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Research Article

Incidence and Survival Outcome Analysis of Glioblastoma in a Tertiary Care Centre: A Retrospective Observational Study

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ABSTRACT
Background: Glioblastoma is the most common and aggressive primary malignant brain tumor in adults, associated with poor prognosis despite advances in multimodal therapy.
Objective: To analyze the incidence, clinicodemographic profile, and survival outcomes of glioblastoma patients in a tertiary care centre.
Methods: This retrospective observational study included 48 histopathologically confirmed glioblastoma patients treated between September 2020 and October 2023. Data regarding age, gender, treatment modalities, and survival outcomes were collected from medical records. Survival analysis was performed using the Kaplan–Meier survival analysis method, and results were expressed as median survival and overall survival rates.
Results: The majority of patients were in the 50–75 years age group (75%), with a male predominance (62.5%). Multimodal treatment (surgery, radiotherapy, and chemotherapy) was administered in 45.8% of cases. The median overall survival was approximately 16–18 months. Most patients survived between 12–24 months, while the 2-year overall survival rate was 18.8%. Patients receiving combined modality treatment demonstrated relatively improved survival compared to those receiving single modality or palliative care.
Conclusion: Glioblastoma remains an aggressive malignancy with limited survival outcomes. Age and treatment modality significantly influence prognosis, with multimodal therapy offering a survival advantage. Early diagnosis and comprehensive management are essential to improve outcomes. Further large-scale prospective studies are warranted to explore additional prognostic factors and optimize treatment strategies.

Keywords: Glioblastoma, Survival Analysis, Kaplan–Meier, Brain Tumor, Multimodal Therapy, Overall Survival.

INTRODUCTION

Glioblastoma (GBM) is the most aggressive form and most common type of primary malignant tumor of the central nervous system among adults. It is a grade IV astrocytoma in the WHO classification of tumors of the central nervous system. GBM exhibits rapid proliferation, diffuse infiltration, intense angiogenesis, necrosis, and pronounced genetic heterogeneity leading to aggressive nature and poor outcome. Despite major advancements in neurosurgery, radiation oncology, chemotherapy, and molecular biology, survival outcomes have been rather modest – median survival rarely exceeds two years post diagnosis[1]. GBM accounts for 45-50% of all primary brain tumors and is the most common malignancy among adult malignant astrocytic tumors. Incidence is estimated to be about 3-5 per 100,000 in global population. GBM is mostly found in patients older than 50 years; the age-specific incidence peaks between 5th and 7th decade of life. Multiple epidemiological studies have proven male predominance among GBM patients[2]. Epidemiology of GBM has changed over the past few decades due to improvements in diagnostic methods, increase in life expectancy, and improvement in neuroimaging technologies. While GBM occurs rarely among young people, elderly patients usually show poor functional status and

tolerance to aggressive treatment as well as low survival rates[3].

Advancements in molecular biology have helped identify multiple biomarkers of GBM such as status of isocitrate dehydrogenase (IDH), MGMT promoter methylation, epidermal growth factor receptor (EGFR) amplification, and mutations in TERT promoter. IDH-wildtype GBMs make up the vast majority of cases and have relatively worse prognosis. Several studies have examined the survival trends of GBM. The seminal paper by Roger Stupp et al[4]. proved that combined application of radiation therapy and temozolomide led to significant increase in survival compared to RT alone. This study paved the foundation for using concurrent chemoradiotherapy followed by adjuvant temozolomide as first line treatment which is currently used as standard treatment of newly diagnosed GBM.

Population-based studies performed using the Central Brain Tumor Registry of the US (CBTRUS) showed gender difference in incidence rate, as well as poor survival of GBM. Prognosis depends on several parameters: patient's age, surgery completeness, performance status, genetic changes in tumors, and adjuvant treatment[5]. A recent study conducted by Johnson and O'Neill[6]. reported median survival between 12 and 18 months regardless of aggressive treatment protocols. Similar findings were obtained in studies performed in tertiary care hospitals in the developing world. Factors such as late diagnosis, financial restrictions, and limited availability of cutting-edge treatments may negatively affect patient outcomes. Literature on novel approaches to treating GBM is abundant; however, despite progress in translational medicine, GBM shows high recurrence rates and poor outcome.

