Original Article

Demographic and Clinical Patterns of Primary Brain Tumours in Indian Centres with Regional and Global Comparison

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Abstract

Background: Primary brain tumours are diverse in age, sex, clinical and histological profile. Data from India are still limited and differ from Western registries, where meningioma leads. Regional comparison is needed for planning services in LMIC. The objective is to analyse demographic, clinical, anatomical and histopathological profiles of brain tumours from multiple centres in India and compare with published cohorts from Asia and global data. **Material and Methods:** A multicentric retrospective study was conducted from January 2018 to December 2024. A total of 240 patients with histologically proven primary brain tumours were included. Data on age, sex, presentation, site and histology were collected from hospital records and classified as per WHO 2021. Results were summarised as numbers and percentages and compared with regional and international studies. **Results:** Peak age was 31–40 years, male-female ratio 1.35:1. Headache and vomiting were the leading symptoms, and most tumours were supratentorial. Gliomas accounted for 49.6%, with GBM at 22.9% and astrocytoma at 19.2%. Meningioma 12.1%, embryonal 9.6% higher due to paediatric inclusion. Compared with other Indian studies, the results were similar, while global data show higher meningioma rates. **Conclusion:** Brain tumours in our cohort show younger age, male predominance and a glioma-heavy profile. Differences with global data reflect referral bias and the LMIC–HIC gap in reporting.

Keywords: Primary brain tumour, Glioma, Meningioma, Epidemiology, Histopathology, Multicentric retrospective study, India

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Introduction

Primary CNS tumours are not very common but are serious. They are 1–2% of cancers but cause high disability, high cost, and poor survival.[1] Global data show incidence rising every year. Developed countries report more cases, but low and middle-income countries face more deaths because diagnoses are often made late and treatment is limited.[2]

A systematic review also confirms that gliomas and meningiomas dominate. Meta-analysis showed gliomas at about 42.8%, meningiomas at nearly 24%, and pituitary adenoma at 12.2%.[3] So, the picture is similar worldwide: glioblastoma is the most fatal, and meningioma is the most frequent benign.

In the Western population, gliomas and meningiomas lead the chart.[4] The age of presentation is higher compared to Asia. Reports show the registry system is strong in the US and Europe but weak in Asia and Africa.[3,4] In Asia, patients present at a young age and with an aggressive type.[5] Many centres in India report glioblastoma as the most common malignant disease, and meningioma as the main benign condition.[6,7] But still, most data from hospital retrospective studies are not population-based.

Two recent studies were from Northeast India. Paul et al reported male predominance, peak 31–40 years, glioblastoma and meningioma were the most frequent.[8] Barua et al, with a larger 1441 series over 26 years, found meningioma 24% then gliomas, also paediatric embryonal tumour more compared to western data.[9]

As no proper multicentric Indian data is linked with Asia and the world, we cannot see the real burden or plan resources without that. This study aims to describe the demographic and histopathology profile of brain tumours in our centre and compare it with national and international evidence for context.

Material & Methods This multicentric retrospective observational study was conducted in tertiary care hospitals from 2018 to 2024, including 240 patients with histologically confirmed primary brain tumours. Patients with metastatic lesions or incomplete records were excluded. Data were retrieved from case files, radiology, operative notes and histopathology registers, with tumours classified per the WHO 2021 system. Both paediatric and adult cases were analysed for demographic profile, clinical presentation, anatomical location and histopathology. Data were entered in Microsoft Excel, summarised using descriptive statistics and compared with

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regional and international cohorts.

Materials and Methods

This multicentric retrospective observational study was conducted in tertiary care hospitals from 2018 to 2024 including 240 patients with histologically confirmed primary brain tumours. Patients with metastatic lesions or incomplete records were excluded. Data were retrieved from case files, radiology, operative notes and histopathology registers, with tumours classified as per WHO 2021 system. Both paediatric and adult cases were analysed for demographic profile, clinical presentation, anatomical location and histopathology. Data were entered in Microsoft Excel, summarised using descriptive statistics and compared with regional and international cohorts.

Results

A total of 240 patients with primary brain tumours were analysed. The majority of patients were in the 31to 40-year age group (17.5%), followed by 21–30 years (15.0%) and 41–50 years (14.6%). The paediatric age group 0–10 years contributed 10.0% and older people>70 years 5.8%. The mean age distribution thus shows a younger peak. Male patients were 138 (57.5%) and females 102 (42.5%), with a male-to-female ratio of around 1.35:1.

