Normative values for the Bath Ankylosing Spondylitis Metrology Index (BASMI)

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Outline

• Background to study
• Methodology
• Results
• Discussion and implications for practice
• Limitations of study
• Future work
• Key messages
Spinal mobility in AS

• Natural history of AS
  ‘Progressive restriction in spinal mobility’

• Google image search
  ‘Ankylosing Spondylitis and age’
Assessment of spinal mobility in AS

- Loss of spinal mobility **important clinical sign**
  - Modified NY criteria\(^2\)
  - ASAS core domain\(^3\)

- **Recommended measure** of spinal mobility (ASAS) – **BASMI**\(^3\)

- Spinal mobility
  - Obtain **baseline** measurement\(^4\)
  - Monitor **change** over time\(^4\)
  - Assess the impact of clinical interventions\(^3\)
BASMI scoring systems

**BASMI 2 scoring system**

<table>
<thead>
<tr>
<th></th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cervical rotation</strong></td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>(Mean of L &amp; R)</td>
<td>&gt; 70 degrees</td>
<td>20 – 70 degrees</td>
<td>&lt; 20 degrees</td>
</tr>
<tr>
<td><strong>Tragus to wall</strong></td>
<td>&lt; 15cm</td>
<td>15 – 30 cm</td>
<td>&gt; 30 cm</td>
</tr>
<tr>
<td>(Mean of L &amp; R)</td>
<td>&gt; 10cm</td>
<td>5 – 10 cm</td>
<td>&lt; 5 cm</td>
</tr>
<tr>
<td><strong>Lumbar side flexion</strong></td>
<td>&gt; 4 cm</td>
<td>2 – 4 cm</td>
<td>&lt; 2 cm</td>
</tr>
<tr>
<td>(modified Schober)</td>
<td>&gt; 100cm</td>
<td>70 – 100 cm</td>
<td>&lt; 70 cm</td>
</tr>
</tbody>
</table>

**BASMI linear scoring system**

1. **Lateral spinal flexion**: Patient standing with heels and buttocks touching the wall, knees straight, shoulders back, outer edges of feet 30 cm apart, feet parallel. Measure minimal fingers-to-floor distance in full lateral flexion without flexion, extension or rotation of the trunk or bending the knees.

2. **Tragus-to-wall distance**: Maintain same starting position as above. Ensure head in neutral position (anatomical alignment) as possible, chin drawn as far as possible. Measure distance between tragus of the ear and wall on both sides, using a rigid ruler. Ensure no cervical extension, rotation, flexion or side flexion occurs.

3. **Lumbar flexion (modified Schober)**: With the patient standing upright, place a mark at the lumbosacral junction (at the level of the dimples of Venus on both sides). Further marks are placed 5 cm below and 10 cm above. Measure the distance of these two marks when the patient bends forward as far as possible, keeping the knees straight.

4. **Maximal intermalleolar distance**: Patient supine on the floor or a wide plinth, with the knees straight and the feet pointing straight up. Patient is asked to separate legs along the resting surface as far as possible. Distance between medial malleoli is measured.

5. **Cervical rotation**: Patient supine on plinth, head in neutral position, forehead horizontal (if necessary head on pillow or foam block to allow this, must be documented for future reassessment). Gravity goes some way placed centrally on the forehead. Patient rotates head as far as possible, keeping shoulders still, ensure no neck flexion or side flexion occurs.

