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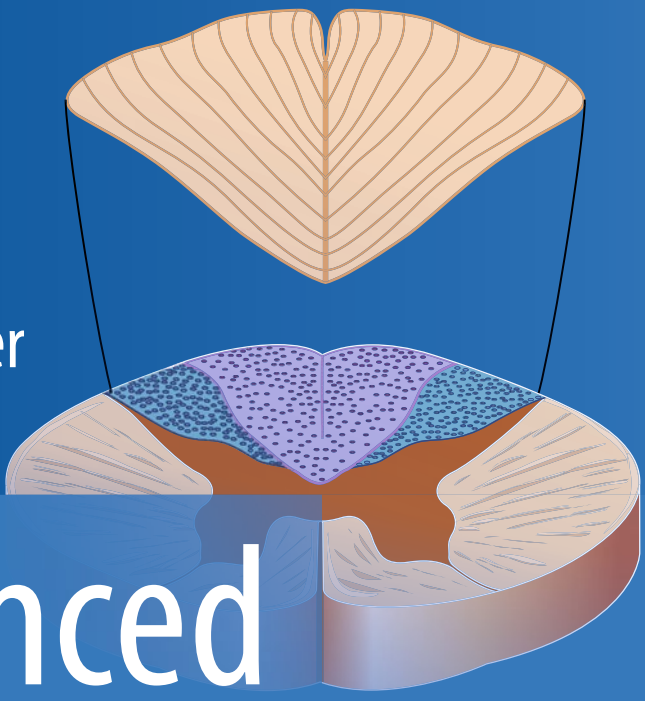

Advanced Procedures for Pain Management

A Step-by-Step Atlas

Springer

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Sudhir Diwan • Timothy R. Deer
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This atlas is dedicated to my mother, late Raniba Diwan, for teaching me the true meaning of life; to my wife Indira for her unconditional love and support; to our children Kaushal, Shira, Sneh, and Christian; and to our most wonderful grandchildren, Belen and Jonathon, for bringing joy and happiness to our lives. I am a better person because of my family.

I dedicate this book to the internationally renowned expert in neuromodulation for his dedication, research, and education, my dear friend and esteemed colleague, Timothy Deer. His contribution to the specialty of interventional pain medicine is unparalleled.

This atlas is also dedicated to the hard work of the section editors (Leonardo Kapural, Jason Pope, Steven Falowski, Ken Aló, Timothy Davis, and Corey Hunter) and all authors. Lastly, I dedicate this atlas to all my former fellows who made me an educator and mentor.

Sudhir Diwan, MD, FIPP, DABIPP

This book is a creation based on many people. My gratitude to my friend and colleague, Sudhir Diwan, for all of his vision and for shaping our field with his training of many young minds. He is a truly wonderful person and has a very kind heart. Greatest appreciation to our fellow authors and friends who led to this excellent piece of work.

The book is dedicated to my wife, Melissa, and to my children, Morgan, Taylor, Reed, and Bailie, for all the support over the years to build my career; to Jane, Jim, and Joe for guidance; to my Korean brother, Christopher Kim; to my family of physicians, nurses, physician assistants, and staff at the practice who make my work achievable; and to Jeff and Michelle for keeping my daily life functioning and successful.

Most of all, this book is dedicated to my patients who give me so much purpose in trying to make things better and reduce suffering, improve function, and reduce the need for opioids. Lastly, and most importantly, all praise and thanks go to my God, to whom I owe all blessings.

Timothy R. Deer, MD

Preface

The spine is a complicated structure that has led to great suffering and medical intrigue since antiquity. The process of being debilitated by spinal disease and subsequently reborn after a spinal intervention is a familiar story in our culture and in many cultures around the world. The ability for patients to continue in pain is unacceptable to most concerned parties, but unfortunately the solutions for this problem have also often proven to be fraught with issues. These solutions have included extensive and invasive surgeries, opioids, repetitive injections, and other passing trends that have not stood the test of evidence-based examination.

The continued quest to relieve pain and suffering in the twenty-first century has brought a desire for physicians, engineers, and industry to work together to achieve a goal of less invasive and more efficacious options for patients who suffer from spine-related maladies. This illustrated atlas is a modern update of these newly developed, cutting-edge procedures. Each chapter has an objective to create a roadmap to give optimal instruction regarding techniques, complication mitigation, and patient selection for better outcomes. This allows the physician to consider the critical steps of each method and the pearls of each treatment option. This layout allows for advancement of the physician who is learning these therapies such as residents and fellows but also allows for patient care improvement in the experienced hands of a seasoned doctor. This book goes beyond perceived boundaries of specialties, providing critical information and guidance to invasive pain specialists, anesthesiologists, physiatrist, neurosurgeons, and orthopedic spine surgeons.

In this colorful atlas, we examine minimally invasive options for treatment of ailments caused by the disc, nerve, joint, ligament, and combined disease states involving multiple structures. For each procedure, we go by a step-by-step approach to help make the review of these methods easier for reference in the daily performance of these techniques.

