Spinal Cord Stimulation- Patient Selection, Education and Troubleshooting Complications

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Goals for Discussion

- Optimizing patient selection and technology to obtain durable outcomes
- Education strategies
- Troubleshooting complications with SCS
Indications for SCS

Chronic intractable pain of the trunk or limbs
Indications

- Chronic radicular pain
- Axial pain patients who are not surgical candidates
- Failed back syndrome
- Complex regional pain syndrome (DRG)
  - CRPS Type I
  - CRPS Type II
  - Budapest Criteria used for CRPS diagnosis
- Causalgia (DRG)
  - Knee pain, foot pain, groin pain after hernia repair, phantom limb pain, post herpatic neuralgia, neuropathic chest wall pain, neuropathic pain due to peripheral neuropathy, pelvic pain and ankle pain
A Definition of Refractory Pain to Help Determine Suitability for Device Implantation

“Pain is defined as refractory, regardless of etiology, when 1) multiple evidenced-based biomedical therapies used in a clinically appropriate and acceptable fashion have failed to reach treatment goals that may include adequate pain reduction and/or improvement in daily functioning or have resulted in intolerable adverse effects, and when 2) psychiatric disorders and psychosocial factors that could influence pain outcomes have been assessed and appropriately addressed.”

Deer, TR, Caraway D, Wallace M. Neuromodulation 2014; 17: 711-715
Patient Selection

➢ Patient selection and the timing of SCS placement are both crucial to success of the procedure

➢ Patient selection process involves:
  ➢ Medical history
  ➢ Physical Examination
  ➢ Psychological screening
  ➢ Thoracic imaging
  ➢ Optimizing medical comorbidity management
  ➢ SCS trial
Selection (continued)

- Temporary vs permanent percutaneous leads
- Battery type matters - primary cell (non-rechargeable) device or an SCS with rechargeable battery
- Several approaches to consider, depending on whether the goal is to create pain relief with paresthesia (conventional SCS) or without paresthesia using newer approaches with 10 kHz high frequency stimulation
- HF10 Therapy
- Burst Stimulation
- DRG Stimulation (focal pain pattern)
Time to SCS implantation affects outcomes

When greater than 4 weeks lapses after the end of a trial, the odds of a patient converting to a permanent implant decrease by 10% each week.

Rosenberg J, Jackson A, Saranita J, Tavel E, Ghodsi A, Rasa A. Lower pain relief during trial spinal cord stimulation associated with delayed permanent implant. Presented at INS, June, 2015, Montreal, Quebec.
Patient Education

- Neurostimulation Appropriateness Consensus Committee (NACC) - the recommendations are based on evidence scoring and peer-reviewed literature
- CDC infection control measures
- The preoperative evaluation of the patient is an important process. Patient education during the preoperative workup stage is highly valuable and can also lead to the important identification of risks and discussions on risk reduction
- Smoking cessation at least four weeks before the procedure
- Diabetic management – optimize HbA1C and glucose
- Limiting steroids in the immediate preoperative period
- Management of anticoagulation therapy
- Screening for MRSA and MSSA - the leading cause of SSIs is S. aureus, accounting for approximately 30% of all SSIs.
Education

- Antibiotic Prophylaxis- agent selection, weight-based dosing, and timing of administration
- NACC and CDC both recommend preoperative use of antibiotics for neuromodulation
- Surgical Scrub
- Risk reduction strategies

**Postoperative teaching:**
- Dressings
- Antibiotics
- This is the time patient and family should be educated on signs and symptoms of an emerging SSI and incisional care
Troubleshooting for Spinal Cord Stimulation

Post-Implantation Troubleshooting

- **Loss of stimulation in the affected region of pain**
  - Lead migration is the most common complication of SCS implantation
  - Map the leads in the office
  - Obtain X-ray of the leads to visualize the positioning
  - It may be necessary to revise the lead positioning
  - Decrease the incidence of lead migration by using tapered, silicone anchors with the tip buried deep past the fascia.
Lead Migration
Thoracic and Upper Lumbar Dorsal Root Ganglion Stimulation Lead Migration and Anchoring Technique

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Abstract

Introduction

As most of the dorsal root ganglion neurostimulation (DRG-SCS) leads are placed in the lumbar spine to treat a variety of chronic pain syndromes, the accepted practice of securing the lead in the lumbar foramen is achieved by forming an “S” tension loop with the lead inside the epidural space. Tension loop placement reduced the need for the placement of an anchor during permanent implant and a tunneled epidural catheter technique is often used to get the leads to the pocket rather than an incision and anchoring (1). This technique is optimal for less mobile segments of the lumbar spine however as utility of DRG SCS expands to upper lumbar/thoracic regions, concerns regarding migration of leads with a larger distance to travel to the generator and in more mobile parts of the lumbar spine have arisen.

Objective

To identify migration risk using certain implantation techniques of dorsal root ganglion stimulation at the upper lumbar and lower thoracic regions and to present our DRG-SCS lead anchoring technique to maximize the intrafidelar lead positional stability.

