

MIS Lateral Platform

Surgical Technique



Table of Contents

Introduction	3
Patient Positioning	4
Approach	6
Access	7
Annulotomy and Disc Space Preparation	15
Indications and Contraindications	20

Introduction

The PIPELINE™ Access System and the PIPELINE™ LS Access System are a complement of disposable and reusable instruments providing access to the thoracic and lumbar spinal regions. Specialized instruments are compatible with the retractors and retraction ports, along with general disc and end plate preparation instruments.

The reusable instruments are supplied non-sterile and must be sterilized prior to first use. The disposable instruments consist of the retraction port, clamp and incision template. The disposable instruments, with the exception of the incision template are supplied sterile and are intended for single use.

The PIPELINE™ Access system is designed with a universal connection to attach numerous light sources. The light source cable comes with two adapters preassembled. The adapters will accommodate a Karl Storz light source, a Richard Wolf light source, and the ACMI light source. The light source is compatible with the light source attachment for ease of adjustment. The light source attachment is connected to one of the universal connections located on top of the retractor.



Patient Positioning

Surgical Considerations

This approach enables the spine to be accessed via a lateral retroperitoneal approach. The anatomic landmarks the surgeon should consider are the iliac crest, the ribs and the lateral border of the erector spinae muscles.

- **If intraoperative neuromonitoring is to be used, a trained neurophysiologist or technician should apply all desired electrodes prior to patient positioning.**

The patient is placed on a bendable surgical table in a direct lateral decubitus (90°) position so that the iliac crest is directly over the table break. Flexion of the table can be used to aid in the opening of the space between the 12th rib and the iliac crest. Once the desired position is achieved, secure the patient (Figure 1).

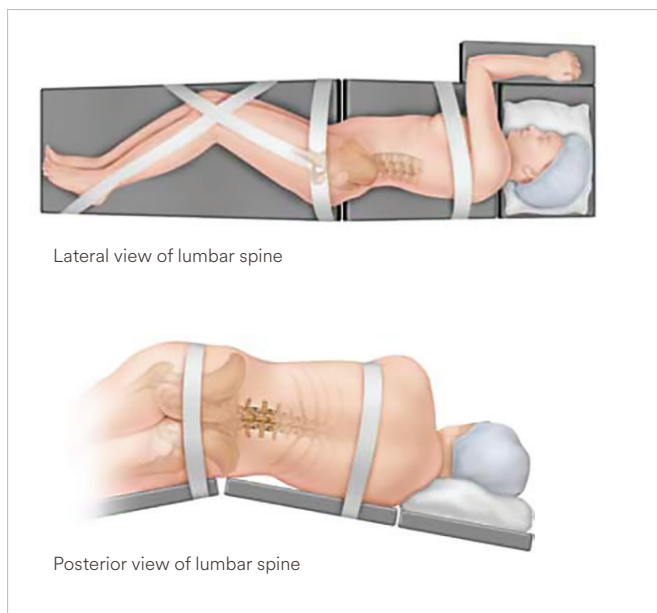


Figure 1

Once the patient is secured, adjust the table to increase the distance between the iliac crest and rib cage in order to gain direct access to the disc (Figure 2). This configuration ensures the pelvis tilts away from the spine allowing access to all lumbar levels, particularly L4–L5.

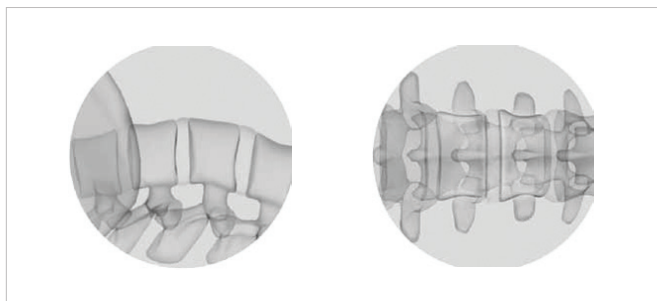


Figure 2

Anatomic landmark identification & initial incisions

Using fluoroscopy the disc space is identified by crossing and centering two K-wires over the affected disc space. Mark the skin at the intersection of the K-wires to indicate the location of the skin incision for the operative corridor (Figure 3).

