CAUDAL Approach for Percutaneous Spinal Cord Stimulator Implantation.

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Spinal cord stimulation has been used for thirty years (introduced in 1967), to diminish pain in patients. It is extremely beneficial to patients with certain types of low back and lower extremity pain. It is a pain treatment modality focused on reducing the intensity, duration, and frequency with which pain is felt. Currently spinal cord stimulation is an extremely effective treatment for numerous painful conditions including Failed back syndrome [1] i.e. persistent pain in patients who have undergone at least one previous operation; may involve epidural fibrosis and arachnoiditis, Reflex sympathetic dystrophy [2], Refractory angina [3], Peripheral vascular disease [4], Post amputation pain (phantom limb pain) [5], Chronic intractable pelvic pain [6]; Post herpetic neuralgia [7]; Spinal cord injury dysesthesias, Chronic Painful diabetic neuropathy[8]; Pain associated with multiple sclerosis, Meralgia paresthesia [9]; Interstitial cystitis [10]; Cancer, and Chemotherapy induced pain[11]. Although it was developed on the basis of the gate control theory of pain proposed by Melzack and Wall [12], its mechanism of action involves more than inhibition of pain pathways in the dorsal horn nucleus [13] and exact mechanism of action is not yet fully understood. Placement of electrodes used in spinal cord stimulation differs depending on the type of pain being treated. For pain in the lower extremities and lower back, the stimulator electrode implant is generally placed between T8 and L1 levels. Sacral stimulation is used to treat conditions including pelvic pain, rectal pain, interstitial cystitis and vulvodynia. Previously both retrograde and sacral transforaminal approaches have been described (Alo et al., 1999;Chancellor and Chartier-Kastler, 2000; Wyndaele et al., 2000) Interstim (Medtronic Corp.) is FDA approved for placement in sacral foraminae. Currently percutaneous spinal cord stimulation lead(s) are placed either by anterograde approach i.e. to approach from caudal to cephalic direction or by retrograde approach (figure 1), which means to approach from cephalic to caudal direction (e.g. to implant electrode between S1 and S3, approach from L1 level). Placement of sacral paddle leads may also be performed laminotomy of the os sacrum. Placement of stimulator electrodes for pelvic, sacral, vulvar and vaginal pain is generally between S1 and S4 levels. We describe a novel approach for both trial and permanent stimulation of the sacral nerve roots using entry at the sacral hiatus and navigating the lead in a cephalad direction which we call the Haider Caudal approach for sacral stimulation (figure 2).
CASE DESCRIPTION:

Our patient was a 50-year-old woman with a 6-year history of pelvic and vaginal pain, which started 8 weeks status post vaginal hysterectomy in 2000. During her surgery, the gynecologist had difficulty removing the uterus transvaginally, due to uterine size. The patient began to experience burning dysesthesias primarily localized to the vulva as well as the introitus with intermittent dysesthesias of the perineum and significant pressure in the rectal area. In regards to her vaginal symptoms, she noted that the introitus and proximal (DISTAL?) third of vagina tended to burn and further up (MORE PROXIMAL?) in the vagina she felt significant pressure and extreme pain with intercourse. Her symptoms progressed in severity and she developed significant discomfort with bowel movements. She denied any dysuria or incontinence of urine or feces. The patient’s past medical history was also significant for removal of adhesions in 2002 and 2003, and head and neck pain from trauma in October 2004. The examination of vaginal and anal area revealed burning dysesthesia involving the distal ½ of anterior vaginal wall, most notably at the introitus. The posterior vaginal wall was significant for deep pressure type pain, however no burning dysesthesias were appreciated. There was evidence of brush allodynia and dysesthesias involving both the labia major and minor. There was evidence of hyperalgesia to gentle pinprick involving the perineal area as well as the region of the labia majora. Rectal tone was normal. Pt was clinically diagnosed with vulvodynia.

She was started on neurontin 100 mg po tid and titrated to 1800 mg daily but the symptoms did not improve. Topical cream consisting of ketamine, lidocaine and ketoprofen did not improve the symptoms. The patient had tried bed rest, physical therapy, muscle relaxants, narcotic analgesics, membrane stabilizing drugs, and NSAIDS in the past without any significant improvement. A series of 5 fluoroscopic guided Ganglion Impar sympathetic blocks only temporarily relieved her symptoms.

