

# Spinal Cord Stimulation - Percutaneous Technique

Typically this procedure is done in two stages. Stage 1 would be a system trial and Stage 2 would be the permanent internalization of the system. If the system trial is considered successful, that is pain relief of 50% or greater in the appropriate area, the patient proceeds to stage 2.

## Stage 1

- Placing the leads
- Performing an intra-operative test to determine optimal lead positioning
- Creating a pocket for the test extension
- Externalizing the test extensions

Fluoroscopy is required for this procedure to achieve correct lead positioning.

The patient is placed in a prone position, typically 2 pillows are placed underneath the abdomen to promote a slight forward flexion of the spine and then the patient is prepped. The patient is given a sedative to help them relax. During the intra-operative testing the patient should be awake and alert to provide feedback about lead positioning.

The fluoroscopy C-Arm is positioned over the patient to facilitate visualization of the entry site and lead placement. Placing a marker at the T10 site provides a reference point for later in the procedure. The entry site is identified and marked with the use of fluoroscopy. A typical entry site is the L1/L2 interspace when the electrodes are to be placed at T10 or above, for lower extremity pain, the distal stimulating electrode is generally placed between T8 and T10. For upper extremity pain, electrode placement is commonly in the C2 and C5 area.



A local anaesthetic is administered around the marked entry site and the incision is made prior to placing the needles. The incision is dissected down to the dorsal lumbar fascia. Alternatively a stab wound may be made to place the needles, an incision is then made to anchor the leads after lead placement has been completed and tested.



Using a 14g epidural needle with the bevelled edge transverse to the dural fibers, the needle is inserted at an angle of no more than 30 degrees, a steeper angle will hinder the passage of the leads and increase the risk of lead damage during lead insertion and manipulation. Needle entry into the epidural space is confirmed by using the loss of resistance technique. The lead blank is introduced through the needle. The lead blank creates a path for the placement of the lead. Using fluoroscopy for visualization, the lead blank is guided in the desired direction. Rotating the epidural needle changes the direction of the bevel tip and helps control the lead blank. A small bend may also be put in the lead blank stylet tip to increase control.



Once the desired pathway is established, the epidural needle is removed and the introducer will be inserted. Carefully remove the needle while holding and stabilizing the lead blank. The introducer will now be placed over the lead blank and inserted into the epidural space, slightly twisting the introducer assists in passing it through the surrounding tissue. Advance the introducer until it reaches the desired spinal level for electrode placement, once in place, the lead blank is removed.



The permanent lead is then inserted through the introducer. Using fluoroscopy, the lead is advanced until the electrodes reach the desired spinal level. When implanting a dual lead system, the leads are normally approximately 1-2mm to the left and right of midline. In addition, the leads are placed so that the electrodes are staggered enabling the current to be more focused on the desired target. During positioning (intra-operative screening), make sure the proximal electrodes on the leads are exposed outside of the introducer, do not fully remove the introducer so that you may still manipulate the lead position if needed during the intra-operative testing.

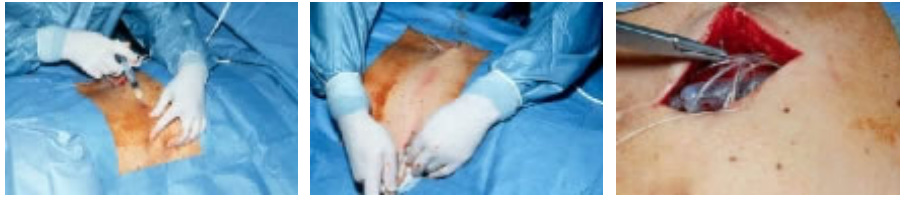


The lead will now be connected to the external test extension in preparation for intra-operative testing. Fully insert the lead into the connector of the test cable and lock. The test extensions are passed out of the sterile field and connected to a test transmitter. The patient is awake and alert to provide feedback during intra-operative testing. Different electrode combinations and electrical settings are tested until adequate paresthesia overlays the patient's painful area, it may be necessary to slightly reposition the leads in order to achieve the necessary coverage. Once the desired lead position has been confirmed through testing, a final fluoroscopic picture should be taken for the patient's records. A lateral view image should be captured as well to show the posterior placement and ensure the leads are not anterior or intrathecal.



