Cervical Laminoplasty: Indications and Techniques

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Disclosure

- Consultant for Orthofix
Surgery for Myelopathy

- Unknowns / controversies:
  - Timing of surgery
    - Short pre-operative period of $S_X$ better
  - Surgical approach
    - Anterior vs Posterior?
  - Prospective, controlled studies lacking

CSM
Surgical Rx

- ACDF
- Corpectomy
  - ± Plates
- Laminectomy
  - ± Fusion
- Laminoplasty

Similar rate of neurological recovery

Yonenobu-Spine, 1985

Difference in outcome depends on complications and other factors
Anterior Corpectomy vs Laminoplasty

Outcome

- Functional outcome similar, but complications greater with corpectomy
  - Yonenobu, et. al. – Spine, 1992
  - Wada, et. al. – Spine, 2001

Laminoplasty

- Devised as solution to post-operative kyphosis after cervical laminectomy
  - Reconstruction, rather than removal, of lamina
  - Provides posterior decompression + stability
Post-operative Kyphosis

- May occur following as little as 25% facetectomy
- Causes cord to lie against impinging anterior structures

Types of Laminoplasty

- Z-plasty
- Hemilateral Bilateral
- Open (Hattori, Hirabayashi, Iwasaki)
- Bone Graft (Ichikawa, Watanabe, Matsuzaki)
- Expansive Laminoplasty (LAP)
- Laminectomy (LAM)
Hirabayashi Technique

Example

Pre-op  Post-op
Laminaplasty Techniques

- Suture ± anchor
- Plate
- Bone strut
- “French door”

Keeping the Door Open

- Pre-op
- Post-op
- Spinous process bone graft
Laminoplasty: Advantages

- Excellent multilevel spinal cord decompression
- Technically easier than multilevel anterior corpectomy
- Similar outcome to anterior decompression
  - Avoids anterior complications (e.g. dysphagia)

Laminoplasty: Advantages (cont’d)

- Less risk of kyphosis than laminectomy
- Avoids fusion
  - Better motion (?)
  - Less risk of adjacent level degeneration (?)
- Can address (decompress) segments at future risk (e.g. mildly stenotic) with little additional morbidity
Laminoplasty: Disadvantages

- Contraindicated with kyphosis
- Risk of post-operative kyphosis
- Cannot create lordosis (cf. laminectomy and fusion)
- Neck pain/stiffness
  - Contraindicated with pre-existing neck pain
- Hinge closure
- Risk of C5 nerve root palsy
  - Also a risk with other post. (and ant.) procedures

C5 Root Palsy

- May occur with either posterior or anterior surgery
- 4-level ant. cervical corpectomy for CSM
  - Retrospective review of 31 pts
  - 4/31 severe delayed (temporary) C5 root palsy
    - Root stretch from anterior cord shifting

Saunders, et.al.
Spine, 1998
C5 Palsy with Laminoplasty

- Associated with posterior cord shift (≈2.7 mm)
  - 8% C5 root palsy
- C5 at apex of lordosis
- May occur immediate post-op or delayed

Advantages of Laminoplasty vs Anterior Decompression

- Safer if severe compression present
- Quicker
- Fusion generally not performed
  - Preserves motion
- Does not “burn any bridges”
  - Anterior surgery can still be performed in future
- Fewer complications
Laminoplasty: Ideal Indications

- Myelopathy/myeloradiculopathy
- Multi-level disease
- Lordotic (± neutral) posture

Technique: Exposure

- Laminoplasty levels: C3-C7
- Expose laterally to visualize lateral masses
- ± Remove interspinous lig. @ C2-3 & C7-T1
Laminaplasty Plate: Technique

1) Allograft Selection
2) Plate Selection
3) Drill/Screw Lamina
4) Drill/Screw Lateral Mass
Canal Expansion

Pre-op

Post-op

Final Construct

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Laminoplasty: Hardware vs No Hardware

**Hardware**
- More costly
- Less bracing/earlier motion
  - Less stiffness & neck pain
- Can deal with “floppy hinge” segment
- Possible hardware complications

**No Hardware**
- Less costly
- Requires bracing
  - ↓ motion
- Potential for closure of hinge

Example

Pre-op

Post-op
Review of Laminoplasty Literature

- National Library of Medicine and Cochrane database
  - 314 citations
  - 46 studies: laminoplasty and outcome


Laminoplasty vs Anterior Surgery

- L’plasty vs *single level ACDF* (3 studies)
  - Similar outcome
  - Higher complication with ACDF due to graft

- L’plasty vs *corpectomy* (6 studies)
  - L’plasty: more severe pain
  - Corpectomy: better ROM preservation

Laminoplasty vs Posterior Surgery

- L’plasty vs laminectomy (4 studies)
  - Better % recovery with laminectomy
    - 49% vs 18% improvement in Nurick scores

- L’plasty vs laminectomy/fusion
  - Similar outcome (Nurick scores)
  - L’plasty: better ROM preservation


Laminoplasty: Critical Review

- Meta-analysis of literature up to 2002
  - 71 series / 2580 pts.
  - All retrospective, uncontrolled, nonrandomized case series
  - No prospective studies

Ratliff and Cooper
J Neurosurg (Spine)-2003
**Laminoplasty: Critical Review**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neurological Outcome</td>
<td>50-60%</td>
</tr>
<tr>
<td>Post-op Alignment</td>
<td>22-46% worse</td>
</tr>
<tr>
<td>Post-op ROM</td>
<td>50% ↓</td>
</tr>
<tr>
<td>Neck Pain</td>
<td>6-60% (average 30%)</td>
</tr>
<tr>
<td>C5 Root Dysfunction</td>
<td>8%</td>
</tr>
<tr>
<td>Restenosis</td>
<td>21%</td>
</tr>
<tr>
<td>Postlaminoplasty kyphosis</td>
<td>10%</td>
</tr>
</tbody>
</table>

Ratliff and Cooper  
J Neurosurg (Spine)-2003

**Laminoplasty vs. Laminectomy:**
- Neurological outcome  
- Spinal alignment  
- Kyphotic deformity  

Same  

Ratliff and Cooper  
J Neurosurg (Spine)-2003
Laminoplasty: Critical Review

- Similar ↓ ROM between laminoplasty and laminectomy + fusion
- Adjacent-level disease?
- Need for prospective studies!

Ratliff and Cooper
*J Neurosurg (Spine)*-2003

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Laminoplasty: Pearls

- Must monitor “flip” to prone position (cf. anterior)
  - Use spinal cord monitoring
    - Pre-flip recording
    - Post-flip/pre-operative recording
    - Intraoperative recordings
- Make the opening on the side of radiculopathy (i.e. “hinge” on the asymptomatic side) so foraminotomy can be performed if necessary

Laminoplasty: Pearls (Cont’d)

- Manage epidural bleeding while preparing troughs
- Avoid aggressive bone removal on hinged side (“floppy hinge”)
- Primary surgeon: position plate
- Assistant (Fellow/Resident): insert screws
**Laminoplasty: Neck Pain**

- Can reduce incidence of neck pain by *not* including C7 in laminoplasty


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**Sagittal Alignment**

- **Lordosis**
- **Kyphosis**

*Must* have pre-existing lordotic (neutral) alignment!
CSM: Algorithm

Lordotic (neutral)

Anterior Surgery

Posterior Surgery

Single level ACDF

Multilevel ACDF

Corpectomy

(Laminectomy)

Laminectomy + Fusion

Laminoplasty

≤ 2 levels: Corpectomy only

>2 levels: Corpectomy + Post. Fusion or Hybrid

Thank You!