Results

Two recent papers for the placement of 12 DRG leads for low back pain showed lead migration in 4/12 and 4/15 implants (2,3). Our practice has recently revised. Multiple factors may play a role in causing migration including the distance travelled from the upper lumbar/lower thoracic spine to generator site, the rotational torque of the thoracolumbar junction, and the improved pain control and degree of disability in these patients leading to more activity.

A relevant migration rate was noted by both Kallewaard et al. (2,4) and our studies and implant techniques were subsequently modified. Multiple factors may play a role in causing migration including the distance travelled from the upper lumbar/lower thoracic spine to generator site, the rotational torque of the thoracolumbar junction, and the improved pain control and degree of disability in these patients leading to more activity.

Our group uses a 3 cm incision in the midline (right) after the leads were placed in the usual fashion using “S” loops. After dissection to the fascia and hemostasis is obtained, the tuohy needle is taken back to the skin and the tuohy needle is advanced to drive the lead into the incision (Figure). Once the lead is in the incision, forceps are used to pull the free end of the lead through the tuohy needle and into the incision site. The tuohy needle is then removed. The Abbot DRG anchor is then placed around the lead and anchored to the fascia with 2-0 Ethibond sutures. This is repeated on the contralateral side if needed, and leads from the level above or below can be driven into the midline migration and anchored if needed. Tunneling to the pocket is performed in the usual fashion with the tunneling device.

The Kallewaard group now anchors leads using the traditional Abbot DC SCS anchors with individual incisions at the lead site.

Clinical Results


discussion


drug neurostimulation at the upper lumbar and lower thoracic spine is proving to be an effective therapy to reduce pain for RSD/CRPS as well as truncal pain syndromes including axial low back pain. An increased rate of migration, 13 out of 58 implants in leads between the T12-L3 levels, may be secondary to increased trunical mobility, longer distance from the epidural space lead entry to the pocket, an increase in function and disability leading to more activity, as well as other potential reasons. In our 31 patients, initially the same technique was used for all implantations, which included “S” loops, no anchor or incision, and tunneled epidural catheter technique to tunnel leads to the pocket. After our first noted migration we changed the technique to using “S” loops in the epidural space, making a small midline incision, driving the leads to the incision, and anchoring leads with anchors provided in the DRG lead kit (described). As our results are at 9 months thus far with zero migrations, it appears anchoring upper lumbar and lower thoracic DRG leads may be vital to decrease the odds of migration either using the described technique or a two incision technique over the lead puncture sites. The improvement in migration rates with anchoring are consistent with those found by the Kallewaard group.

References


Anchoring technique

3-cm midline single incision approach:

- Figure 1. Example of DRG lead that pulled back into the pocket from the T12 epidural space in a 34 year old patient. All leads in the upper levels were found to have migrated back into the epidural space.

- Figure 2. Initial implant technique used. Multiple S loops were placed and a tunneled epidural catheter technique was used to without anchors placed or a midline incision.

- Figure 3. Incision made after leads and S loops placed. Dissection made to fascia.

- Figure 4. Tuohy needle used to drive lead to midline incision.

- Figure 5. Lead pulled into midline incision from pocket and anchor placed in pocket using Abbott DRG lead anchors.

- Table: Study Lead locations Total leads Total Implants Migrations

<table>
<thead>
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<th>Study</th>
<th>Lead locations</th>
<th>Total leads</th>
<th>Total Implants</th>
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<td>14</td>
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<tr>
<td>TOTAL</td>
<td>152</td>
<td>58</td>
<td>13</td>
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References

Continued

➢ Lead fracture
  - Obtain X-ray of the leads to visualize possible fracture site
  - Will need to replace the fractured site

➢ Loose connection with IPG
  - Obtain X-ray to visualize the connection points on IPG
  - Open IPG site, and reconnect the leads

➢ Battery failure

➢ Exhibits symptoms at surgical site (ex: tenderness, edema, induration, erythema)
  - Seroma
    - Consider abdominal binder
    - Do NOT aspirate with needle
Continued

Infection

➢ **Superficial** (skin and subcutaneous tissue surrounding the incision)
  - Debridement and washout
  - Course of antibiotics after consultation with infectious disease specialist
  - Close monitoring

➢ **Deep** (deep soft tissue involving muscle and fascia)
  - Debridement and washout
  - Explant the entire device
  - Course of antibiotics after culture and consultation with infectious disease specialist
  - Close monitoring
  - Possible future reimplantation once infection has cleared
Continued

- **Sensory and or motor deficits** (parathesias, weakness, numbness)
  - Epidural hematoma
    - Radiographic spine imaging to rule out an epidural hematoma
      If positive, then emergent neurosurgical evacuation
  - Epidural Abscess
    - Radiographic imaging to rule out an epidural abscess
      If positive, then emergent neurosurgical washout
    Explant the device
Continued

- Lead causing mechanical irritation of nerve roots
  - Obtain X-ray to visualize the paths of the leads
  - May require revision of the leads
- Pain related to device components
- Skin erosion
- Dural puncture
Take home message

Advanced practice providers need to know, understand, and put into practice the guideline recommendations from established organizations. This will help with neuromodulation selection, education, troubleshooting and management.
References


