



Posterior Cervical Laminoplasty

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Posterior cervical laminoplasty has been performed since 1973 when it was first introduced.⁴ Cervical laminoplasty was first used as a treatment option for ossification of the posterior longitudinal ligament (OPLL).^{2,6} This technique allows for indirect spinal cord decompression while reducing the risk of post-operative scar tissue formation on the dura, and can preserve neck movement if done without a fusion.

A posterior laminoplasty can be completed just as a laminoplasty (single or multi-level), in conjunction with a discectomy, and/or with a fusion.² The wide range of options for the surgeon as well as the patient makes the posterior cervical laminoplasty a popular surgical option. As advancements in medicine have allowed spinal surgery to progress, so have the indications for cervical laminoplasty. The main goal of a laminoplasty is to decompress the spinal cord while providing solid points of fixation to improve stability.³ By decompressing the spinal cord, normal neurological function can continue and improve. The cervical laminoplasty is used to treat many conditions such as tumors and cysts on the spinal cord, cervical myelopathy, and various neuromuscular disorders.^{3,6} The leading indication remains spinal stenosis. Spinal stenosis is the narrowing of the spinal canal and can contribute bone spurs in the vertebrae causing neurological symptoms such as arm pain, numbness and weakness in the hands, and muscle

LEARNING OBJECTIVES

- ▲ Learn about the conditions cervical laminoplasty is used to treat
- ▲ Analyze the three most common methods of posterior cervical laminoplasty
- ▲ Review the anatomy affected by this type of procedure
- ▲ Detail the specific tasks the CST is responsible for during these types of cases
- ▲ Recall the procedural steps taken during the operation

spasms in the legs. The laminoplasty is a surgical procedure that creates more space for the spinal cord and exiting nerve roots along the cervical spine.

There are three most commonly used methods of posterior cervical laminoplasty including the open door, double door, and muscle-sparing techniques.^{2,6} Each option has its own advantages as well as disadvantages. Deciding which technique to use depends on a variety of patient factors. Some factors to consider include age, preexisting medical conditions, spinal curvature, mobility of the spine in flexion as well as extension, the number of levels involved, and location of stenosis.^{4,6} The ideal patient for a posterior cervical laminoplasty will display two or more levels with a normal curvature of the spine. There also will be no excessive movement in flexion or extension, and no neck pain.²

ANATOMY

The cervical spine includes seven vertebrae. Each is routinely named C1 to C7 superior to inferior. The anatomy of C3-C6 consists of the body, pedicle, lamina, and spinous process.¹ The anatomy of C1, C2, and C7 have slight anatomy differences from C3-C6. The C1 vertebrae is named atlas and has a unique ring-like shape used in support of the head. C2 is named axis and has tooth-like projects that fit into the ring of C1. They work together to allow the head to rotate front to back and side to side. C7, or vertebra prominens, is unique because of its distinctive long spinous process.¹ Each vertebra protects the spinal cord and allows for movement of the body. The vertebra also acts as an exit for nerve roots from the spinal cord allowing the peripheral nervous system to send impulses to and from the brain.¹ The constriction of the spinal cord at any level can cause neurological malfunctions.⁶

ROOM SETUP AND POSITIONING

The room setup and positioning of the patient is one of the most important parts of the procedure. Without proper attention to a patient in the prone position, the situation can become fatal.⁵ Other risks of a patient being placed in the prone position include increased bleeding in the vertebral veins, pressure on the abdominal structures, increased optical pressure, air way complications, and an increased risk of cardiac arrest. With proper interventions, these risks can be eliminated or greatly reduced. The use of egg-crete foam,

pillows, and gel chest rolls assist in the reduction of prone positioning risks to the patient.

The patient is usually administered general anesthesia with an endotracheal tube. Special caution is used during intubation to not move the cervical spine as there is an elevated risk for damaging the spinal cord.^{2,4} After intubation, the patient is prepped for attachment to the Mayfield halo. Three sites are prepped for the placement of skull pins that will be attached to the Mayfield for proper distraction and positioning of the patient. Depending on the severity of spinal stenosis, the physician may order sensory and motor monitoring during the procedure. Somatosensory evoked potentials (SSEP) and motor evoked potentials (MEP) are two common methods to monitor both sensory and motors of the patient before, during, and after surgery.^{4,6} Both forms of monitoring are done by technician specialized in neurophysiological monitoring. Prior to flipping the patient prone, a set of baseline motors will be collected.