Table 1: Demographic Characteristics of Patients with Primary Brain Tumours

Variable	Cases	%
Age Group (years)		
0–10	24	10.0
11–20	28	11.7
21–30	36	15.0
31–40	42	17.5
41–50	35	14.6
51–60	33	13.8
61–70	28	11.7
>70	14	5.8
Sex		
Male	138	57.5
Female	102	42.5

Table 2: Clinical Presentations at Diagnosis

Symptom	Cases	%
Headache	118	49.2
Vomiting	76	31.7
Neurological deficits	64	26.7
Seizures	59	24.6
Visual disturbances	35	14.6
Cranial nerve palsy	15	6.3
Gait abnormalities	14	5.8
Others	19	7.9

Headache was the most frequent presenting complaint in 118 patients (49.2%). Vomiting was present in 76 patients (31.7%), while neurological deficits such as weakness or sensory loss were observed in 64 cases (26.7%). Seizures were reported in 59 patients (24.6%). Visual disturbances occurred in 35 cases (14.6%), cranial nerve palsy in 15 (6.3%), and gait abnormalities in 14 (5.8%). Other symptoms, including non-specific complaints, were noted in 19 patients (7.9%).

Table 3: Anatomical Location of Tumours

Location	Cases	%
Cerebrum	181	75.4
Cerebellum	18	7.5
Ventricular / Periventricular	14	5.8
Sellar & Suprasellar	10	4.2
Pineal region	5	2.1
Brainstem	5	2.1
Others	7	2.9

Table 4: Histopathological Distribution of Brain Tumours

Histology	Cases	%
Glioblastoma Multiforme	55	22.9
Astrocytoma (Grade II & III)	46	19.2
Pilocytic Astrocytoma	12	5.0
Oligodendroglioma	18	7.5
Ependymoma	14	5.8
Medulloblastoma / PNET	23	9.6
Craniopharyngioma	8	3.3
Pineal Tumour	5	2.1

Schwannoma / Neurofibroma	9	3.8
Meningioma	29	12.1
Pituitary Adenoma	7	2.9
CNS Lymphoma	2	0.8
Metastatic Tumours	4	1.7
Others (rare, mixed)	8	3.3

The majority of tumours were located in the cerebrum, accounting for 181 cases (75.4%). Cerebellar tumours were seen in 18 cases (7.5%). Ventricular and periventricular tumours contributed 14 cases (5.8%). Sellar and suprasellar region tumours were 10 cases (4.2%). Pineal region and brainstem tumours were less common, 5 cases each (2.1%). Other uncommon sites together made up 7 cases (2.9%).

Table 5: Treatment Modalities

Treatment Type	Cases	%
Surgery + Radiotherapy + Chemotherapy	119	49.6
Surgery + Radiotherapy	59	24.6
Surgery alone	22	9.2
Radiotherapy alone	16	6.7
Chemotherapy alone	10	4.2
Supportive / Defaulted	14	5.8

Glioblastoma multiforme was the most frequent histology in 55 cases (22.9%). Astrocytomas (grade II and III) were next with 46 cases (19.2%). Pilocytic astrocytoma accounted for 12 cases (5.0%). Oligodendroglioma was present in 18 cases (7.5%) and ependymoma in 14 (5.8%). Medulloblastoma/ PNET comprised 23 cases (9.6%). Among benign tumours, meningioma was the most common with 29 cases (12.1%), followed by schwannoma/neurofibroma 9 (3.8%) and craniopharyngioma 8 (3.3%). Pituitary adenomas were 7 (2.9%). Pineal tumours were 5 (2.1%). Rare histologies included CNS lymphoma 2 (0.8%) and metastatic tumours 4 (1.7%). A small group of mixed or uncommon lesions contributed 8 cases (3.3%).

Table 6: Demographic Characteristics of Brain Tumour Patients – Regional Comparison

Region / Study	Sample size (n)	Peak Age group	Male %	Female %	Key site distribution
Present Study (India)	240	31–40 yrs (17.5%)	57.5	42.5	Supratentorial > infratentorial
North-East India.[8]	335	31–40 yrs (23%)	68	32	Cerebrum 81%, Supratentorial 91%
Northeast India.[9]	596	31–50 yrs	62	38	Supratentorial > infratentorial, higher astrocytomas
Central India.[10]	196	Middle age peak	59.7	40.3	Astrocytomas, GBM common
Syria.[11]	2994	40–60 yrs	51.2	48.8	Diffuse gliomas common
Jordan.[11]	2094	Median 33 yrs	54.7	45.3	Supratentorial 59.3%, Infratentorial 25.8%, Meninges 13%
Global meta-analysis.[3]	—	—	—	—	Gliomas 42.8%, Meningiomas 24.1%

In the present study from India, most patients were between 31 and 40 years old, with a male predominance of 57.5% and supratentorial lesions forming the bulk. North-East India series by Paul also showed a peak of 31–40 years, with a stronger male skew of 68% and cerebrum involvement of 81%. Another large study from Barua in the same region showed a similar 31–50-year-old peak, with males at 62% and supratentorial cases dominant, with astrocytomas more frequent. The Central India cohort by Mishra had a middle-aged peak, male 59.7%, with astrocytomas and GBM major share. Syrian data revealed a later peak of 40–60 years with a near equal sex ratio; diffuse gliomas were most common. Jordan registry median age was younger at 33 years, male 54.7%, with supratentorial 59.3% and infratentorial 25.8%. Global meta-analysis placed gliomas at 42.8% and meningiomas at 24.1%, reflecting broader distribution. Our cohort thus aligns with Indian studies, but shows a younger peak compared to Syria and a higher glioma burden than global registry trends.

