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Anatomical changes in resection cavity during brain radiotherapy

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Abstract

Background and purpose: Brain tumors are in general treated with a maximal safe resection followed by radiotherapy of remaining tumor including the resection cavity (RC) and chemotherapy. Anatomical changes of the RC during radiotherapy can have impact on the coverage of the target volume. The aim of the current study was to quantify the potential changes of the RC and to identify risk factors for RC changes.

Materials and methods: Sixteen patients treated with pencil beam scanning proton therapy between October 2019 and April 2020 were retrospectively analyzed. The RC was delineated on pre-treatment computed tomography (CT) and magnetic resonance imaging, and weekly CT-scans during treatment. Isotropic expansions were applied to the pre-treatment RC (1-5 mm). The percentage of volume of the RC during treatment within the expanded pre-treatment volumes was quantified. Potential risk factors (volume of RC, time interval surgery-radiotherapy and relationship of RC to the ventricles) were evaluated using Spearman's rank correlation coefficient.

Results: The average variation in relative RC volume during treatment was 26.1% (SD 34.6%). An expansion of 4 mm was required to cover > 95% of the RC volume in > 90% of patients. There was a significant relationship between the absolute volume of the pre-treatment RC and the volume changes during treatment (Spearman's $\rho = -0.644$; $p = 0.007$).

Conclusion: RCs are dynamic after surgery. Potentially, an additional margin in brain cancer patients with an RC should be considered, to avoid insufficient target coverage. Future research on local recurrence patterns is recommended.

Keywords: Anatomical changes; Neuro-oncology; Radiotherapy; Resection cavity.

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