The patient is then flipped onto the operating room table. The use of gel rolls, egg-crate padding, and pillows will be

The cervical laminoplasty is used to treat many conditions such as tumors and cysts on the spinal cord, cervical myelopathy, and various neuromuscular disorders.^{3,6}

used to keep the patient comfortable and protected. It is important to take extreme caution while flipping the patient to ensure there is constant support of the neck and spine. Care also must be taken to avoid accidental dislodgement of the endotracheal tube or other indwelling catheters placed prior to surgery.⁵ The Mayfield attachment is connected and positioned to keep the cervical spine in a neutral position.² The patient's arms are typically tucked down to the sides of the patient with a long draw sheet and foam, securing the sheet and arms with towel clips on the patient's back. Tape is usually applied from the shoulders to the hips around the bottom of the table for visualization as well as assistance in intraoperative fluoroscopy. To further assist with visualization, the patient is placed in 20 to 30 degrees of Trendelenburg.² A C-arm is placed at the head of the bed to gain lateral views of the cervical spine. It is important to ensure that

no portion of the C-arm is resting on the patient and that all members in the operating room are properly shielded from fluoroscopic radiation exposure. After the patient is positioned, another set of SSEP and MEP will be collected to ensure proper positioning.

The patient is prepped from the base of the hairline down to the tops of the shoulders, according to surgeon preference. It is important to note the dry times indicated for each type of prep before draping can take place. Draping is performed by the Certified Surgical Technologist (CST), according to surgeon preference. A common draping routine includes a half sheet over the lower body, a quarter drape to cover the top of the head and Mayfield halo, four towels to square the surgical site secured with a stapler, quarter sheets halved over to cover each side of the neck and secured with a stapler, a pen to mark the surgical incision, an antimicrobial drape, lap sheet, and C-arm drapes. The CST will pass the bipolar/monopolar cords, suction tube, and power cords off the surgical field to be plugged in. Other equipment that will need to be available include monopolar and bipolar electrocautery, headlamps, suction machine, power box to operate burrs, and autologous blood transfusion equipment, if requested.

PROCEDURE AND INSTRUMENTATION

Under fluoroscopy, C3 to C7 are marked. After a time out is performed, the initial skin incision is made with a #15 blade on a #3 handle as a midline longitudinal posterior to expose these levels.² Electrocautery or Metzenbaum scissors are used to dissect down and through the midline fascia.⁶ Weitlaners, or other various self-retaining retractors, are used for superficial retraction and a Cobb can assist the surgeon in dissection. Each level of cervical vertebrae is identified with fluoroscopy and by the surgeon. The paravertebral muscles are lifted from the spinous processes with a Cobb or key elevator and retracted for proper visualization.^{2,3} A peanut on a Kelly hemostat is useful in blunt dissection. Ray-tech sponges soaked in 1:1000 epinephrine mixed with 500mLs of injectional saline are used for packing between the margins and to control bleeding. It is important for the CST to verify the concentration of epinephrine in the saline and to properly label all fluids on the back table. Once the proper levels are exposed, and verified with fluoroscopy, the laminoplasty will begin.

The laminoplasty is started with a Kerrison rongeur. Bone fragments are chipped away from the cortex and spinous process to allow for access. These are collected by the CST and preserved for later use as bone graft if a fusion is

