Section: Neuropathology

Original Research Article

# DESCRIPTIVE EPIDEMIOLOGICAL AND CLINICOPATHOLOGICAL STUDY OF GLIOMAS IN A TERTIARY CARE HOSPITAL

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## Abstract

**Background:** Tumours of the central nervous system (CNS) are difficult to treat, and the survival time for patients with high-grade tumours is short. This study aims to conduct a clinicopathological investigation of gliomas to understand their characteristics, prevalence, and clinical manifestations. **Materials and Methods:** This retrospective descriptive clinicopathological study was conducted at the Department of Neuropathology, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai, from 2008 to 2013. Seven hundred fourteen cases of glioma specimens were received during this study period. **Result:** Gliomas were highest in the age group of 51 to 60 years, and Glioblastoma multiforme was the most common form of glioma, with 213 cases (29.8%). Grade IV tumours were common among males, while grade II tumours were more common in women. The cerebrum was the most common location for glioma involving the frontal lobe (22.41%). HPE evaluation revealed glioblastoma multiforme as the most common, followed by diffuse astrocytoma in 176 cases (24.6%). Pilocytic astrocytoma was found to commonly affect the age group of 0 to 20 years with a relative percentage of 44.5%. Diffuse astrocytoma was most common in the age group 21 to 40 years. GBM was seen most commonly in the age group of 41 to 60. **Conclusion:** The data in this study represents the clinical manifestations and prevalence of gliomas in Chennai, including all age groups. The evidence generated from this study can be beneficial in making informed decisions for funding further research needed for this tumour.

## INTRODUCTION

Tumours of the central nervous system (CNS) are difficult to treat, and the survival time for patients with high-grade tumours is short.[1] Much research has been performed to understand the molecular mechanisms behind such tumours. Malignant CNS tumours are rare and on the rise. This could be due to early diagnosis owing to better imaging modalities that can also pick up small lesions. Nervous system neoplasms affect both adults and children. The effects of these tumours were devastating even though they constitute a small percentage of all cancers.[1,2]

Most central nervous system (CNS) tumours are derived from glial cells (gliomas), the most malignant and frequent being glioblastoma. CNS tumours account for less than 2% of all malignancies (About 175,000 cases yearly).[3,4] The incidence does not vary markedly between regions or populations (Thambi, 2017).[5] A spectrum of factors interplay in the genesis of tumours of the central nervous system, and more research is required to understand the complex interplay of genes involved in the pathogenesis of these tumors. Generally, incidence rates are higher in men. In particular, malignant brain tumors occur more frequently in males, while benign meningiomas occur predominantly in females.

During the past decade, the incidence of glioblastomas in older people has increased by 1-2% per year. Still, to some extent, this may be due to the introduction of enhanced neuroimaging, which aids in picking up the smallest of lesions that could have been missed in earlier days with the use of other modes of neuroimaging.[4-7] There is a dire need for descriptive data on the primary brain and nervous system tumours, as highlighted by Salimi et al. 2020.[8] Hence, this study is contemplated to get descriptive data. There is also a need to decode the molecular genetics involved in gliomagenesis to aid in achieving the targeted therapy that is lifesaving in treating these tumours that are not easily resectable.


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## MATERIALS AND METHODS

This is a retrospective descriptive clinicopathological study of gliomas conducted at the Department of Neuropathology, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai, from 2008 to 2013. Seven hundred fourteen cases of glioma specimens were received during this study period. Ethical committee approval and informed consent from the patients were obtained.

**Inclusion Criteria**

All the cases of gliomas of the nervous system were included.

**Exclusion Criteria**

Patients with non-gliomatous tumours of the CNS were excluded.

**Methodology**

A detailed history of the cases regarding age, sex, laterality of symptoms, history of previous surgery and details of gross characteristics was obtained for all the cases of glioma from the neuropathology register. Freshly cut 4 µ thick sections were stained with Hematoxylin and eosin and graded using the WHO grading criteria.

**Statistical Analysis**

The statistical analysis was performed using a statistical package for social science software.

