	2.5%

Table 2: Age distribution of study subjects

Age group (years)	Frequency (n)	Percentage (%)
18-30	18	22.8%
30-50	33	41.8%
50-70	26	32.9%
70-100	2	2.5%

Table 3: Distribution of intracranial lesions by anatomical location

Location	Frequency (n)	Percentage (%)
Frontal lobe	25	31.7%
Parietal lobe	19	24.1%
Cerebellopontine angle	8	10.1%
Temporal lobe	6	7.6%
Sellar–suprasellar region	5	6.3%
Cerebellum	4	5.1%
Multiple lobes	3	3.8%
Ventricle	3	3.8%
Posterior fossa	3	3.8%
Thalamus	2	2.5%
Occipital lobe	1	1.3%

Table 4: WHO grade distribution of neoplastic lesions

WHO Grade	Frequency (n)	Percentage (%)
Grade I	28	35.4%
Grade II	8	10.1%
Grade III	11	13.9%
Grade IV	17	21.5%
Grade 0	15	19%

Discussion:

The present prospective study evaluated the histopathological spectrum of intracranial lesions in 79 adult patients at a tertiary care center in Central India. Neoplastic lesions constituted the majority of cases (86.1%), whereas non-neoplastic lesions accounted for 13.9%. Gliomas (40.5%) were the most common histopathological diagnosis, followed by meningiomas (25.3%), while infective lesions represented the most frequent non-neoplastic category. These findings are comparable with recent Indian studies that have also reported the predominance of gliomas and meningiomas among adult intracranial lesions **[7–9].** The mean age of the study population was 44.5 years, with the highest incidence observed in the 30–50-year age group. Although the overall gender distribution was nearly equal, gliomas were more common in males, whereas meningiomas showed a female predominance. Similar demographic trends have been described in previous studies, indicating that the age and sex distribution of intracranial lesions remains relatively consistent across different regions of India **[7, 8 and 10].** Most lesions in the present study were located in the supratentorial compartment (79.7%), with the frontal lobe being the most commonly affected site. This observation is in agreement with earlier reports demonstrating that supratentorial gliomas and meningiomas constitute the majority of surgically treated intracranial lesions in adults **[8, 11].** WHO Grade I tumors were the most frequent, followed by Grade IV tumors. Gliomas were predominantly high grade, whereas meningiomas and schwannomas were mainly low-grade lesions. Similar WHO grade distribution has been reported in recent studies using the 2021 WHO classification of CNS tumors **[9, 12].** Histopathological examination remained the definitive method for establishing the diagnosis and WHO classification of intracranial lesions. In selected cases, immunohistochemistry was used to confirm the diagnosis whenever routine histomorphology was inconclusive. These findings highlight the continued importance of histopathological evaluation in the accurate diagnosis and classification of adult intracranial lesions **[11, 12].**

Conclusion:

Neoplastic lesions predominated, mainly gliomas and meningiomas and occurred mostly in the supratentorial compartment in patients aged 30–50 years. Histopathology remains the gold standard for diagnosis and WHO classification, with immunohistochemistry as a useful adjunct. These findings provide regional reference data on adult intracranial lesions in Central India.

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