We are very proud of this atlas and greatly acknowledge the work of the many excellent physicians, researchers, and colleagues who participated in this book. Not only does their scholarly work make this book an excellent resource that should be in all libraries of those treating spinal disease, but the work of these amazing physicians advances the field daily in the United States and throughout the international

community. We also acknowledge the critical eye and timely editorial guidance given to this project by Lee Klein, who did an extraordinary job.

We are hopeful that this illustrated atlas meets our primary goal. That objective is to elevate patient care and improve outcomes. This goal of helping our patients is why we continue to strive continuously to improve care and to serve those who need our assistance to reduce suffering and improve quality of life.

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Part I
Advanced Spinal Interventions

Steven M. Falowski and Kenneth M. Aló

The subspecialty of minimally invasive surgery (MIS) for the treatment of pain has been practiced in various forms for decades, but never has it undergone such simultaneous growth and transformation. The MIS neurosurgeon of old has evolved into today's MIS pain management interventionalist thanks to the advent of miniaturized optics, implants, electrodes, batteries, and endoscopic portals; high-resolution stereotaxy, perioperative mapping, and neurophysiologic monitoring systems; and directional, multichannel catheters with real-time intraoperative imaging. Transformed by these innovations, physicians are now focused on objective, compassionate, less traumatic, and advanced surgical care, as well as continuous, advanced training and education. Minimally invasive access, technology, and tools are changing rapidly with options that will soon fit in the hands of all pain specialists. It is therefore fitting that this new *Atlas*, in part dedicated to minimally invasive spinal education, arrives to help advance the field and future of minimally invasive surgery for the management of pain.

Chapter 1
Advanced Spinal Mapping: An Interventional Continuum for Axial, Radicular, and Dorsal Root Ganglion–Related Pain

Jonathan D. Carlson and Kenneth M. Aló

1.1 Indications

The anatomy of the spine can undergo numerous changes that result in pain. Various forms of chronic pain, including pain of the neck, back, or extremities, may indicate one or more spinal pathologies. Differing treatments may be used depending on the pain generator, including radiofrequency neurotomy, corticosteroid injection, decompression, and neurostimulation. Utilizing an appropriate treatment may be challenging, given frequently comorbid spinal pathologies and potentially overlapping symptoms. Spinal mapping enables the identification and treatment of the appropriate pain generator. Spinal mapping and subsequent treatments can be used for a number of varying indications:

- Facet arthropathy
- Posterior disc herniation or extrusion
- Anterior disc herniation or extrusion
- Central canal stenosis
- Lateral canal stenosis
- Neuroforaminal stenosis
- Chemical disruption of the disc
- Intradiscal pressure
- Annular disc tear
- Dorsal root ganglion (DRG) mapping to optimize DRG stimulation

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1.2 Relevant Anatomy

Denis' three-column theory divides the anatomy of the spine into three parallel vertical columns [1]:

- Anterior column
- Middle column
- Posterior column

The anterior column includes the anterior longitudinal ligament (ALL) and the anterior half of the vertebral body and intervertebral disc. The middle column includes the posterior half of the vertebral body and intervertebral disc, as well as the posterior longitudinal ligament (PLL). The posterior column includes everything posterior to the PLL: the ligamentum flavum, pedicles, facet joints, and the neural arch and supraspinous ligaments.

1.3 Contraindications

Most spinal mapping techniques and associated interventional procedures tend to be minimally invasive, with low risk, but as with any spinal intervention, each patient must be carefully examined for any associated pathophysiological conditions or other contraindications to their use:

- Coagulopathy, platelet count of less than 100,000
- Implants (pacemaker, neural implants, etc.)
- Skin infection over placement site
- Allergic reaction to local anesthetics or any other medication provided during procedure
- Malignancy near placement site
- Hypovolemia
- Sepsis
- Spinal abnormalities or decreased spinal stability
- Pregnancy
- Renal insufficiency
- Chronic liver dysfunction
- Cerebrovascular disease
- Increased intracranial pressure
- Patient refusal

1.4 Preoperative Considerations

- The patient should receive an explanation of the procedure and all risks and sign an informed consent form.
- Patient must be able to remain in a prone position for the entire duration of the procedure.
- A complete preoperative checklist should be followed, including reports of medications such as anticoagulants.
- The needle placement site should be examined to ensure that no negative skin conditions are present.
- Intravenous access should be established for IV fluid and medication, in case the patient experiences a vasovagal reaction.

1.5 Fluoroscopic Views

Classic fluoroscopic views for selective nerve root block (SNRB) are utilized: anteroposterior (AP), oblique, and lateral views.

