Cervical Spinal Cord Stimulation: Technical Challenges and Strategies

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The Size of the Spinal Cord Varies According to the Spine Levels

- High Cervical
- Cervical Enlargement
- Mid Thoracic
- Low Thoracic
- Lumbar Enlargement
High Cervical

Mid Cervical

Low Cervical

T1
A Special Case

Above C1

Cisterna Magna

C1

C2

Cisterna Magna

You Cannot Obtain Any Stimulation!!!
The Cervical Cord

- Occupies a Large Portion of The Spinal Canal
- Narrow Dorsal CSF Space
- High Level of Mobility Due To Cervical Spine Motion
- Extreme Variability of Electrical Fields With Movement
An Example Of How Tricky Things Can Be

- 35 y/o male with RSD of the upper extremity
- Cervical SCS trial: Excellent pain relief
- Scheduled for permanent implant
- Comes to the permanent implant surgery one month later
- Says that the pain has changed. The pain now is not only burning, but also sharp shooting in the first two fingers
- Stimulator surgery postponed
- MRI of the neck: large herniated disk C5-6
- Cervical diskectomy performed.
- Stimulator placed two months after cervical diskectomy and fusion

*Had the stimulator been implanted at the scheduled time,*
Previous Cervical Spine Surgery not necessarily a contraindication to SCS

Anterior Neck Surgery Definitely NOT a contraindication.
Posterior Cervical Surgery

The main question is:
In the area where I want to place the lead(s)
Is the epidural space patent or is it scarred in?
### Posterior Neck Surgery.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Percutaneous</th>
<th>Paddle Leads</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bilateral Laminectomy</td>
<td>NO</td>
<td>Yes</td>
</tr>
<tr>
<td>Hemilaminectomy</td>
<td>Yes on the contra-lateral side only</td>
<td>Yes</td>
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<tr>
<td>Foraminotomy</td>
<td>May be, depending on the extent of bone removal</td>
<td>Yes</td>
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</tbody>
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Even though Paddle Leads can be utilized in case of previous posterior neck surgery, the procedure is more risky.
Stenosis
Lumbar Stenosis : Frequent
Thoracic Stenosis : Rare
Cervical Stenosis : Frequent
Stenosis

Normal cervical canal diameter: 13 to 15 mm
Stenosis: less than 13 mm

More important than actual dimensions: No CSF around the spinal cord at the interested level

Even more important:
No CSF around the spinal cord at the interested level
+ Focal hyper-intense signal in the spinal cord

MRI or CAT Scan can assess those dimensions.

MRI and Myelo-CT are the best way to assess it.
Mostly Anterior Compression

Circumferential Compression
Stenosis

Mostly Anterior (osteophytes or disk protrusion) → Anterior surgery → Stimulator (percutaneous or paddle leads)

Mostly posterior
Or
Congenital canal stenosis
Or
Mixed anterior and posterior

→ Posterior decompression and insertion of paddle leads in the same procedure
Every patient considered for cervical SCS must have an imaging study of the neck

First Choice: MRI
Second Choice: CAT Scan
A Worrisome Scenario

- 45 y/o female implanted with two cervical plate electrodes
- No MRI prior to surgery (big mistake)
- Excellent paresthesiae and pain relief
- Goes home the next day
- Calls in the evening saying that she cannot turn off the stimulator
- Both my nurse and I talk her through the programmer
- The stimulator is off
- She claims that she feels the stimulation paresthesiae in both arms
A Worrisome Scenario

- Patient scheduled to come see me in the office at 7:30 AM
- At 6 AM patient shows up in the Emergency Room with progressive quadriparesis
- Emergency Myelo-CT performed
Cervical Myelogram

Complete Block

Contrast in the epidural space

Leads
A Worrisome Scenario

Paresthesiae
NOT due to SCS
but due to
COMPRESSION
of the Spinal Cord !!!!!!