Doppler Imaging In Hypoxic Ischemic Encephalopathy: What is the Value of the Resistivity Index with and Without Compression of the Fontanelle?

Tuva Sandgren, Anton Flink Elmfors, Valerie Chock, Hans Ringertz, Richard Barth, Erika Rubesova
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Hypoxic Ischemic Encephalopathy

• Gray scale is suboptimal to diagnose HIE

• Doppler showed potential to detect HIE*

To Compress or Not to Compress?


Normal RI Values

With Compression

Without Compression

Pediatr Radiol. 2019; 49:646
Purpose of the Study

• Is there a value to the RI in the diagnosis of HIE?

• Is there any added value in the RI performed with compression for the diagnosis of HIE?
Conclusions of the Study

• Is there a value to the RI in the diagnosis of HIE?
  • Yes, but limited
• Is there any added value in the RI performed with compression for the diagnosis of HIE?
  • No
Patients

- 53 babies with clinically, cord and blood PH and EEG proven HIE
- 51/53 babies scanned within 2 days of life
- HIE was graded as mild – moderate – severe based on the SARNAT* score
- 174 normal babies

Technique

• Ultrasound Machines:
  – Siemens S 3000 - transducers 10V and 9L
  – GE E9 with transducers 10V4 and 9V4.

• Doppler obtained of the pericallosal artery, in a sagittal plane, through the anterior fontanelle

• RI without compression followed by RI with a gentle compression
Doppler without and with Compression
Results
Distribution of Patients

By Gestational Age

By Severity of HIE

Number of patients

GA (weeks)

< 36 36 - 39 > 39

HIE grade

mild moderate severe
## Etiologies of the HIE

<table>
<thead>
<tr>
<th>Etiology of the HIE</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cord related (nuchal, prolaps)</td>
<td>12</td>
</tr>
<tr>
<td>Meconium aspiration/ Respiratory failure</td>
<td>12</td>
</tr>
<tr>
<td>Asystole at birth</td>
<td>10</td>
</tr>
<tr>
<td>Fetal decelerations/bradycardia</td>
<td>6</td>
</tr>
<tr>
<td>Other (placental abrubtion/CDH, etc)</td>
<td>13</td>
</tr>
</tbody>
</table>
Grayscale HIE

- 40/53 grayscale US of HIE babies were reported normal 75%
- 13 had increased echogenicity or hemorrhage
## Mean RI Values

### Without Compression

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>0.66</td>
<td>0.08</td>
<td>174</td>
</tr>
<tr>
<td>HIE</td>
<td>0.63</td>
<td>0.13</td>
<td>53</td>
</tr>
</tbody>
</table>

P = 0.027

### With Compression

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>0.68</td>
<td>0.09</td>
<td>174</td>
</tr>
<tr>
<td>HIE</td>
<td>0.65</td>
<td>0.12</td>
<td>53</td>
</tr>
</tbody>
</table>

P = 0.004

Statistically significant difference between mean RI of normal and HIE babies *but useless in practice*
Dispersion of RI values HIE vs Normal

Without Compression

Greater dispersion of RI in HIE babies

P = 0.016

With Compression

P = 0.037
Dispersion of RI by Severity Grade

Without Compression

Moderate and severe grades had significantly higher dispersion in RI compared to mild grade p=0.017

Thus very high or very low RI indicate HIE
Dispersion of RI by Severity Grade

With Compression

Only severe grade had significantly higher dispersion in RI compared to mild grade

p=0.007

Thus very high or very low RI indicate more severe HIE
Conclusions

• Statistically significant difference in RI values between HIE and normal babies
  But limited or no practical value
• Greater dispersion of RI values in babies with HIE than normal babies when performed without compression
• Severe grade HIE has greater dispersion of RI values than mild grade
  Very high or low RI indicate severe HIE
Thank You