

## Journal Article



## Evaluation of invasiveness of astrocytoma using $^1\text{H}$ -magnetic resonance spectroscopy: correlation with expression of matrix metalloproteinase-2

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### Abstract

**Introduction** Even low-grade astrocytomas infiltrate the entire brain, a feature that precludes their successful therapy. So to assess the invasive potential of astrocytoma is very important. The aim of this study was determine whether there is a significant correlation between the results of  $^1\text{H}$ -magnetic resonance spectroscopy ( $^1\text{H}$ -MRS) and tumor invasive potential of astrocytoma, which is reflected by expression of matrix metalloproteinase-2 (MMP-2).

**Methods** The  $^1\text{H}$ -MRS spectra of 41 histologically verified astrocytomas were obtained on a 3-T MR scanner. According to the World Health Organization classification criteria for central nervous system tumors, there were 16 low-grade astrocytomas (2 pilocytic astrocytomas, 14 grade II astrocytomas) and 25 high-grade astrocytomas (5 anaplastic astrocytomas, 20 glioblastomas). The choline/*N*-acetylaspartate (Cho/NAA) and choline/creatine (Cho/Cr) ratios were calculated. Of the 41 astrocytomas, 19 (8 low-grade and 11 high-grade) were analyzed immunohistochemically. Expression of MMP-2 was determined using streptavidin-peroxidase complex (SP) staining which was quantified by calculating its calibrated opacity density (COD) using an image analysis system. The correlations between metabolite ratios and the quantitative data from the immunohistochemical tests in the 19 astrocytomas were determined.

**Results** The Cho/NAA and Cho/Cr ratios of high-grade astrocytoma were both significantly greater than those of low-grade astrocytoma ( $t = -6.222$ ,  $P = 0.000$ ;  $t = -6.533$ ,  $P = 0.000$ , respectively). MMP-2 COD values of high-grade astrocytomas were also significantly greater than those of low-grade astrocytomas ( $t = -5.892$ ,  $P = 0.000$ ).

There were strong positive correlations between Cho/NAA ratio and MMP-2 COD ( $r=0.669$ ,  $P=0.002$ ), and between Cho/Cr ratio and MMP-2 COD ( $r=0.689$ ,  $P=0.001$ ).

*Conclusion*  $^1\text{H}$ -MRS is helpful in evaluating the invasiveness of astrocytomas and predicting prognosis preoperatively by determining the Cho/NAA and Cho/Cr ratios.

**Keywords** Astrocytoma - Magnetic resonance spectroscopy - Immunohistochemistry

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