1.6 Positioning of the Patient

Patient positioning is a very important component of the procedural process. Incorrect patient positioning can lead to various problems and even bodily damage. A significant portion of epidurals, medial branch blocks, and radiofrequencies require patients to be on their abdomen in a prone position. When the patient is prone, it is best to provide support under the abdomen to reduce lumbar lordosis; this can be achieved by using a pillow. Furthermore, a pillow should be placed under the feet (upper foot) as a form of comfort. If the patient is placed laterally—such as during a cervical medial branch block and/or radiofrequency—then a pillow should be placed under the head to keep the cervical spine aligned and minimize lateral flexion.

1.7 Equipment

Standard radiofrequency ablation (RFA) equipment, probes, and needles are used for spinal nerve root mapping (Figs. 1.1 and 1.2).

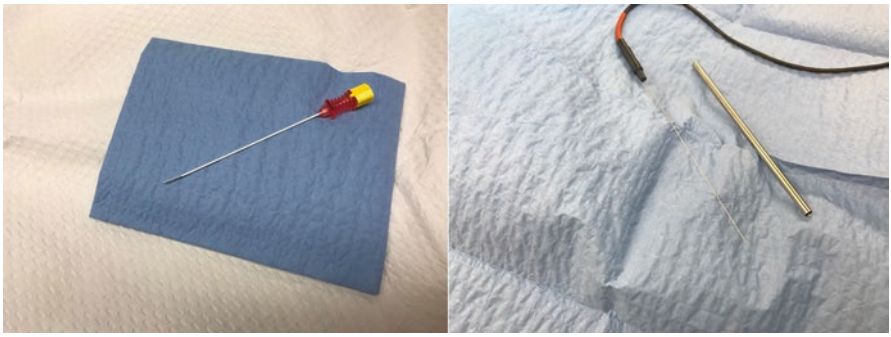

Fig. 1.1 *Left*, Standard radiofrequency ablation (RFA) needle with 10-mm active tip. *Right*, RFA probe

Fig. 1.2 Standard RFA machine with sensory program used for spinal nerve root mapping

1.8 Technique

Interventional treatments for chronic pain originating in the spine involve the localization of pain to the anterior or posterior column of one or more segments of the spine (Figs. 1.3 and 1.4). This mapping has traditionally involved either the selective injection of an anesthetic at the medial branch or spinal nerve roots (allowing a pain generator to be identified at a specific vertebral level) or provocative discography with pressure manometry to identify a pain generator at a specific intervertebral disc. There are some limitations with these traditional spinal mapping techniques. Pain relief provided by the anesthetics is usually delayed, meaning that the patient will not be able to provide immediate feedback on whether the targeted region is actually painful. Furthermore, several of these mapping techniques require structural imaging (MRI, CT, or xeroradiography) in order to identify potentially painful regions. These techniques suffer from additional disadvantages, including overlapping clinical presentations of facet-based and radicular pain, variance in patients'

Fig. 1.3 Needle and probe placement for lumbar spinal nerve root mapping

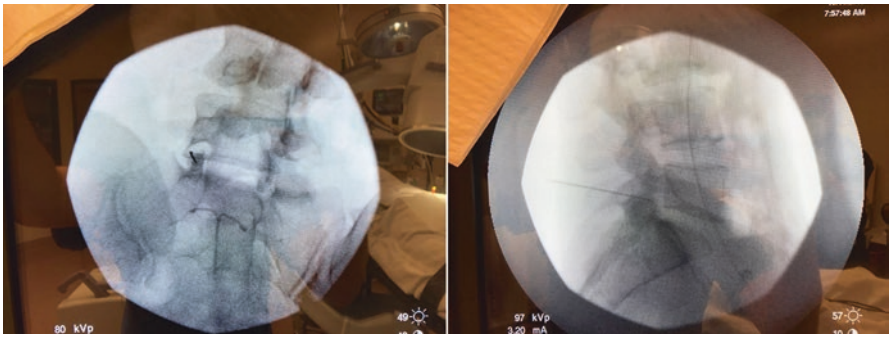

Fig. 1.4 Anteroposterior (AP) and lateral fluoroscopic views showing an example of needle placement for left L5 spinal nerve root mapping

pain reporting, and complications when attempting to identify the relationship between symptoms and structural imaging.

More recently, additional techniques have been introduced for the localization of pain generators. One such technique is radiofrequency needle stimulation [2]. Needle quantity varies by case, based on the number of regions being targeted. Radiofrequency stimulation can be used to generate paresthesia in multiple anatomical regions. Patients can provide immediate feedback on whether the affected region(s) are concordant with their pain. Additionally, this stimulation allows differentiation between radicular and segmental pain [3]. When concordant paresthesia is achieved through stimulation, anesthetic can be introduced to the corresponding nerves. A positive response to both radiofrequency needle stimulation and anesthetics should be followed by radiofrequency neurotomy [4, 5].

Despite its efficacy, radiofrequency stimulation has a few limitations. It requires multiple needle placements to examine the various levels, which generally requires multiple needle punctures, though it is possible to map multiple levels from a single incision by administering radiofrequency stimulation through an epidural catheter

[3]. The epidural catheter would allow for radiofrequency stimulation mapping of the dorsal ganglion and spinal root at numerous levels both bilaterally and ipsilaterally.

