MRI and MRS in Metabolic diseases

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Contents

- The Scanner

- Cardiomyopathies
  - Cardiac MRI

- Hepatic diseases
  - Liver MRI and MRS
The Scanner

@GMC: BioSpec 94/20 USR (9.4 Tesla)

- Superconductor solenoid
  † Static magnetic field
- Gradients
  † time-dependent magnetic fields
- Radio frequency coils + amplifiers
  † high frequency electromagnetic fields
  † cryprobe
Cardiomyopathies

- Dilated cardiomyopathy: enlarged chambers
- Hypertrophic cardiomyopathy: walls thickening
- Ischemic cardiomyopathy: walls thinning
- Valve defect: regurgitation
- Etc…
Cardiac MRI

- Safety
- Clarity of anatomical visualization
- Inter-observer consistency
- Quantitative accuracy
- Variable tissue contrast (also with contrast agent)
- Standard tool in reference medical centers
- versatile and powerful tool for CV imaging
Cardiac MRI

BioSpec 70/20USR

Cryoprobe™
Cardiac MRI

- Dimensions of ventricles (left and right): systole and diastole
- Walls dimensions: systole and diastole
- Visualization of aortic arch
- Calculation of heart performance: EF and FS
- Myocardial contraction
- Atria shape
- Further analysis † special softwares
Cardiac MRI

- Examples

Dilated heart (R)  Healthy heart
Cardiac MRI

- Examples

Dilated heart (R)  Healthy heart
Cardiac MRI

- Examples

Dilated heart (R)  Healthy heart
Cardiac MRI

- Examples

Dilated heart (R)       Healthy heart
**Cardiac MRI**

- Short axis: measuring walls thicknesses, chambers diameters...
Cardiac MRI

- Examples

Hypertrophic heart (L & R)  Healthy heart
Cardiac MRI

- Examples

Hypertrophic heart (L & R)  Hypertrophic heart (L & R)
Cardiac MRI

- Examples

Dilated heart (L)  Healthy heart
Cardiac MRI

- Examples

Dilated heart (R)  Healthy heart
Cardiac MRI

- Examples

Dilated heart (R)  Healthy heart
Cardiac MRI

- Examples

Dilated heart (L & R)  Healthy heart
Cardiac MRI

- Examples

Dilated heart (R)  Healthy heart
Cardiac MRI

... and much more...
Hepatic diseases: Liver MRI and MRS

Liver MR Imaging and Spectroscopy for obesity/diabetes research

- Ingestion of high amounts of fat
  - obesity
  - fatty liver
  - diabetes

<table>
<thead>
<tr>
<th>Fat content</th>
<th>Steatosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5 %</td>
<td>none</td>
</tr>
<tr>
<td>5 - 33 %</td>
<td>NAFLD</td>
</tr>
<tr>
<td>33 - 66 %</td>
<td>NASH</td>
</tr>
<tr>
<td>&gt; 66 %</td>
<td>Fibrosis, cirrhosis, etc</td>
</tr>
</tbody>
</table>
Hepatic diseases: Liver MRI and MRS

Liver MR Imaging and Spectroscopy for obesity/diabetes research

- Preliminary studies: mice on high fat diets
  - Saturated fatty acids
  - Unsaturated fatty acids

- MRI/S on different time points:
  - 0
  - 3 weeks
  - 6 weeks
  - 12 weeks
Hepatic diseases: Liver MRI and MRS

- MR Imaging

Week 0

Week 12
Hepatic diseases: Liver MRI and MRS

(A) Liver volume (cm³) over time (weeks)

(B) Liver volume (cm³) over time (weeks)

S_56, S_54, S_58, S_53, L_57, L_55, L_52
Hepatic diseases: Liver MRI and MRS

- MR Spectroscopy (\(^1\text{H}\))
Hepatic diseases: Liver MRI and MRS
Hepatic diseases: Liver MRI and MRS
Hepatic diseases: Liver MRI and MRS

- Fat to water ratios

TF: Total fat
Unsat: Unsaturated fat (poly and mono)
Thanks for the attention!

Questions?