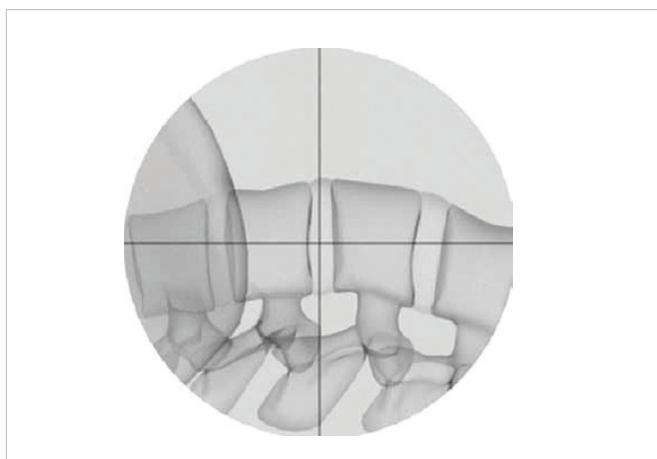


Figure 3

Approach

To approach the disc space, a vertical to slightly oblique skin incision is made over the target level (Figure 4). A monopolar cautery may be used for hemostasis and a small retractor is used to aid in the blunt dissection of the subcutaneous tissues. Visualise the external abdominal oblique fascia and begin blunt dissection through the muscle.

After dissecting through both the external and internal oblique abdominal muscles, bluntly penetrate the transversalis fascia exposing the retroperitoneal fat.

Once inside the retroperitoneal space, palpation or visualization of the psoas muscle is necessary prior to dilator introduction.

- **All dissection should be done in line with the muscle fibers.**

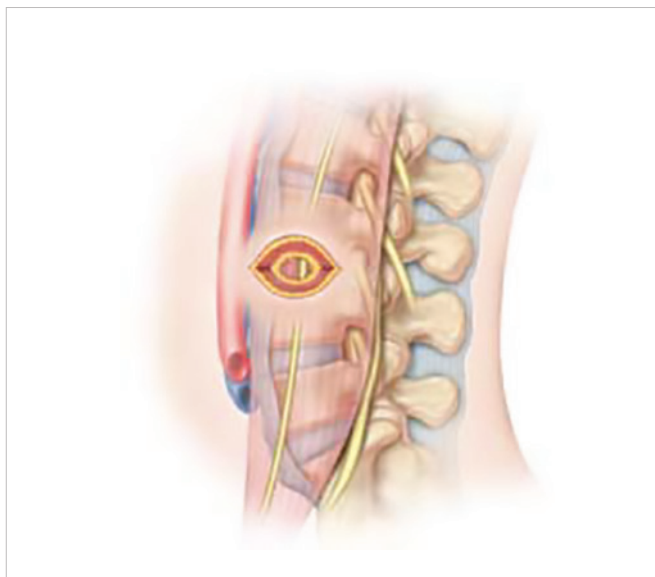


Figure 4

Initial and sequential dilation

Introduce the first 5 mm dilator through the incision to the psoas muscle (Figure 5).

Once through the psoas, confirm the initial dilator position using fluoroscopy. The preferred position on the lateral disc is just anterior to the midsection of the vertebral body (Figure 6). Use A/P fluoroscopy to confirm that the initial dilator is flush with annulus.

Precaution:

- Ensure either clear visualization of the psoas and nerves or use a triggered EMG neuromonitoring device when gaining access to the disc space.

Insert the guidewire through the first dilator into the disc space. Confirm fluoroscopically that the guidewire is positioned approximately halfway into the disc space (Figure 7).