Another limitation of radiofrequency stimulation is that nerve branches at adjacent levels have overlapping areas of neural innervation. This can leave some ambiguity about the anatomical pain generator. Diagnostic epiduroscopy allows for the direct visualization of the epidural space. This technique allows for greater localization of pain generators. In the case of radiofrequency nerve stimulation, one can identify either dermatomal or sclerotomal pain patterns [6]. Diagnostic epiduroscopy can localize pain to either the anterior or posterior epidural space. New interventional techniques, such as new forms of decompression, new electrode designs for spinal cord stimulation, and new stimulation waveforms, can potentially take advantage of the more precise localization provided by advances in spinal pain mapping.

1.9 Middle Column/Anterior Column: Posterior Epidural Space

Fibrosis or the thickening and scarring of connective tissues has been treated in a multitude of ways. One popular treatment of choice for fibrosis within the posterior epidural space has been chemical adhesionolysis. Paired with fluoroscopy and enhanced with an endoscopic camera, epiduroscopic chemical adhesionolysis provides physicians with a better ability to penetrate through scarred tissue [7]. Though positive results have been found with the use of epiduroscopic chemical adhesionolysis, problems such as root compression and scarring can occur. Additionally, even though epiduroscopy provides visualization of change in inflammation within the epidural space, it has been limited by its poor optics and insufficient steering capability of the catheter(s) [8]. To ameliorate these epiduroscopy challenges, multiport endoscopes have been developed for the posterior epidural space, which allow increased instrumentation range and clearer and more precise visualization [9].

1.10 Anterior Epidural Space

Chronic pain can result from various pathologic changes of the anterior epidural space, such as acute neovascularization, annular disc tears, anterior disc herniations or extrusions, and chronic scar tethering. The anterior epidural space and disc-nerve interface can be directly visualized and accessed through an expanded in-line laminotomy and release of the filum terminale [10]. Alternatively, the anterior epidural space can be accessed through the sacral hiatus with a flexible endoscope [6]. The endoscope can be used to introduce balloons, stimulating catheters, laser waveguide

fibers, and quantum molecular resonance fibers for both diagnosis and treatment. This approach has been used to successfully deliver decompression of the anterior epidural space [11].

1.11 Post-procedure Considerations

The patient should be contacted via telephone the day after the procedure to check for any potential complication that might have arisen. The patient should also be questioned about pain relief secondary to the local anesthetics. For interventional pain procedures, the patient should be reminded that relief may take several days (as for the anti-inflammatory effects of a steroid injection) or weeks (as for radiofrequency neurotomy). The patient should be monitored closely and should contact the pain clinic if he or she experiences any procedure-related complications or unexpected neurologic deficits:

- Urinary or bowel incontinence
- Bleeding
- Persistent nausea or vomiting
- Fever
- Severe site pain
- Paresthesia
- Weakness

1.12 Potential Complications

The procedures discussed in this chapter are primarily less invasive than other operations. They require percutaneous needle placement, but with the use of precise needle-placement techniques, complications associated with these procedures are rare. Site infections are a potential complication, but they can be easily circumvented by following sufficient aseptic guidelines. Other complications are also possible:

- Bruising of placement site
- Hematoma
- Paresthesia
- Nerve damage/injury
- Adverse injectate reaction
- Severe allergic reaction to local anesthetics
- Confusion
- Dural puncture headaches
- Chronic adhesive arachnoiditis

1.13 Clinical Pearls and Pitfalls

- Managing patient expectations and patient education are essential. Although nerve root mapping can help in elucidating which spinal nerve roots are affected, it is important to correlate the direct afferent and local anesthetic phase responses. The clinical diagnosis and decision-making on which nerve(s) may be affected is ultimately at the discretion of the provider.
- If intravenous sedation is to be used, it is important let the anesthesiologist know that the patient must be able to maintain meaningful communication throughout the entire procedure, for both safety and diagnostic purposes.
- It is very important to educate the patient that the important question is not how "intense" the sensory perception or paresthesia is when electrical stimulation is implemented, but rather whether it covers the area of the patient's pain (concordant paresthesia, etc.).
- Sensory stimulation of the intended spinal nerve root should ideally be done between 0.5 and 1.0 V, or the needle should be adjusted to optimize paresthesia perception.
- Once spinal nerve root mapping is complete, performing a concurrent selective nerve root block at the nerve root that may be the most affected should be considered, to further confirm the findings of the nerve root mapping.

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Chapter 2
MILD: Percutaneous Lumbar Decompression for Spinal Stenosis

Sudhir Diwan, Timothy R. Deer, Leonardo Kapural, and Jason E. Pope

2.1 Introduction

Lumbar spinal stenosis (LSS), or the narrowing of the spinal canal and neuroforamina, is secondary to degenerative changes in the spine, causing hypertrophy of the ligamentum flavum, degenerative disc disease, facet arthropathy, and osteophyte formation (Fig. 2.1). Central LSS leads to compression of the spinal cord, and foraminal stenosis causes compression of exiting nerve root causing radiculopathy. The hallmark symptom of LSS is neurogenic claudication (NC), which is pain aggravated by axial extension and relieved by forward flexion. Patients with LSS may also present with radiculopathy described as radiating pain in a dermatomal distribution. LSS generally affects men and women after age 50.