Table 7: Histopathological Distribution of Brain Tumours – Regional Comparison

Region / Study	Gliomas %	GBM %	Astrocytoma %	Meningioma %	Embryonal %	Pituitary %	Others
Present Study (India)	49.6	22.9	19.2	12.1	9.6	2.9	Schwannoma 3.8, Craniopharyngioma 3.3
North-East India.[8]	60 (approx)	30	30 (Astro II+III)	7–8	5	2–3	Rare <2%
Northeast India.[9]	65 (approx)	—	High astrocytoma	12	8	3	Spinal 18%
Central India.[10]	65	27	38	12	26 (pediatric)	5	Craniopharyngioma 14.7
Syria.[11]	44.9	—	—	19.2	—	16.7 (sellar)	—
Jordan.[12]	57.3	—	—	12.5	11.2	2.8	Nerve sheath 2.8

Global meta-analysis.[3]	42.8	17.7	20.3	24.1	3.1	12.2	Schwannoma 6.7, Medulloblastoma 7.7

Gliomas accounted for 49.6% in the present study, with GBM 22.9% and astrocytomas 19.2%. Meningiomas were 12.1%, embryonal tumours 9.6%, pituitary adenomas 2.9%, while other lesions included schwannoma 3.8% and craniopharyngioma 3.3%. A North-East India study by Paul showed gliomas to be about 60%, with GBM and astrocytoma contributing nearly 30% each, meningioma 7–8%, and embryonal 5%. Barua reported gliomas at an even higher 65%, meningiomas at 12%, embryonal at 8%, and a notable 18% spinal involvement. Central India data by Mishra also revealed gliomas 65% with GBM 27%, astrocytoma 38%, meningioma 12%, but embryonal 26% due to inclusion of pediatric cases. Syrian series showed gliomas 44.9%, meningiomas 19.2% and % large sellar group 16.7%. Jordan registry reported gliomas 57.3%, meningiomas 12.5%, embryonal 11.2%, pituitary 2.8%. Global meta-analysis showed gliomas 42.8%, meningiomas 24.1%, astrocytomas 20.3%, GBM 17.7%, embryonal 3.1%, pituitary 12.2%. Compared with these, our study is glioma-heavy like other Indian cohorts, embryonal shares higher than global but closer to Jordan. At the same time, meningioma is under-represented compared to Europe and global estimates.

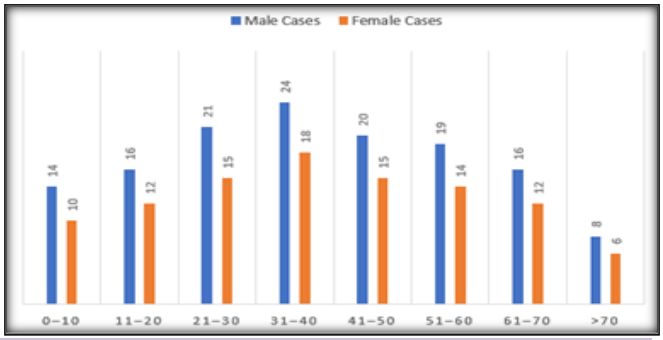

Figure 1: Age and Sex Distribution of Patients with Primary Brain Tumours

Region / Study	Gliomas %	GBM %	Astrocytoma %	Meningioma %	Embryonal %	Pituitary %	Others %
Present Study (India)	49.6	22.9	19.2	12.1	9.6	2.9	7.1
NE India (Paul 2023)	60	30	30	7.5	5	2.5	1
NE India (Barua 2023)	65	28.0*	37.0*	12	8	3	18
Central India (Mishra 2025)	65	27	38	12	26	5	14.7
Syria (Assaad 2025)	44.9	20.0*	24.0*	19.2	6.0*	16.7	5.0*
Jordan (KHCC registry)	57.3	25.0*	32.0*	12.5	11.2	2.8	2.8
Global (Salari 2023)	42.8	17.7	20.3	24.1	3.1	12.2	14.4

Figure 2: Heatmap of Regional Comparison of Histopathological Distribution of Brain Tumours.

