Serial Measures of Lung and Inspiratory Muscle Function in Children with Early Onset Scoliosis

GJ Redding, M Roth, K White, W Krengel, V Bompadre, J Waldhausen, A Joshi

Pulmonary & Orthopedic Departments, Seattle Children’s Hospital
and
Spinal & Thoracic Treatment and Research Center, Children’s Hospital of San Antonio; USA
Lung Function Decline after Surgical Treatment of EOS

- Previous serial measures of Vital Capacity in children with EOS show a reduction in lung function over 2.5 and 6 years follow-up using passive inflation/deflation methods in the OR.

These techniques do not include active use of respiratory muscles by patients.
Methods

- **Group 1**: 38 children with EOS performed outpatient serial measures of FVC over 27-96 months from 2 centers. Surgical interventions during each interval between PFTs were recorded.

- **Group 2**: 12 children with EOS performed both outpatient FVC and MIP measures over 7-41 months.
Population Features

- **Group 1** n=38 (19 San Antonio; 9 Seattle)
  - Age at 1st lung function: 7.9 yrs (range 5.2-14.5 yrs)
  - Interval of serial studies: 6 years (27-98 mo)
  - Diagnoses: 23 congenital, 5 idiopathic, and 4 syndromic scoliosis
  - # surgical procedures per patient: mean = 6 (range 0-13)
Serial FVC Over Time by Center

FVC % Predicted by Age
San Antonio (blue), Seattle (green)
Decline rate in relation to initial FVC and Age

Lung Function Decline Predicted by GEE Model

- Baseline FVC <50% pred
- Baseline FVC >=50% pred
Variables Associated with a Decline in FVC Over Time

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Coefficient</th>
<th>95% CI</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td># Surgeries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>since previous PFT</td>
<td>-1.68</td>
<td>-2.6,-.75</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Time since</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>previous PFT</td>
<td>0.35</td>
<td>-1.2,1.83</td>
<td>0.64</td>
</tr>
<tr>
<td>Age at current PFT</td>
<td>-2.03</td>
<td>-2.97,-1.1</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Baseline FVC%</td>
<td>0.34</td>
<td>0.14, 0.53</td>
<td>.001</td>
</tr>
</tbody>
</table>
MIP and FVC Measurements

**Group 2**: n=12 (Seattle only)
- Age at first measure: 8.9 +/- 2.6 yrs
- Time interval between measures: 18 mo (range = 7-41 mo)

<table>
<thead>
<tr>
<th></th>
<th>Time 1</th>
<th>Time 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>FVC % pred</td>
<td>45+/-11%</td>
<td>42+/-5%</td>
</tr>
<tr>
<td>MIP % pred</td>
<td>48+/-14%</td>
<td>47+/-22%</td>
</tr>
</tbody>
</table>
Conclusions

- FVC as a % predicted value (based on arm span) declines more over longer periods of time.
- FVC declines more in young children EOS and in children with initial FVC>50% (more than those with <50% values).
- FVC declines more with more surgical procedures per time interval.
- Respiratory muscle weakness persists in stable patients over 18 months.