Lumbar spinal stenosis is defined as decrease in caliber of the spinal canal.

- Absolute spinal stenosis: 10 mm midsagittal lumbar canal diameter on CT
- Relative spinal stenosis: 13 mm midsagittal lumbar canal diameter on CT

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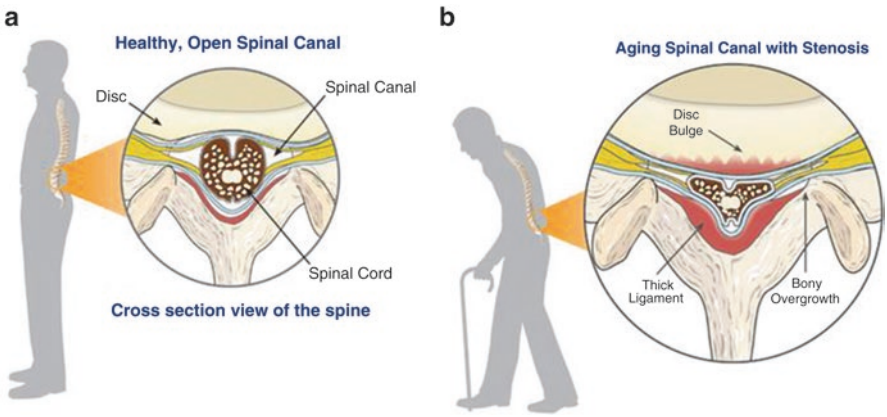

Fig. 2.1 (**a**, **b**) Comparing healthy open spinal canal with spinal canal stenosis with ligamentum flavum hypertrophy (*Courtesy of* Vertos Medical Inc.; Aliso Viejo, CA, USA)

The initial clinical presentation of LSS is insidious, and treated with conservative management including physical therapy, nonsteroidal anti-inflammatory and analgesic medications, and epidural steroid injections. The epidural steroid injections provide only short-term relief of radicular pain and are generally less effective in treating painful NC, which is not caused by central canal stenosis secondary to hypertrophied ligamentum flavum. Unfortunately, if the epidural steroid injections fail to provide adequate pain relief, the next step is surgical laminectomy decompression of the lumbar spinal canal with or without spinal fusion.

However, the quest for less invasive surgical techniques continues to shorten recovery times, decrease complication rates, and reduce tissue trauma, iatrogenic instability, and adjacent level disease secondary to extensive fusion. Percutaneous lumbar decompression of LSS is performed in an ambulatory set-up. The decompression of narrow spinal canal is achieved by removing small portions of lamina and ligamentum flavum (LF). The minimally invasive lumbar decompression (MILD) procedure is performed through a 6-gauge port under fluoroscopic guidance, with minimal tissue disruption. There is plenty of evidence in literature for the safety and clinical efficacy of this procedure, which virtually eliminates the possibility of serious complications including dural tear, blood loss requiring transfusion, and neurological complications.

2.2 Causes of Symptomatic LSS

- Ligamentum flavum hypertrophy (Fig. 2.2).
- Ligamentum flavum buckling
- Facet joint hypertrophy
- Vertebral body osteophytosis

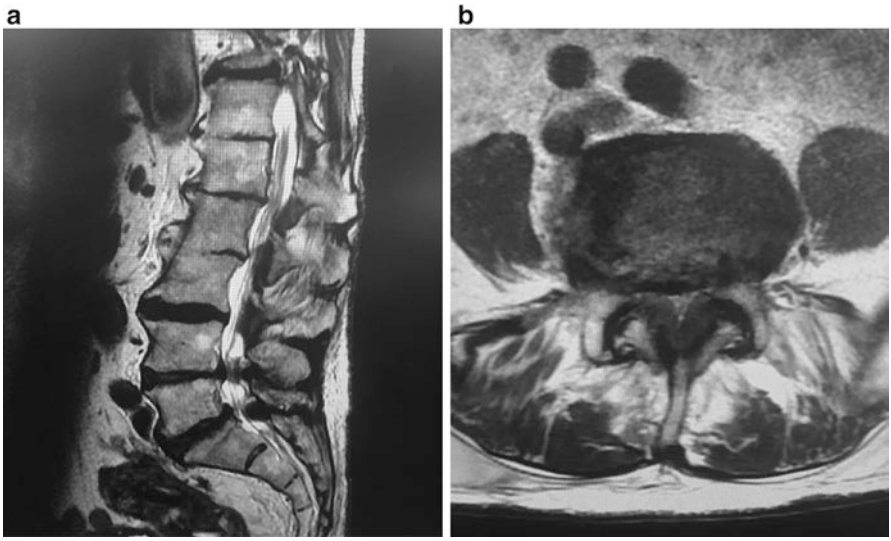

Fig. 2.2 (**a**, **b**) Severe spinal stenosis in sagittal (**a**) and axial (**b**) views