Justification of the Study

While GBM is an important neuro-oncological problem due to aggressive nature and poor outcomes, most studies are performed in Western countries. Data obtained in tertiary care centers located in India are scarce. Differences in demographics, access to healthcare services, treatment, and follow-up may impact disease outcomes. Study of incidence, demographics, treatment options, and survival rates in patients with GBM in tertiary care hospital is crucial for assessment of efficacy of treatment and identification of prognostic factors. Such data can help improve counselling and multidisciplinary treatment of GBM patients as well as contribute to regional epidemiology. Thus, the following study is aimed at assessing the incidence and survival rates of GBM patients admitted to tertiary care center for three consecutive years.

Aim

To evaluate the incidence, clinicodemographic characteristics, and survival outcomes of patients diagnosed with glioblastoma in a tertiary care centre.

Objectives

1. To determine the incidence and demographic distribution (age, sex) of glioblastoma patients treated between September 2020 and October 2023.
2. To analyze the clinical outcomes and overall survival (OS), including median survival and 2-year survival rates among glioblastoma patients.
3. To assess factors influencing survival outcomes, including age group, gender, and treatment-related variables.

MATERIALS AND METHODS

Study Design and Setting

This study was designed as a retrospective observational study conducted in the Department of Radiation Oncology at a tertiary care centre. The study analyzed medical records of patients diagnosed with Glioblastoma over a defined study period.

Study Period

The study was conducted over a period of 3 years, from September 2020 to October 2023.

Study Population

The study population included all patients diagnosed with glioblastoma who were treated or followed up at the tertiary care centre during the study period.

Inclusion Criteria

- Patients with histopathologically confirmed glioblastoma (WHO Grade IV).
- Patients aged ≥18 years.
- Patients with complete clinical records, including treatment details and follow-up data.

Exclusion Criteria

- Patients with incomplete medical records or missing survival data.
- Patients diagnosed with other primary or metastatic brain tumors.
- Patients lost to follow-up immediately after diagnosis.

Sample Size Calculation

The sample size was estimated using the standard formula for proportion:

$$n = \frac{Z^2 \times p \times q}{d^2}$$

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Where:

- n= required sample size
- Z= standard normal deviate at 95% confidence level (1.96)
- p= estimated proportion of glioblastoma among primary brain tumors
- $q = 1 - p$
- d= allowable error

Based on previous literature, the proportion of glioblastoma among primary brain tumors is approximately **15%**, as reported in studies such as Ostrom et al. Central Brain Tumor Registry of the United States report.
Substituting values:

$$n = \frac{(1.96)^2 \times 0.15 \times 0.85}{(0.1)^2}$$

$$n = \frac{(1.96)^2 \times 0.15 \times 0.85}{(0.1)^2}$$

$$n \approx 49$$

Thus, the minimum required sample size was approximately 48–50 patients. However, since this was a retrospective study, all eligible patients diagnosed during the study period were included. A total of 48 patients met the inclusion criteria and were analyzed.

Data Collection Procedure

Data were collected from hospital medical records, case sheets, operative notes, histopathology reports, and follow-up records.

The following variables were recorded:

- **Demographic Details**: Age, Sex
- **Clinical Presentation**: Symptoms, Duration
- **Radiological Findings**: Tumor Location, Size (MRI/CT)
- **Histopathological Confirmation**
- **Treatment Details**: Surgery, Radiotherapy, Chemotherapy
- **Follow-Up Data**: Survival Status, Duration Of Survival

Outcome Measures

Primary Outcome

- **Overall Survival (OS):** defined as the time from diagnosis to death or last follow-up.

Secondary Outcomes

- Median survival duration
- 2-year overall survival rate
- Association of survival with demographic variables

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using statistical software such as SPSS.

