An upper limb loading during a seated push-up test: a clinical measure to determine the body composition of individuals with spinal cord injury

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Introduction & Objective

Spinal cord injury (SCI)

Body composition changes

- Lean body mass (LB M)
- Bone mineral content (BMC)
- Body fat mass (FM)

Method

Complete SCI (n=21)

Incomplete SCI (n=21)

ULL-SPUT

HCG

BMI

DXA

CT scan

MRI

Current assessments for body compositions

- DXA
- CT scan
- MRI
- SPUT
- SPUT

Statistical analyses:

- Pearson correlation coefficients (r) and Spearman rank correlation coefficient (r)
- Stepwise multiple linear regression

Results

Table 1 Participants characteristics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Total (n=42)</th>
<th>Complete SCI (n=21)</th>
<th>Incomplete SCI (n=21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>48.50±18.15</td>
<td>50.3±17.9</td>
<td>46.7±17.9</td>
</tr>
<tr>
<td>Body mass index (BMI)</td>
<td>26.6±4.3</td>
<td>26.8±3.7</td>
<td>26.6±4.8</td>
</tr>
<tr>
<td>Gender (male %)</td>
<td>34 (80)</td>
<td>19 (90)</td>
<td>15 (71)</td>
</tr>
<tr>
<td>Stage of injury (chronic %)</td>
<td>34 (80)</td>
<td>19 (90)</td>
<td>15 (71)</td>
</tr>
<tr>
<td>Level of injury (paraplegia %)</td>
<td>34 (80)</td>
<td>19 (90)</td>
<td>15 (71)</td>
</tr>
<tr>
<td>Core muscle functions</td>
<td>34 (80)</td>
<td>19 (90)</td>
<td>15 (71)</td>
</tr>
</tbody>
</table>

To assess the ability of ULL-SPUT to determine body composition of individuals with SCI as compared to the data found from the HCG test and BMI

Table 2 Correlation between outcomes of ULL-SPUT, HCG, and BMI body compositions

<table>
<thead>
<tr>
<th>Body compositions</th>
<th>Total (n=42)</th>
<th>Complete SCI (n=21)</th>
<th>Incomplete SCI (n=21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULL-SPUT</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>HCG</td>
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<tr>
<td>BMI</td>
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</table>

Results (Cont.)

Table 3 Predictive ability of outcomes of ULL-SPUT, HCG, and BI M

<table>
<thead>
<tr>
<th>Model</th>
<th>Equation</th>
<th>AdjR²</th>
<th>Equation</th>
<th>AdjR²</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULL-SPUT</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>HCG</td>
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<td>BMI</td>
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</tbody>
</table>

Conclusion

- Etc.,...
  - Muscular functions
  - Risk of numerous metabolic sequelae
  - Medical complications

(Asmatchaya et al., 2019; Tan et al., 2012; Khan et al., 2019; Musselman et al., 2020)

- Simple muscle strength tests (e.g., handgrip test: HCG) moderately reflect body composition.
- Body mass index (BMI) is commonly used to indicate the body's stores of fat and muscles.
- A seated push-up test, a closed-kinetic & challenging activity, with combination of active force and BMI.

- The measurement for the amount of upper limb loading during a seated push-up test or ULL-SPUT may be able to determine body composition of individuals with motor complete and incomplete SCI better than does the HCG test and BMI.

(Barbot-Antigues et al., 2013; Tieland et al., 2005; Estrada et al., 2007; Ingrova et al., 2017; Sutton et al., 2019)

Health status

Rehabilitation outcomes

Ability of Independence

- Open from being an important rehabilitation strategy, the
  present findings suggest an additional benefit of ULL-SPUT to
determine body composition for individuals with SCI.

- The ULL-SPUT may be used as a simple and practical measure to determine
  body composition for individuals with SCI in various clinical and home-based
  setting via using digital bathroom scales.