- Bulging and herniated discs
- Spondylolisthesis

2.3 Surgical Treatment of Central LSS

- Lumbar laminectomy
- Laminectomy with fusion
- Discectomy with laminectomy and fusion
- Interspinous space distraction

MILD procedure is a minimally invasive therapeutic option for LSS. It debulks the ligamentum flavum and portions of the lamina to restore space in the spinal canal. The restoration of space in the canal can be confirmed during the procedure utilizing the epidurogram (Fig. 2.2).

2.3.1 Epidurogram

The epidurogram is a key aspect of the MILD procedure. It is important for the safety during the procedure allowing decompression while ensuring that the rongeur or sculpter does not contact the dura, preventing potential patient injury. It should be performed at the same level and on the ipsilateral side of the level being treated. It is recommended to use the contralateral oblique fluoroscopic view to

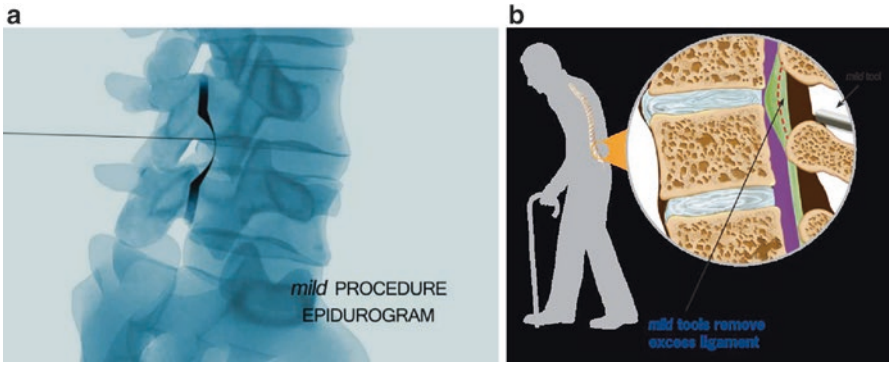

Fig. 2.3 Pre-procedure epidurogram (**a**) and hypertrophic ligament flavum (**b**) causing severe stenosis before MILD. (*Courtesy of* Vertos Medical Inc.)

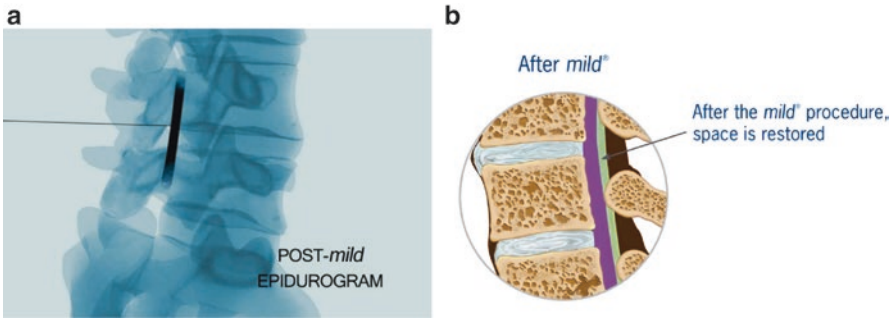

Fig. 2.4 (**a**) Epidurogram after MILD. (**b**) Space is restored, pressure reduced, and spinal canal mobility is restored after the procedure. (*Courtesy of* Vertos Medical Inc.)

visualize the epidurogram at the treatment site during decompression of the ligamentum flavum. The epidurogram provides an anterior safety margin that should be recognized at all times. The entire decompression procedure should be posterior to the epidurogram line to protect the spinal canal and neural structures.

In the contralateral view, the epidurogram presents as a clear line representing the posterior border with a "scalloped" appearance secondary to enlarged ligamentum flavum (Fig. 2.3). Reduction in the "scalloped" appearance, and thickening and straightening of the epidurogram line, indicate adequate decompression of the ligamentum flavum tissue (Fig. 2.4).

The MILD procedure only provides decompression.

- Removes only a small portion of the lamina to get access to the ligament
- 5.1 mm MILD portal minimizes tissue and muscle disruption
- Debulks the ligamentum flavum and decompresses the neural structures
- Leaves anterior fibers of the ligament flavum intact
- Supports structures like spinous process, facets, and the majority of the lamina is left intact

2.3.2 Fluoroscopic Guidance

Fluoroscopy is a necessary imaging tool to perform the MILD procedure. Align the inferior endplate of the level being treated in anteroposterior (AP), and open the interlaminar space for placement of the epidural needle for epidurogram. The epidural needle should be positioned in the ipsilateral side of the interlaminar space of the level being treated. The AP and contralateral oblique views are used for portal placement. The entire debulking procedure should be performed under the contralateral oblique view. AP view is used during resection to confirm medial-lateral instrument positioning. The contralateral oblique fluoroscopic view is obtained by rotating the C-arm to 40°–45° oblique on the contralateral side of the treatment side. The depth of instrument placement during the MILD procedure is observed in the contralateral oblique fluoroscopic view. All advancement of instruments, and the entire decompression procedure, should be performed utilizing this view.

