Posterior Cervical Laminectomy and Fusion for Three Level Cervical Disc Disease

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CSRS Instructional Course 2016
50 y/o male neck pain with radiculopathy failed conservative management
Goals of Surgical Procedure

• Alleviate Radicular symptoms
• Alleviate a component of the neck pain
• Least surgical morbidity/complications
• Return to work
Surgical Options

- Multi level ACDF
- Posterior laminoforaminotomy
- Posterior laminoplasty
- Cervical Laminectomy and Fusion
Data source: NIS-HCUP

Mean Est. cervical procedures after weight adjustment:
- 150,372 in 2002 (52.2 per 100,000)
- 186,679 in 2009 (60.8 per 100,000)
  - ACF accounted for 80.3%

Mean age increased 3.4yrs (50.7 to 54.1yrs)
Mean CCI increased from 1.97 to 2.44

Conclusions:
- Procedure numbers continue to increase with primary increase in ACF
- Age and number of comorbid conditions continue to increase but mortality has not changed
- Further Increased cost per procedure
- Increased cost proportional to increase age and comorbidity profile?
ACDF

- Excellent Results
- Predictable
- Low Morbidity
- High Patient Satisfaction
- Long Term?
RESULTS OF FUSION
SUPERB

• Bohlman et al JBJS 1993
• Klein, Vaccaro, Albert Spine, 2000 (SF-36)
ACDF – Potential Pitfalls

• Surgical Morbidity
  – Pseudarthrosis
  – Graft problems
    • Donor site pain, complications
    • Allograft disease transmission
    • Graft dislodgement
  – Plate prominence, loosening
  – Screw placement, loosening
  – Revision issues
Clinical Study

Pseudoarthrosis rates in anterior cervical discectomy and fusion: a meta-analysis

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17 eligible articles
Absence of continuous bridging trabecular bone, FLEXION/EXTENSION $>$3 mm translation or $>$2 degree
Widening of Spinous processes
Different definitions in different Scenarios
Relative Risk Calculations
Allograft-4.8\%, Autograft-0.9\%

Overall Average rate in Single Level ACDF- 3.7\%
# Pseudarthrosis Rates

## Operative levels

<table>
<thead>
<tr>
<th>Authors</th>
<th>Type of Graft</th>
<th>1 Level</th>
<th>2 Levels</th>
<th>3 Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wang et al. (1999)</td>
<td>Autograft</td>
<td>8.00%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>With plate</td>
<td>5.00%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Samartzis et al. (2004)</td>
<td>Autograft</td>
<td>0%</td>
<td>10%</td>
<td></td>
</tr>
<tr>
<td>Bohlman et al. (1993)</td>
<td>Autograft</td>
<td>11%</td>
<td>27%</td>
<td></td>
</tr>
<tr>
<td>Zdeblick and Ducker (1991)</td>
<td>Autograft</td>
<td>5%</td>
<td>17%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Allograft</td>
<td>5%</td>
<td>63%</td>
<td></td>
</tr>
<tr>
<td>Wang et al. (2000)</td>
<td>Autograft</td>
<td>25%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>With plate</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Samartzis et al. (2003)</td>
<td>Autograft</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Allograft</td>
<td>4%</td>
<td>13.00%</td>
<td></td>
</tr>
<tr>
<td>Emery et al. (1997)</td>
<td>Autograft</td>
<td>4%</td>
<td>45%</td>
<td></td>
</tr>
<tr>
<td>Wang et al. (2001)</td>
<td>Autograft</td>
<td>87%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>With plate</td>
<td>18%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bolesta et al. (2000)</td>
<td>Autograft</td>
<td>53%</td>
<td></td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>With plate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Papadopoulos et al. (2006)</td>
<td>Allograft</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Anterior Approach

Problems

• I don’t like dysphagia
• I don’t like nonunions
• I don’t like long surgical procedures
• I don’t like anterior posterior surgeries
Anterior Surgery Problems

Multi-level corpectomy reconstruction

Most common complications are graft related

- Graft dislodgment or fracture (10-29%)
- Pseudoarthrosis (15-40%)
- Hardware failure / plate dislodgment (10%)
Cervical Spine Complications

Decompression

- Inadequate decompression
  - persistent pathology
  - corpectomy < cord width
  - OPLL
RESULTS OF LAMINOFORAMINOTOMY SUPERB

HENDERSON SCOVILLE
Central vs Lateral
Advantages

• Avoid fusion
• Rapid recovery
  – No restrictions
  – Return to sports
• Minimally invasive potential
Disadvantages

• Root or cord retraction
• Greater infection rate
• Less familiar to most surgeons
• Limited access to osteophytes anterior to root
• Epidural bleeding
• No anticipated relief axial pain
Laminoforaminotomy

• Radiculopathy – 172 patients
• Pain relief – 97%
• Improvement in weakness – 97%
• Complications:
  – 1 central cord
  – 4 air embolisms
  
  Zeidman and Ducker, Neurosurg., 1993

• Posterolateral soft disc herniation
• Prospective study – 44 patients, 4.3 year follow-up
• ACDF - 94% G / E
• Laminoforaminotomy – 74% G / E
• No statistical difference between approaches
  