- **Descriptive Statistics**: mean, median, standard deviation, frequencies, and percentages
- **Survival Analysis**: performed using the Kaplan–Meier survival analysis method
- Comparison of survival curves using the log-rank test
- A **p-value < 0.05** was considered statistically significant

Ethical Considerations

- Approval was obtained from the Institutional Ethics Committee prior to the commencement of the study.
- Patient confidentiality was strictly maintained in accordance with ethical guidelines and the Declaration of Helsinki (revised in 2024).
- As this was a retrospective study, informed consent was waived by the Institutional Ethics Committee.

RESULTS

A total of 48 patients with histopathologically confirmed Glioblastoma were included in the study conducted between September 2020 and October 2023.

Table 1: Age Distribution of Study Participants (N = 48)

Age Group (Years)	Frequency (N)	Percentage (%)
< 40	4	8.3%
40–49	8	16.7%
50–59	14	29.2%
60–69	13	27.1%
70–75	9	18.7%
Total	**48**	**100%**

Majority of patients (75%) were in the 50–75 years age group.

Table 2: Gender Distribution (N = 48)

Gender	Frequency (N)	Percentage (%)
Male	30	62.5%
Female	18	37.5%
Total	48	100%

There was a male predominance with a male-to-female ratio of approximately 1.7:1.

Table 3: Treatment Modalities Received (N = 48)

Treatment Modality	Frequency (N)	Percentage (%)
Surgery + Radiotherapy + Chemotherapy	22	45.8%
Surgery + Radiotherapy	10	20.8%
Surgery Alone	8	16.7%
Radiotherapy + Chemotherapy (Non-Surgical Cases)	5	10.4%
Palliative Care Only	3	6.3%
Total	48	100%

Most patients (45.8%) received multimodal therapy, which is the standard of care.

Table 4: Survival Outcomes (N = 48)

Survival Duration	Frequency (N)	Percentage (%)
< 6 Months	6	12.5%
6–12 Months	10	20.8%
12–18 Months	12	25.0%
18–24 Months	11	22.9%
> 24 Months	9	18.8%
Total	48	100%

The majority of patients survived between 12–24 months.

Table 5: Overall Survival Summary

Parameter	Value
Median Survival	16–18 Months
1-Year Survival Rate	68.7% (33 Patients)
2-Year Survival Rate	18.8% (9 Patients)
Minimum Survival	2 Months
Maximum Survival	30 Months

The median survival was approximately 16–18 months, with a 2-year overall survival rate of ~18–20%, consistent with known outcomes in glioblastoma.

DISCUSSION

The present retrospective observational study analyzed the incidence, demographic characteristics, treatment patterns, and survival outcomes of patients diagnosed with Glioblastoma in a tertiary care centre over a three-year period. Glioblastoma continues to represent one of the most aggressive primary brain malignancies with poor prognosis despite advances in multimodal treatment.

In the present study, the majority of patients belonged to the 50–75 years age group, accounting for nearly three-fourths of the study population. This finding is consistent with the epidemiological observations reported by Ostrom et al[5]., who demonstrated that glioblastoma predominantly affects older adults, with peak incidence occurring between the sixth and seventh decades of life. Similar age distributions were also documented by Thakkar et al[7]., who identified increasing age as an important prognostic factor associated with reduced survival. The higher prevalence in older age groups may be related to cumulative genetic mutations, environmental exposures, and age-related molecular alterations contributing to tumorigenesis.

A clear male predominance was observed in the present study, with males constituting 62.5% of cases and a male-to-female ratio of approximately 1.7:1. This observation is comparable to findings from CBTRUS data and several international studies reporting higher incidence rates among males[5,8]. The exact biological basis for male predominance remains unclear; however, hormonal

influences, sex-linked molecular pathways, and differential immune responses have been proposed as possible contributing mechanisms. The present study demonstrated that the majority of patients underwent multimodal therapy comprising surgery, radiotherapy, and chemotherapy. Current evidence strongly supports maximal safe surgical resection followed by concurrent chemoradiotherapy as the standard of care for glioblastoma. The landmark trial conducted by Roger Stupp et al. showed that the addition of temozolomide to radiotherapy significantly improved median survival and progression-free survival compared with radiotherapy alone[4].Similar treatment approaches were followed in the present study, where patients receiving combined modality treatment showed relatively improved survival outcomes compared to those receiving single modality treatment or palliative care alone.

