Computer-based Intra and Inter-observer Segmentation Spatial Correlation for Brain Metastasis: Evaluation for Potential Systematic Error Improvement.

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BACKGROUND: The local control for metastatic brain lesions treated with stereotactic radiation (SRS) is on average 80%. Stereotactic radiation treatment for brain lesions results are hindered by various systematic errors. Small target lesions segmentation are extremely susceptible to volume change depending on image processing and interpretation. For example, a 1 mm segmentation difference between a 9 mm and a 10 mm lesion results in a 37% volume difference.

HYPOTHESIS: Target delineation segmentation variance reduction might be one of the variables that might improve local control for SRS-treated metastatic brain lesions. Determining the baseline variance on current clinical practice is relevant to build a process to improve target delineation with the help of image resolution selection and/or processing

METHODS: We evaluated the intra-observer and inter-observer brain metastasis target delineation among 4 physicians and 2 physicists using the Dice coefficient to explore the spatial correlation of the segmented target volumes. A total of 13 brain metastatic lesion ranging from 0.04 to 3 cc from patients subjected to SRS were segmented in the planning T1 weighted post-contrast MRI images. Target structures were then converted to binary images and analyzed in a homebuilt MATLAB™-based program. All relevant permutations among observers and intra-observer segmentations were obtained and analyzed.

RESULTS: The average spatial correlation among all segmented images was 86.7% (SD 0.6%). Average Intra-observer correlation was 92 % (SD 0.4%). Most of the differences were seen, as expected, in the edges of the segmented volumes. Based on these results and given the nature of the high precision delivery of SRS for brain lesion, effort to reduce such variance needs to be explored. Computer base image processing tools are being developed to improve such variances.