Glioma Survival Prediction Study: Identification of Prognostic Factors and Development of an Optimized Mixed Model Algorithm for Prediction of Glioma Survival Time

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Learning Objectives

Participants should be able to: 1) Identify the significant prognostic factors for survival in patients with glioma, and 2) Recognize the relative contributions of the prognostic factors to patient survival

Introduction

Gliomas represent a hetergeneous entity with widely varying survival outcome. We examine a large national database in order to identify the prognostic factors that contribute the most to patient survival, and consequently develop a predictive model for survival.

Methods

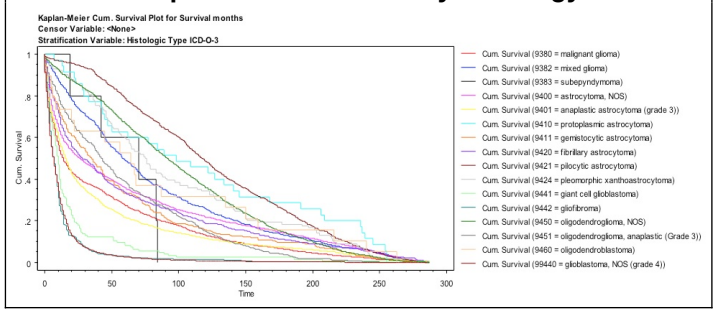
NCI SEER program was used to retrieve the records of 27,325 subjects diagnosed with glioma between 1985 and 2008. The primary outcome measure was survival following diagnosis. Parameters examined for effects on this outcome included: age at diagnosis, gender, race, histology, tumor location and size, surgery, radiation, and geographic region. Cox proportional hazard regression and Kaplan-Meier survival and risk functions were used to examine and compare these parameters. Predictive algorithms were developed and tested.

Conclusions

The analyses identified and quantified the relative importance of clinical and demographic parameters on survival for glioma patients. The novel predictive algorithm may be used to assist patient counseling and management decision making.

Cox Proportional Hazard Modeling of Survival Months

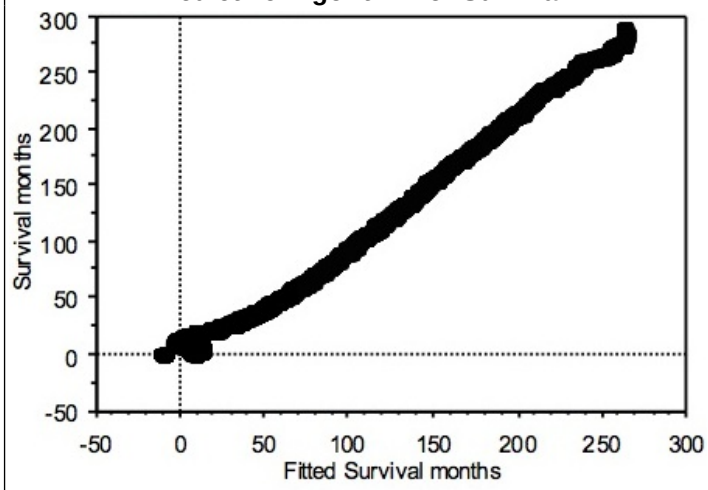
Kaplan-Meier Survival by Histology



Results

Age at diagnosis was the most significant prognostic factor (X2=5186.4,p<0.0001), with an increase in hazard risk of 3.4% per year. Second was histology (X2=4134.7, p<0.0001), with pilocytic astrocytoma and oligodendroglioma having 84.9% and 80.5% decreases in mortality risk respectively, compared to glioblastoma. Surgery was the most significant modifiable prognostic factor (X2=815.8,p<0.0001). Relative to gross total resection, no surgery, biopsy, and subtotal resection were associated with 58.7%, 82.6%, and 14.5% increases in hazard respectively. Tumor location (X2=362.2,p<0.0001) was significant, with brainstem having a 30.2% increased mortality risk compared to cerebrum. Lack of radiation (X2=359.9,p<0.0001) increased hazard by 36.8%. Females had a 5.3% reduced hazard (X2=16.5, p<0.0001). Unexpectedly, geographic region was also significant (X2=20.2,p=0.0002), with Northern Plains and Southwest showing 4.9% and 7.7% hazard increases respectively, compared to East Coast (X2=6.6 ,p=0.0104; X2=9.9,p=0.0017). Race was not significant (X2=2.5, p=0.28). There was a hazard increase of 0.8% per mm of tumor size (X2=261.7,p<0.0001)(n=15,771). Our algorithm was 98% accurate at predicting survival in 27,325 patients.

Predictive Algorithm for Survival



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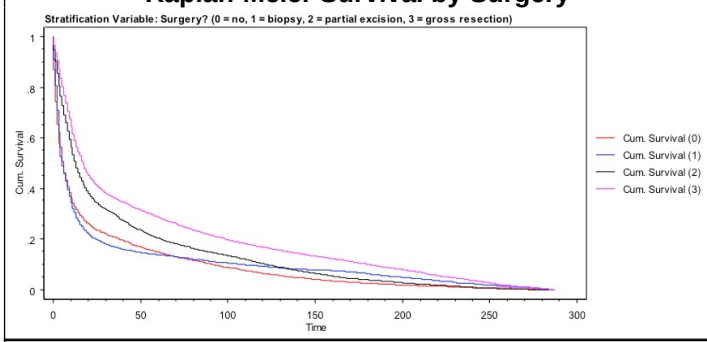
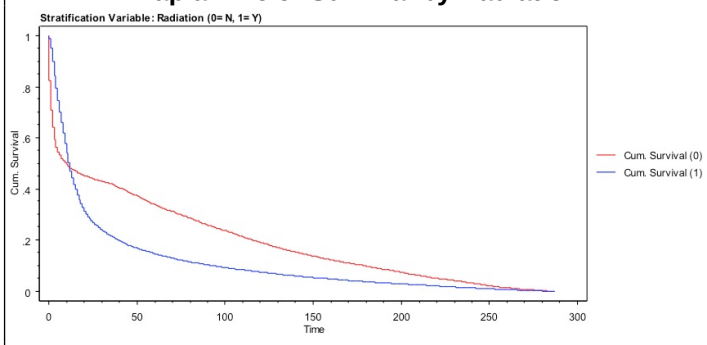
Kaplan-Meier Survival by Surgery



Kaplan-Meier Survival by Radiation



Note the intersection at 12 months.