

Impact of radiotherapy on normal brain tissue: Semi-automated quantification of decrease in perfusion

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Purpose: We attempted to ascertain the impact of Co-60 conventional external radiotherapy (cRT) on the perfusion of normal brain tissue in relation to the radiation doses delivered to the tumors in patients with primary brain tumors.

Materials and Methods: After surgery 18 patients (pts) were due to undergo cRT with a total dose of 5400–6400 cGy. All the patients had a Tc-99m-HMPAO SPECT study prior to cRT (basal), 15th and 30th days of cRT as well as 1 (in 6 pts), 3 (in 9 pts), and 6 (in 3 pts) months after cRT. For quantitative evaluation, the entire set of transverse slices were divided into 4 regions as frontal, parietal, occipital and temporal regions by means of a computer software program. Semi-automated quantification was performed on a total of 1392 regions in 87 studies to determine left to right ratios. An interregional difference of at least 10% was considered abnormal.

Results: After elimination of tumor sites, 80 normal brain regions showed decreased perfusion after cRT. The percent decrease in perfusion was (mean 22.5 ± 9.9) significantly higher in areas irradiated with doses > 3000 cGy ($p < 0.05$).

Conclusion: cRT has adverse effects on the perfusion of normal brain tissue for doses > 500 cGy. Our findings justify treating patients with small and limited lesions with stereotactic radiotherapy in order to minimize the adverse effects of cRT on normal tissues.

Key words: Tc-99m-HMPAO, radiotherapy, brain imaging, single photon emission computed tomography