## RESULTS

The WHO grade II tumours had a maximum incidence of 40.1%; the second most common was WHO grade IV tumours, accounting for 30.7 % of the cases. WHO grade III was the third most frequent, with a relative percentage of 14.1 % of the total cases. The least was WHO grade I tumours, constituting 13.3 % of all cases.

The total number of cases of gliomas in males was 449, which accounts for (62.9% of cases), and in females, glioma was reported in 265 cases, amounting to (37.1%). Among 714 patients, glioma incidence was high in the age group of 51 to 60 years, with 143 (27%) cases. The least incidence in the age group of > 60 years was 52 (7.3%).

**Table 1: Demographic data of the study**

| | | Number of cases | Percentage |
|---|---|---|---|
| WHO Grade | I | 95 | 13.30% |
| | II | 286 | 40.10% |
| | III | 101 | 14.10% |
| | IV | 219 | 30.70% |
| Gender | Male | 449 | 62.90% |
| | female | 265 | 37.10% |
| Age (Years) | 0 to 10 | 69 | 9.70% |
| | 11to 20 | 77 | 10.80% |
| | 21 to 30 | 137 | 19.20% |
| | 31 to 40 | 123 | 17.20% |
| | 41 to 50 | 113 | 15.80% |
| | 51 to 60 | 143 | 27% |
| | >60 | 52 | 7.30% |
| Site | Posterior fossa | 24 | 3.40% |
| | Cerebellum | 10 | 1.40% |
| | Brain stem | 23 | 3.20% |
| | Intraventricular | 34 | 4.80% |
| | Thalamus | 36 | 5.00% |
| | Suprasellar | 67 | 9.40% |
| | Spinal cord | 7 | 1.00% |
| | Frontal | 160 | 22.40% |
| | Temporal | 47 | 6.60% |
| | Parietal | 66 | 9.20% |
| | Occipital | 10 | 1.40% |
| | Fronto parieto occipital | 1 | 0.10% |
| | Fronto parietal | 53 | 7.40% |
| | Fronto temporal | 6 | 0.80% |
| | Parieto occipital | 34 | 4.80% |
| | Temporoparietal | 95 | 13.30% |
| | Fronto temporo parietal | 8 | 1.10% |
| | Intraorbital | 2 | 0.30% |

The cerebrum is most commonly involved by the glioma, of which the most favoured site seems to be the frontal lobe, accounting for 22.41%. The frontal lobe is the most common site involved in glioma when all the sites are included, and the number of recurrent tumours was 23, accounting for 3.2% of the total cases (Table 1).


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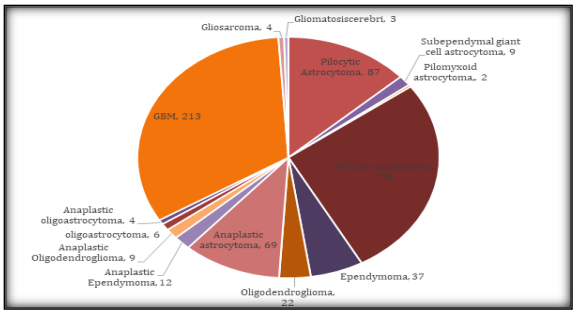


**Figure 1. Distribution of HPE diagnosis**

Glioblastoma multiforme was the most common, with 213 cases for 29.8%. Followed by Diffuse astrocytoma, 176 cases were reported, constituting about 24.6%. The least of all was Pilomyxoid astrocytoma, which accounted for 0.2% of the cases, followed by gliomatosis cerebri, which included 0.4% (Figure 1).

