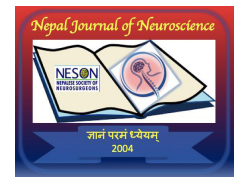


National Brain Tumor Registry Of Nepal: A Multi Center Analysis Of Brain Tumor Epidemiology And Diagnostic Trends

Rajiv Jha¹, Chardham Budhathoki², Sandip Shrestha³, Binod Rajbhandari⁴, Sameer Aryal⁵, Rajendra Shrestha⁶, Akschhit R Jha⁷, Narendra Shalike⁸, Namrata Khadka⁹, Sindhu Gautam¹⁰



¹Professor and HOD National Neurosurgical Referral Center (NNRC), National Academy of Medical Sciences (NAMS) Bir Hospital.

²Medical officer Department of Neurosurgery Bir hospital National Academy of Medical Sciences

³MCh Neurosurgery Resident Department of Neurosurgery National Academy of Medical Sciences, Bir Hospital

⁴Associate Professor Department of Neurosurgery Bir Hospital, National Academy of Medical Sciences, Kathmandu Nepal

⁵.Associate Professor, Department of Neurosurgery Bir Hospital, National Academy of Medical Sciences, Kathmandu Nepal

⁶Associate Professor Department of Neurosurgery Bir Hospital National Academy of Medical Sciences

⁷Rato Bangala School, Kathmandu Nepal

⁸Assistant Professor and Senior Consultant Neurosurgeon, NNRC Bir Hospital, NAMS Kathmandu Nepal

⁹Assistant Professor Department of Neurosurgery Bir Hospital National Academy of Medical Sciences

¹⁰Nursing officer, Bir hospital, Kathmandu Nepal

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Abstract

Introduction: Brain tumors are among the leading causes of neurological morbidity and mortality worldwide. In low and middle income countries, including Nepal, limited epidemiological data and delayed diagnosis remain major challenges in improving neuro oncology services. To address this gap, the National Brain Tumor Center (NBTC) established the first nationwide multicenter brain tumor registry to systematically collect demographic, clinical, and pathological information from participating neurosurgical institutions throughout Nepal. Objective was to describe the epidemiological characteristics, pathological trends, and geographic distribution of brain tumors registered in Nepal during 2024-2025 and to identify priorities for improving brain tumor care.

Materials and Methods: A retrospective observational study was performed using data from the National Brain Tumor Registry. The registry included patients diagnosed with intracranial brain tumors at more than 20 neurosurgical centers across Nepal, making it the largest collaborative brain tumor registry currently available in the country. Demographic characteristics, tumor pathology, WHO grade, and provincial distribution were analyzed using descriptive statistics.

Results: A total of 2,600 patients were registered during 2024 (BS 2081), increasing to 3,000 patients during 2025 (BS 2082), representing a 15.4% increase in annual patient volume. The mean patient age was 46.32 years, with the highest disease burden occurring among individuals aged 30-50 years. Male and female patients were almost equally represented (50.07% and 49.93%, respectively). Glioma remained the most common primary brain tumor, followed by meningioma. The proportion of high grade gliomas increased from 43.1% to 55.9%, while high-grade meningiomas increased from 7.4% to 27.1% during the study period. Bagmati Province contributed the highest proportion of registered cases, whereas Karnali and Sudurpashchim Provinces remained underrepresented.

Conclusion: The National Brain Tumor Registry demonstrates an increasing burden of brain tumors in Nepal and reveals a concerning trend toward advanced disease at diagnosis. Expansion of early detection programs, strengthening of referral systems, equitable access to specialist neuro oncology care, and continued development of the national registry are essential for improving patient outcomes.

Keywords: Brain tumor, Brain tumor registry, Glioma, Meningioma, Neuro oncology, Nepal, Epidemiology.

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Address for correspondence:

Prof. Dr. Rajiv Jha

National Neurosurgical Referral Center, NAMS Bir Hospital
Kathmandu, Nepal

Email: medrajiv18@hotmail.com

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INTRODUCTION

Brain tumors comprise a heterogeneous group of neoplasms arising from the brain parenchyma, meninges, cranial nerves, pituitary gland, and metastatic lesions involving the central nervous system. Although they account for only a small proportion of all cancers, they contribute disproportionately to neurological disability, mortality, and healthcare expenditure because of their critical anatomical location and complex management.¹

The World Health Organization (WHO) Classification of Tumors of the Central Nervous System (5th edition) has significantly improved the diagnostic classification of brain tumors by integrating molecular and histopathological criteria, enabling more accurate diagnosis, prognostication, and treatment planning.² Despite these advances, many low and

middle income countries continue to face substantial challenges related to delayed diagnosis, limited neurosurgical infrastructure, inadequate access to advanced imaging and molecular pathology, and the absence of comprehensive national disease registries.³ Population based registries play a pivotal role in understanding disease burden and informing health policy. The Central Brain Tumor Registry of the United States (CBTRUS) and the Global Cancer Observatory (GLOBOCAN) have demonstrated the value of standardized registry systems in monitoring incidence, survival, and treatment trends while guiding national research priorities.^{4,5} Similar national registries have been established in Europe, Australia, China, and India, contributing significantly to improvements in neuro oncology care. However, until recently, Nepal lacked a coordinated national brain tumor registry capable of providing multicenter epidemiological data.

