Year in review: Imaging

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Declarations

- None
Search Medline/PubMed/Cochrane databases.
April 2014 to April 2015
Search terms “osteoarthritis” + either “radiography”, “MRI”, “ultrasound”, “computed tomography”, or “nuclear medicine.”

- Papers (n=471)
- Human (n=217)
  - Knee (n=131)
  - Hip (n=30)
  - Hand (n=15)
  - Back (n=7)
- MRI (n=144)
- Radiography (n=84)
- CT (n=45)
- US (n=17)
- Nuclear medicine (n=7)
This talk

- Cartilage composition: MRI and other modalities
- Cartilage quality as a predictor of outcome
- Assessment other structures: Muscle
- MRI and phenotyping of patients with OA
- What about other joints?
  - Hip
  - Back
  - Hands
Cartilage composition : MRI and other modalities
Glycosaminoglycan Chemical Exchange Saturation Transfer

- Molecular MRI method for assessing changes in GAG
- cf dGEMERIC: quicker time, no contrast
- But highly sensitive to magnetic field inhomogeneities
- This paper describes corrections with gradient echo method

Wei et al, Magnetic Resonance Imaging 32 (2014) 41–47
3-D High frequency US backscatter analysis of human cartilage

Surface maps

Scatter patterns correlate with cell density

Cartilage quality as a predictor of outcome
Importance of considering cartilage quality

- ↓ dGEMRIC associated with ↑ cartilage thickness in medial TF compartment
- ? swelling of cartilage in early stages of degeneration

Cartilage signal intensity on T1-weighted MRI

↓ mean signal associated with:

- ↑ cartilage defects
- ↓ CTX-II
- ↓ cartilage thickness over 2.9 years

→ low cartilage signal intensity reflects early OA
Assessment other structures: Muscle
Intramuscular fat

- 3-T MRI of the thigh muscles using chemical shift-based water/fat MRI
- Quadriceps intramuscular fat fraction associated with knee OA
- Illustrates importance of measuring fat infiltration as well as muscle size
MRI and phenotyping of patients with OA

- Normal
- Cartilage defects
- Radiological OA
- Joint replacement

10% cartilage loss
(Jones et al. Ost Cart 2002)

Potential for phenotyping
Effect of wt change on structure +/- meniscal pathology in community population

## Effect of MTX in OA with synovitis

<table>
<thead>
<tr>
<th></th>
<th>Methotrexate (n = 72)</th>
<th>Placebo (n = 72)</th>
<th>Mean difference in change</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAS (0-100 mm)</td>
<td>-26.2</td>
<td>-14.8</td>
<td>11.4 (2.8, 20.0)</td>
</tr>
<tr>
<td>WOMAC pain (0-20)</td>
<td>-3.3</td>
<td>-1.4</td>
<td>1.9 (0.7, 3.1)</td>
</tr>
<tr>
<td>WOMAC function (0-68)</td>
<td>-12.2</td>
<td>-4.0</td>
<td>9.5 (3.7, 15.3)</td>
</tr>
<tr>
<td>WOMAC stiffness (0-8)</td>
<td>-2.1</td>
<td>-0.7</td>
<td>1.4 (0.5, 2.3)</td>
</tr>
<tr>
<td>Synovial thickness (mm)</td>
<td>-1.4</td>
<td>-0.4</td>
<td>1.0 (0.4, 1.6)</td>
</tr>
</tbody>
</table>
What about other joints?
Hip remains a challenge

Heavy lifting (18 to 30 yrs): BMI **central SL** OR 3.9 (1.6 to 9.8)

Persistent heavy lifting: ↑ cartilage defects **central SL** OR 1.6 (1.0 to 2.5)

Structure and back pain: Does it matter?

Disk height

Modic changes

Fat infiltration in paraspinal muscles

PLOS ONE: 10.1371/jDec 15, 2014

Exiting data coming from Genodisk consortium
Hand OA

Incident joint tenderness and:

- Synovitis (OR=2.66 (1.38 to 5.11), BMLs (OR=2.85 (1.23 to 6.58))

US-detected inflammation predicts radiographic progression in hand OA after 5 yrs


Summary

- Significant work continues at the knee, particular MRI
- Also focus on cartilage quality
- MRI being increasingly used as an outcome measure but important role of other imaging modalities ie US
- Phenotyping of patients with OA will be very important
- ↑ Work into other joints