Next the leads will be anchored in place. Prior to removing the introducers, place a purse string suture in the tissue surrounding the leads to help secure the lead and prevent slippage, however, the suture is not tightened until the introducer is removed. Remove the introducers carefully while using fluoroscopy to ensure that the leads do not move. Tighten the purse string sutures. The anchor is

lubricated with sterile water and slipped over the lead. The anchor should be positioned snugly against the exit site. Secure the anchor to the intra spinas ligament. To prevent lead damage, avoid kinking the leads or placing the sutures directly on the lead itself. Next the pocket which houses the excess portion of the lead and percutaneous test extension is prepared. The pocket is created off midline so that the percutaneous extensions and excess leads do not cause the patient unnecessary discomfort.



For the trial phase, the percutaneous test extension will be tunnelled under the skin a short distance and then be externalized. Mark the tunnel pathway and administer local anesthetic. Before connecting the lead to the percutaneous extension, the connector end of the lead must be cleaned with sterile water, make sure the lead is dry before continuing. The connector boot shields the connection and prevents bodily fluid contact. Carefully place the boot over the connector end of the lead and slide it into place. Use the torque wrench to tighten the screw until a click is heard. Secure the boot over the connector site with tight ligatures at both ends.

The tunnelling tool creates a pathway to pass the leads to the externalization site. Tunnel subcutaneously from the lead anchor site to the marked externalization site. Remove the metal portion of the tunnelling tool leaving the cannula sleeve in place. Thread the percutaneous extensions through the sleeve. Grasp the sleeve at the exit site and pull it and the extension through. Coil the excess lead and connector loosely into the pocket being very careful not to kink any part of the leads. The percutaneous extension will be connected to an extension cable at the exit site and later connected to a temporary test transmitter during the patient's evaluation period. Close and apply appropriate dressing to both incision sites.

## Stage 2

It is important to discuss the options of receiver site placement with the patient prior to the procedure. The most typical receiver placement sites are mid-axillary just below the lowest rib and above the belt line, or in the upper buttock region below the belt line. The patient should decide on the most comfortable and accessible area. Mark the waist line for a reference point and the area where the receiver will be placed. It is important that the patient be seated when marking the receiver site, this will ensure placement in a flat area so that transfer of the Radio Frequency signal between the receiver and the antenna is maximized.

The permanent internalization procedure involves four steps:

- Removing the percutaneous test extension
- Creating a pocket for the receiver
- Tunnelling and connecting the leads to the receiver
- Final test of the system prior to closing

At the end of the procedure a fluoroscopy unit is required to confirm correct lead placement.

Patient positioning is dependent on the intended receiver site

- Prone when the receiver is placed in the upper buttock area
- Slightly on one side when the receiver is placed mid-axillary

Cut the extension at a sterile point by pulling it slightly out through the skin. Allow the balance of the extension to retract. The patient is prepped as before.

Locate the connectors through palpation and administer local anaesthetic so that a small incision can be made to remove the connectors and the remaining portion of the extension. Be extremely careful not to cut through the leads themselves. Pull the connectors through the incision. Loosen the set screw and disconnect the extensions. Irrigate the wound with antibiotic solution. Pull out the leads being careful not to dislodge them.

Make the incision for the receiver pocket just medial to the receiver site so that it is not directly over the receiver. Create the receiver pocket no more than 1cm below the skin surface.

Once the pocket has been made, the leads are tunneled to the receiver site. Insert the tunnelling tool at the lead site and pass it subcutaneously to the receiver site, remove the metal portion leaving the cannula sleeve in place. Thread both leads into the cannula and carefully pull them through to the receiver site.

Before connecting the leads to the receiver, the connector ends must be cleaned with sterile water. Make sure the leads are dry before continuing. Slip the boot over the lead. Without using force, fully insert the lead into the receiver and use the torque wrench to tighten the set screws until a click is heard. Once the set screws are tightened, slide the boot over the connector. Secure the boots with tight ligatures.

The receiver will lie in the pocket with the excess leads coiled loosely underneath. It is important that the label side of the receiver be facing up towards the skin surface so that the antenna and receiver connection is properly established. Before closing, verify that the link between the antenna and receiver has been properly established and that the system is operational. This is done by placing the antenna in a sterile bag, placing it over the receiver site and stimulating the patient.

Close and apply appropriate dressing.