Figure 5

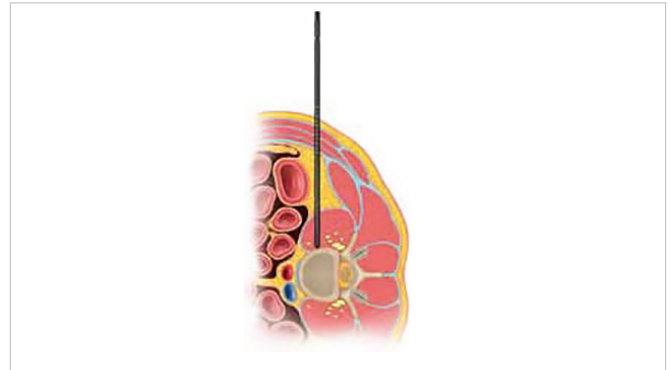


Figure 6

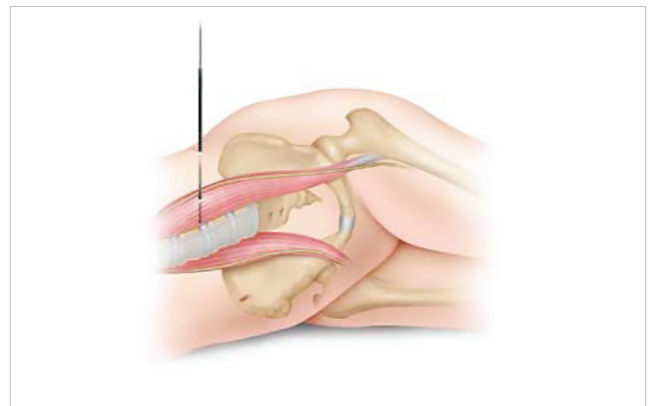


Figure 7

Sequential Dilation

Sequential dilation is performed by passing the next largest dilator over the previously inserted dilator. A twisting motion should be used to advance each dilator. Once all dilators are introduced, fluoroscopy should be used to verify position and that the dilators are flush with the vertebral body (Figure 8).

- There are four (4) dilators included in the set; 5 mm, 10 mm, 14 mm and 18 mm.

Measure the working depth off of the dilator. The depth can be taken at the point where the skin contacts the second, third or fourth dilator.

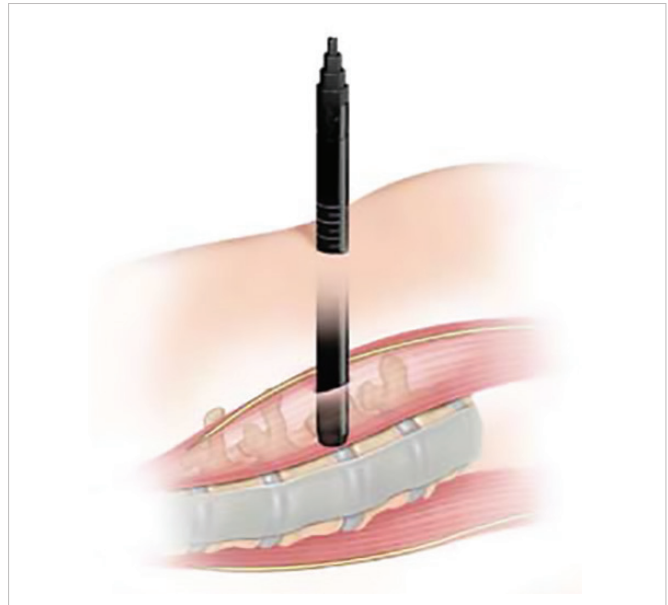


Figure 8

PIPELINE™ Retractor assembly

The retractor comes in three (3) individual sections with three (3) individual telescoping blades (Figure 9).

Insert the telescoping blades into the three sections of the retractor. Ensure the blades are properly seated by engaging one tooth of the ratcheting mechanism. This can be confirmed with both tactile and audible feedback (Figure 10).

Assemble the retractor by placing each of the racks into the slots of the corresponding sections by lining them up and sliding together. Depress the release buttons during these steps in order to disengage the ratchet feature (Figure 11).