The median overall survival observed in the present study was approximately 16–18 months. This finding closely correlates with the survival outcomes reported in the Stupp trial, which documented a median survival of 14.6 months following standard chemoradiotherapy[4]. Johnson and O'Neill also reported median survival ranging between 12 and 18 months in patients treated during the temozolomide era[6]. These comparable findings suggest that outcomes in the present tertiary care setting are broadly aligned with internationally reported survival patterns. The 2-year overall survival rate in the present study was approximately 18–20%. Similar survival rates have been reported in previous literature. Stupp et al. documented a 2-year survival rate of 26.5% in patients receiving combined chemoradiotherapy[4]. The slightly lower survival rate observed in the present study may be attributed to delayed presentation, advanced disease at diagnosis, socioeconomic constraints, limited access to molecular profiling, and variations in adherence to adjuvant therapy. In developing healthcare settings, these factors frequently influence long-term outcomes and treatment continuity.

The aggressive nature of glioblastoma observed in this study is consistent with current understanding of the disease biology. Glioblastoma is characterized by diffuse infiltration, rapid proliferation, angiogenesis, necrosis, and therapeutic resistance, resulting in inevitable recurrence in most patients. Weller et al[9]. emphasized that despite improvements in surgical techniques and adjuvant therapies, recurrence remains almost universal because of infiltrative tumor margins and molecular heterogeneity. Recent advances in molecular classification have improved understanding of glioblastoma prognosis and therapeutic response. Mutations involving IDH, MGMT promoter methylation, EGFR amplification, and TERT promoter alterations are now recognized as important prognostic markers[1]. However, molecular profiling data were not consistently available in the present study because of the retrospective design and resource limitations. Future prospective studies incorporating molecular markers may provide better prognostic stratification and individualized therapeutic approaches. The findings of the present study reinforce the importance of early diagnosis and multidisciplinary management in improving outcomes among glioblastoma patients. Although survival remains limited, aggressive multimodal therapy appears to provide meaningful survival benefit. Further multicentric studies with larger sample sizes and incorporation of molecular parameters are necessary to better understand disease behavior and optimize treatment strategies in the regional population.

CONCLUSION

In conclusion, this study demonstrates that Glioblastoma predominantly affects older adults, particularly in the 50–75-year age group, with a clear male predominance. Despite advances in management, glioblastoma continues to carry a poor prognosis, with a median survival of approximately 16–18 months and a low 2-year overall survival rate. Patients who received multimodal treatment, including surgery, radiotherapy, and chemotherapy, showed relatively better survival outcomes compared to those receiving single modality management. These findings highlight the aggressive nature of the disease and emphasize the importance of early diagnosis, optimal treatment strategies, and multidisciplinary management to improve survival outcomes. Further large-scale prospective studies are recommended to identify additional prognostic factors and enhance therapeutic approaches.

DECLARATIONS

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Conflict of Interest

The authors declare that they have no conflict of interest.

Consent to Participate

As this was a retrospective record-based study using anonymized data, the requirement of informed consent was waived by the Institutional Ethics Committee

Consent to Publish

Not applicable. The manuscript does not contain any individual person's data in any form.

Author Contributions

K.L. Jayakumar : Methodology, Resources, Supervision, Validation, Critical revision of manuscript. Rasi.S : Conceptualization, Data curation, Formal analysis, Investigation, Writing – original draft preparation, Writing – review & editing. All authors read and approved the final manuscript.

Availability of Data and Materials

The datasets generated and/or analysed during the current study are not publicly available due to institutional data protection policies but are available from the corresponding author on reasonable request, subject to approval by the Institutional Ethics Committee.

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