Interobserver Variability and User-friendliness of a Commercially Available Software for Semiautomated Volumetric Analysis of Brain Tumors

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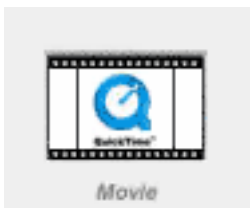
Learning Objectives

By the conclusion of this session, participants should be able to: 1) Describe the importance of volumetric analysis in brain tumor surgery for its implications in prognostic assessment, 2) Discuss, in small groups, the pitfalls of computer-assisted volumetric assessment, especially in postoperative examinations (discrimination of edema and tumor remnant).

Introduction

Computer-assisted volumetric analysis of the extent of brain tumor resection is increasingly common and may have significant prognostic value [1-2]. Though multiple software packages are available, few have been rigorously validated [3-4]. We sought to evaluate interobserver variability and user-friendliness of a commercially available software package for semiautomated MRI-based volume measurements.



Video showing the two main tools used for volumetry ("lasso" and "wand") and the output with 3D representation.

Methods

Pre- and post-operative (within 72 hours) MRI scans from patients undergoing craniotomy for glioma were reviewed. MRI data were retrospectively analyzed by 3 independent observers. Post-contrast T1-weighted sequences were used for enhancing tumors and T2 or FLAIR sequences for non-enhancing lesions. Volumes were calculated respectively using the Stealthviz software for volumetric analysis (Medtronic®, Minneapolis, MN, USA). Time required to calculate volume was also recorded. Interobserver variability was calculated. Statistical analysis was performed with JMP software.

Results

Images were reviewed for ten patients with contrast -enhancing lesions and 10 patients with non-enhancing tumors. Mean pre-operative tumor volume was 39.3mL (5.3-141.6mL), 44.5mL (8.3-153.1mL) and 43.8mL (6.2-165.9mL) for the three observers, respectively. Mean post-operative volume was 7mL (0-48mL), 6.1mL (0-43.7mL) and 6mL (0-42.7mL) respectively. Mean working time of the 3 observers was significantly shorter for postoperative examinations (3.6 minutes, 3 to 4.2 95% CI) than for preoperative measurements (6.2 minutes, 5.5 to 6.9 95% CI), $P<0.0001$. The intraclass interobserver correlation was 0.96 (0.93 to 0.98 95% CI) for preoperative measurements and 0.98 (0.97 to 0.99 95% CI) for postoperative volumetry of residual lesion. No statistically significant correlation differences were found between enhancing or non-enhancing tumors.

Aknowledgments

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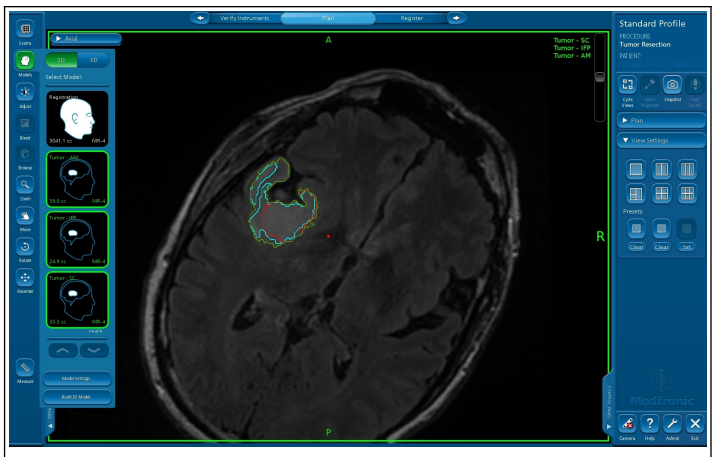

An example of high interobserver variability in FLAIR volumetry of a right insular tumor. Each color represents the tumor margings according to a different observer.

Conclusion

Semiautomated segmentation of brain tumors on MRI scans with Stealthviz software yielded reproducible volume measurements with a low interobserver variability in both preoperative and postoperative examinations and in both enhancing and non-enhancing tumors. Volumetric assessment was straightforward and could be performed quickly. This data may facilitate more widespread objective outcome analysis following glioma resection.

References

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