

# LUMBAR RADICULOPATHY, LUMBAR SPINAL STENOSIS, LOW BACK PAIN, AND FAILED BACK SYNDROME

Ligia Viorela Onofrei, MD  
University of Utah Hospitals and Clinics

## Introduction

Even though low back pain with or without limb pain is a very common condition, there is still considerable variation among practitioners in the diagnosis and treatment of this disorder [1]. With escalating costs and burden of disability, it has become increasingly important for physicians to be able to understand the etiology of low back pain with or without referred limb pain, the appropriate diagnostic tests that can be obtained, whether intervention with medications, procedures, or surgery is appropriate, and how to effectively use additional treatments such as physical therapy, chiropractic manipulation, and cognitive behavior therapy. This presentation uses cases to illustrate important concepts in the diagnosis and management of axial back pain, back pain with referred limb pain, lumbar radiculopathy, lumbar spinal stenosis, and failed back surgery syndrome. All cases will be presented in the companion slide presentation with answers provided after the presentation. In order to provide a clinical framework for the assessment and management of patients, it is helpful to classify patients as either having acute or chronic back pain, and also as having primarily axial or primarily radicular back pain [2,3]. The importance of clinically differentiating between patients with primarily axial pain versus patients with primarily radicular pain is driven by the different approaches in diagnosis and treatment of these different pain syndromes [2,3].

## Acute Low back pain with or without radiation to the limb

Acute pain is typically defined as pain lasting less than 3 to 6 months [3, 4, 5].

Low back pain is one of the most common reasons patients are seen by physicians with one quarter of US adults reporting having back pain lasting at least one whole day in the previous 3 months. The number of physician visits for low back pain has remained steady since 1996, at approximately 2% of all physician office visits [2]. A significant proportion of patients have self-limited episodes of low back pain and do not require extensive medical evaluation or treatment [1]. Among the patients who do require evaluation and treatment, most recover sufficiently within the first one to three months [1,2].

Most patients who present for evaluation of low back pain (approximately 85%) have nonspecific low back pain, which means that the cause of their low back pain “cannot be reliably attributed to a specific disease or spinal abnormality” [1]. Patients with back pain may also develop pain that is referred to the limb. While some of the patients with low back and lower limb pain have radiculopathy, there are other possibilities for referred limb pain including hip joint dysfunction, facet arthropathy, and SI joint dysfunction.

A thorough history and physical examination to look for neurological deficits should be undertaken. Most patients with acute back pain and/or limb pain have primarily pain and subjective sensory loss or hyperesthesia rather than objective clinical changes.

Regarding the acute treatment of low back pain, either axial or with limb pain, it is important to educate patients about the typical course: resolution or substantial improvement of symptoms in most patients within the first month. It is also important to encourage patients to continue engaging in physical activities as much as they are able as it has been shown that bed rest results in worse outcomes [1]. Additionally, it is important to educate patients early about the course and nature of back pain, as misinformation can lead to a host of problems including pain catastrophizing and engaging in treatment/activities that can be detrimental to the patient either financially or medically. Pain catastrophizing, in particular, is a maladaptive cognitive response to pain, with patients focusing excessively on the experience of pain, magnifying pain sensations, with most feeling helpless about their ability to manage pain. [6]. Unfortunately, this leads to increased pain and reduction of recovery and adjustment. Research has shown that cognitive behavior therapy which focuses on correcting harmful beliefs and pain catastrophizing behaviors and beliefs while offering strategies to change patterns of thinking and ways to increase relaxation can significantly improve outcomes. [6] On the opposite end of the spectrum, when patients

feel empowered by their abilities to cope with illness, they have better outcomes. Patients who have greater self-efficacy—essentially believing that one can perform a task or respond effectively to a situation, have a reduction in the perceived level of pain and improved functional status and psychological adjustment [6].

In terms of nonpharmacologic therapies, the most recent guidelines of the American College of Physicians (ACP) did find that there is low quality evidence that suggests mild to moderate benefit in terms of improved pain and/or function for acupuncture, massage, heat, and spinal manipulation [3]. While exercise itself did not provide significant benefit when compared to usual care, there was improvement of pain and or function when patients combined exercise with spinal manipulation or superficial heat [3]. Another potential beneficial combination is low level laser therapy and NSAIDs, which showed moderate benefit but again the level of evidence was of low-quality [3]. While laser therapy may be beneficial, most insurance companies do not currently cover this treatment and commercial models range from a two hundred dollars to thousands of dollars, which is cost prohibitive for most patients. Evidence was insufficient to recommend other therapies such as transcutaneous electrical nerve stimulation (TENS) units, electrical muscle stimulation, inferential therapy, short-wave diathermy, traction, superficial cold, motor control exercise, Pilates, tai chi, yoga, psychological therapies, multidisciplinary rehabilitation, ultrasound, and taping [3].

In terms of medications, previous recommendations included both acetaminophen and NSAIDs however the most recent guidelines from the ACP found that acetaminophen is not at all effective and only recommend NSAIDs in the acute phase, with modest improvement compared to placebo [1,3]. The side-effects of NSAIDs include GI issues and HTN, while acetaminophen use is restricted by potential uses in patients with liver dysfunction [1]. While there are no specific dose recommendations for NSAIDs, using scheduled doses two to three times a day for 1-2 weeks in the acute setting may be more helpful than using as needed dosing.