**BASMI 10 scoring system**

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tragus to wall (cm)</strong></td>
<td>≤ 10</td>
<td>10-12.9</td>
<td>13-15.9</td>
<td>16-18.9</td>
<td>19-21.9</td>
<td>22-24.9</td>
<td>25-27.9</td>
<td>28-30.9</td>
<td>31-33.9</td>
<td>34-36.9</td>
<td>≥ 37</td>
</tr>
<tr>
<td><strong>Lumbar Flexion (cm)</strong></td>
<td>≥ 7.0</td>
<td>6.4-7.0</td>
<td>6.3-7.0</td>
<td>5.5-6.3</td>
<td>5.0-6.5</td>
<td>4.3-5.0</td>
<td>4.9-5.6</td>
<td>4.2-5.0</td>
<td>2.9-3.5</td>
<td>2.2-3.0</td>
<td>≥ 0.9</td>
</tr>
<tr>
<td><strong>Intermalleolar distance (cm)</strong></td>
<td>≥ 120</td>
<td>110-119.0</td>
<td>100-109.0</td>
<td>90-99.0</td>
<td>80-89.0</td>
<td>70-79.0</td>
<td>60-69.0</td>
<td>50-60.0</td>
<td>40-50.0</td>
<td>30-40.0</td>
<td>≥ 20</td>
</tr>
<tr>
<td><strong>Cervical Rotation (degrees)</strong></td>
<td>≥ 35</td>
<td>28-35</td>
<td>21-28</td>
<td>15-21</td>
<td>9-15</td>
<td>3-9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>≥ 0</td>
</tr>
<tr>
<td><strong>Lumbar Side Flexion (cm)</strong></td>
<td>≥ 20</td>
<td>18-20</td>
<td>15.5-17.9</td>
<td>13.8-15.8</td>
<td>11.7-13.7</td>
<td>9.8-11.6</td>
<td>7.5-9.5</td>
<td>5.4-7.0</td>
<td>3.3-5.0</td>
<td>1.2-2.0</td>
<td>≥ 1.2</td>
</tr>
</tbody>
</table>
Are we correct to expect a score of zero is representative of normal spinal movement in a healthy population?
Work informing this study

- Inter- and intra-rater reliability of BASMI

- Incidental finding
  - Some *healthy volunteers* had *worse BASMI scores* than AS patients
  - 7 healthy volunteers
  - BASMI scores ranged 0.7-2.0
  - Mean BASMI score 1.3

*This study suggests that a score of zero should not be expected in a healthy population*
Spinal changes with age

- Google image search
  ‘Spinal posture and age’
If spinal ROM decreases with increasing age, should we expect the BASMI to increase with age also?
To explore the normative values for total BASMI score in healthy men and women in a UK population
Methodology

- Cross-sectional study
- 168 participants recruited - UK population
- Stratified by gender and age

<table>
<thead>
<tr>
<th>Age range</th>
<th>18-30</th>
<th>30-50</th>
<th>50 and over</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>Number</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

- 14 Physiotherapists involved in recruiting and measuring participants
- AssignW consensus of measurement for each domain was followed
- Exclusion criteria:
  - Pregnancy
  - Diagnosis of AS/Axial SpA,
  - Acute back problems
  - Chronic back problems,
  - Impairment limiting normal movement at time of measurement
Statistical analysis

• Descriptive statistics were obtained:
  – Therapist experience
  – Total BASMI scores
  – BASMI component scores
  – Percentage scoring zero on the BASMI

• Age-specific centiles were calculated\textsuperscript{16}
  - Centiles presented start at age 25 and increase in 10 year intervals
Results

- **168** participants (age range 18-85)
  - Males = 84, Females= 84
  - 18-30 = 56, 30-50 = 56, 50+= 56

- BASMI scores: **0 – 4.4**

- **1.2%** individuals scored 0

- **BASMI** scores increased with increasing age

- Corresponding **trends** with BASMI **component** scores

- No gender differences
## Total BASMI score

<table>
<thead>
<tr>
<th></th>
<th>&lt;30 years</th>
<th>30-50 years</th>
<th>&gt;= 50 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total BASMI score</td>
<td>0.8</td>
<td>1.0</td>
<td>2.2</td>
</tr>
<tr>
<td></td>
<td>0.8</td>
<td>1.4</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td><strong>0.8</strong></td>
<td><strong>1.2</strong></td>
<td><strong>2.0</strong></td>
</tr>
<tr>
<td>M</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M &amp; F</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Zero is not a ‘normal’ score for an individual from a healthy population
- Increase in total BASMI score with increasing age
## Modified Schober’s Test