Figure 9



Figure 10

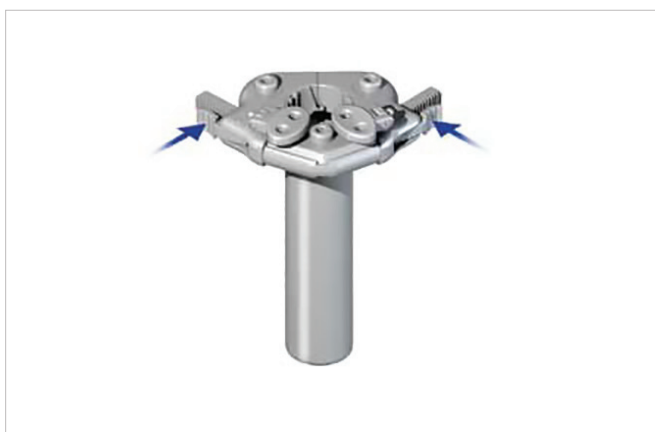


Figure 11

Setting retractor depth

The retractor can be deployed to the measured working depth using the blade depth tower (Figure 12).

Rotate the ring on the blade depth tower until the top surface of the ring corresponds to the desired depth as etched.

Align the blade depth tower with the telescoping blades of the retractor and press downward to deploy the blades (Figure 13).

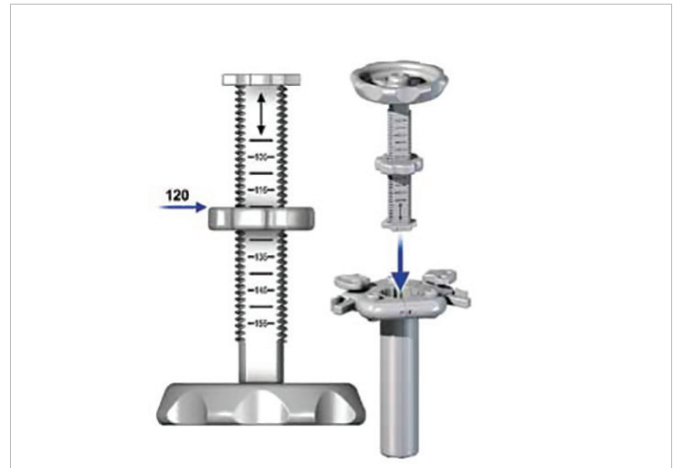


Figure 12



Figure 13

Retractor insertion

The retractor can be inserted over the dilators, with the V-shaped section on the patients back posteriorly with relation to the dilator, by gently rotating the retractor back and forth until the retractor flange reaches the skin surface or the telescoping blades of the retractor reach the spine. Irrigating the outer surfaces of the retractor may assist in inserting the device.

Precaution:

- Care should be taken to ensure that no nerve roots are in the area prior to beginning the discectomy.

If the retractor needs to be expanded for better visualization, twisting the skate key will open the retractor in 1 mm increments.

Use bipolar cautery to clear muscle from the lateral annulus.

Place the retractor in the final position by orientating the section of the retractor containing the racks facing posteriorly as shown (Figure 14).

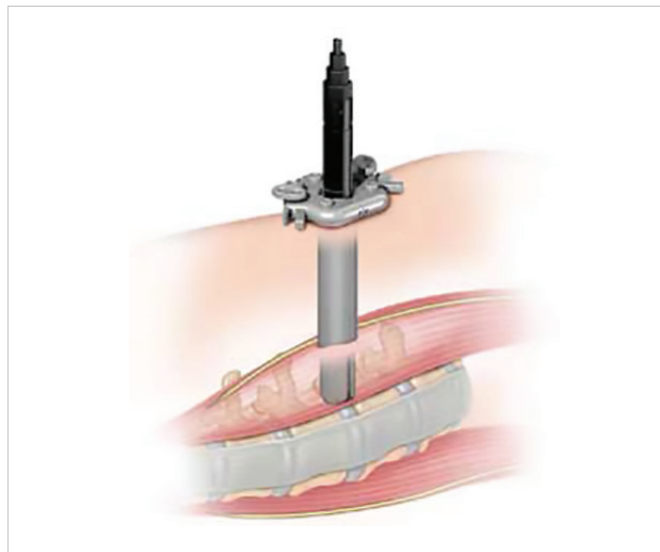


Figure 14

Rigid arm attachment

On the anterior side of the patient, position a bed rail clamp on the table rail approximate to the mid or upper thigh to facilitate subsequent placement of the rigid arm assembly (Figure 15).

Since the surgical preparation and draping are completed, the sterile rigid arm assembly is attached to the table via the bed rail clamp with the aid of the circulating nurse.

