Annual Meetings of the American Epilepsy Society and Canadian League Against Epilepsy

Filename: 751176

Presenting Author: Neda Bernasconi
Author for Correspondence Neda Bernasconi, MD, PhD
Department/Institution: Montreal Neurological Institute
Address: 3801 University
City/State/Zip/Country: Montreal, QC, H3A 2B4, Canada
Phone: 514 398-3361  Fax: 514 398-2975  E-mail: neda@bic.mni.mcgill.ca

Abstract Categories: 21. 5C All Ages
Presentation format: Either Platform or Poster
AES Young Investigator Travel Award: Yes
AES Nurse's Travel Award: No
Consideration for the Pediatric Highlights session: Yes
Consideration for the Basic Science Poster session: No
AES member: Yes
Keyword 1: Brain Imaging  Keyword 2: Magnetic Resonance Imaging (MRI)  Keyword 3: Cortical Dysplasia (CD)

Title: MRI texture analysis enhances the visibility of cortical tubers in tuberous sclerosis

Neda Bernasconi, MD, PhD¹, Pierre Besson, MsC¹, Thomas Mansi, MsC¹ and Andrea Bernasconi, MD¹, ¹Neurology and Neurosurgery, Montreal Neurological Institute, Montreal, Quebec, Canada, H3A 2B4.

RATIONALE: Cortical tubers (CT) are the most frequent epileptogenic lesions in tuberous sclerosis (TS). CT may go unrecognized by standard radiological analysis due to the lack of signal.
abnormalities on T2-weighted images, their subtlety and the complexity of brain folding patterns. We previously demonstrated that computational models based on texture analysis increases the sensitivity of conventional T1-weighted MRI for the detection of subtle dysplastic lesions by 30% (Bernasconi, 2001). Our objective here was to assess the performance of MRI texture analysis as diagnostic test in TS.

METHODS: We studied 5 TS patients (mean age: 27; two males). All had 3D T1-weighted (FFE sequence, 1mm3 isotropic voxels), proton-density (PD), T2-weighted, and FLAIR images (thickness 3-5mm). To model cortical thickness, blurring of the GM/WM transition and hyperintense signal, we used our previously developed method (Bernasconi, 2001) based on a set of voxel-wise operators applied to 3D T1-weighted MRI and resulting in a 3D map for each feature. To maximize visibility, the three maps were combined into a composite map. Conventional images and texture maps were coregistered in a common stereotaxic space. Conventional MRIs were presented in random order to two independent observers who labeled each CT. A CT was considered to have been detected only if found by both observers. Disagreement was resolved by consensus. A consensus label was created for each conventional MRI modality. A final consensus including all conventional modalities was created and presented concomitantly to the composite texture map.

RESULTS: A total number of 32 CT were identified on T1-weighted MRI. The number of CT increased to 79 on T2-MRIs (T2, PD and FLAIR combined), yielding an increase of 146%. All but one CTs seen on T1-MRI were seen on FLAIR. By using the composite texture map concomitantly with the conventional MRIs, further 35 CT were seen, yielding an additional increase of 44%. All lesions seen on the texture maps were overlooked on the initial evaluation of FLAIR images most likely because of their small size. 25% of tubers were bilateral mirror lesions, i.e. located in the same gyrus in both hemispheres.

CONCLUSION: MRI texture analysis of T1-weighted MRI enhances the visibility of small cortical lesions in TS that may be overlooked by conventional MR imaging. This method is a useful adjunct to T2-weighted images, particularly FLAIR sequences.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Consensus-T1</th>
<th>Consensus-T2s</th>
<th>% increase adding T2s</th>
<th>Total CT (T1+T2s)</th>
<th>Additional CT on texture</th>
<th>% increase adding Texture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>4</td>
<td>100%</td>
<td>4</td>
<td>3</td>
<td>7/4 (75%)</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>7</td>
<td>250%</td>
<td>7</td>
<td>0</td>
<td>7/7 (0%)</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>33</td>
<td>200%</td>
<td>33</td>
<td>6</td>
<td>39/33 (18%)</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>22</td>
<td>120%</td>
<td>22</td>
<td>13</td>
<td>35/22 (59%)</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
<td>13</td>
<td>85%</td>
<td>14</td>
<td>13</td>
<td>27/14 (93%)</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
<td>79</td>
<td></td>
<td>80</td>
<td>35</td>
<td>115/80</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>146%</td>
<td></td>
<td></td>
<td></td>
<td>44%</td>
</tr>
</tbody>
</table>

CT: cortical tubers

**Funding supported by:** Canadian Institutes for Health Research
Disclosure: No