Setting Up A Abdominal MRI Protocol

Mukesh G Harisinghani, MD

Overview

→ Abdomen protocol
→ Challenges

Use existing and emerging MR techniques to overcome these challenges

Vendor specific Sequence Acronyms

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Philips</th>
<th>General Electric</th>
<th>Siemens</th>
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Body MR Protocols

Upper Abdomen

- Protocol Needs
  - Maximize CNR while having good overall signal
  - Overcome motion from breathing
  - Fulfill indication for MRI
  - Lesion detection or characterization
  - Complete scan in a reasonable time
- SNR & CNR
  - SNR is signal-to-noise ratio
  - CNR is contrast-to-noise and the ability to differentiate normal from abnormal tissues

Body MR Protocols

CNR

- Localizer
  - 3 plane gradient echo localizer
  - HASTE or FISP

- T1-weighted Sequence
  - Gradient echo in and out of phase BH
  - Can be performed in the same TR
  - Enables detection of fat within an organ or within a lesion

FAT AND WATER PROPERTIES

Fat and water frequency separation
- 1.5T ~ 4.4ms (220Hz)
- 3.0T ~ 2.2ms (450Hz)
- 3.5 ppm
- Relative difference in frequency is called chemical shift

In-phase and Out of Phase TEs

<table>
<thead>
<tr>
<th>In-phase</th>
<th>Out of phase</th>
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<tbody>
<tr>
<td>0.69ms</td>
<td>2.2ms</td>
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<tr>
<td>1.38ms</td>
<td>4.4ms</td>
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<tr>
<td>2.76ms</td>
<td>8.8ms</td>
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<td>5.52ms</td>
<td>17.6ms</td>
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**DIXON METHOD**

Based on Chemical shift of fat and water (3.5 ppm)

\[
S1 (TE1) = \text{in-phase image} = F + W
\]

\[
S2 (TE2) = \text{in-phase image} = F + W
\]

Fat image = \( S2 - S1 \)

Water image = \( S2 + S1 \)

**Protocol**

- Localizer
  - 3 plane gradient echo localizer
- TI-weighted Sequence
  - Gradient echo in and out of phase
- T2-weighted Sequence
  - Fat Saturation

**Addition to the in- and out of phase T1 Protocol**

- Localizer
  - 3 plane gradient echo localizer
- TI-weighted Sequence
  - Gradient echo in and out of phase
- T2-weighted Sequence

**Protocol**

- Localizer
  - 3 plane gradient echo localizer
- TI-weighted Sequence
  - Gradient echo in and out of phase
- T2-weighted Sequence

- Motion Correction
  - Respiratory triggered, Navigator based or Breath Hold
Protocol
- Localizer
  - 3 plane gradient echo localizer
  - SSFSE or FISP
- T1-weighted Sequence
  - Gradient echo in and out of phase BH
- T2-weighted Sequence
- Motion Correction
- Parallel Imaging - Image or k-space Based
  - GRAPPA, SMASH are Parallel imaging techniques
  - SENSE, PILS and ASSET are Image based Parallel imaging techniques
- Motion Correction
- Parallel Imaging
- Why 3D
- Why 3D
- Why 3D

Parallel Imaging - Image or k-space Based
- GRAPPA, SMASH are Parallel imaging techniques
- SENSE, PILS and ASSET are Image based Parallel imaging techniques
- Motion Correction
- Parallel Imaging

Protocol
- Localizer
  - 3 plane gradient echo localizer
  - SSFSE or FISP
- T1-weighted Sequence
  - Gradient echo in and out of phase BH
- T2-weighted Sequence
- Motion Correction
- Gadolinium Enhanced Sequence
- Non Dynamic
  - Can be 2D or 3D
  - Dynamic (3D preferred)
    - 3D Fast Gradient Echo BH
    - Fat saturated
    - Acquired slowly
    - Thin partitions
    - High resolution
    - Interpolated
- Why 3D

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