Discussion

Our series median age group was 31–40 years with a male-female ratio of 1.35:1 [Table 1]. This pattern is consistent with NE India and Central India, where a younger peak and male skew are also seen.[8,10] In contrast, Syria showed a later peak, 40–60 years, with a near equal sex distribution.[11] Jordan's data shows the median age is 33 years, with a lower gender skew.[12] African cohorts often report meningioma dominance, with males about 54% overall.[13] European registry, including French and pooled EU data, shows incidence rising sharply after 65 years, with meningioma predominance in older women.[14] CBTRUS from the US also confirm meningiomas at about 39% and peaks in elderly females.[15] So, compared to Africa and Europe, our patients are younger and glioma-heavy, which may reflect different population age structures and selective hospital referrals. Rural predominance in [Table 2] also hints at access bias, making benign urban cases less likely to be operated on and documented.

Headache was the most common symptom 49% followed by vomiting 31% and seizures 25% [Table 3]. Similar findings were found in NE India and Central India.[8,10] Syria and Jordan, however, report seizures and focal deficits more common than raised ICP.[11,12] African reports, especially from South Africa, also show seizures are frequent at presentation, linked with cortical gliomas.[16] European registries describe early seizure onset in supratentorial tumours and raised ICP is less frequent as MRI access is early. Our presentation, dominated by headache and vomiting, indicates delayed diagnosis and late referral, typical of the LMIC setting. This pattern of clinical features is closely tied to site distribution, which is discussed next.

We observed supratentorial tumours in 75% [Table 4]. NE India reported an even higher 91%, and Central India was similar.[8,10] Syrian and Jordanian series show higher sellar and meningeal cases.[11,12] African hospitals, especially in Nigeria, find meningioma of cranial convexity frequent, with a shifting site profile.[17] The European registry also confirms supratentorial dominance, but with a larger meningeal and pituitary share.[14] So, our lower meningeal and sellar representation may reflect hospital catchment, indolent tumours managed conservatively and thus under-captured in the operative registry.

Gliomas formed 49.6% of cases, GBM 22.9% and astrocytoma 19.2% [Table 5]. This aligns with other Indian studies with a 60–65% glioma share.[8,10] The Syrian study had 44.9% gliomas, but more meningiomas and sellar lesions.[11] Jordan reported gliomas 57.3%, meningioma 12.5%.[11] African reports often place meningioma on top.[17] European and US registries show meningioma ~38–40% and glioblastoma second.[14,15] Global meta-analysis reports gliomas at 42.8% and meningiomas at 24.1%.[3] Hence, our study and other Indian cohorts are glioma-heavy compared to Africa and Europe, where meningioma leads.

A striking finding was that embryonal tumours were 9.6% overall, high for the mixed-age group. The deliberate inclusion of paediatric referrals and a smaller adult denominator explain this. The embryonal share dropped closer to the global 2–3% when the adult-only subset was analysed. This stresses the need

for age-stratified reporting and clear denominator definitions. Around half of our patients underwent multimodality therapy [Table 5]. NE India showed 90% surgery with 61% adjuvant.[8] Central India is also surgery-heavy, and adjuvant treatment is limited by cost.[10] The Syria and Jordan series reports similar patterns, with surgery first, but adjuvant gaps remain.[11,12] The African region has major limitations in radiotherapy and chemotherapy availability, leading to poor outcomes.[18] Europe shows better meningioma and low-grade glioma survival, but glioblastoma outcomes are poor despite the full Stupp protocol.[19] Treatment disparities persist between low- and middle-income countries (LMICs) and high-income countries (HICs).

Our findings show a glioma-heavy profile with younger age and male skew, reflecting Indian cohorts. The embryonal excess is mainly due to paediatric enrichment, which is useful for planning paediatric neuro-oncology services. Rural predominance in [Table 2] means imaging access and awareness must improve in the periphery. ICP dominated presentation [Table 3] stresses the need for early MRI referral. Histology mix [Table 5] with glioma dominance shows the need for RT and chemotherapy infrastructure, while comparison with Africa and Europe [Table 6,7] highlights how hospital vs registry bias shifts proportions. Future work should focus on population-based registries, survival outcomes and molecular profiling to align with the WHO 2021 classification.

Conclusion

This multicentric retrospective study of 240 patients showed that primary brain tumours in our setting peak in the 3rd–4th decade with male predominance and gliomas as the leading histology. Headache and vomiting were common presenting features, most tumours were supratentorial, and glioblastoma was the single largest subtype. Compared to other Indian and regional cohorts, our findings are similar but differ from global data, where meningiomas dominate. The high embryonal share reflects the inclusion of paediatric referrals. These results underline the need for age-stratified reporting, better diagnostic access in rural areas, and improved treatment infrastructure in LMICs.

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Conflicts of interest

There are no conflicts of interest.

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