Over the past decade, neurosurgical services in Nepal have expanded considerably, with increasing availability of advanced neuroimaging, microsurgical techniques, neurocritical care, and multidisciplinary oncology services. Nevertheless, disparities in healthcare access remain pronounced between urban and rural regions, resulting in delayed referrals and late stage disease presentation. Reliable nationwide data have therefore become essential for understanding disease patterns, identifying regional disparities, and supporting evidence based healthcare planning.

To address these challenges, the National Brain Tumor Center (NBTC), established at the National Academy of Medical Sciences (NAMS), Bir Hospital, Kathmandu, developed the National Brain Tumor Registry. This collaborative initiative collects standardized clinical and pathological data from more than 20 neurosurgical centers distributed across Nepal, representing the largest multicenter registry of brain tumors in the country. The registry serves multiple purposes, including epidemiological surveillance, quality improvement, clinical research, and policy development.

The present study reports the first nationwide analysis of data from the National Brain Tumor Registry covering BS 2081-2082. The primary objective was to describe patient demographics, tumor pathology, disease trends, and geographic distribution while identifying opportunities to strengthen early diagnosis and improve equitable access to neuro oncology services throughout Nepal.

Materials and Methods

This was a retrospective multicenter observational study based on data obtained from the National Brain Tumor Registry of Nepal. The National Brain Tumor Registry is coordinated by the National Brain Tumor Center (NBTC), National Academy of Medical Sciences (NAMS), Bir Hospital, Kathmandu. The registry receives standardized data from more than 20 neurosurgical centers located across all provinces of Nepal, making it the largest collaborative brain tumor registry established in the country. All patients diagnosed with primary intracranial brain tumors during 2024 (BS 2081) and 2025 (BS 2082) at participating neurosurgical centers were eligible for inclusion in the registry. Patients with incomplete diagnostic information or duplicate records were excluded during data verification. Data were collected using standardized registry forms completed by participating institutions. Variables included: Age, Sex, Province of residence, Histopathological

diagnosis, WHO tumor grade, Annual patient volume and Registry center Patient identifiers were removed before analysis to maintain confidentiality.

Data were entered into the National Brain Tumor Registry database and analyzed using descriptive statistical methods. Continuous variables are presented as means, while categorical variables are expressed as frequencies and percentages. Comparative analysis between BS 2081 and BS 2082 focused on changes in patient volume, tumor distribution, and pathological grading. The National Brain Tumor Registry was established to improve clinical quality, epidemiological surveillance, and research.

Result

The National Brain Tumor Registry collected data from more than 20 neurosurgical centers across Nepal during 2024-2025 (BS 2081-2082). A total of 2,600 patients were registered during 2024 (BS 2081), increasing to 3,000 patients during 2025 (BS 2082), representing a 15.4% increase in annual patient volume (Table 1). This increase likely reflects improved referral pathways, increased awareness, expansion of neurosurgical services, and improved registry participation (Table 1)

Table 1: Annual brain tumor registry volume during BS 2081–2082.

Registry Year	Number of Patients	Percentage Change
BS 2081	2,600	—
BS 2082	3,000	+15.4%

The demographic profile of patients remained stable during the study period. The mean age of patients diagnosed with brain tumors was 46.32 years, with the greatest disease burden observed among individuals aged 30-50 years. Male and female patients were affected almost equally, with males accounting for 50.07% of cases and females 49.93% (Table 2).

Table 2. Demographic Characteristics of Patients (BS 2082)

Variable	Result
Total patients	3,000
Mean age	46.32 years
Peak age group	30–50 years
Male	50.07%
Female	49.93%

Glioma (31%) remained the most frequently diagnosed primary brain tumor throughout the study period, followed by meningioma (21%). Together, these tumors constituted the majority of cases recorded in the registry. Additional tumor types including pituitary adenoma (8%), vestibular schwannoma (6%), metastatic tumors (5%), Craniopharyngioma (3%), and other rare intracranial neoplasms accounted for the remaining cases (26%). (Table 3, Figure 1).