2.4 Patient Selection for the MILD Procedure

2.4.1 Inclusion Criteria

Ideal candidates for the MILD procedure would be patients with symptomatic LSS and dorsal element hypertrophy. Nearly all selected patients experienced prior failure of conservative therapy that included physical therapy, medications, and/or epidural steroid injections. Typically, patients would experience back and/or leg pain with or without unilateral or bilateral numbness that occurs with axial loading especially when walking or prolonged standing. There should be radiologic evidence of LSS/ligamentum flavum thickness >2.5 mm and typically reduction of dural sac cross-sectional area to $\leq$100 mm^2.

2.4.2 Exclusion Criteria

There should not be anterior listhesis of >5.0 mm. The MILD procedure is avoided at prior decompression surgery level. During MIDAS studies history of recent spinal fractures with concurrent pain symptoms and disabling back or leg pain from causes other than LSS were considered exclusion criteria and should be considered relative contraindications for the procedure. Other exclusion criteria include a significant or symptomatic disc protrusion or osteophyte formation, as well as symptomatic facet hypertrophy at the targeted level.

In addition to MILD-specific exclusion criteria, general spinal surgery exclusion criteria also apply, like bleeding disorders, use of anticoagulants within 3–7 days of procedure, use of ASAs and/or NSAIDs within 7 days prior to treatment.

Lastly, inability of the patient to lie prone with anesthesia support and any pathologies affecting wound healing should be considered exclusion criteria for the MILD procedure as well.

2.5 MILD Procedure Equipments (Fig. 2.5)

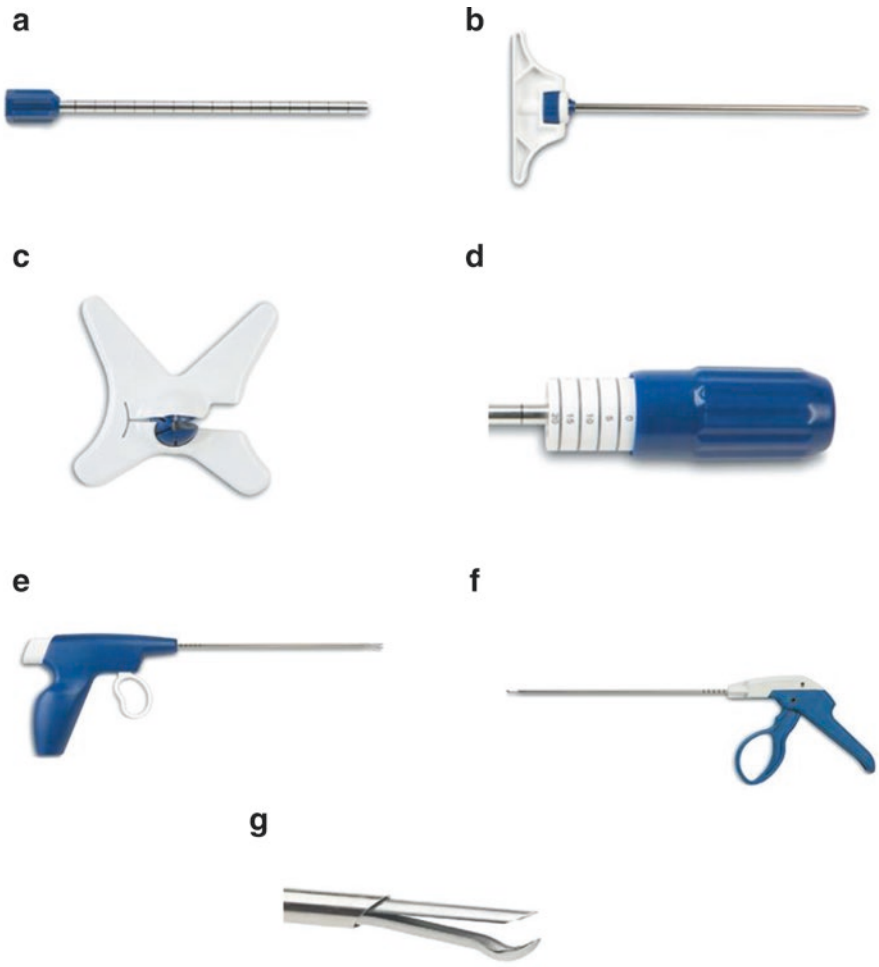

Fig. 2.5 (**a**) Portal. 5.1-mm portal minimizes tissue disruption. (**b**) Trocar and handle. (**c**) Portal stabilizer to minimizes medial and lateral movement. (**d**) Depth guide to ensure depth of cutting device. (**e**) Bone sculpter rongeur. (**f**) Tissue sculpter allows resection and retraction of ligamentous tissue. (**g**) Close-up of tissue sculpter. Top cutting surface cuts only at correct angle, and spoon-bill cuts only at correct angle. (*Courtesy of* Vertos Medical Inc.)