Connect the rigid arm attachment to the retractor using the universal connection slot. Note that there are two (2) universal connection slots available, anterior or posterior, depending on anatomical limitations or surgeon preference.

Once the rigid arm attachment is secure, the rigid arm can be connected by inserting the rigid arm attachment fork to the end and tightening the thumb lever. This assembly will hold the retractor in place for the remainder of the procedure.

The rigid arm assembly can be loosened at any point during the procedure to allow the retractor to be angled for an alternative field of view.

Once the retractor has been fully positioned and the rigid arm assembly has been tightened, the dilators can be removed (Figure 16).



Figure 15

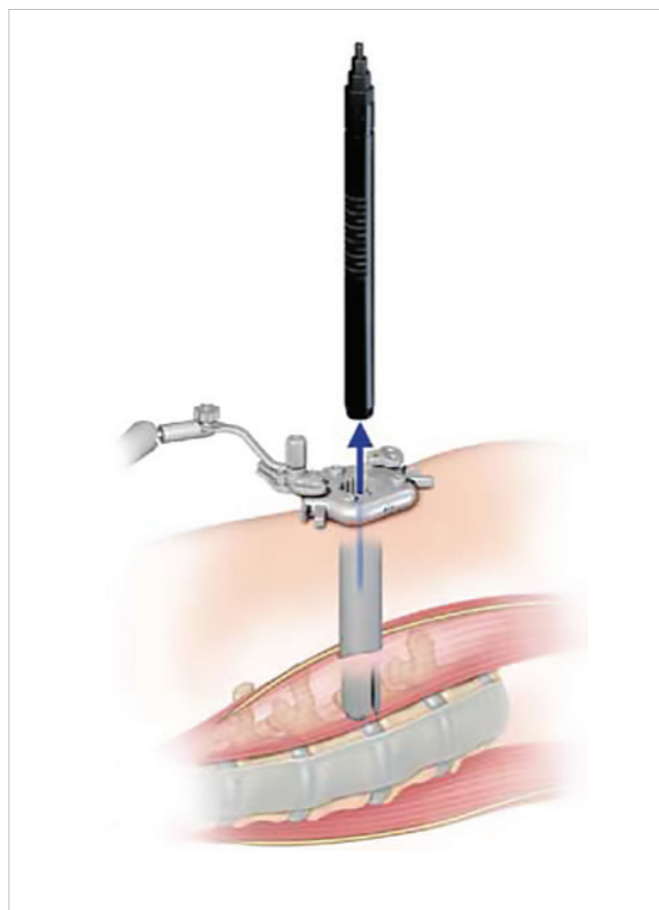


Figure 16

Initial expansion and toeing

Expand the retractor by rotating the skate keys as indicated by the etchings on the top of the retractor to open (Figure 17). Both sections can be opened independently of each other. Depress the locking buttons to release the sections.

The skate keys can be folded out of the way anytime during the procedure to facilitate visualization.

Toeing of the blades can be performed with the blade toe driver.

Place the driver into the drive gears within the section to toe and rotate clockwise to toe outward and counter-clockwise to toe back to the origin (Figure 18). Once the retractor is in position the fixation pin may be placed (Figure 19).

- Return the toeing blades to original position at the end of the procedure to facilitate removal of the retractor from the working space and ensure no muscle or other tissues are caught between the collapsed blades.