Equipment
Suction
Electric hand held drill
Sensory and motor monitoring
Chest rolls
Pillows
Mayfield halo headrest
C-arm fluoroscopy
Electrocautery machine
Operating table
Head lamps
Autologous blood transfusion equipment (if requested)
Supplies
#15 Blade
Small egg burr
Ray-tec sponges
Surgical peanuts
Laparotomy drape
3/4 and half drapes
Antimicrobial infused drape
Stapler
C-arm drapes
Monopolar handpieces
Benzoin
Steri-strips
4x4 gauze
Dressing tape
Skin prep kits
Instruments
Cervical spinal instrument trays including:
Curettes
#1, #2, and #3 Kerrison rongeurs
Penfield #4
Nerve hooks
Pituitary rongeurs
Metzenbaum scissors
Adson with teeth
Weitlaner retractor
Spinal self-retaining retractors
Perforating towel clips
Hand powered burr
Bipolar forceps
Mayfield prongs
Medications
1% lidocaine 10mLs for local injection
1:1000 epinephrine 1ml in 500mLs injectable saline
50,000 units of bacitracin in 500mLs normal saline for irrigation
5,000 units of thrombin in gelfoam
1 gram vancomycin powder

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required.^{2,3} The posterior laminoplasty is performed with or without a fusion to preserve neck rotation post operatively. If a fusion is requested, the discectomy will be performed at this time. Commonly, the disc is removed with a pituitary rongeur and curettes. The dorsal cortex is thinned with either a Kerrison or egg burr on hand-help power without cutting completely through the cortex.^{2,4,6} Caution needs to be taken to avoid contact with the dura by both the surgeon and CST. This maneuver allows for the creation of a greenstick fracture.⁶ The opposing cortex is then cut completely through allowing for free movement of the spinous process. This method is referred to as an open-door method, where the cortex is cut on a single side. Cutting through the cortex on both sides is the French door method.^{4,6} Choosing which method of laminoplasty is based on the surgeon's preference or patient's preference, however, the French door method is the most common.³ Small 2.0 curettes and #1 Kerrison's are useful in cleaning the laminotomy site as well as in the preparation and cleaning of the greenstick fracture site. To control excess bleeding in the bone, bone wax is used on a Penfield #4. Further hemostasis comes from gelfoam pieces soaked in thrombin. A lamina spreader is inserted into the opening to widen the space and allow for placement of plates and spacers, if indicated.^{3,4}

If a spacer is requested, preparation and sizing is done dependent on the type of implants being used. Once the size of the spacer is selected, a plate is trialed for fit and then selected. Pre-bent plates may be used, or if preferred, straight plates may be bent and cut to fit the patient's anatomy. If a spacer is used, the plate is attached first to the spacer, and then attached to the lamina. Small variations are made with securing the plate if self-tapping or self-drilling screws

are used. Commonly, 2.0 screws are used in for plate fixation. The plate is placed in the center of the lamina to ensure the screw does not rupture through the edge. Drilling and screw placement are performed under fluoroscopy to ensure proper placement. Screw selection is made by the surgeon, however, the CST's role in ensuring the proper type, size, and length of screw is crucial to the safe placement. The number of screws used is dependent on the type of plate system used. This process is repeated for all affected levels. Another method of fixation is the use of suture anchors and non-absorbable suture to secure the lamia opening.⁶ Upon completion of securing each level for the laminoplasty, a vertebral fusion is performed, if consented. Plates and screws are used to fuse the two or more levels of the spine. Doing a fusion in conjunction with a laminoplasty will decrease the range of motion in the neck post operatively for the patient.² If a fusion of two or more vertebrae is requested, a single plate is selected based on the levels involved, and the height of the vertebrae. Small screws, typically 2.0 in size, are used to adhere the plate to the bone.

Once the laminoplasty is secured along with any other procedures required, final X-rays are taken, and the closing will begin. The wound is irrigated with an antibiotic solution and the retractors are removed. If preferred, vancomycin power is added to the wound prior to closing. Hemostasis is achieved with monopolar or bipolar cautery. The wound is closed in layers, per surgeon preference. An example of a layered closing routine includes a 0 polyglactin 910 suture for the fascia, 2-0 poliglecaprone 25 for the subcutaneous layer, and a running 2-0 spiral quill suture for the skin. To control post-operative pain, 1% lidocaine may be injected around the operative site. If a running suture is used to close the skin, benzoin and wound closure strips covered with a sterile 4x4 gauze and paper tape is used to dress the wound. Staples are another alternative for wound closure. Final dressings are applied in a sterile fashion, and then all drapes are removed. Caution must be taken while removing drapes if staples were used for securing. A rigid cervical collar is applied, and the patient will be transferred supine onto a stretcher to begin the process of reversing general anesthesia.