2.6 Technical Steps of the MILD Procedure

2.6.1 Patient Position

Patient is placed in a prone position with pillows under the abdomen to reduce lumbar lordosis (Fig. 2.6).

2.6.2 Fluoroscopy

Under fluoroscopic guidance, the midline with spinous process and bilateral medial pedicular lines are identified and marked at the intended level. The skin markings are useful guides for the trajectory and orientation of the instruments.

2.6.3 Epidurogram

The fluoroscope is positioned with the perfectly alligned inferior endplate of the level to be treated in order to open the superior aspect of the intervertebral space (Fig. 2.7). An epidural needle is positioned high to target intervertebral space close to midline and ipsilateral to the treatment side. Epidural space is accessed using loss of resistance technique and fluoroscopic guidance. Proper needle placement is assured by injecting and then confirming epidural spread of a small amount of non-ionized contrast in the contralateral oblique fluoroscopic view. Intravenous (IV) extension tubing should be used for contrast injection.

2.6.4 Determine the Trajectory

Identify the skin entry site, usually one and one half levels below, or at the level of the pedicle one level down the treatment site on the ipsilateral side, and usually about 15° off of the midline. By using a 5″ 22G spinal needle, first infiltrate skin with local anesthetic and advance the needle under fluoroscopic guidance while anesthetizing inferior lamina.

Use an AP fluoroscopic view to direct the needle to determine the medial to lateral trajectory needed at this level on this side. Once the trajectory of the needle is determined, the fluoroscopic view is changed to the contralateral oblique view to advance the lamina to visualize the portal depth. Do not advance the instrument unless utilizing direct visualization in the contralateral oblique view.

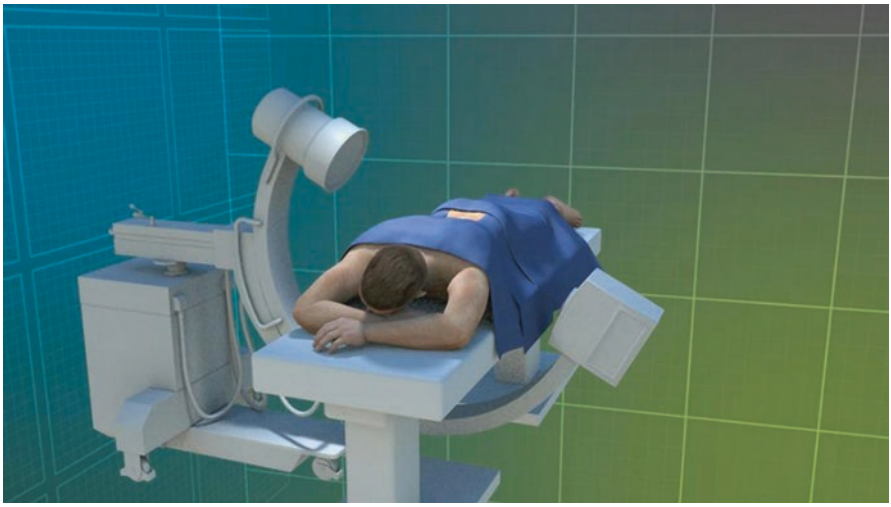

Fig. 2.6 Patient in prone position with contralateral fluoroscopic view. (*Courtesy of* Vertos Medical Inc.)

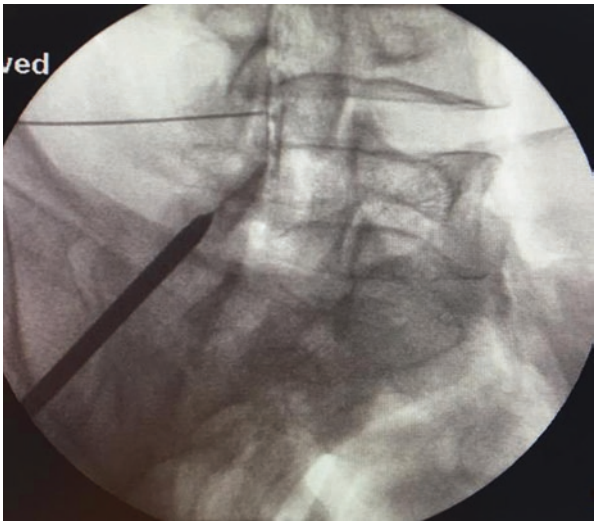

Fig. 2.7 This epidurogram line in contralateral fluoroscopic view. (*Courtesy of* Vertos Medical Inc.)