Evaluation of 31-P-MR-Spectroscopy in brain metastases correlated to histopathological results

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Disclosure

The authors declare no conflicts of interest
Introduction

Brain metastases (BM) well-circumscribed lesions
Amount of edema suggested either mechanisms of infiltration or defense

Better understanding of the mechanisms within the edema of BM seems reasonable, to preoperatively identify areas of infiltration and resect them.

Modern MR-algorithms may discover areas at high risk by perfusion, diffusion-weighted imaging and spectroscopy. BM represent tumors with high energy-demand and cell-turnover, therefore they qualify for preoperative investigation with 31-Phosphorus – MR – Spectroscopy (31PMRS), revealing information about those characteristics.
Methods

-10 patients
-BM in non-eloquent areas
-MRI, with additional 31PMRS preoperatively

Biopsies:
-Within the contrast-enhancing tumor (CE+)
-At the border (including CE+ areas and surrounding T2-hyperintensive (T2+)
-distant biopsy purely including T2+ areas (but amable for supramarginal resection)

Fig. 2: Biopsies were taken after craniotomy before the opening of the dura to avoid brain shift. Blue: tumor, green: border, pink: edema
Biopsies were taken using frameless stereotaxy after fusion of 31P-MRS.
Results

<table>
<thead>
<tr>
<th></th>
<th>CE⁺</th>
<th>BORDER</th>
<th>T²⁺</th>
<th>control</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resynthesis</td>
<td>1.109±0.192</td>
<td>1.112±0.158</td>
<td>1.083±0.097</td>
<td>1.063±0.085</td>
<td>0.520</td>
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<tr>
<td>Hydrolysis</td>
<td>0.303±0.089</td>
<td>0.360±0.122</td>
<td>0.321±0.089</td>
<td>0.335±0.073</td>
<td>0.406</td>
</tr>
<tr>
<td>Energy demand</td>
<td>4.227±2.35</td>
<td>3.453±1.284</td>
<td>3.599±0.833</td>
<td>3.317±0.7573</td>
<td>0.880</td>
</tr>
<tr>
<td>Membrane turnover</td>
<td>1.239±0.2611</td>
<td>3.453±1.284</td>
<td>3.599±0.283</td>
<td>0.784±0.186</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
31PMRS in BMs provides information on metabolic changes in CE+, tumor and surrounding edema. There is a proof of enhanced metabolism in tissue without histological tumor manifestation.