  Herkowitz, Spine, 1990
Laminoforaminotomy

• Complications 3%
  – Wrong level
  – Dural tear
  – Inadequate foraminotomy
  – Nerve root injury
  – Instability
Biomechanics

- > 50% facet excision = potential instability
  Zdebluck, JBJS A, 1992
  Raynor, J. Neurosurg, 1985
Prospective studies
ACDF vs posterior foraminotomy

- **Herkowitz et al** *Spine* 1990
  - 33 patients
  - Good/excellent results 94% anterior vs 75% posterior

- **Korinth et al** *Spine* 2006
  - 292 patients total
  - Good/excellent results 93.6% anterior vs 85.1% posterior
  - Also overall results better for soft as compared to hard disc for both groups
Treatment options Single Level Laminoforaminotomy

- Avoids anterior complications
- Motion preserving
- Optimal in larger patients
- C7/T1 and C2/3/4
Laminectomy or Laminoplasty show clinical improvements in 62.5% to 83%.

New minimally invasive decompression techniques may reduce morbidities associated with an open approach and also reduce the need for prophylactic fusion by maintaining osteoligamentous anatomy.
  - This may result in less iatrogenic sagittal plan deformity.

**Conclusion:**
10 year period, 256 patients treated with MIDCS had complication rates of 0% to 7%, most commonly durotomy, epidural hematomas and C5 palsies.

- MIDCS has been shown to reduce LOS, postoperative pain, and provides preservation of motion segments.
Treatment Options Multilevel Involvement

• Typically approach posteriorly
• Laminectomy and fusion vs. Laminoplasty
• Requires neutral to lordotic alignment
• Good outcomes /8.3% increased neck pain

Wang et al., Neurosurg Focus 2008
Laminectomy and fusion versus laminoplasty for the treatment of degenerative cervical myelopathy: results from the AOSpine North America and International prospective multicenter studies

M.G. Fehlings et al. / The Spine Journal (2016) *** – ***

**Conclusion:**

- No superiority was seen between procedures
- Similar clinical improvement as well as complications and rates were seen between groups

<table>
<thead>
<tr>
<th>Complications by surgical approach</th>
<th>Laminoplasty (N=100)</th>
<th>Laminectomy and fusion (N=166)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware failure</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>C5 radiculopathy</td>
<td>3.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Adjacent segment degeneration</td>
<td>0.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Dural tear</td>
<td>3.00</td>
<td>5.00</td>
</tr>
<tr>
<td>Deep infection</td>
<td>0.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Superficial infection</td>
<td>2.00</td>
<td>5.00</td>
</tr>
<tr>
<td>Dysphagia</td>
<td>0.00</td>
<td>2.00</td>
</tr>
<tr>
<td>New radiculopathy (not C5)</td>
<td>1.00</td>
<td>3.00</td>
</tr>
<tr>
<td>Postoperative kyphosis</td>
<td>1.00</td>
<td>5.00</td>
</tr>
<tr>
<td>Cardiopulmonary event</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Relevant bleeding</td>
<td>0.00</td>
<td>3.00</td>
</tr>
<tr>
<td>Instrumentation malposition/ migration</td>
<td>0.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Neck/arm pain</td>
<td>7.00</td>
<td>13.00</td>
</tr>
<tr>
<td>Surgical wound problems</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>(eg, hematoma, dehiscence)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other*</td>
<td>5.00</td>
<td>9.00</td>
</tr>
<tr>
<td>Any</td>
<td>21.00</td>
<td>47.00</td>
</tr>
</tbody>
</table>

*Other complications include wound dehiscence, hematoma, and other minor complications.
Fusion for cervical DDD
Huang J Spin Disorders 16:2003

• 32 patients with multilevel DDD and myelopathy - mean f/u 15 months.
• All improved/stabilized Nurick classification
• All confirmed decompression on post-op MRI

• Complications - 1 pseudo, 3 (9%) wound infx, 2 C5 nerve palsies
Fusion for cervical DDD

- **Kumar** *(Neurosurgery 1999)* 25 pts: 2yr f/u
  - No progression of kyphosis
  - 76% improved/ 24% stabilized *(Nurick)*
  - No HDW complications

- **Houten** *(Neurosurgery 2003)* 38 pts: 2.5 yr
  - 97 % improvement in JOA scores
  - 8 screw pull-outs or breakage - none reoperated
  - 1 needed to be repositioned
**Results:**
- No neurovascular injuries sustained
- 9/10 patients had improved Nurick grades at last follow-up

**Conclusion:**
- Cervical pedicular fixation yields good fusion rate and should be considered a good alternative to other techniques
- Laminectomy may reduce the risk of malposition during cervical pedicular fixation
Posterior Decompression and Fusion

What are the treatment goals?

- **Decompression**
- **Stability/Alignment** *(Maintain or restore)*
- **Pain relief**
- **Minimal morbidity**
- **Maximal durability**
Conclusion

Posterior Cervical Approach is a viable option for Multilevel Cord Radiculopathy.

Achieves all operative goals, simple, safe, fast, avoids morbidity associated with anterior based surgery.
Thank you