A Population-Based Study of Temporal Lobe Malignancies

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ABSTRACT

Background: Temporal lobe malignancies can pose a challenge given the important functions of the temporal lobe including auditory and visual sensory processing, language recognition, and memory formation. This study aimed to utilize the 1973-2015 Surveillance, Epidemiology, and End Results (SEER) to identify demographic and treatment differences affecting overall survival in patients with temporal lobe malignancies.

Methods: A search of the SEER database for patients with malignant temporal lobe tumors was performed. The Kaplan Meier method was used to analyze univariate factors affecting overall survival. Logistic regression analysis was used to perform a multivariate analysis of overall survival.

Results: A total of 12,690 patients were identified. The male to female ratio was 1.5:1. The majority of patients were treated with surgery as part of their treatment regimen. On univariate analysis surgical vs. nonsurgical treatment, tumor histology, sex, and race significantly affected overall survival. On multivariate analysis race, sex, and surgical vs. nonsurgical treatment significantly affected overall survival.

Conclusions: Surgical treatment, non-white race, and female sex were associated with significantly increased overall survival in patients with temporal lobe malignancies.

Keywords: Brain, cancer, survival, tumor.

I. INTRODUCTION

Brain tumors affect approximately 250,000 patients globally per year and represent approximately 2% of total malignancies [1]. The temporal lobe of the brain contains structures responsible for the development of long-term memory, auditory processing, language recognition, and other important neurological functions. Typically, astrocytomas and gliomas are the most common temporal lobe malignancies, but other less common tumors such as sarcomas, ependymomas, and embryonal tumors can also affect the temporal lobe [2]-[4]. As with any brain tumor, temporal lobe tumors present a treatment challenge given the elegant and vital functions of tissue found within the temporal lobe. This study sought to utilize the Surveillance, Epidemiology, and End Results (SEER) database maintained by the National Cancer Institute (NCI) to examine the demographics and factors affecting survival in patients with temporal lobe malignancies identified in the 1973-2015 SEER database.

II. METHODS

The 1973-2015 SEER database (https://seer.cancer.gov) was queried for any patient with a malignant tumor located in the temporal lobe. Data was extracted using the NCI SEER*STAT software (SEER*STAT version 8.3.5, NCI; Bethesda, MD, USA) and then imported into Microsoft Excel (Microsoft; Redmond, Washington). XLSTAT-Biomed (Addinsoft; Paris, France/New York, NY) was used for data analysis. The Kaplan-Meier/log-rank method was used for univariate analysis of overall survival (OS) at five years. Logistic regression was utilized for multivariate analysis of overall survival at five years. Significance was set at p<0.05.

