Validation and Simplification of the Radiation Therapy Oncology Group Recursive Partitioning Analysis Classification for Glioblastoma

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Purpose
Previous recursive partitioning analysis (RPA) of patients with malignant glioma (glioblastoma multiforme [GBM] and anaplastic astrocytoma [AA]) produced six prognostic groups (I–VI) classified by six factors. We sought here to determine whether the classification for GBM could be improved by using an updated Radiation Therapy Oncology Group (RTOG) GBM database excluding AA and by considering additional baseline variables.

Methods and Materials
The new analysis considered 42 baseline variables and 1,672 GBM patients from the expanded RTOG glioma database. Patients receiving radiation only were excluded such that all patients received radiation+carmustine. "Radiation dose received" was replaced with "radiation dose assigned." The new RPA models were compared with the original model by applying them to a test dataset comprising 488 patients from six other RTOG trials. Fitness of the original and new models was evaluated using explained variation.

Results
The original RPA model explained more variations in survival in the test dataset than did the new models (20% vs. 15%) and was therefore chosen for further analysis. It was reduced by combining Classes V and VI to produce three prognostic classes (Classes III, IV, and V+VI), as Classes V and VI had indistinguishable survival in the test dataset. The simplified model did not further improve performance (explained variation 18% vs. 20%) but is easier to apply because it involves only four variables: age, performance status, extent of resection, and neurologic function. Applying this simplified model to the updated GBM database resulted in three distinct classes with median survival times of 17.1, 11.2, and 7.5 months for Classes III, IV, and V+VI, respectively.

Conclusions
The final model, the simplified original RPA model combining Classes V and VI, resulted in three distinct prognostic groups defined by age, performance status, extent of resection, and neurologic function. This classification will be used in future RTOG GBM trials.

Author Keywords: Glioblastoma; prognostic factors; recursive partitioning analysis; RTOG
Introduction

Methods and Materials

Patient population
Training database
Testing database
Prognostic variables
Statistical methods

Results

New RPA models using the updated RTOG GBM database
Expanded GBM (training) database
Patient characteristics
New RPA models
Simplified version of the original RPA model

Testing fitness of the four RPA models using a different RTOG GBM database

Distinction among the RPA classes in the different models
Comparison of the new and original models
Final model: The reduced original model

Discussion

Acknowledgements

References

Conflict of interest: Minesh Mehta serves as a consultant for Schering-Plough and Genentech, which markets drugs for treating GBM. He also serves as a consultant for Tomotherapy Inc and Adnexus and is on the Board of Directors of Pharmacyclics. No other authors have any conflict of interest to disclose.

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