Table 3: Major Histopathological Categories

Tumor Type	BS 2081	BS 2082
Glioma	940	705
Meningioma	617	373
Other brain tumors	Remaining cases	Remaining cases
Male	50.07%	
Female	49.93%	

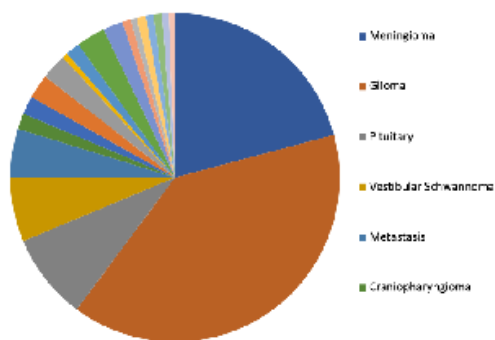


Figure 1: Major Histopathological Categories

A notable finding of the registry was the increasing proportion of patients presenting with high grade tumors. The proportion of high-grade gliomas increased significantly from 43.1% in BS 2081 to 55.9% in BS 2082 ($p < 0.001$). Similarly, the proportion of high-grade meningiomas increased significantly from 7.4% to 27.1% ($p < 0.001$ (Table 4)). The 95% confidence intervals for both differences exclude zero, supporting a statistically significant increase in the proportion of high-grade tumors between the two years.

Table 4: High-Grade Tumor Distribution.

Tumor Type	BS 2081	BS 2082
High-grade glioma	43.1%	55.9%
High-grade meningioma	7.4%	27.1%
Female	49.93%	

The registry demonstrated considerable geographic variation in access to specialized brain tumor care. Bagmati Province contributed the largest proportion (36.4%) of patients registered during 2025 BS 2082. The remaining 63.6% were distributed among the other six provinces. Karnali Province and Sudurpashchim Province contributed relatively few patients despite their population size, suggesting disparities in access to neurosurgical services rather than a lower disease burden (Table 5 Figure 2).

Table 5: Provincial Distribution of Patients.

Province	Percentage of Patients	BS 2082
Bagmati	36.4%	55.9%
Remaining Provinces	63.6%	27.1%

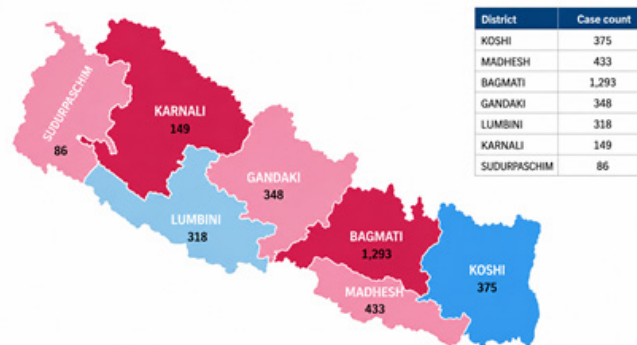


Figure2: Provincial Distribution of Patients.

The findings demonstrate a steadily increasing burden of brain tumors in Nepal. Expansion of the registry to include more than 20 neurosurgical centers has provided the first comprehensive national overview of disease patterns. The increasing patient volume likely reflects both improved access to neurosurgical care and enhanced registry participation. However, the growing proportion of high grade gliomas and meningiomas suggests that delayed diagnosis remains a major challenge.

Furthermore, the unequal provincial distribution indicates persistent disparities in access to specialist services, emphasizing the need for decentralized neuro-oncology care, earlier diagnosis, and stronger referral systems throughout Nepal.

Discussion

This study represents the first nationwide multicenter analysis of brain tumor epidemiology in Nepal, utilizing data from the National Brain Tumor Registry coordinated by the National Brain Tumor Center (NBTC), NAMS Bir Hospital. The registry incorporates data from more than 20 neurosurgical centers distributed across Nepal, making it the largest collaborative neuro oncology database currently available in the country. The findings provide valuable baseline epidemiological information that can guide future research, healthcare planning, and policy development.

One of the most notable findings was the 15.4% increase in registered brain tumor patients between 2024-2025(BS 2081 and BS 2082). Several factors may explain this observation. Expansion of neurosurgical services, increasing availability of advanced neuroimaging, greater public awareness, improved referral pathways, and progressive participation of neurosurgical centers in the national registry have likely contributed to higher case ascertainment. Similar increases in reported incidence have been described by the Central Brain Tumor Registry of the United States (CBTRUS), where improvements in surveillance systems have enhanced detection of primary brain tumors rather than reflecting a true biological increase alone.¹

The demographic profile observed in this study was comparable with international literature. The mean age of 46.32 years suggests that brain tumors predominantly affect adults during their economically productive years. The nearly equal male to female distribution is consistent with previous

epidemiological studies demonstrating that, although certain tumor types exhibit sex predilections, the overall burden of primary brain tumors affects both sexes almost equally.^{2,3}

