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## Differentiating Radiation-Induced Necrosis from Recurrent Brain Tumor Using MR Perfusion and Spectroscopy: A Meta-Analysis.

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### Abstract

**PURPOSE:** This meta-analysis examined roles of several metabolites in differentiating recurrent tumor from necrosis in patients with brain tumors using MR perfusion and spectroscopy.

**METHODS:** Medline, Cochrane, EMBASE, and Google Scholar were searched for studies using perfusion MRI and/or MR spectroscopy published up to March 4, 2015 which differentiated between recurrent tumor vs. necrosis in patients with primary brain tumors or brain metastasis. Only two-armed, prospective or retrospective studies were included. A meta-analysis was performed on the difference in relative cerebral blood volume (rCBV), ratios of choline/creatine (Cho/Cr) and/or choline/N-acetyl aspartate (Cho/NAA) between participants undergoing MRI evaluation. A  $\chi^2$ -based test of homogeneity was performed using Cochran's Q statistic and I<sup>2</sup>.

**RESULTS:** Of 397 patients in 13 studies who were analyzed, the majority had tumor recurrence. As there was evidence of heterogeneity among 10 of the studies which used rCBV for evaluation (Q statistic = 31.634, I<sup>2</sup> = 97.11%, P < 0.0001) a random-effects analysis was applied. The pooled difference in means (2.18, 95%CI = 0.85 to 3.50) indicated that the average rCBV in a contrast-enhancing lesion was significantly higher in tumor recurrence compared with radiation injury (P = 0.001). Based on a fixed-effect model of analysis encompassing the six studies which used Cho/Cr ratios for evaluation (Q statistic = 8.388, I<sup>2</sup> = 40.39%, P = 0.137), the pooled difference in means (0.77, 95%CI = 0.57 to 0.98) of the average Cho/Cr ratio was significantly higher in tumor recurrence than in tumor necrosis (P = 0.001). There was significant difference in ratios of Cho to NAA between recurrent tumor and necrosis (1.02, 95%CI = 0.03 to 2.00, P = 0.044).

**CONCLUSIONS:** MR spectroscopy and MR perfusion using Cho/NAA and Cho/Cr ratios and rCBV may increase the accuracy of differentiating necrosis from recurrent tumor in patients with primary brain tumors or metastases.

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