Quality of Glioblastoma Resections is Similar Between Neurosurgical Care Teams from the United States of America and The Netherlands

Domenique Mueller MD; Mitchel S. Berger MD; Philip C. De Witt Hamer MD, PhD; Pierre Alain Robe MD; William P. Vandertop MD, PhD, Prof; Seunggu Jude Han MD; Frederik Barkhof MD PhD

Departments of Neurological Surgery, Radiology and Nuclear Medicine, VU University medical center, Amsterdam, NL; Department of Neurological Surgery, University Medical Center Utrecht, NL; Department of Neurological Surgery, University of California San Francisco, USA

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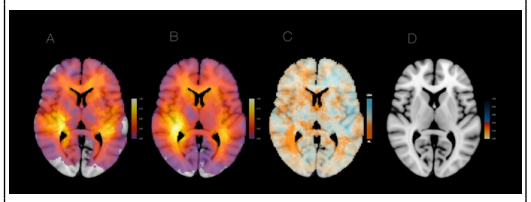
Introduction

The extent of resection is important to improve survival in patients with a glioblastoma. The neurosurgeon's aim is to maximize the extent of resection, while preserving functional integrity. A standard to assess and compare the quality of neurosurgical care of teams is lacking. In this study we present a novel volumetric method to quantify post-resection residual tumors throughout the brain for patient populations. This allows direct comparison of surgical results between care teams.

Methods

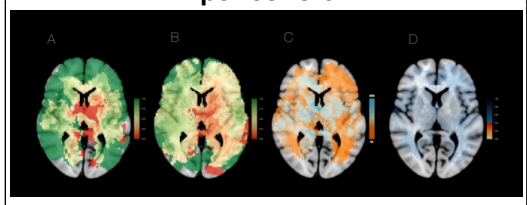
All adults with first-time glioblastoma surgery in 2012-2013 in each of two Dutch and one United States tertiary referral centres for neuro-oncological care were included in this study. From each of these patient populations preoperative tumors and postoperative residual disease were segmented on MRI and registered to standard space. Brain maps of tumor and residual tumor locations were constructed for each country. Differences between these brain maps were analysed to explore patient selection and treatment variation.

Figure 1. Tumor localization maps illustrating GBM locations within the brain



Transversal sections from (A) the United States care team, n=106, and (B) the Dutch care teams, n=268, where tumors are superimposed on standard brain space (MNI152). The legends refer to the relative number of patients with glioblastoma tissue at a voxel. (C) shows the relative differences between each cohort in patient selection before statistical analysis, whereas (D) shows the results between the comparisons after statistical analysis. This statistical analysis includes multiple testing analysis per voxel, corrected for by the false discovery rate. Voxels are considered statistically significant if thresholded by an FDR<0,4, depicted in red. No differential pattern of selected patients with a glioblastoma was found through analysis, indicating similar patient referral patterns, selection or recruitment.

Figure 2. Resection probability maps per cohort



Results comparing (A) the United States care team and the Dutch care teams, considering the resection probability. A probability of 0 (red) represents locations where tumor was never resected, and a probability of 1 (green) represents locations where tumor was resected in all patients. An intermediate probability (yellow) represents locations where glioblastoma was removed in a subset of patients. Statistical analysis and patient numbers are as described in Figure 1 and indicate no treatment variation (C+D). No differential residual tumor localization was noted throughout the brain, indicating similar surgical decision making.

Conclusions

Brain maps of tumor localization convey important information that can be used to compare neurosurgical care teams in terms of patient selection. In addition, surgical decision making can be made explicit through resection probability maps. This novel volumetric approach can provide objective arguments for discussions between care teams on the quality of neurosurgical care for patients with a glioblastoma.

Learning Objectives

By the conclusion of this session, participants should be able to 1) understand the essence of providing the optimal form of care for the individual patient with a glioblastoma, 2) use volumetric imaging analysis by brain maps to evaluate and compare their quality of care with other neurosurgical care teams, 3) use this new knowledge for self-evaluation and future guidance in neurosurgical strategy for the patient with a glioblastoma, providing the most optimal neurosurgical care.

References

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Correspondance

Poster presentor: Dr. Seunggu J. Han; Mail: Dr. Domenique M.J. Mueller dmj.muller@vumc.nl