Short 3T MRI Protocol for Head, Neck & Azygus MS study

With Contrast

(NOTE: Please follow the sequence order)

**Head - with Contrast**
(Center at the orbital ridge)

<table>
<thead>
<tr>
<th>Sequence Order</th>
<th>#1</th>
<th>#2</th>
<th>#3</th>
<th>#4 / #12</th>
<th>#13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequence</td>
<td>Dual Echo SWI</td>
<td>T2 WI</td>
<td>3D FLAIR</td>
<td>MPRAGE Pre/ Post Gad</td>
<td>3D VIBE Post Gad - Sagittal</td>
</tr>
<tr>
<td>Orientation</td>
<td>gre</td>
<td>tse</td>
<td>tse_vfl</td>
<td>tfl</td>
<td>fl3d_vibe</td>
</tr>
<tr>
<td>TR (ms)</td>
<td>29</td>
<td>7080</td>
<td>6000</td>
<td>1750</td>
<td>3.97</td>
</tr>
<tr>
<td>TE (ms)</td>
<td>1st TE = 6, 2nd TE = 20</td>
<td>77</td>
<td>397</td>
<td>2.98</td>
<td>1.43</td>
</tr>
<tr>
<td>Ti (ms)</td>
<td>2200</td>
<td>900</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FA (degree)</td>
<td>15</td>
<td>120</td>
<td>9</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>FOV (mm²)</td>
<td>256x192</td>
<td>256x192</td>
<td>256x256</td>
<td>256x256</td>
<td>352x275</td>
</tr>
<tr>
<td>Matrix size</td>
<td>512x256</td>
<td>512x256</td>
<td>256x256</td>
<td>352x384</td>
<td>384x384</td>
</tr>
<tr>
<td>Nz/TH (mm)</td>
<td>128/2</td>
<td>100/2</td>
<td>160/1</td>
<td>192/1</td>
<td>256/0.9</td>
</tr>
<tr>
<td>Voxel size (mm³)</td>
<td>0.5x1x2</td>
<td>0.5x1x2</td>
<td>1x1x1</td>
<td>0.5x1x1</td>
<td>0.9x0.9x0.9</td>
</tr>
<tr>
<td>Ave./Meas.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Phase oversmpl</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slice oversmpl</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16.7%</td>
</tr>
<tr>
<td>Dist. factor</td>
<td>20%</td>
<td>0%</td>
<td>0%</td>
<td>50%</td>
<td>20%</td>
</tr>
<tr>
<td>Phase Enc. Dir</td>
<td>R&gt;&gt;L</td>
<td>R&gt;&gt;L</td>
<td>A&gt;&gt;P</td>
<td>R&gt;&gt;L</td>
<td>A&gt;&gt;P</td>
</tr>
<tr>
<td>iPAT</td>
<td>2/24</td>
<td>2/24</td>
<td>2/24</td>
<td>2/24</td>
<td>2/24</td>
</tr>
<tr>
<td>BW (Hz/pixel)</td>
<td>470 and 120</td>
<td>222</td>
<td>781</td>
<td>180</td>
<td>690</td>
</tr>
<tr>
<td>Flow Comp</td>
<td>Yes for 1st TE, No for 2nd TE</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Phase partial Fourier</td>
<td>Off</td>
<td>Off</td>
<td>Allowed</td>
<td>Off</td>
<td>6/8</td>
</tr>
<tr>
<td>Slice partial Fourier</td>
<td>Off</td>
<td>Off</td>
<td>7/8</td>
<td>Off</td>
<td>6/8</td>
</tr>
<tr>
<td>Flow Mode/Direction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Venc. (cm/s)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st Signal/Mode</td>
<td>11.1</td>
<td>3.32</td>
<td>7.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Echo spacing (ms)</td>
<td>18</td>
<td>141</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Echo trains per slice</td>
<td>6</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coils</td>
<td>Head</td>
<td>Head</td>
<td>Head</td>
<td>Head</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>06:39</td>
<td>2:30</td>
<td>5:20</td>
<td>4:03x2</td>
<td>1:45</td>
</tr>
</tbody>
</table>