### Table

<table>
<thead>
<tr>
<th></th>
<th>&lt; 30 years</th>
<th>30-50 years</th>
<th>&gt;= 50 years</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Modified Schober’s</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(cm)</td>
<td>M</td>
<td>F</td>
<td>M &amp; F</td>
</tr>
<tr>
<td></td>
<td>6.5</td>
<td>6.6</td>
<td><strong>6.5</strong></td>
</tr>
<tr>
<td><strong>Modified Schober’s</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BASMI score</td>
<td>1</td>
<td>1</td>
<td><strong>1</strong></td>
</tr>
</tbody>
</table>

- Decrease in Modified Schober’s test with increasing age
- Corresponding increase in component BASMI score

### Key messages
- Background
- Methodology
- Results
- Discussion
- Future Work
- Key messages
## Intermalleolar Distance

<table>
<thead>
<tr>
<th></th>
<th>&lt; 30 years</th>
<th>30-50 years</th>
<th>&gt;= 50 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>F</td>
<td>M &amp; F</td>
</tr>
<tr>
<td>IMD (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>110</td>
<td>117</td>
<td>115</td>
</tr>
<tr>
<td>IMD BASMI score</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

- Decrease in intermalleolar distance with age
- Corresponding increase in component BASMI score
Cervical Rotation

<table>
<thead>
<tr>
<th></th>
<th>&lt; 30 years</th>
<th>30-50 years</th>
<th>&gt;= 50 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>F</td>
<td>M &amp; F</td>
</tr>
<tr>
<td>Cx rotation (deg)</td>
<td>86</td>
<td>82.5</td>
<td>85</td>
</tr>
<tr>
<td>Cx rotation BASMI score</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

- Decrease in cervical rotation with age
- Corresponding increase in component BASMI score
# Tragus-to-wall distance

<table>
<thead>
<tr>
<th></th>
<th>&lt; 30 years</th>
<th>30-50 years</th>
<th>&gt;= 50 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>F</td>
<td>M &amp; F</td>
</tr>
<tr>
<td>Tragus-to-wall (cm)</td>
<td>10.6</td>
<td>10.0</td>
<td>10.3</td>
</tr>
<tr>
<td>Tragus-to-wall BASMI score</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

- Small increase in tragus-to-wall distance with age
- No change in component BASMI score
- Suggests this measure is disease specific
Lumbar side flexion

<table>
<thead>
<tr>
<th></th>
<th>&lt; 30 years</th>
<th>30-50 years</th>
<th>&gt;= 50 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>F</td>
<td>M &amp; F</td>
</tr>
<tr>
<td>Lx lateral flexion (cm)</td>
<td>21.7</td>
<td>21.5</td>
<td><strong>21.5</strong></td>
</tr>
<tr>
<td>Lx lateral flexion BASMI score</td>
<td>0</td>
<td>0</td>
<td><strong>0</strong></td>
</tr>
</tbody>
</table>

- Decrease in lumbar side flexion with age
- Corresponding increase in component BASMI score
Centiles of total BASMI score

- Background
- Methodology
- **Results**
- Discussion
- Future Work
- Key messages
Centiles of total BASMI score

- Background
- Methodology
- Results
- Discussion
- Future Work
- Key messages
Implications for practice

• Illustrate to patients what a ‘normal’ age-matched individual would score on the BASMI
  - Important in newly diagnosed
  - Inform expectations about treatment effects

• Potentially accounts for influence of age
  - Not just disease process
  - Important when assessing change over time
Limitations of study

- Measurements taken by a number of different therapists
- UK population only
- Sample size
- Did not account for factors such as height, activity level etc.
Future work

- Larger sample size

- Assess height, weight, activity level

- UK and other populations
Key ‘take-home’ messages

• A total BASMI score of zero is not normal in the healthy adult population

• The BASMI score increases with age in healthy individuals

• The normative values shown will aid interpretation of BASMI scores in individuals with AS/ Axial SpA
Acknowledgements

• Supervisory team – Dr Jane Martindale and Dr Lynne Goodacre

• Anna Hart (medical statistician)

• WWL (especially CEO and Physiotherapy Lead)

• Lancaster Medical School, Lancaster University

• ASSIGNw volunteers

• Our ‘normal’ participants!

• NIHR
References

Thank you for listening

Any Questions?