Glioma remained the most frequently diagnosed tumor in the registry. This observation agrees with reports from CBTRUS and other international registries where diffuse gliomas constitute the largest group of malignant primary brain tumors.² Although meningioma is the most common benign intracranial tumor worldwide, gliomas account for most neurosurgical oncology admissions because of their aggressive clinical behavior and need for multidisciplinary treatment.³

A particularly important finding was the increase in the proportion of high grade gliomas from 43.1% to 55.9% and high-grade meningiomas from 7.4% to 27.1% during the study period. This trend likely reflects delayed diagnosis and referral rather than a true change in tumor biology. Similar challenges have been reported throughout South Asia and other low and middle income countries, where limited access to neuroimaging, specialist consultation, and pathology services often results in patients presenting only after neurological deficits become severe.⁴

The increasing proportion of advanced tumors has important clinical implications. High grade gliomas are associated with poorer survival despite advances in surgery, radiotherapy, and chemotherapy. Likewise, higher grade meningiomas demonstrate increased recurrence rates and reduced progression free survival compared with WHO Grade I lesions.² Early diagnosis therefore remains one of the most important strategies for improving outcomes in Nepal.

The geographic distribution of patients also revealed important disparities in access to specialized care. Bagmati Province contributed the highest proportion of registry patients, whereas Karnali and Sudurpashchim Provinces remained underrepresented. These findings probably reflect differences in healthcare accessibility, neurosurgical workforce distribution, and availability of advanced diagnostic facilities rather than differences in disease incidence. Similar regional inequalities have been reported in India, China, and other developing countries where tertiary neurosurgical centers are concentrated within major metropolitan areas.⁵

The establishment of the National Brain Tumor Registry represents a major advancement for neuro oncology in Nepal. National registries provide opportunities not only for epidemiological surveillance but also for monitoring quality of care, evaluating treatment outcomes, supporting multicenter clinical research, and informing government health policy. Continuous expansion of registry participation will improve the accuracy of incidence estimates and facilitate future survival analyses and molecular epidemiological studies.

An additional strength of the present registry is the use of standardized data collection across participating institutions. This approach minimizes variability in reporting and provides a consistent national framework for future research. Incorporation of molecular markers according to the WHO Classification of Tumors of the Central Nervous System (5th Edition) will further enhance diagnostic precision and international comparability in future registry updates.²

Strengths of the Study

The present study has several notable strengths. It represents the first nationwide multicenter brain tumor registry analysis in

Nepal, incorporating data from more than twenty neurosurgical centers. The registry captures patients from all provinces, providing the most comprehensive overview of brain tumor epidemiology currently available in the country. Standardized registry forms and centralized coordination by the National Brain Tumor Center enhance data consistency and establish a valuable platform for future multicenter research.

Limitations

Several limitations should be acknowledged. First, although the registry includes more than twenty neurosurgical centers, it may not capture all brain tumor cases diagnosed in Nepal, particularly patients managed in smaller hospitals or those who never reach specialist care. Second, the present analysis primarily reflects descriptive epidemiology and does not include survival outcomes, treatment specific analyses, or molecular tumor classification. Third, some registry variables remain incomplete because of differences in institutional reporting practices. Continued expansion of the registry and implementation of standardized electronic data collection will improve future analyses.

Future Directions

Future development of the National Brain Tumor Registry should focus on expanding participation to all neurosurgical units in Nepal and incorporating comprehensive treatment and follow up information. Collection of molecular biomarkers recommended by WHO CNS5, integration with digital pathology systems, and linkage with national cancer registries will substantially strengthen future epidemiological research.

The registry should also facilitate prospective multicenter clinical studies evaluating treatment outcomes, quality of life, survival, and healthcare disparities. Collaboration with international organizations, including the International Brain Tumour Alliance (IBTA), American Brain Tumor Association (ABTA), and regional neuro oncology networks, will further enhance research capacity and promote evidence based improvements in patient care.

Conclusion

The National Brain Tumor Registry provides the first comprehensive multicenter overview of brain tumor epidemiology in Nepal. Analysis of registry data from more than 20 neurosurgical centers demonstrates a rising number of patients receiving specialized care and identifies an increasing proportion of advanced pathological disease at diagnosis. Glioma remains the most frequently encountered primary brain tumor, while important geographic disparities persist in access to specialized neuro-oncology services.

These findings emphasize the urgent need to strengthen early diagnosis, improve referral pathways, expand neurosurgical and neuro oncology services outside major urban centers, and continue development of the National Brain Tumor Registry. As the registry matures, it has the potential to become a cornerstone of neuro oncology research, quality improvement, and health policy in Nepal, ultimately contributing to improved outcomes for patients with brain tumors nationwide.

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