**Note:**
- Position the subject at the orbital ridge.
- Slice position for the above sequences (Dual Echo SWI, T2, MPRAGE) should be true axial.
- If Dual Echo SWI is not possible at your center, run the sequence with a single echo TE = 20ms.
- 3D FLAIR and 3D VIBE POST GAD should be acquired in a sagittal plane.
**Neck (CSF / Jugulars) - with Contrast**  
(Center at the chin)

<table>
<thead>
<tr>
<th>Sequence Order</th>
<th>#5</th>
<th>#6</th>
<th>#7</th>
<th>#8</th>
<th>#9</th>
<th>#10</th>
<th>#11</th>
</tr>
</thead>
<tbody>
<tr>
<td>2D MRV (neck)</td>
<td>T2 WI</td>
<td>3D VIBE Pre Gad - Sagittal</td>
<td>3D MRV (Dynamic) Inject Contrast after 3rd measurement for the 3D MRV</td>
<td>3D VIBE Post Gad - Sagittal</td>
<td>Flow Quantification (CSF)</td>
<td>Flow Quantification (Jugulars)</td>
<td></td>
</tr>
</tbody>
</table>

**Sequence**  
- fl_tof  
- tse  
- fl3d_vibe  
- fl3d_ce  
- fl3d_vibe  
- fl_fq_retro  
- fl_fq_retro

**Orientation**  
- Axial  
- Sagittal  
- Sagittal  
- Coronal  
- Sagittal  
- Axial  
- Axial

**TR (ms)**  
- 29  
- 2800  
- 3.97  
- 3.31  
- 3.97  
- 95.25  
- 95.25

**TE (ms)**  
- 5.02  
- 82  
- 1.43  
- 1.25  
- 1.43  
- 10  
- 10

**FA (degree)**  
- 60  
- 160  
- 25  
- 20  
- 25  
- 20  
- 20

**FOV (mm²)**  
- 320x256  
- 256x256  
- 352x275  
- 340x255  
- 352x275  
- 256x256  
- 256x256

**Matrix size**  
- 512x256  
- 384x268  
- 384x384  
- 384x384  
- 384x384  
- 384x384  
- 384x384

**Voxel size (mm³)**  
- 0.6x1.3x3  
- 0.7x1x3  
- 0.9x0.9x0.9  
- 0.9x0.9x0.9  
- 0.9x0.9x0.9  
- 0.6x0.6x2.5  
- 0.6x0.6x2.5

**Ave./Meas.**  
- 1  
- 1  
- 1  
- 1/15  
- 1  
- 1  
- 1

**Phase oversmpl**  
- 100%

**Slice oversmpl**  
- 11.1%

**Dist. factor**  
- -25.0%  
- 0%  
- 20%  
- 20%  
- 20%  
- 20%  
- 20%

**Phase Enc. Dir**  
- A>P  
- H>F  
- A>P  
- R>L  
- A>P  
- A>P  
- A>P

**iPAT**  
- 2/24  
- None  
- 2/24  
- PE: 2/48, 3D: 2/24  
- 2/24  
- 2/24  
- 2/24

**BW (Hz/pixel)**  
- 217  
- 260  
- 690  
- 650  
- 690  
- 192  
- 192

**Flow Comp**  
- Yes  
- Read  
- No  
- No

**Phase partial Fourier**  
- Allowed  
- 6/8  
- 6/8  
- 6/8  
- 6/8

**Slice partial Fourier**  
- 6/8  
- 6/8  
- 6/8

**Special Sat. Tracking**  
- F

**Pre Saturation Gap**  
- 10mm; TH 40mm

**Flow Mode / Direction**  
- Single Dir./ Through Plane  
- Single Dir./ Through Plane

**Venc. (cm/s)**  
- 15  
- 50

**1st Signal/Mode**  
- Pulse/Retro  
- Pulse/Retro

**Echo spacing (ms)**  
- 10.3

**Turbo factor**  
- 11

**Echo trains per slice**  
- 49

**Coils**  
- Head+Nec k+SP1,2  
- Head+Neck +SP1,2  
- Head+Neck +SP1,2  
- Head+Neck +SP1,2  
- Head+Neck +SP1,2  
- Head+Neck+S P1,2  
- Head+Neck+S P1,2

**Time**  
- 6:57  
- 5:22  
- 1:45  
- 2:52  
- 1:45  
- 1:42  
- 1:42(x3)

**Total Time**  
- 6:57  
- 9:19  
- 11:04  
- 13:56  
- 15:41  
- 17:23  
- 22:29

**Note:**  
- Position the subject to the chin for the neck. Make sure to use HEA;HEP;NE1,2;SP1,2 coils are highlighted.  
- Please put a pulse trigger on the patient’s index finger.  
- Flow quantification will be done perpendicular to the CSF flow at C2/C3 neck level with a venc of 15cm/sec, and perpendicular to the internal jugular veins (IJV’s) at the C2/C3, C5/C6 and T1/T2 neck levels with a venc of 50cm/sec.

