

AbstractID: 14289 Title: Use of pre-surgery MRI images for post-surgery brain tumor target delineation using multiple-intensity deformable image registration

Purpose:

While the brain tumors can be clearly identified in the pre-surgery MR images, it can be challenging to qualitatively define the radiation treatment target and margins in the post-surgery images because of tumor removal and tissue deformation. This study presents a way to use image processing and deformable registration methods to aid treatment target definition in post-surgery MR images.

Method:

Multiple MR image datasets of the patient, in different spatial orientations and using different MRI pulse sequences, were obtained before and after surgery operation for diagnosis, surgical planning and evaluation purposes, and were retrospectively used in this study. All images were rigidly fused using CERR (Deasy, 2003) after CERR MRI functions were improved. The pre-surgery images were deformed to post-surgery images using DIR (deformable image registration) methods. Technical challenges, including mismatching image content, inconsistent image intensities and utilization of multiple image datasets, are solved with a combination of image processing methods and improvements of DIR methods. Tumor delineated in pre-surgery images was warped using DIR results to the post-surgery image to suggest the treatment target.

Results:

Multiple image datasets of different orientations and MRI pulse sequences were utilized in deformable image registration to improve the overall accuracy. The DIR results on normal brain tissue were visually verified. Assuming the target is the brain minus normal brain tissue, the treatment target can then quantitatively be determined.

Conclusion:

The proposed method provides a feasible way to quantitatively use pre-surgery diagnostic MR images into the post-surgery radiation treatment planning. It may help to improve the confidence of treatment target delineation, and therefore to improve tumor control and reduce normal tissue complications. The method can be potentially useful in other similar pre- and post-surgery target definition situations for other cancer sites.