**Table 2: Individual tumours in gender, age, and lobe involved**

| | | Grade I | Grade II | Grade III | Grade IV |
|---|---|---|---|---|---|
| Gender | Male (n=449) | 11.6% | 40.3% | 14% | 31.8% |
| | Female (n=265) | 16.2% | 39.6% | 14.3% | 28.7% |
| Age range | 0 to 10 (n=69) | 55.1% | 27.5% | 8.7% | 2.9% |
| | 11 to 20 (n=77) | 42.9% | 36.4% | 6.5% | 11.7% |
| | 21 to 30 (n=137) | 13.9% | 58.4% | 14.6% | 12.4% |
| | 31 to 40 (n=123) | 0.8% | 62.6% | 13.8% | 19.5% |
| | 41 to 50 (n=113) | 2.7% | 27.4% | 25.7% | 43.4% |
| | 51 to 60 (n=143) | 0.7% | 25.9% | 14.7% | 58% |
| | >60 years (n=52) | 0 | 26.9% | 5.8% | 67.3% |
| Lobe involved | Frontal lobe | 2.5% | 45.6% | 20% | 28% |
| | Temporal lobe | 8.5% | 48.9% | 14.9% | 27.7% |
| | Parietal lobe | 9.1% | 28.8% | 9.1% | 53% |
| | Occipital lobe | 10.% | 20% | 30% | 40% |
| | Cerebellum | 70% | 20% | 0 | 10% |
| | Fronto-parietal | 3.8% | 39.6% | 20.8% | 35.8% |
| | Fronto-temporal | 0 | 66.7% | 16.7% | 16.7% |
| | Parieto - occipital | 0 | 38.2% | 8.8% | 52.9% |
| | Temporoparietal | 7.4% | 33.7% | 13.7% | 42.1% |
| | Fronto-temporo- parietal | 0 | 62.5% | 25.5% | 12.5% |

Grade IV tumours (the most malignant form of glioma) were common among males compared to the rest. In contrast, Grade II tumours were relatively common in women. This concurs with the popular hypothesis that benign and low-grade tumours are common in women while the more malignant forms are common in men.

WHO Grade I tumours were the most common in the age group of 0-10 years, accounting for 55.1%. The WHO Grade II tumours were most common among the age group of 31- 40 years, with a relative percentage of 62.6%. In the age group of 41-50, WHO Grade III tumours were most common, accounting for 25.7%. The age group 51 to 60 years and above showed WHO Grade IV tumours to be the most common among them, with a relative percentage of 58.3% and 67.3%, respectively.

The frontal, parietal, and temporal lobes are affected predominantly by WHO Grade II glioma. While the occipital lobe, though rarely involved compared to the other three lobes, shows a relatively higher incidence of Grade IV glioma. The cerebellum is most commonly involved by the WHO Grade I tumour- pilocytic astrocytoma. The bi-lobe or tri-lobe involvement seems to be commoner with Grade II and Grade IV glioma (Table 2).

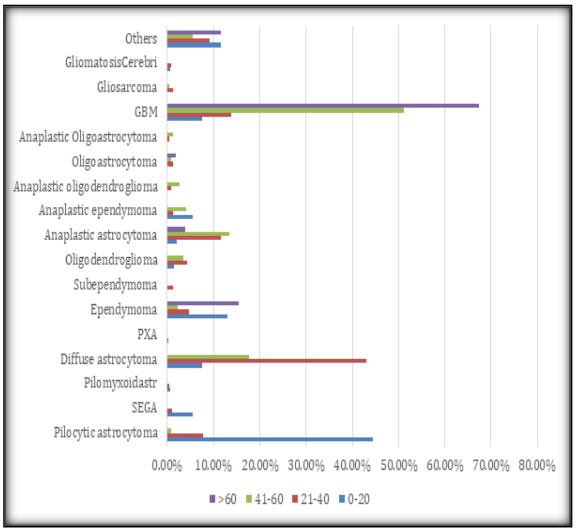


**Figure 2: The commonest age group of individual tumours**

Pilocytic astrocytoma was found to commonly affect the age group of 0 to 20 years with a relative percentage of 44.5%. Diffuse astrocytoma was most common in the age group 21 to 40 years. GBM was seen most commonly in the age group of 41 to 60 (Figure 2).

A total of 37 cases (5.2%) of ependymoma were reported, two of which were clear cell ependymoma and seven cases of cellular ependymoma. A male-to-female ratio of 1:3 was observed. Six cases were


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found with lesions involving the spinal cord; the other cases included the cerebral hemisphere. In addition, anaplastic astrocytoma was reported in 69 cases (9.7%), affecting the age group between 20 to 40 years. Astrocytoma accounted for 43.1% of the overall tumor (mean age, 40-45 years) and a male-to-female ratio of 2:7:1, respectively.

