Prolonged Weakness Affects Recovery of Motor Function Following Anterior Cervical Discectomy and Fusion

Ronald Huang MD
David Beck MD
Andrew G. Park MD
Gus Barrazueta BA, MS
Alan S. Hilibrand MD

Disclosures:
AAOS: Board or committee member
Aesculap/B.Braun: IP royalties
Amedica: IP royalties; Stock or stock Options
Benvenue Medical: Stock or stock Options
Biomet: IP royalties
Cervical Spine Research Society: Board or committee member
Lifespine: Stock or stock Options
Nexgen: Stock or stock Options
North American Spine Society: Board or committee member
Paradigm spine: Stock or stock Options
PSD: Stock or stock Options
spinal ventures: Stock or stock Options
Stryker: IP royalties
Vertiflex: Stock or stock Options
Purpose

- ACDF for cervical spondylosis
  - Effective for pain relief
  - Prevention of progression of myelopathy

- ACDF for significant preop weakness?

- Determine prevalence of weakness among ACDF pts
  - significant preoperative weakness
  - ≤ grade 3/5 motor strength

- Determine natural history of recovery of motor function following ACDF

- Identify risk factors for persistent weakness following ACDF
Methods and Materials

- Retrospective review using our institutional database
- Inclusion criteria:
  - **603** ACDF cases performed at our institution between January 2011 and December 2012
- Exclusion criteria (Total Excluded: **138** cases):
  - Revision cases (45)
  - Corpectomy (39)
  - Concomitant posterior procedure (3)
  - Disc arthroplasty (2)
  - Acute trauma (29)
  - Tumor (1)
  - Infection (4)
  - Congenital Deformity (2)
  - Loss to followup (13)
Methods and Materials

- **Outcome measure**: Motor strength as measured by attending surgeon at 6wk, 3m, 6m, 1yr, and 2yr
- Defined “significant weakness”
  - Grade ≤3/5 of at least one motor group preop
- Defined motor recovery
  - Increase of ≥2 grades in one motor group
  - 1 grade in 2 or more motor groups
- **Statistical Analysis**:
  - Univariate and multivariate logistic regression
465 patients met inclusion and exclusion criteria

<table>
<thead>
<tr>
<th>ACDF Number of Levels</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>134</td>
</tr>
<tr>
<td>2</td>
<td>217</td>
</tr>
<tr>
<td>3</td>
<td>111</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>
Demographics and Variables

- Avg age: 51.8 years (22 to 84 years)
- Avg BMI: 29.4 kg/m² (14.0 to 55.3 kg/m²)
- 222 Male / 243 Female
- Myelopathy = 37.4% (174/465 patients)
- Sensory deficits = 43.7% (203/465 patients)
- 6.2% (29/465 pts) had significant preoperative upper extremity weakness
- 17% (5/29 pts) with preop weakness had persistent weakness at 2 year F/U
# Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Motor Recovery (N=24)</th>
<th>Persistent Weakness (N=5)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>55.8 ± 11.6</td>
<td>55.4 ± 13.6</td>
<td>0.953</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>26.1 ± 4.1</td>
<td>27.3 ± 1.3</td>
<td>0.509</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>14 (58.3%)</td>
<td>4 (80%)</td>
<td>0.364</td>
</tr>
<tr>
<td>Female</td>
<td>10 (41.7%)</td>
<td>1 (20%)</td>
<td></td>
</tr>
<tr>
<td>Sensory Deficits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>10 (41.7%)</td>
<td>2 (40%)</td>
<td>0.945</td>
</tr>
<tr>
<td>No</td>
<td>14 (58.3%)</td>
<td>3 (60%)</td>
<td></td>
</tr>
<tr>
<td>Myelopathy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>12 (50%)</td>
<td>3 (60%)</td>
<td>0.684</td>
</tr>
<tr>
<td>No</td>
<td>12 (50%)</td>
<td>2 (40%)</td>
<td></td>
</tr>
<tr>
<td><strong>Duration of Preop Weakness</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 mo (IQR: 2 to 10.5 mo)</td>
<td>34 mo (IQR: 9.5 to 187 mo)</td>
<td>0.006</td>
</tr>
</tbody>
</table>

**Multivariate Variable**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds Ratio</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of Weakness</td>
<td>1.15 (95% CI; 1.02-1.29)</td>
<td>0.021</td>
</tr>
</tbody>
</table>
Discussion

- High rate of motor recovery following ACDF
  - 83% significant motor improvement in our study

- Complete motor recovery in 62% and partial recovery in 30% of 87 patients undergoing ACDF for myelopathy
  - Emery et al. JBJS 1998

- 79% to 91% improvement in motor recovery in 76 patients undergoing ACDF for myelopathy
  - Chiles et al. Neurosurgery 1999

- 95% of patients recovered strength < 1 year after one level ACDF for cervical radiculopathy
  - Lehmann et al. Global Spine J 2014
Limitations

- Preop duration of weakness per patient
- Retrospective nature
  - Motor testing per treating surgeon notes
  - Not performed by standardized observer
- Small sample size
Prolonged preop weakness is a risk factor for persistent weakness following ACDF

High rate of motor function recovery
- 83% recovery rate
- In patients with ≤ 3/5 strength preop

Help with preoperative patient counseling