Now center at the brain to run the sequences #12 and #13 from page #1.
### Azygus - with Contrast
(Center at the mid sternum)

<table>
<thead>
<tr>
<th>Sequence Order</th>
<th>#14</th>
<th>#15</th>
<th>#16</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sequence</strong></td>
<td>fl_tof</td>
<td>fl_tof</td>
<td>fl_fq_retro</td>
</tr>
<tr>
<td><strong>Orientation</strong></td>
<td>Axial</td>
<td>Axial</td>
<td>Axial</td>
</tr>
<tr>
<td><strong>TR (ms)</strong></td>
<td>41</td>
<td>40</td>
<td>95.25</td>
</tr>
<tr>
<td><strong>TE (ms)</strong></td>
<td>5.02</td>
<td>5.02</td>
<td>10</td>
</tr>
<tr>
<td><strong>FA (degree)</strong></td>
<td>60</td>
<td>60</td>
<td>20</td>
</tr>
<tr>
<td><strong>FOV (mm²)</strong></td>
<td>256x256</td>
<td>256x256</td>
<td>256x256</td>
</tr>
<tr>
<td><strong>Matrix size</strong></td>
<td>512x256</td>
<td>512x256</td>
<td>448x448</td>
</tr>
<tr>
<td><strong>Nz/TH (mm)</strong></td>
<td>92/3</td>
<td>46/3</td>
<td>1/2.5</td>
</tr>
<tr>
<td><strong>Voxel size (mm³)</strong></td>
<td>0.5x1x3</td>
<td>0.5x1x3</td>
<td>0.6x0.6x2.5</td>
</tr>
<tr>
<td><strong>Ave./Meas.</strong></td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Phase oversmpl</strong></td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td><strong>Dist. factor</strong></td>
<td>-33.0%</td>
<td>-33.0%</td>
<td>20%</td>
</tr>
<tr>
<td><strong>Phase Enc. Dir</strong></td>
<td>R&gt;&gt;L</td>
<td>R&gt;&gt;L</td>
<td>A&gt;&gt;P</td>
</tr>
<tr>
<td><strong>iPAT</strong></td>
<td>2/24</td>
<td>2/24</td>
<td>2/24</td>
</tr>
<tr>
<td><strong>BW (Hz/pixel)</strong></td>
<td>217</td>
<td>217</td>
<td>192</td>
</tr>
<tr>
<td><strong>Flow Comp</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Sat Region 1</strong></td>
<td>86 mm – Anterior</td>
<td>86 mm – Anterior</td>
<td></td>
</tr>
<tr>
<td><strong>Sat Region 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Special Sat.</strong></td>
<td>Tracking H</td>
<td>Tracking F</td>
<td></td>
</tr>
<tr>
<td><strong>Pre Saturation</strong></td>
<td>Gap10mm; TH 40mm</td>
<td>Gap10mm; TH 40mm</td>
<td></td>
</tr>
<tr>
<td><strong>Flow Mode / Direction</strong></td>
<td>Single Dir./ Through Plane</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Venc. (cm/s)</strong></td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>1st Signal/Mode</strong></td>
<td>Pulse/Retro</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Coils</strong></td>
<td>Neck +SP1,2,3,4</td>
<td>Neck +SP1,2,3,4</td>
<td>Neck +SP1,2,3,4</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td>10:39</td>
<td>5:12</td>
<td>1:42</td>
</tr>
<tr>
<td><strong>Total Time</strong></td>
<td>10:39</td>
<td>15:51</td>
<td>17:33</td>
</tr>
</tbody>
</table>

**Note:**
- Position the subject center to the mid sternum. Make sure to use NE1,2;SP1,2,3,4 coils.
- Flow quantification will be done perpendicular to the azygus vein at the upper level. Please use venc of 50cm/s.