Anaplastic ependymoma was observed in 12 patients (1.7%) of overall cases, affecting majorly the age group of 15 to 35 years with a gender ratio of 1:1.3. A total of 1.3% of cases were of anaplastic oligodendroglioma affecting the age group between 30 to 55 years with a gender ratio of 1:1.25. The frontotemporal region was most commonly affected by anaplastic oligodendroglioma.

## DISCUSSION

In Southeast Asian subcontinent regions (SEAR), findings from other studies indicate a higher occurrence of meningioma among females and a greater prevalence of glioma among males. Additionally, male predominance has been observed in glioma patients across similar investigations. For instance, Jaiswal et al. and Tambi et al. conducted comparable studies in India, including 4295 and 510 patients, respectively, encompassing all primary intracranial tumors. Both studies revealed that the fourth decade of life was the most common age group affected by these tumors.[21,22]

The current study was conducted among 714 patients, where glioma was prevalent in the age group between 51 and 60 years, with 143 cases (27%). The last incidence was reported in the age group > 60, including 52 patients (7.3%). The prevalence of glioblastoma was higher in the elderly age group. In our study, we observed that the average age of the affected individuals is approximately ten years younger than what is commonly reported in Western literature (such as CBTRUS) and other Indian studies.[22]

Among the various types of brain tumors observed in our study, Glioblastoma multiforme was the most prevalent, accounting for 29.8% with 213 cases. Diffuse astrocytoma was the second most frequent, with 176 reported cases, making up approximately 24.6% of the total cases. The findings from our study indicate a higher incidence of glioma among the younger population.

Our study findings reported that WHO Grade I tumors were most common in the 0-10 age group, with 55.1% of cases. In contrast, the 31-40 age group had the highest percentage (62.6%) of WHO Grade II tumors, and the age group 41-50 years had a higher occurrence (25.7%) of WHO Grade III tumors, among individuals aged 51 to 60 years and above, WHO Grade IV tumors predominated, with relative percentages of 58.3% and 67.3%, respectively.

Similar trends were noted in studies conducted by Ahsan J. et al. and Thambi R. et al., where they also observed a year-wise distribution of cases, indicating a steady rise over time. Chen L et al. reported an even more pronounced growth rate, reaching 106% to 139% in their study's three most recent years. Over time, this pattern of increasing case numbers highlights the importance of improved healthcare access and heightened disease awareness.[22,24,25]

In our study, glioblastoma, followed by diffuse astrocytoma, emerged as the most common histopathological subtypes of brain tumors. Consistent with other studies conducted in India, glioblastomas were also reported as the most common tumor, constituting approximately 38% of cases in previous data. However, in contrast to these earlier findings, we observed a lower percentage of anaplastic oligodendrogliomas cases (5.6%) in our study. Similarly, a separate study by Manoharan et al. with 1989 cases reported 21.5% glioblastoma, supporting the consistent prevalence of this subtype in different Indian studies.[26]

Moreover, we observed a higher prevalence of rare gliomas such as angiocentric glioma, giant cell glioblastoma, gliosarcoma, and desmoplastic ganglioglioma compared to previously reported data.[24,27-32] Including a diverse patient population and detecting rare glioma subtypes in our study highlights the importance of comprehensive and detailed investigations for understanding the disease. Such studies contribute valuable insights into the prevalence and distribution of various glioma types, enhancing our knowledge of the disease's heterogeneity and guiding more effective diagnostic and treatment approaches.

## CONCLUSION

The retrospective, descriptive clinicopathological study was one of the few studies conducted to assess gliomas, aimed to understand the clinical manifestations among patients and identify the prevalence. Gliomas were most common in the elderly (51 to 60 years), with a diagnosis of Glioblastoma multiforme among 213 cases (29.8%). The current study is one of the studies to be conducted on more than 500 patients diagnosed with glioma specimens. Additionally, the research sheds light on the rising burden of glioma in developing countries over the past decade, with a notable trend of the disease manifesting at younger ages. These findings underscore the growing importance of addressing glioma and its impact on public health in the context of developing nations.

**Limitations**

The hospital-based study did not reflect the true incidence and prevalence in the community. Since this is a retrospective study, data regarding follow-up is unavailable.

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