Presentation Abstract

Title: P-39 - Man vs Machine - Validation of the Qualitative Imaging Feature Set VASARI Using Volumetric Analysis by 3 D Slicer of the TCGA GBM Dataset: A TCGA Glioma Phenotype Research Group Project

Keywords: Glioblastoma; TCGA; volumetrics

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Abstract Body:
Purpose
Glioblastoma (GBM) was the first tumor to undergo comprehensive genetic analysis as part of the NCIs The Cancer Genome Atlas (TCGA). Clinical images were collected in The Cancer Imaging Archive (TCIA) to augment this genomic repository. While volumetric analysis is likely more precise, the current tooling available to support such analysis (e.g., 3D SLICER, MIPAV, etc.) require a significant amount of domain expertise. Thus, volumetric analysis remains difficult in clinical practice, and qualitative assessments of imaging features are still critical, particularly if they have clinical relevance. The purpose of this study was to assess the correlation between semiquantitative image (human-generated) features generated by the current gold standard (i.e., neuroradiologists) against quantitative imaging volumetric measurements (machine-aided).
Materials & Methods
Each image was assessed by at least three independent neuroradiologists who recorded a set of 30 imaging features describing the size, location, and morphology of the tumor. To perform a systematic evaluation of these images, a set of qualitative imaging features (the VASARI feature set) was developed which included a visual assessment of key features of the MRI data. For practical reasons, a number of these imaging features were scored visually including the contribution of individual tumor compartments (e.g., the necrotic component, the contrast

enhancing portion, edematous component, and noncontrast enhancing tumor) to the overall tumor volume. For each tumor, radiologists reviewed a series of images which included a T1 axial image both before and after gadolinium contrast administration, and a T2 axial FLAIR image. These features involved the trained neuroradiologists estimating the total volume of abnormal tissue noted on the image stack. Estimating from within the mass of abnormal tissue four compartments were defined as the percentage of tumor that showed contrast enhancement, the proportion of tumor showing no-contrast enhancement, the proportion of the volume that appeared to be necrotic tissue, and the proportion of the estimated volume that appeared to be edematous tissue. In parallel, we performed volumetric analysis using the 3 D slicer platform to quantitatively measure actual volumes of each individual region. The flair-volume, contrast-enhancing region, and necrotic core were independently segmented and verified by a trained neuroradiologist (RRC).

Results

Univariate linear regressions of the volumetric contrast-enhancing portion, edema, and necrosis measurements upon the neuroradiologist-generated contrast enhancing, edema, and necrosis estimates respectively, were performed. These analyzes indicated very strong correlations between the volumetric and human measurements (p-value < 0.0001 in each case).

Conclusion

This study, which included consensus reads by three neuroradiologists in 75 patients, indicated a high-degree of concordance between these two methodologies. Given that quantitative volumetry is not performed in every day cancer clinical practice, this work suggests that clinical visual semiquantitative estimations of tumor volume are both reproducible and valid.

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