III. RESULTS

A total of 12,690 patients with malignant temporal lobe tumors were identified in the 1973-2015 SEER database. Most patients were between 50 and 79 years of age at the time of diagnosis, with the greatest 5-year age range being 60-64 years of age (n=1593). Fig. 1 illustrates the Kaplan-Meier overall survival for the entire cohort. Overall survival at 5 years was 20.2%, while overall survival at 10 years was 14.6%. Fig. 2 demonstrates the overall survival for patients treated with surgery as part of their treatment regimen (n=10116) vs. patients treated nonsurgically (n=2574). Survival was greater at 5 years for patients treated surgically (20.7%) vs. patients treated nonsurgically (18.3%) (p<0.0001). Fig. 3 shows the overall survival by AJCC (American Joint Committee on Cancer) staging. AJCC
staging was unknown in 12,412 patients, stage I in 231, stage II in 14, stage III in 5, and stage IV in 28. There was no statistically significant difference in five-year survival by AJCC stage \((p=0.3)\). Fig. 4 illustrates the Kaplan-Meier overall survival by tumor grade. There were 258 B-cell/pre-B, or B-precursor patients and 6 T-cell patients, while grade was unknown in 7714. Of the remaining patients 172 had well differentiated grade I tumors, 526 had moderately differentiated grade II tumors, 298 had poorly differentiated grade III tumors, and 3716 had undifferentiated grade IV tumors. There was a statistically significant difference in overall survival at 5 years by tumor grade, with grade I and grade II tumors having the greatest OS, while grade IV tumors had the lowest 5-year OS \((p<0.0001)\). Fig. 5 shows the Kaplan Meier survival by tumor histology. Astrocytomas \((n=10,369)\) and gliomas \((n=1616)\) were the most common tumors, with the other tumors being embryonal tumors \((n=55)\), ependymomas \((n=56)\), germ cell tumors \((n=7)\), lymphomas \((n=285)\), melanomas \((n=14)\), neuroblastomas \((n=5)\), sarcomas \((n=28)\), and unspecified tumors \((n=255)\). Patients with germ cell tumors and sarcomas demonstrated the highest 5-year OS, while patients with neuroblastomas and astrocytomas had the lowest 5-year OS \((p<0.0001)\). Fig. 6 demonstrates the Kaplan-Meier overall survival by patient sex. Female patients \((n=5051)\) showed higher 5-year OS than male patients \((n=7639)\), \(p<0.0001\). Fig. 7 illustrates the Kaplan-Meier overall survival by patient race. Black \((n=742)\) and other \((n=618)\) patients had greater 5-year OS than white patients \((n=11276)\), \(p<0.0001\). Patient race was unknown in 54 patients. On multivariate analysis only race \((p<0.0001)\), sex \((p<0.0001)\), and surgical treatment vs. non-surgical treatment \((p<0.0001)\) remained significant predictors of overall survival, while on multivariate analysis histology \((p=0.1)\), grade \((p=0.3)\), and AJCC stage \((p=0.6)\) were not statistically significant.
Temporal lobe tumors pose a challenge to treating physicians given the auditory, visual, language, and memory centers housed within. Reference [2] used the SEER database to examine patients with gliosarcoma. They noted that 35.2% of the patients had tumors in the temporal lobe, and overall 5-year survival was 2.7%. The average age in the study was approximately 60 years at diagnosis. Similar to the present study, patients treated with surgery had greater OS than patients treated nonsurgically (p < .001). Interestingly, [2] found age and surgical treatment to be significant prognostic factors for 5-year OS on univariate and multivariate analysis, with sex, race, and grade all nonsignificant on univariate and multivariate analysis.

Reference [5] examined the effect of race on survival in patients with malignant brain tumors. Interestingly they noted that when the SEER data was adjusted for demographic, tumor, and treatment factors blacks and whites showed no significant survival differences based on race. The difference in the findings of the present study are likely due to the use of the 2004-2015 SEER database in [5], while the present study utilizes the 1973-2015 database. In the present study race remained a significant predictor of survival, even on multivariate analysis. The SEER database has been utilized in the analysis of many different types of brain tumors in pediatric and adult populations [6]-[12], demonstrating the usefulness of the database for large scale analysis of relatively uncommon or common tumors. Reference [13] noted that older age at diagnosis, year of diagnosis, tumor location, tumor histology, tumor size, gross total resection, and treatment with radiotherapy as well as chemotherapy significantly affected tumor-related mortality. Reference [14] examined meningioma-related mortality using a German population-based database and noted that meningioma-related mortality was significantly affected by patient sex, increasing age at diagnosis, and a higher WHO grade of the tumor.

There are limitations to this study. The retrospective nature of the data introduces the possibility of recall and selection bias, although the standardization of the data collection for the SEER database minimizes these concerns. Additionally, constraints of the SEER database, such as age reporting by 5-year block (i.e. 60-65 years old) and frequent missing stage data, introduce some bias. However, the large number of patients provides valuable prognostic and demographic data.

V. CONCLUSION

The present study found overall 5- and 10-year OS for all patients with temporal lobe malignancies to be 20.2% and 14.6%, respectively. Univariate analysis showed surgical vs. non-surgical treatment, lower grade, sarcoma, and germ cell histology vs. other histologies, female sex, and black or other race to portend greater survival. On multivariate analysis only race, sex, and surgical treatment significantly affected overall survival.
REFERENCES