POST-OP

Hospital stays post-operatively are typically short, lasting 24 to 48 hours.² In many cases, patients begin therapy as soon as the night of surgery. Patients usually are seen three to four weeks after surgery to assess pain and neurological function.⁶ X-rays are taken at post-operative visits to ensure

placement has remained. It is encouraged for the patient to return to their day-to-day activities as soon as possible.⁶

SUMMARY

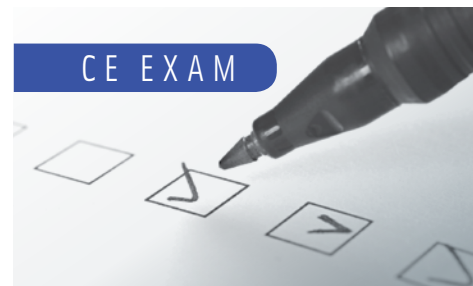
The posterior cervical laminoplasty is a common treatment for cervical spondylotic myelopathy, ossification of the posterior longitudinal ligament, and other cervical stenosis diseases.² The surgical approach does pose certain complications, but the approach and surgical method continues to be refined. Overall, the complication occurrence is low.⁶ The option of having a way to decompress the spinal cord that reduces the risk of post-operative dura scarring without cervical fusion makes the laminoplasty a popular solution for patients.

ABOUT THE AUTHOR

Courtney Anders, CST, CSFA, received her surgical technologist training while serving in the United States Navy, graduating and completing her certification in August of 2012. While in the Navy, she completed her requirements for surgical first assistant and was awarded certification in July of 2017. Courtney has worked as the orthopedic coordinator for the operating room at Beaufort Memorial. Currently, she works for Low Country Bone and Joint assisting and specializing in joint replacement and preservation under the guidance of Vandit Sardana, MD, FRCSC; and Tiffany Rahn, PA-C, MS. Courtney has received her associates in applied health sciences with honors from American Military University, and her bachelor of science in health science in professional development magna cum laude, and advanced patient care from Grand Canyon University.

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Posterior Cervical Laminoplasty

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1. How many vertebrae make up the cervical spine?
 - a. 7
 - b. 8
 - c. 9
 - d. 10

2. Spinal stenosis is the narrowing of _____.
 - a. C2
 - b. The spinal canal
 - c. The spinal cavity
 - d. The spinal cord

3. A posterior laminoplasty can be completed as a _____.
 - a. Laminoplasty
 - b. In conjunction with a discectomy
 - c. With a fusion
 - d. All of the above

4. After which stage is a vertebral fusion performed, if consented?
 - a. After securing each level for the laminoplasty
 - b. Before securing the final level for the laminoplasty
 - c. Between securing the most middle levels
 - d. After the fusions for C1 and C2 are complete

5. C7 is also known as the _____.
 - a. Atlas
 - b. Axis
 - c. Vertebra prominens
 - d. None of the above

6. The Mayfield attachment is connected and positioned to keep the cervical spine in a _____ position.
 - a. Posterior
 - b. Neutral
 - c. Axial
 - d. Anterior

7. The laminoplasty is started with a _____.
 - a. Cobb elevator
 - b. Kerrison rongeur
 - c. Metzenbaum scissors
 - d. Pituitary rongeur

8. Three of the most common methods used to treat posterior cervical laminoplasty include:
 - a. Open door
 - b. Double door
 - c. Multi door
 - d. Both a and b

9. Following this procedure, patients generally stay in the hospital for _____.
 - a. 4-6 hours
 - b. 12-24 hours
 - c. 24-48 hours
 - d. 48-64 hours

10. Somatosensory evoked potentials (SSEP) and motor evoked potentials (MEP) are two common methods to monitor both sensory and motors of the patient at which point during the surgery?
 - a. Before
 - b. During
 - c. After
 - d. All of the above

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