AXIAL LOADED MRI OF THE LUMBAR SPINE

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General

- Low back pain: public health problem.
- MRI: reference spine imaging.
- Disadvantage: performed in a supine relaxed position.
- Leading to radio-clinical discordance.
- Solutions: Upright MRI,
  Axial loading device: Dynawell®.
OBJECTIVE

Evaluate the effectiveness of MRI of the lumbar spine with axial loading in patients with lower back pain.
MATERIALS

- Prospective study at Toulouse University Hospital,

- From May 2013 to April 2015,

- MRI 1.5 Tesla Toshiba Vintage Titan,

- With axial loading system : Dynawell®.
POPULATION

➢ Inclusion criteria :

- Adult patient,

- Low back pain with sciatic or neurogenic claudication.

➢ Exclusion criteria :

- The usual contraindications for MRI,

- Recent vertebral fractures,

- Lumbar spine surgery,

- Tumor and infectious processes.
Nonmagnetic device.

Including a harness and a foot-operated compression device connected by straps.

The patient was lying supine with extended hips and knees.
MATERIALS AND METHODS

DEVICE

➢ 50% of the subject’s body weight with equal load distribution on both legs.
MRI PROTOCOL

- **1st step**: Pre-load
  - Sagittal T2
  - Axial T2 on the last 3 lumbar discs

- **2nd step**: Load implement
  - Sagittal T1
  - Waiting 5 min

- **3rd step**: Post-load
  - Sagittal T2
  - Axial T2 on the last 3 lumbar discs
ANALYSIS

- Morphological analysis,

- Quantitative analysis,

- The measurements were performed by two radiologists independently:
  - one resident radiologist,
  - one experienced radiologist.

- Information about the clinical and the axial loading was omitted.
MORPHOLOGICAL ANALYSIS

- Comparison of Pre- and Post-load:
  - Disc abnormalities (protrusions, hernias),
  - Facet joint synovial cysts.

- Highlight a disco-radicular conflict not seen in pre-load.
Measurements at L3-L4, L4-L5 and L5-S1 before and after the load:

- **the surface of dural sac,**
- **the surface of right and left foramina.**
RESULTS
61 patients

2 excluded patients:
- claustrophobia
- not supporting the load

A total of 177 disc spaces from 59 patients
The axial compression enabled:

- an increase in **herniated discs** in 5 patients (8.5%),
- detection of a disco-radicular conflict, not seen in pre-load, in 2 patients (3.4%).
The axial compression enabled:

- detection of a **facet joint synovial cyst** in 1 patient,
- an increase in the size of the cyst in 2 patients.
DURAL SAC

- The axial loaded has decreased the area of the dural sac:
  - L3-L4: a reduction of 10%,
  - L4-L5: a reduction of 8.4%,
  - L5-S1: a reduction of 6%.

<table>
<thead>
<tr>
<th>Disc level</th>
<th>L3-L4</th>
<th>L4-L5</th>
<th>L5-S1</th>
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</thead>
<tbody>
<tr>
<td>Pre-load = Pre (mm²)</td>
<td>125.8</td>
<td>113.9</td>
<td>160.4</td>
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<tr>
<td>Post-load = Post (mm²)</td>
<td>113.4</td>
<td>104.7</td>
<td>151.1</td>
</tr>
<tr>
<td>Pre - Post (mm²)</td>
<td>12.1</td>
<td>9.2</td>
<td>9.3</td>
</tr>
<tr>
<td>Pre - Post (%)</td>
<td>10</td>
<td>8.4</td>
<td>6</td>
</tr>
<tr>
<td>P</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
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Comparison the area of the dural sac between MRI pre- and post-load.
The axial compression enabled:
- a reduction of the surface of foramina between 6 and 8%,
- statistically significant, except at left L5-S1 (p=0.06).

<table>
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<tr>
<th>Pre-load</th>
<th>Post-load</th>
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<td>130 mm²</td>
<td>90 mm²</td>
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</table>
By reducing the area of the dural sac and foramen and in some cases by increasing herniated discs, the Dynawell® system improves detection of disco-radicular conflicts.

Therefore, it appears to be a useful tool for the study of low back pain, especially in the context of radio-clinical discordance.
THANK YOU FOR YOUR ATTENTION.