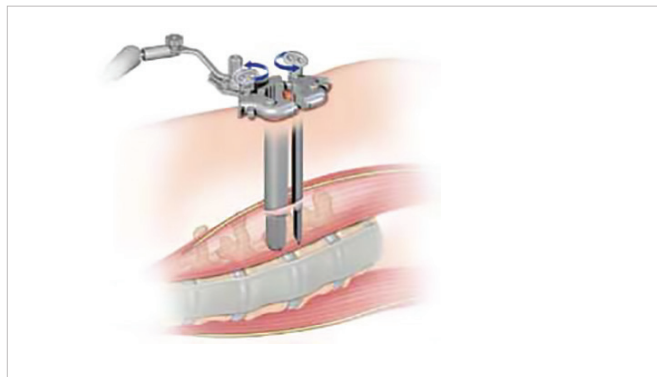


Figure 17

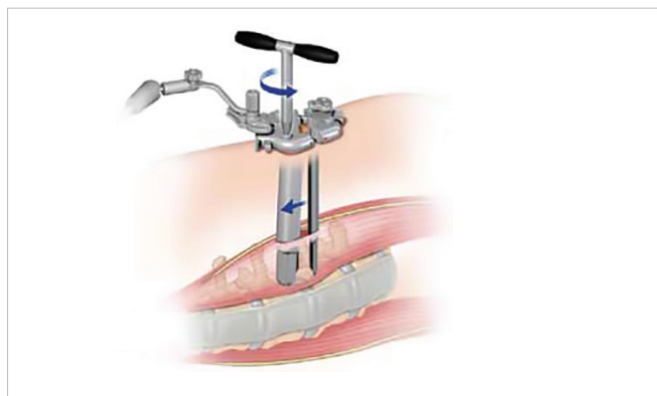


Figure 18

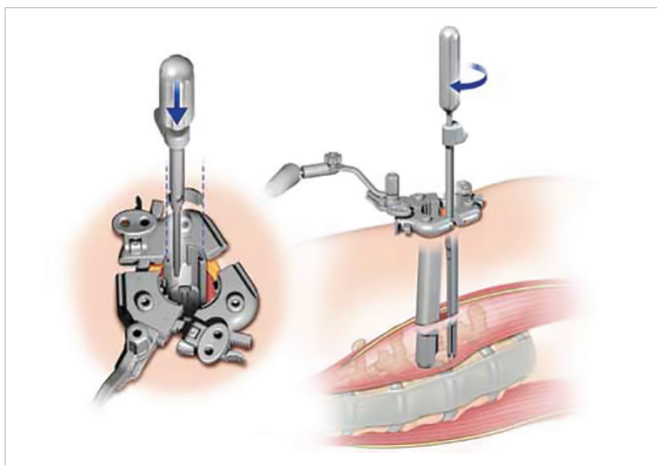


Figure 19

Telescoping Blade adjustment

After the retractor is expanded the blade adjuster may be inserted into the telescoping blade track and used to deploy the telescoping blades further to prevent soft tissue creep in the working space. A small Cobb elevator or equivalent instrument may be utilized to retract the soft tissue while deploying the telescoping blades.

Insert the blade adjuster instrument into the telescoping blade track until the instrument tip is flush with the top of the telescoping blade.

Squeeze and hold the trigger of the blade adjuster instrument to relieve the ratchet mechanism and lock the blade adjuster instrument to the telescoping blade.

Once the two items are locked together the blade adjuster instrument may be pulled or pushed along the telescoping blade track to position the telescoping blade (Figure 20). Release the trigger to unlock the two items. The telescoping blades can also be removed or adjusted upward at any point during the surgery.

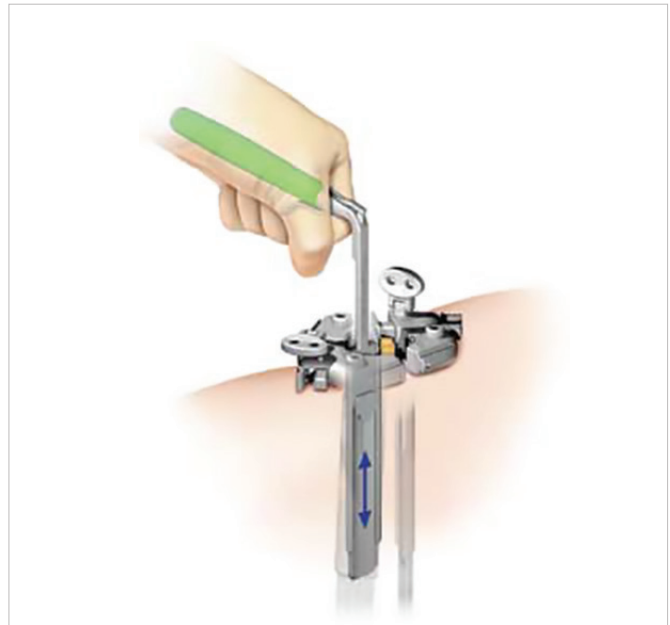


Figure 20

Light source attachment

A Light Source may also be attached to one of the remaining Universal Connections. If desired, the Light Source can be adjusted inward or outward depending on the amount of expansion of the Retractor.