The patient eventually presented to our pain clinic to be evaluated for her spinal pain. During her initial consultation she was diagnosed with vulvodynia. At this point a trial of spinal cord stimulation was discussed with the patient. The patient was referred to psychiatrist for psychiatric assessment and cleared prior to the procedure. As per protocol, using a caudal approach, trial stimulation lead placement was performed for one week and provided significant pain relief (before the trial the pain intensity on VAS scale was 8-9/10, after 4 days pain was reduced to 4-5/10 and after 1 week the pain resolved completely. The patient therefore decided to undergo permanent placement of lead and internal pulse generator.

First, multiplanar x-ray were performed in the AP (figure 3), lateral (figure 3) and oblique (figure 4) views. The fluoroscope was adjusted over the lumbosacral region for AP and lateral views. The sacral hiatus was located and infiltrated with local anesthetic. Through the same spot, a 16G R.K. Epidural Needle (TW) was
introduced into the epidural space under fluoroscopic guidance. Once the needle placement was confirmed to be in the epidural space in AP and lateral views, the stylet was removed. The spinal cord-stimulating electrode was lubricated with saline to prevent it from dragging against the internal needle wall. The spinal cord-stimulating electrode was then advanced through the Tuohy needle into the epidural space.

After the electrode entered the epidural space, it was gently advanced under live fluoroscopic guidance to the midline at the S1-S2-S3 levels. The electrode was attached to the external pulse generator via a sterile screening cable. Trial stimulation was carried out with the patient describing the type and location of stimulation as well as the effect of the stimulation on the patient’s ongoing pain. After verification that the patient perceived an acceptable pattern of stimulation, the needle was carefully withdrawn back along the electrode and removed.

The spinal cord stimulating lead was then anchored using silicone anchoring sleeve just as it exited from the sacral hiatus. The distal end of the lead was then directed laterally and tunneled subcutaneously from the sacral hiatus to the internal pulse generator which was placed into a pocket in posterior buttock just superior to the posterior superior iliac spine.

The patient was seen for follow up one year later and x-rays were performed to check that the implanted lead was present at the appropriate place and had not migrated since it had been placed. The spinal cord stimulator continues to function well after one years time, The patient no longer requires analgesics for vulvodynia, and has had remarkable improvement in both functionality and quality of life.

DISCUSSION:

There may be many benefits of the caudal approach when compared to the other approaches used for sacral stimulation. Technical aspects of the retrograde approach may lead to a higher chances of dural puncture than the caudal approach. Furthermore the retrograde approach may have a higher incidence of lead migration due displacement of leads with spinal movements of flexion, extension, rotation, and laterally bending, especially at the lumbosacral junction. Use of the caudal approach may prevent migration of the leads which occur during such spinal movements.

Furthermore, unlike traditional trans-sacral transforaminal approach which stimulates individual nerve roots, the caudal approach can be used to stimulate multiple sacral levels. A Trans sacral field can be established to capture multiple sacral nerves. (Bennett et al, 2007)

Percutaneous caudal lead placement also prevents the need for surgical laminotomy used for the placement of paddle leads.

Due to the nature of the caudal approach, general anesthesia and conscious sedation may not be necessary. The procedure may be safely done using local
anesthesia. Lead implantation and anchoring may be performed through a punch incision

CONCLUSION:

Spinal cord stimulation has been proved therapeutically effective in treating a variety of painful conditions. Techniques traditionally used to percutaneously implant spinal cord stimulator electrodes are anterograde, retrograde, and transforaminal approaches. The Haider Caudal approach is a novel technique that may be useful in cases in which the traditional approaches are difficult or impossible. This approach may have less chances of lead migration and dural puncture. Furthermore this approach may lead to less chances of motor nerve recruitment during sensory stimulation. The procedure can easily be done under local anesthesia without the need for sedation. Due to the location of this approach, caution should be exercised since there may be an increased risk of infection.

Further investigation and research is warranted to determine if spinal cord stimulation by caudal approach is safe and effective, and to determine whether this approach may be used to treat painful conditions by stimulation in the the sacral region as well as the lower lumbar spine.

REFERENCES:


