INJECTIONS FOR POW

Interventional Approaches to The Management of Spinal Pain

A Summary of ASIPP's Evidence-Based Guidelines

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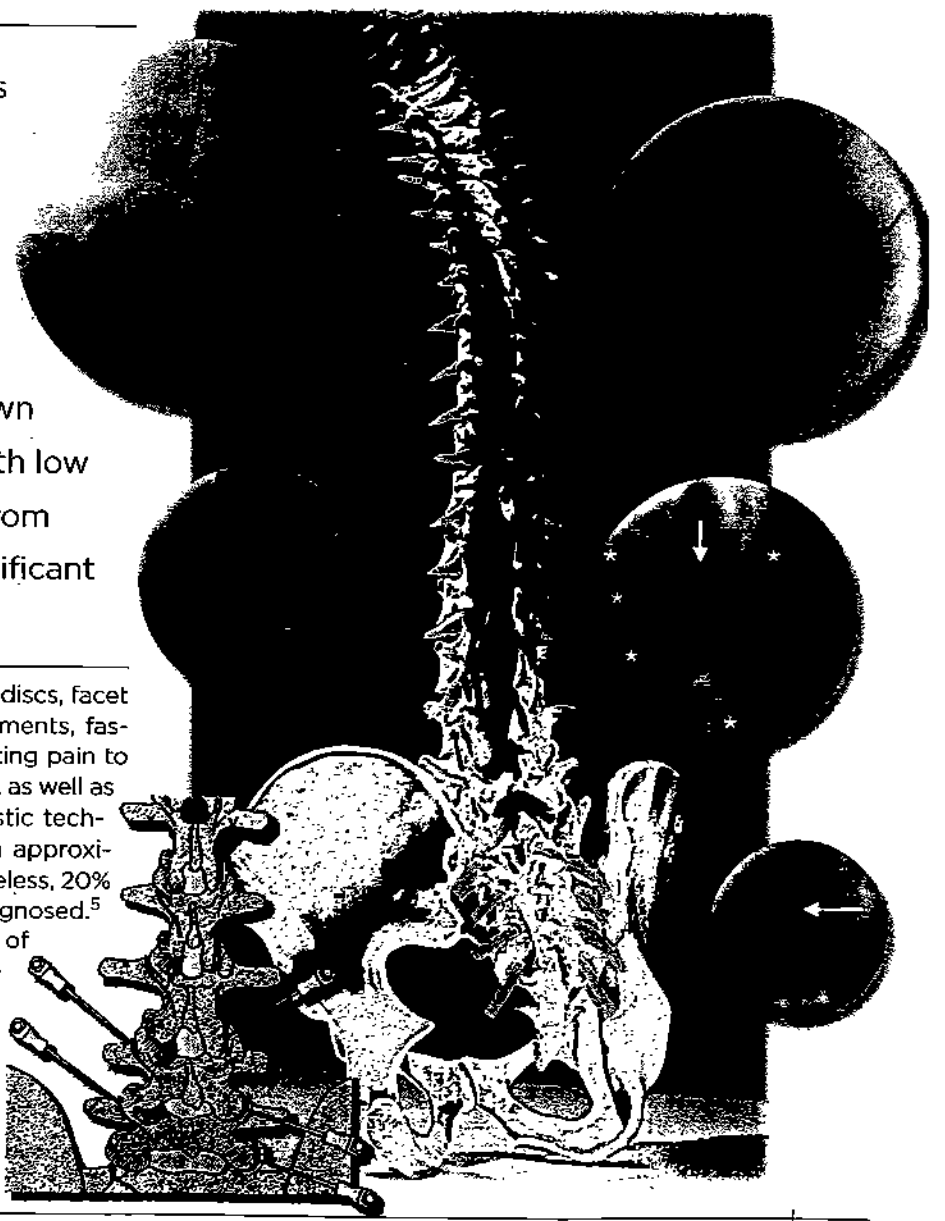
Andrea Trescot, MD, discloses that she is or has been on the speakers' bureaus of Alpharma, Eli Lilly, Endo Pharmaceuticals, Merck, and Pfizer; and was a paid consultant for Wallach.

Introduction

Acute low back pain is very common, with a U.S. prevalence of about 20%.[1] Although most of these episodes were once thought to be short-lived, recent studies have shown that nearly 75% of patients with low back pain continue to suffer from pain at 3 months, with no significant improvement at 12 months.[2]



Kuslich et al[3] identified intervertebral discs, facet joints, the dura of the nerve roots, ligaments, fascia, and muscles as capable of transmitting pain to the lower back. Using advanced imaging, as well as neurophysiologic and precision diagnostic techniques, spinal pain can be identified in approximately 50% to 80% of patients.[4] Nonetheless, 20% to 50% of patients remain incorrectly diagnosed.[5] Furthermore, axial and periaxial patterns of pain from ligaments, muscles, intervertebral discs, and facet joints overlap significantly. Therefore, patients continue to present with a diagnostic dilemma and a therapeutic challenge. And if the diagnosis is unclear or incorrect, the treatment is likely to be ineffective.

The work of Mixter and Barr[6] suggested a discogenic pathology, and the evolution of back surgery followed this model as a therapeutic treatment course for most diagnosed back pain. The progressive surgical intrusion into the components of the spine have led to the development of complex surgical fixation procedures, fusion, and the explosion of postsurgical complications, most notably postlaminectomy syndrome and arachnoiditis. The incidence of back pain has remained stable, although disability awards granted in the United States have steadily risen. Physicians who treat low back pain in a multimodality arena understand that back pain and its complex presentation are not defined by a singular point of pathology, such as a herniated disc, but reflect the complex interrelationship of overall spine structure and function. Within the structural elements of the lower back, the pain generators of the facet, disc, bone, and the supporting sacral joint are recognized as viable and important considerations of treatment in the contemporary differential diagnosis. Rarely does a complaint of low back pain involve only a single pain generator; therefore, it is unlikely that a single treatment, such as surgery, will result in the best outcomes for the majority of causes of low back pain.

Diagnosis

The development of imaging techniques, such as magnetic resonance imaging (MRI), has dramatically increased the ability to view structures previously seen only at surgery. With that improved visualization came the assumption—for both patients and physicians—that such imaging would lead to improved diagnosis. It is commonly assumed that abnormalities found on MRI reflect the etiology of low back pain, but Jensen et al[7] dispelled that idea by reviewing the MRIs of asymptomatic patients, showing that up to 52% had significant—and what would have been considered potentially surgical—pathologies. Reliance on advanced imaging may be the reason that the United States leads the world in spine surgery, with a rate of back surgery at least 40% higher than any other country.[8] In 2002, more than 1 million spinal surgeries were performed in the United States[9]; in 2003, spinal surgeries in the United States represented $2.5 billion of the $3 billion spent on back surgery worldwide.[10]

The use of diagnostic, precision injections, guided by fluoroscopy, computed tomography (CT), or ultrasound, has helped identify the "pain generator"; this has led to precise (and theoretically more effective) delivery of medication to the site of pathology, and the development of various neurolytic denervation procedures. This could be considered analogous to a dental evaluation: X-rays might show multiple cavities, but tapping on a tooth replicates the pain, and local anesthetic abolishes the pain. If the patient obtained temporary relief from the local anesthetic, but no sustained relief from the filling, a root canal denervation procedure might offer long-term relief. However, pulling a tooth that is not the pain generator would not be expected to offer relief.

The use of minimally invasive procedures, such as interventional application of target-specific drug therapy under direct fluoroscopic observation, is a vitally important option to avoid escalating use of controlled substances, disabling patient profiles, and the eventuality of surgery. These injections are safe in trained hands, reproducible, and cost-effective.

Pain medicine in general, and interventional pain techniques specifically, have suffered because of the lack of true placebo controls. In studies examining blood pressure, patients usually cannot tell whether their blood pressure is elevated or lowered; the end points (mean blood pressure, the incidence of heart attack or stroke) are well described and easy to measure, the control easy to identify ("sugar pill"), and the patient has little direct input except complaints of side effects. With pain medicines, especially opioids, it is nearly impossible to mask the central nervous system (CNS) effects, necessitating the use of "active controls"—medicines with a CNS effect but not an analgesic effect. Pain scales are extremely subjective, and are not linear but, rather, logarithmic (Figure 1). Ethical issues also must be considered when denying opioids to patients in severe pain in order to form a placebo group.

With interventional procedures, these issues are even more complex. The use of image guidance, small volumes of local anesthetic, and "double local anesthetics" (injecting a short-acting local anesthetic once, expecting a short-term effect, and then injecting a long-acting local anesthetic, expecting a longer effect) have helped to add precision, but may not aid in diagnosis. As with opioids, it is difficult to design a true placebo. The act of piercing the skin with a needle changes the tissues, as does the injection of saline. Although relatively safe, interventional procedures, by definition, have an inherent risk, and exposing a patient to a sham procedure (injecting the same medicine on a structure not felt to be involved) may raise ethical issues.

Additionally, not all patients respond in the same way to the same local anesthetics; in a study of nearly 1,200 patients[11] in an interventional pain clinic, 7.5% noted hypoesthesia only to mepivicaine (Carbocaine, Sanofi), but not to lidocaine or bupivicaine, whereas an additional 3.8% were hypoesthetic only to lidocaine. Thus, 2 patients undergoing injections of the same local anesthetic might experience totally different responses.

The American Society of Interventional Pain Physicians (ASIPP) recently developed evidence-based guidelines for interventional treatments.[12] As practitioners in the field, interventionalists (more than neurologists, internists, or occupational medicine physicians) are in a unique position to evaluate the appropriateness of the variety of currently available procedures. Just as gynecologists would not consider publishing evaluations of neurosurgical techniques, it is inappropriate for practitioners who do not perform pain procedures to consider themselves qualified to evaluate a procedure about which they have only read.

ASIPP developed search and assessment criteria

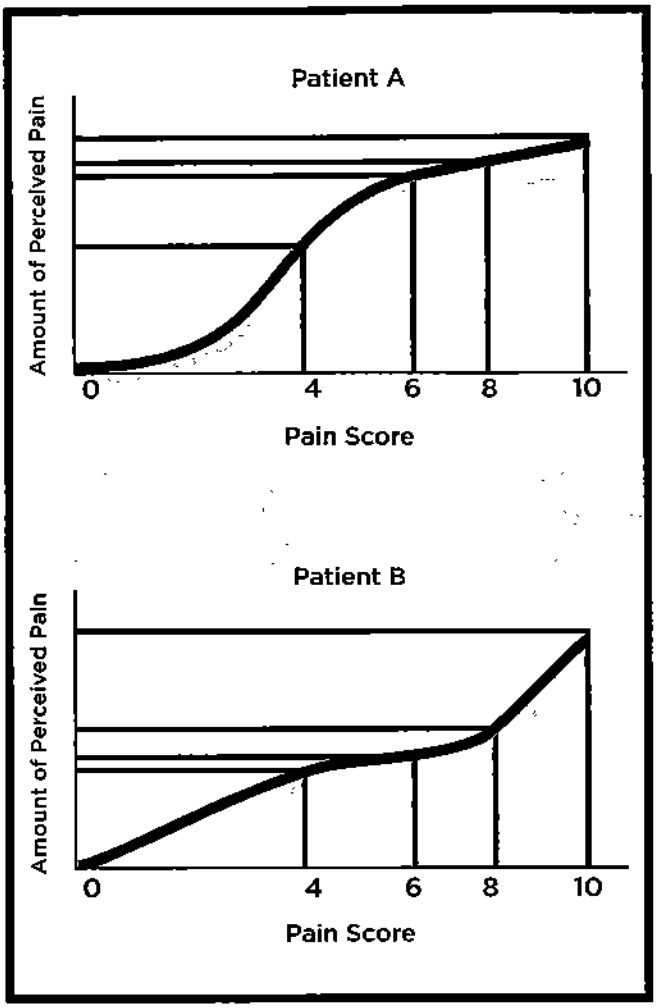


Figure 1. Pain scales.

of the available literature, which is defined as "methodology" of assessment. ASIPP, and those involved in this systematic review of pain interventions, searched EMBASE, Pubmed/Medline, MDConsult, and the Cochrane Database of Systematic Reviews for keywords and terms. Reviewers evaluated 1,300 studies, and included or excluded studies based on quality. Outcome measures included pain relief of 50% or greater. Excluded studies included case and descriptive reports and studies of poor quality. The methodologic quality was supported by the Agency for Healthcare Research and Quality[13] and criteria described by the Quality Assessment of Diagnostic Accuracy Assessment,[14] and Cochran Review Group for Randomized Trials.[15] The studies that were included used fluoroscopic guidance, mandatory for accuracy.

The risks inherent with an interventional procedure and the radiation risk from fluoroscopy suggest that a moderate level of evidence is appropriate for support of use. Level 1 and 2 criteria require research in evidence-based, randomized control trials. Unfortunately, these trials are not useful in all medical scenarios, and validation may be obtained by other means. Because pain is subjective, tools and diagnostic maneuvers are not always beneficial when evaluating a patient's pain. Patients in pain are best assessed by evaluation of function, as well as the physician's diagnostic interpretation.

Evidence-Based Medicine

Evidence-based medicine is defined as the conscientious, explicit, and judicious use of the current best evidence in making decisions about the care of individual patients.[16] Thus, the practice of evidence-based medicine requires the integration of individual clinical expertise with the best available external evidence from systematic research.

Appropriate history, physical examination, and medical decision making are essential to provide appropriate documentation and patient care. Numerous acceptable medical methods exist for evaluating a patient with chronic spinal pain. These methods vary from physician to physician and textbook to textbook. The guidelines established by the Centers for Medicare & Medicaid Services and the American Medical Association's Current Procedural Terminology (CPT) aid the physician in performing a comprehensive and complete evaluation, and assist in complying with regulations.

In 2007, ASIPP published a comprehensive review of interventional techniques,[12] critically evaluating them for efficacy. Both diagnostic and therapeutic procedures were reviewed, and the ASIPP developed a suggested therapeutic algorithm. Although the reviewers also looked at cervical and thoracic procedures, this discussion is limited to a review of low back procedures.

Epidural Steroids

Many of the current concepts of low back pain treatment were developed in the early 20th century. The first epidural for "sciatica" (a caudal epidural) was performed by Viner[17] in 1925, some 10 years before Mixter and Barr[6] defined the herniated nucleous pulposis as a cause of pain radiating down the leg. Lumbar epidurals for low back pain were introduced by Robecci and Capra[18] in 1952, and by the 1980s, it was common to see patients lined up in the recovery room for their series of three blind epidurals.

With the advent of image-guided injection techniques, the ability to inject an individual nerve root as it exits the spinal canal ("selective nerve root" if the injectate stays out of the foramen, or "transforminal" if the medicine is directed through the foramen into the epidural space) allows these injections to become diagnostic. If a small volume of local anesthetic on a single nerve root provides pain relief, that nerve root (or the disc at that level) could be identified as the pain generator.

Several recent literature reviews[19] suggested little efficacy of epidural steroids. However, each of these studies had a severe design flaw: They lumped all epidurals together, despite the large differences in the

site of medication delivery for each distinct procedure. ASIPP separated each study as to caudal, transforaminal, or lumbar locations (Figure 2) and came to markedly different conclusions.

ASIPP Systematic Review[12]

Caudal epidural injections. The evidence for caudal epidural steroid injections in managing chronic low back and radicular pain is strong for short-term relief and moderate for long-term relief. The evidence in postlumbar laminectomy syndrome and spinal stenosis is limited.

Interlaminar epidural injections. Evidence shows strong short-term, but limited long-term relief using interlaminar epidural steroid injections in the management of lumbar radiculopathy.

Selective nerve root injections. Moderate relief has been shown for selective nerve root blocks in the preoperative evaluation of patients, with negative or inconclusive imaging studies and clinical findings seen for nerve root irritation.

Transforaminal epidural injections. The evidence for managing lumbar radicular pain with transforaminal lumbar epidural steroid injections is strong for short-term relief and limited for long-term relief.

ASIPP Treatment Guidelines[12]

Epidural injections. Epidural injections include caudal, interlaminar, and transforaminal injections.

In the diagnostic phase, a patient may receive 2 procedures at intervals of no sooner than 1 week or preferably 2 weeks, except in cancer pain or when a continuous administration of local anesthetic is employed for reflex sympathetic dystrophy. In the therapeutic phase (after completion of the diagnostic phase), the suggested frequency of interventional techniques should be 2 months or longer between each injection, provided that greater than 50% pain relief is obtained for 6 to 8 weeks.

If neural blockade is applied for different regions, it may be performed at intervals of no sooner than 1 week and preferably 2 weeks for most types of procedures.

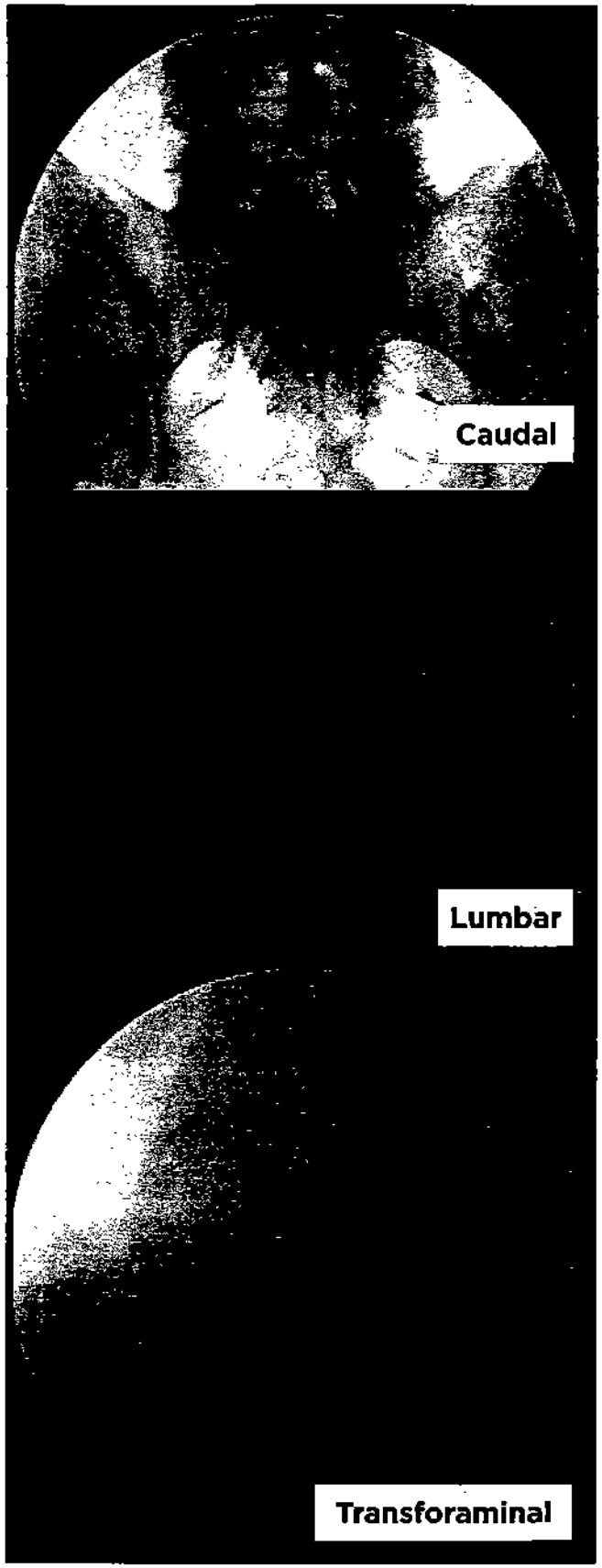
The therapeutic frequency may remain at intervals of at least 2 months for each region. It is further suggested that all regions be treated at the same time, provided all procedures can be performed safely.

In the treatment or therapeutic phase, interventional procedures should be repeated only as necessary according to medical necessity criteria, and it is suggested that these be limited to a maximum of 4 to 6 times per year.

Under unusual circumstances with a recurrent injury, carcinoma, or reflex sympathetic dystrophy, blocks may be repeated at intervals of 6 weeks after diagnosis/stabilization in the treatment phase.

Epidural Adhesiolysis

In the 1920s, Sicard and Forestier[20] injected contrast in the epidural space in an attempt to delineate the anatomy and identify intraspinal lesions. This was soon replaced by myelograms. However, in the late 1980s, the



Courtesy of Dr. Andrea Trescot

Figure 2. Types of epidurals.

Courtesy of Dr. Andrea Trescot

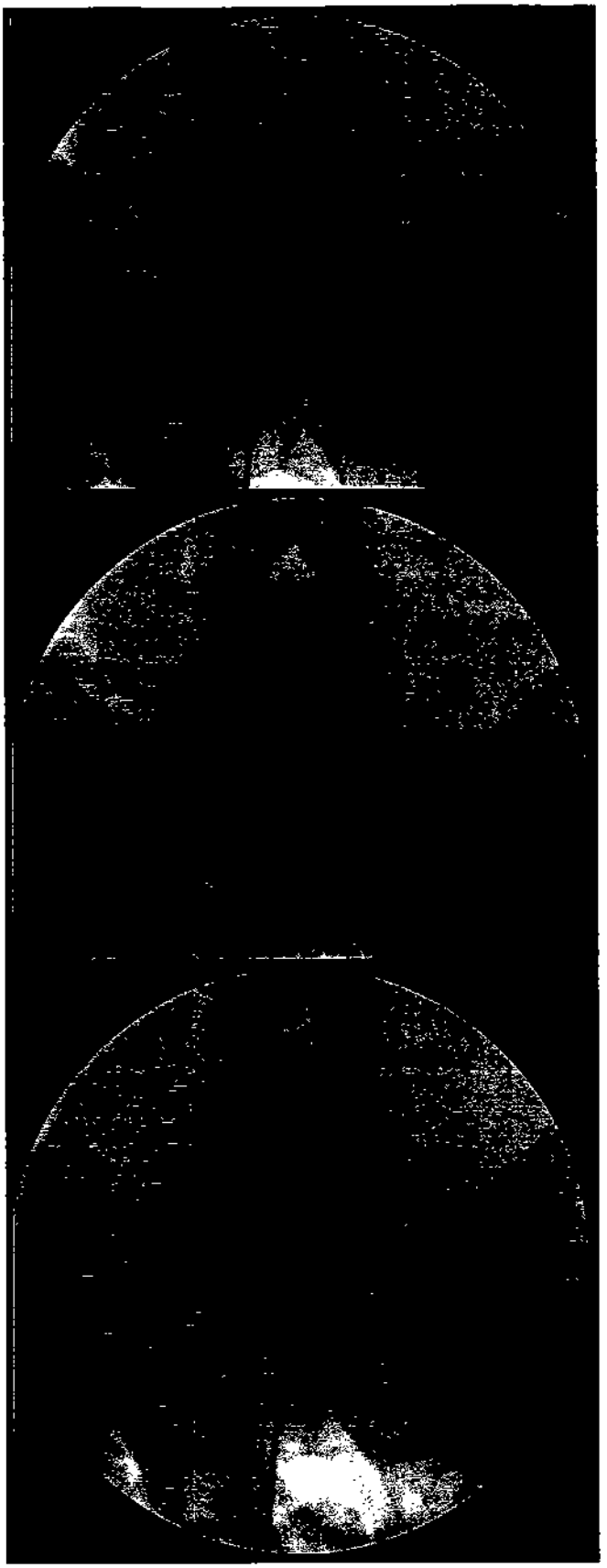
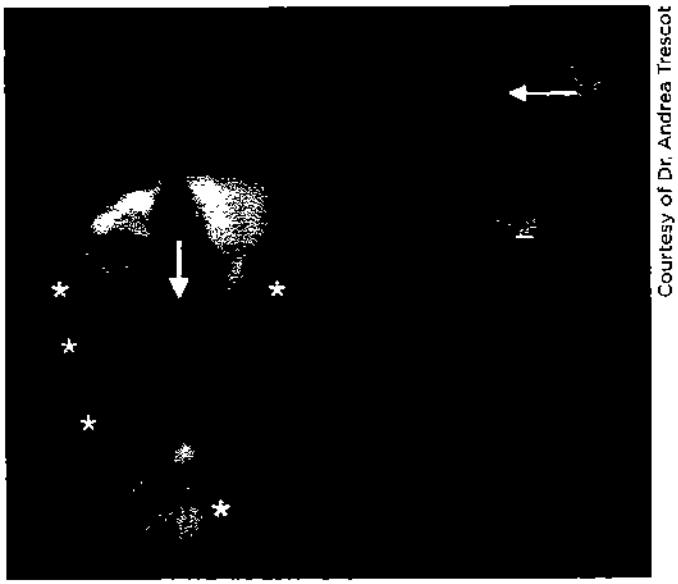


Figure 3. Adhesiolysis.



Courtesy of Dr. Andrea Trescot

Figure 4. Endoscopic adhesiolysis.

technique of injecting water-soluble dye in the epidural space during an epidural was revived. There was soon recognition of "filling defects" (areas where contrast did not or could not go). In 1989, McCarron et al[21] proved that the disc material itself was inflammatory, and nerve root pain might be caused by more than mechanical pressure of the disc herniation. This inflammation creates tethering of the nerve root and scarring in the epidural space. It was soon recognized that, if the contrast did not reach an area, it also would not be reached by a therapeutic medication. Racz et al[22] developed a wire-bound catheter to help direct medication and break up adhesions (percutaneous adhesiolysis; Figure 3). Originally developed as a 3-day procedure, similar results have been seen with 1-day protocols,[23] and are reflected in new CPT codes.

In 1938, Poole[25] first looked into the epidural space with rigid scopes, but it took the development of flexible scopes and fiber optics in the 1990s before the technique could be widely used (endoscopic adhesiolysis; Figure 4). Visualization of the epidural space has aided diagnoses and added to existing knowledge of pathophysiology.

ASIPP Systematic Review[12]

Percutaneous adhesiolysis. Strong evidence exists for the use of percutaneous adhesiolysis in managing chronic low back and lower extremity pain in post-surgery syndrome. Only moderate success has been reported in relieving pain using percutaneous adhesiolysis in patients with low back and lower extremity pain secondary to disc herniation that leads to radiculopathy. Only limited evidence has been noted in using this procedure to manage back and/or lower extremity pain secondary to spinal stenosis.

Endoscopic adhesiolysis. Evidence for spinal endoscopy is strong for short-term relief and moderate

Courtesy of Dr. James Heavner

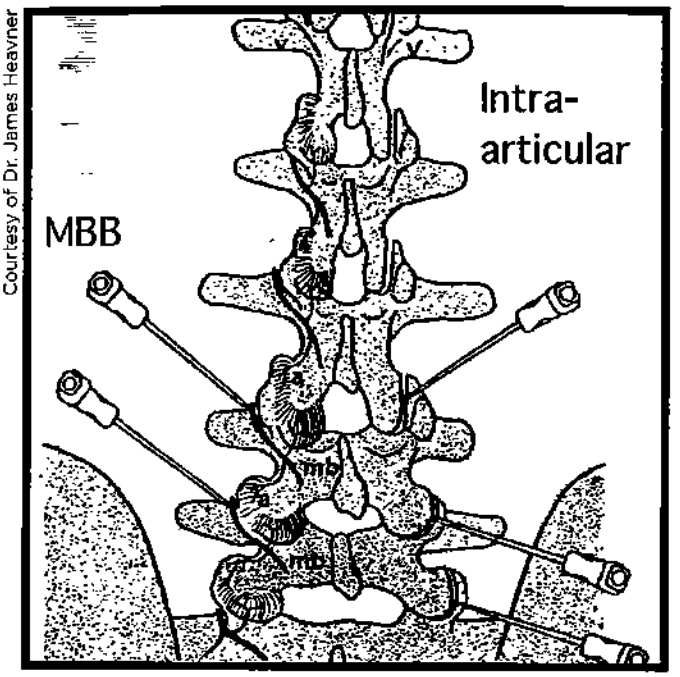
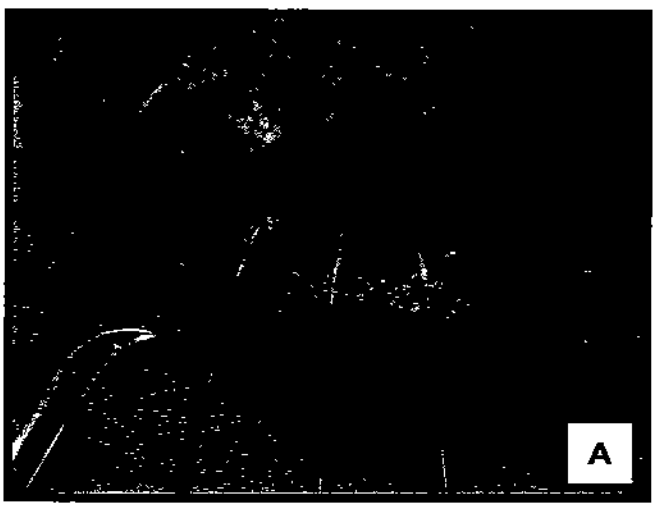


Figure 5. Facet injections.

MBB, medial branch blocks

Courtesy of Dr. Lora Brown



Courtesy of Dr. Rich Marks

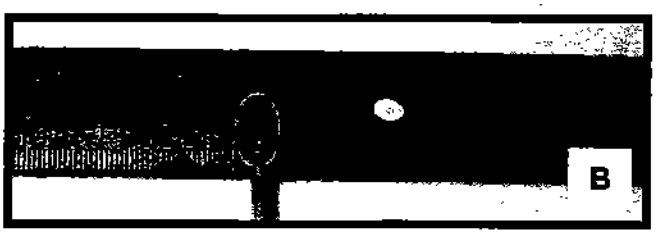


Figure 6. Neurolysis. A) Radiofrequency; B) cryoneuroblation.

for long-term relief in managing chronic refractory low back and lower extremity pain secondary to postlumbar surgery syndrome

ASIPP Treatment Guidelines[12]

Percutaneous adhesiolysis. Percutaneous adhesiolysis procedures are preferably limited to 2 interventions per year with a 3-day protocol and 4 interventions per year with a 1-day protocol.

Spinal endoscopic adhesiolysis. These procedures are preferably limited to a maximum of 2 per year provided the relief is greater than 50% for longer than 4 months.

Facet

The zygapophyseal joints ("z-joints") consist of bony protrusions from the vertebral body above and below an intervertebral disc. The bilateral facets and the disc together make up the "3-joint complex" that allows movement of the spine. Facet arthropathy is the result of increased movement of the facet (caused by loss of height of the disc and/or laxity of the lumbar ligaments). The innervation of the facet is by the median branch of the dorsal median nerve, innervating that facet and the facet below. Diagnostic and therapeutic intra-articular injections can be compared with medial branch blocks (MBB). Positive but temporary response to MBBs is felt to be predictive of positive response to lesioning of the nerve (diagnostic response), however, there also is a potential therapeutic response (Figure 5).

Reviewers are concerned about the potential confounding effects of placebo response for all interventional techniques, but facet MBBs have been—more than other injections—studied specifically for validation of a "double local anesthetic" effect.

ASIPP Systematic Review[12]

Diagnostic medial branch blocks. The accuracy of facet joint nerve blocks is strong in the diagnosis of lumbar facet joint pain.

Intra-articular blocks. There is moderate evidence for short- and long-term improvement in managing low back pain with intra-articular injections of local anesthetics and steroids.

Medial branch blocks. The evidence for lumbar MBBs in managing chronic low back is moderate for short- and long-term pain relief.

ASIPP Treatment Guidelines[12]

Facet joint injections and MBBs. In the diagnostic phase, a patient may receive 2 procedures at intervals of no sooner than 1 week, or preferably 2 weeks.

In the therapeutic phase (after completion of the diagnostic phase), the suggested frequency would be 2 to 3 months or longer between injections, provided that greater than 50% relief is obtained for 6 weeks. If the interventional procedures are applied for different regions, they may be performed at intervals of no sooner than 1 week or preferably 2 weeks for most

types of procedures. It is suggested that therapeutic frequency remain at 2 months for each region. It is further suggested that all regions be treated at the same time, provided all can be performed safely.

In the treatment or therapeutic phase, the interventional procedures should be repeated only as necessary according to the medical necessity criteria, and it is suggested that these be limited to a maximum of 4 to 6 times for local anesthetic and steroid blocks for a period of 1 year per region.

Under unusual circumstances with a recurrent injury or cervicogenic headache, procedures may be repeated at intervals of 6 weeks after stabilization in the treatment phase.

Facet Neurotomy

Once the pathology of the facet has been confirmed by MBBs, relatively few options exist for long-term relief. Radiofrequency (RF) lesioning has been the most studied, although other techniques, such as cryoneuroablation, pulsed RF lesioning, and neurolytic injections (usually phenol), have been described. By denervating the joint (comparable to performing root canal on a painful tooth), long-term relief of facet-related pain can be achieved (Figure 6).

ASIPP Systematic Review[12]

Medial branch neurotomy. Evidence for RF neurotomy of the medial branch of the cervical spine using the techniques with multiple lesioning and strict criteria of 100% pain relief with diagnostic blocks—a tedious and time-consuming procedure—is strong for short- and long-term relief of cervical facet joint pain. Using traditional RF neurotomy techniques as practiced in the United States in the cervical and lumbar region, the evidence for RF neurotomy of medial branches is strong for short-term and moderate for long-term relief. Evidence for cryodenervation and pulsed RF is indeterminate.

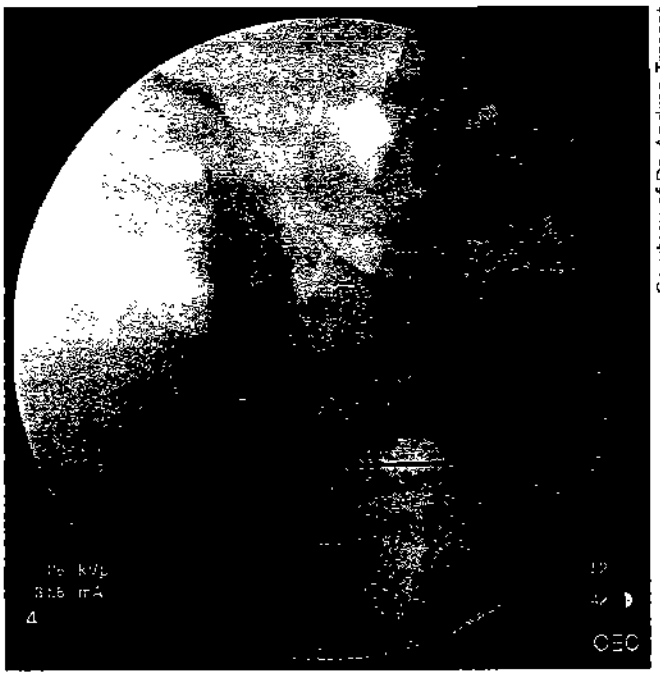
ASIPP Treatment Guidelines[12]

Medial branch neurotomy. The suggested frequency of medial branch neurotomy would be 3 months or longer (maximum of 3 times per year) between each procedure, provided that greater than 50% relief is obtained for 10 to 12 weeks.

The therapeutic frequency for medial branch neurotomy should remain at intervals of at least 3 months for each region. It is further suggested that all regions be treated at the same time, provided all procedures are performed safely.

Sacroiliac Injections

The sacroiliac (SI) joint is a diarthrodial synovial joint with abundant innervation and a capacity to serve as a pain generator. The SI joint was the primary suspect in low back pain prior to the 1934 work of Mixter and Barr, who described disc herniation as the source of pain in the lumbar spine. Because of the unique biomechanical associations of the sacral joint and the pelvis, and the rich innervation that it supports, no singular diagnostic test can isolate this joint, nor are there specific tests that define other tissues in the spine as unique painful entities. The evidence supporting the SI joint as a pain generator was largely empirical prior to precision-guided injections. The sacral joint was assumed to be a pain generator, and treated conservatively, generally with mixed outcomes. Even in experienced hands, blind injections rarely found their target.[25]



Courtesy of Dr. Andrea Trescot

Figure 7. Sacroiliac injection.

Often mistaken for radiculopathy, the SI joint is responsible for at least 20% of back and leg pain presentations to physician offices.[26] It is an uncontested source of pain; cannot be ignored anatomically, historically, or by pain presentation; and is not fully appreciated in its ability to create chronic pain (Figure 7).

Relief with intra-articular injections is considered short term at less than 6 weeks and long term at 6 weeks or longer. Relief with RF neurotomy is considered short term at less than 3 months, and long term at 3 months or longer. The defining relief of pain by injecting this joint assists the physician and care provider in developing pathways to physical rehabilitation, and avoids surgery and further expense to society.

ASIPP Systematic Review[12]

Diagnostic sacroiliac injections. In terms of the accuracy of diagnosis of SI joint pain, these injections have proved only moderately useful.

Intra-articular injections. The evidence for intra-articular SI joint injections is limited for short- and long-term relief.

Radiofrequency neurotomy. The evidence for thermal and pulsed RF neurotomy in managing SI joint pain is limited.

ASIPP Treatment Guidelines[12]

Sacroiliac Joint Injections. In the diagnostic phase, a patient may receive 2 SI joint injections at intervals of no sooner than 1 week or preferably 2 weeks. In the therapeutic phase (on completion of the diagnostic phase), the suggested frequency would be 2 months or longer between injections, provided that greater than 50% relief is obtained for 6 weeks.

If the procedures are done for different joints, they may be performed at intervals of no sooner than 1 week or preferably 2 weeks. It is suggested that therapeutic frequency remain at 2 months for each joint. It is further suggested that both joints be treated at the same time, provided the injections can be performed safely.

In the treatment or therapeutic phase, interventional procedures should be repeated only as necessary according to the medical necessity criteria, and it is suggested that these be limited to a maximum of 4 to 6 times for local anesthetic and steroid blocks over a period of 1 year per region.

Under unusual circumstances with a recurrent injury, procedures may be repeated at intervals of 6 weeks after stabilization in the treatment phase.

Sacroiliac Joint Radiofrequency Neurotomy. The suggested frequency of SI joint RF neurotomy is 3 months or longer between each procedure (maximum of 3 times per year), provided that greater than 50% relief is obtained for 10 to 12 weeks.

The therapeutic frequency for neurotomy should remain at intervals of at least 3 months for each region. It is further suggested that all regions be treated at the same time, provided all procedures are performed safely.

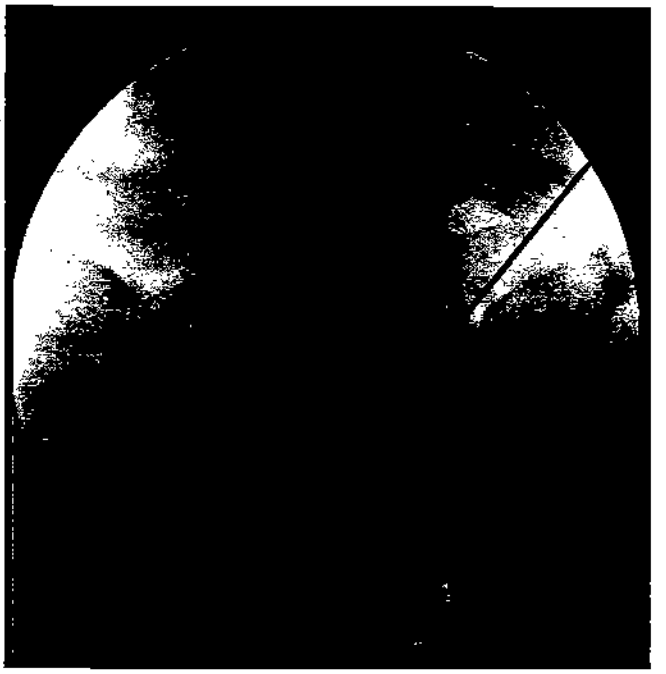
Intradiscal Therapies: Annular

Some forms of back pain may be due to internally disrupted intravertebral discs, especially those with sensitized annular tears.[27] Unfortunately, most of the disc treatments available are surgical in nature, including total disc excision, fusion, and artificial disc replacement. The diagnosis of painful disc disease cannot be made on MRI or CT, but, rather, requires provocative evaluation, analogous to pushing with a finger or tapping on the tooth. Provocative discography,[28] in combination with patient history, a physical examination, evaluation of imaging studies, and analysis of prior therapies, provides unique information on the morphology and painful pathology of intravertebral disc.

Two minimally invasive disc procedures have been proposed as an alternative to open spine surgery: intradiscal electrotherapy (IDET), and RF posterior annuloplasty (RFA).

IDET involves the placement of a heating wire percutaneously into the disc. Andersson et al,[29] in their systematic review of intractable low back pain treatment with IDET versus spinal fusion surgery, concluded that more than 50% of patients treated with IDET can avoid surgery, thus sparing the expense and possible complications (Figure 8).

RFA involves the placement of a wire within the annulus itself, and is more commonly known by its trade name, discTRODE (ValleyLab). A third thermal technique, biaculoplasty, is too new and has not been studied enough for inclusion.



Courtesy of Dr. Andrea Trescot

Figure 8. Intradiscal electrotherapy.

ASIPP Systematic Review[12]

Provocative discography. The evidence for lumbar discography is strong for management of discogenic pain provided it is performed based on patient history, physical examination, imaging data, and analysis of other precision diagnostic techniques. No evidence exists to support discography without other noninvasive or less-invasive treatment modalities or other precision diagnostic injections.

Intradiscal electrothermal therapy. The evidence for IDET is moderate in managing chronic discogenic low back pain.

Radiofrequency posterior annuloplasty. The evidence for RFA is limited for short-term improvement, and indeterminate for long-term improvement of chronic discogenic low back pain.

Intradiscal Therapy: Percutaneous Discectomy

A herniated intervertebral lumbar disc results from a protrusion of the nucleus pulposus, and was initially called a "chondroma," until Mixter and Barr made their classic observations. A ruptured annulus fibrosus causes an extruded disc, whereas an intact but stretched annulus fibrosus results in a contained disc prolapse, which may compress 1 or more nerve roots, causing pain. The primary goal of surgical treatment of a disc prolapse, protrusion, or extrusion is the relief of nerve root compression by removing the herniated nuclear material. The

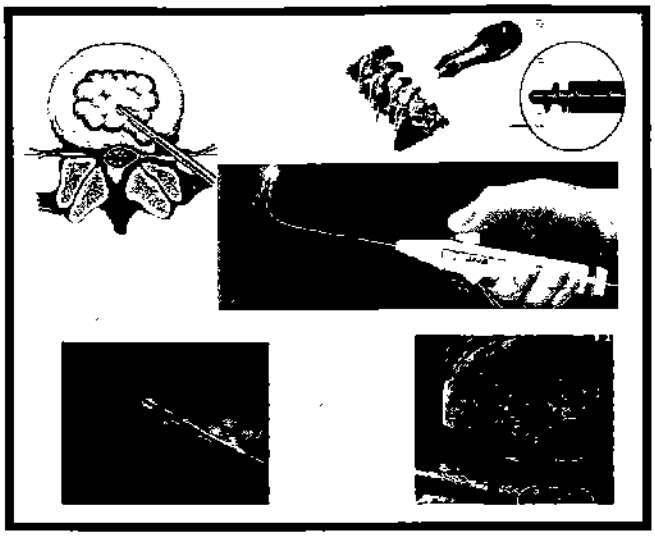


Figure 9. Percutaneous discectomy techniques.

primary modality of treatment has been open discectomy; however, several alternative techniques, including microdiscectomy, chemonucleolysis, automated percutaneous discectomy, laser discectomy, RF coblation or nucleoplasty, mechanical disc decompression known as DeKompressor (Stryker), and manual percutaneous lumbar discectomy have been developed. Each results in the removal of disc material from inside the intact annulus (either by mechanical means or vaporization); the resultant decrease in intradiscal volume decreases the tension on the annular wall and decreases the pressure on the nerve root, thereby decreasing the radicular pain (Figure 9).

ASIPP Systematic Review[12]

Automated percutaneous lumbar discectomy. The evidence is moderate for short-term and limited for long-term relief using this procedure.

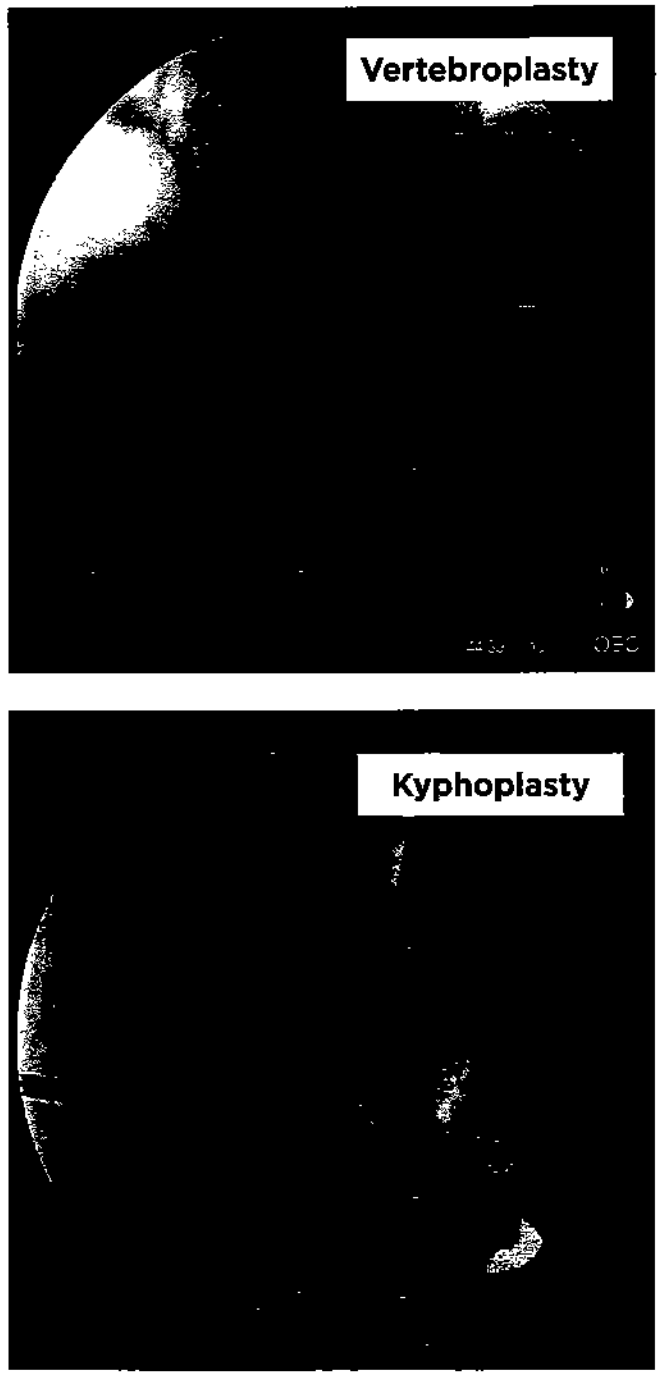
Percutaneous laser discectomy. The evidence is moderate for short-term and limited for long-term relief using percutaneous laser discectomy for pain management.

Nucleoplasty. Nucleoplasty has been shown to provide limited short- and long-term relief.

DeKompressor. The evidence for percutaneous disc decompression using DeKompressor is limited for short- and long-term relief.

Vertebral Augmentation

Vertebral compression fractures (VCFs) are a major health care problem in the United States, not only because of the frequency of these lesions, but also because of their direct and indirect negative consequences for patient quality of life and the costs to the health care system.[30] Vertebral fractures may result in pain at the fracture site, loss of height caused by vertebral collapse, spinal instability, and kyphotic deformity. Until recently, the only treatment for VCFs was



Courtesy of Dr. Ramsin Benyamin

Figure 10. Vertebral augmentation.

bed rest and bracing. However, recently, 2 very effective treatments were developed: vertebroplasty and kyphoplasty.

Vertebroplasty is an outpatient percutaneous technique that involves the placement of a needle (or needles) into the vertebral body, followed by the injection of bone cement. Kyphoplasty is performed similarly, but instead of simply injecting cement, a balloon tampanade is place inside the vertebral body. Inflation of the balloon creates a cavity, which is then filled with cement (Figure 10).

ASIPP Systematic Review[12]

Vertebroplasty. The level of evidence for success of vertebroplasty is moderate.

Kyphoplasty. The level of evidence for success of kyphoplasty is moderate.

Implantable Therapies

Implantable therapies usually refer to spinal cord stimulators (SCS) and intrathecal pumps (ITPs). SCS consists of epidural electrodes placed transcutaneously and connected to a subcutaneous generator or antenna. In the United States, the primary indications for use of SCS are failed back surgery syndrome and complex regional pain syndrome. Other indications have included angina, pelvic pain, and peripheral vascular disease. ITPs provide a continuous infusion of medication into the spinal fluid to treat intractable pain (malignant and nonmalignant) and spasticity (Figures 11 and 12).

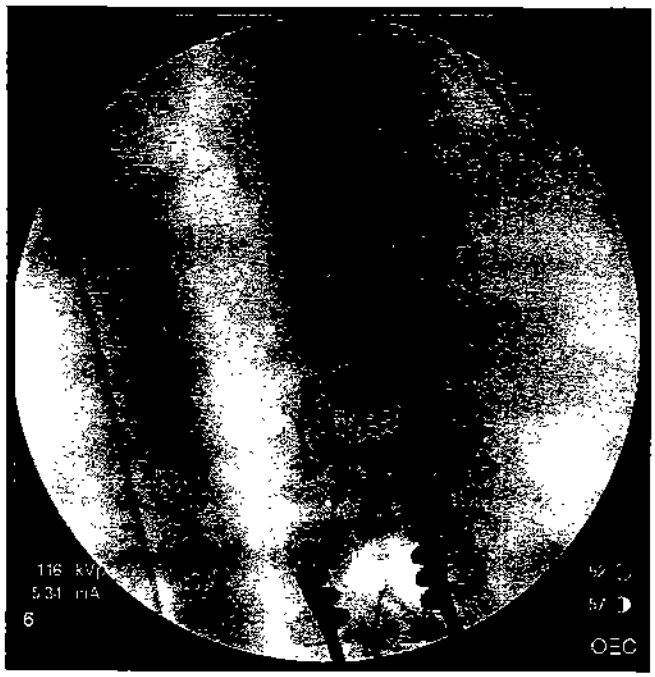
ASIPP Systematic Review[12]

Spinal cord stimulation. The evidence for SCS in failed back surgery syndrome and complex regional pain syndrome is strong for short-term relief and moderate for long-term relief.

Implantable intrathecal drug administration systems. The evidence for implantable intrathecal infusion systems is strong for short-term improvement in pain of malignancy or neuropathic pain. The evidence is moderate for long-term management of chronic pain.

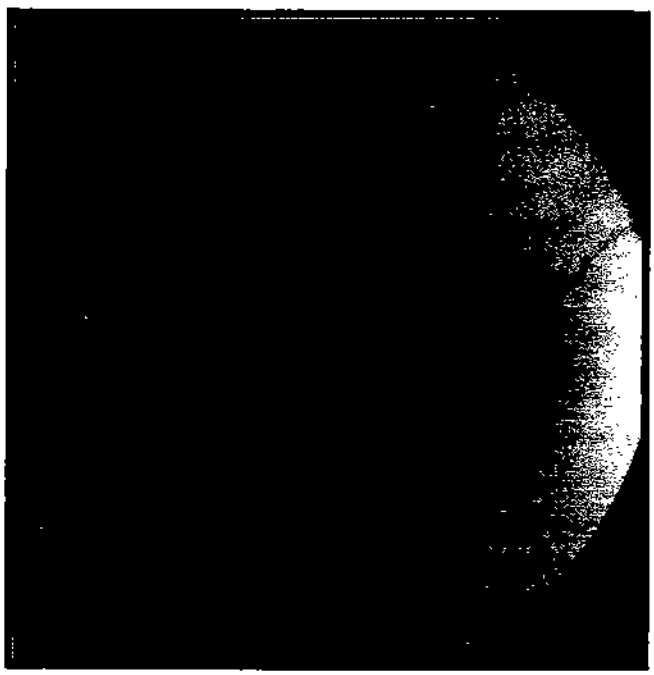
Conclusion

There are many treatments available currently for the diagnosis and treatment of low back pain. Some are well supported by the literature; others are too new to have significant long-term evidence available; whereas others have not been shown to be effective. However, scientific evaluations of interventional pain treatments are difficult to perform because of the subjective nature of pain, the lack of objective tests for pain, and the difficulty in establishing true "controls." When evaluating interventional techniques, it is important to remember, "Lack of evidence in the literature is not evidence of lack of effectiveness."[31]



Courtesy of Dr. Andrea Trescot

Figure 11. Spinal cord stimulators.



Courtesy of Dr. Andrea Trescot

Figure 12. Intrathecal pump.

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