Anterior Blade

If needed, an anterior blade may be attached to the retractor to prevent soft tissue creep through the anterior side of the retractor.

Open the retractor to a position wide enough to accommodate the anterior blade as indicated by etchings on the racks of the retractor.



Figure 21

Annulotomy and Disc Space Preparation

Once appropriate access to the disc space has been established and no neurovascular structures are seen in the bottom of the retractor an annulotomy can be made with the annulotomy knife. Pass the Cobb elevator along both endplates completely through the contralateral annulus. This step is critical to facilitate distraction of the disc space (Figure 22).

- **Release of the contralateral annulus is critical to facilitate distraction of the disc space.**

Use pituitary rongeurs, curettes, disc cutters, scrapers, rasps and other discectomy instruments to thoroughly remove the disc and prepare the endplates for fusion.

- **Care should be taken to make sure all instruments are used in a fashion parallel to the endplate (Figure 23), which can be checked by fluoroscopy in the A/P plane of the patient.**

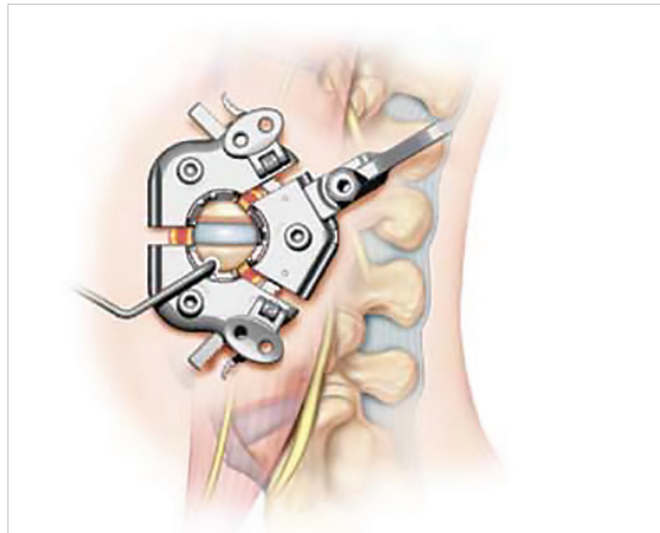


Figure 22



Figure 23

Closure

- Prior to removing retractor, remove fixation pin, untie blades and collapse retractor.

Once the procedure is completed, remove the retractor using direct visualization to verify the absence of significant bleeding in the disc space or psoas muscle (Figure 24).

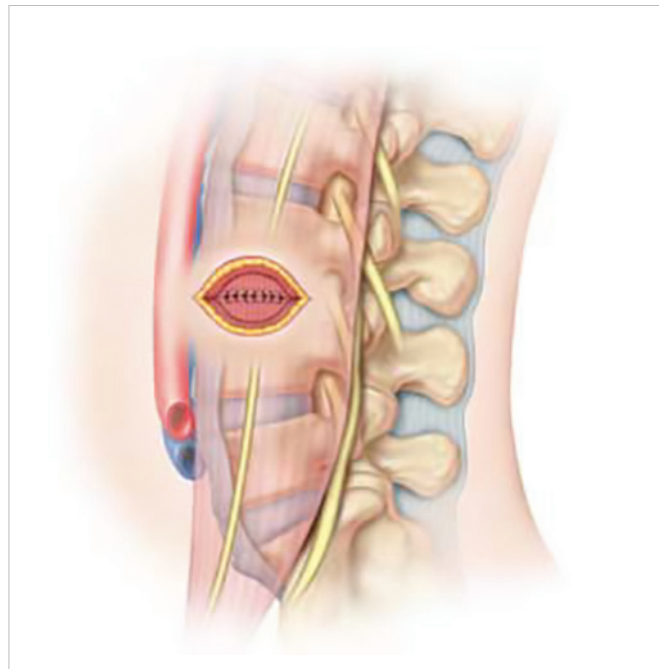


Figure 24

Indications and Contraindications

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