Skeletal muscle relaxants such as cyclobenzaprine, methocarbamol, and carisoprodol continue to have a role in the short term with mild to moderate benefit in the acute phase, although they do have side-effects such as sedation [3].

While the use of oral steroids for back pain is popular, there is currently no evidence of benefit, although the current studies are felt to be too limited to offer a strong recommendation against their use [3].

Opioids have been used in the past for both acute and long term pain including back pain and back pain with radiculopathy. At this stage, there has been a lot of evidence regarding the potential detrimental effects of opioids, with many discussions centering on the potential for dependence and abuse, misuse of opioids, and opioid hyperalgesia. At this point, unfortunately, there is still a paucity of effective agents that can be used in the treatment of acute pain, and as such, the general consensus is that opioids continue to have a role in the treatment of acute pain of all etiologies, including back pain. We must, however, be extremely cautious of the long term use and potential for the aforementioned issues. Dr. Deyo will go into further detail regarding this topic. If opioids are to be used for the treatment of pain, the lowest possible dose must be used in order to avoid side-effects, with the physician and patient engaging in a frank and clear discussion about expectations and length of treatment. At this stage, no data indicates one opioid formulation to be superior in terms of side-effects and/or efficacy [1]. The newest guidelines from the American College of Physicians did not feel the strength of the evidence was sufficient either in favor or against opioids [3].

In an effort to further guide physicians on whether imaging of the low back is indicated, the joint Clinical Guidelines released by the American College of Physicians and the American Pain Society pointed to five potential “red flags”, which, if present in the patients’ history of present illness, would direct the physician to acquire imaging acutely rather than waiting to see how symptoms evolve clinically. The “red flags” point to five disorders in which urgent diagnosis is important: cancer (0.7% of patients), compression fracture (4% of patients), spinal infection (0.01% of patients), cauda equine (0.04% of patients), and ankylosing spondylitis (0.3-5% of patients; I would argue that identification of AS does not have to be done urgently, but that identification of patients is important to be able to institute appropriate treatment) [1]. The factors which were felt to raise a concern for cancer include a personal history of cancer, age greater than 50, unexplained weight loss, and to a lesser extent failure of symptoms to improve after one month [1]. The factors which raise concern for vertebral infection include fever, intravenous drug use, recent infection, relative immunosuppression [1]. Clinicians should be aware that patients with vertebral infection may not have fever at the onset of symptoms, with one study reporting fever in only 30% of patients [7]. The factors which raised concern for compression fractures include history of osteoporosis, use of corticosteroids, and older age [1]. The factors which raised a concern for cauda

equine include urinary retention, motor deficits at multiple levels, fecal incontinence, and saddle anesthesia [1]. The factors which raise a concern for ankylosing spondylitis include morning stiffness, improvement with exercise, alternating buttock pain, awakening due to back pain during the second part of the night, and younger age [1]. While the red flags are felt to be helpful in further stratifying patients, the number of patients with cancer, vertebral infections, cauda equine, and vertebral compression fractures is quite low and there is some controversy whether these red flags are ultimately useful, or whether they lead to unnecessary imaging. One study by Downie et al examined the diagnostic accuracy of red flags to screen for fracture or malignancy. Of the red flags for fracture, the factors that individually increased the probability of fracture to 10-33% were older age, prolonged steroid use, severe trauma, and contusion or abrasion, with the presence of multiple factors further increasing the probability to 42-90% [8]. Of the red flags for malignancy, the only reliable red flag was personal history of cancer, which increased the probability of malignancy to 7-33% [8]. The other red flags for cancer: older age, unexplained weight loss, failure to improve after one month, had post-test probabilities below 3% [8]. These findings point out that further research must be made into the utility of red flags and their use for risk stratification of patients and that clinical judgement must still be exercised when obtaining imaging.

In the absence of “red flags” or significant neurological deficits on examination, most guidelines and clinicians would agree that no imaging is required in the acute setting. This recommendation is derived partly from data showing that most patients with acute low back pain improve within one month and partly from data showing that unnecessary imaging has led to both an increase in direct costs associated with imaging and an increase in indirect costs stemming from further diagnostic testing required for the investigation of incidental findings on imaging [9]. Unfortunately, it does appear that the rise in unnecessary imaging is at least partly because of patient expectations, with higher number of unnecessary MRIs ordered when patients asked for imaging [9]. One way to mitigate this issue is to explain to patients the evidence available and to offer close follow up, possibly supplementing with education materials on the nature and course of back pain and a short guide on different etiologies for back pain [9].

#### Chronic low back and radicular pain

In the chronic setting, the differentiation between axial and radicular pain and back pain due to other etiologies such as facet arthropathy becomes more important because the potential treatments are significantly different.

In this context, if low back or limb pain is persistent (>4-6 weeks duration), obtaining imaging to further direct the diagnosis and management of low back or limb pain may be helpful. X-rays of the low back are useful to see whether there is evidence of spondylolisthesis and to verify alignment. For assessment of spinal cord and nerve roots, MRI of the L spine is preferred because of high resolution. MRI is also preferred as it does not expose patients to radiation. The downside of MRIs is the cost and duration of the scan. CT myelogram can also be used, however it offers a more limited visualization of neural structures including the nerve root, which is only visualized up to the border of the dural sleeve that encapsulates it. Other downsides of CT myelograms are: puncture of the dura, with the risk of spinal headache, and exposure to radiation. CT is superior to MRI in that it is less susceptible to metal artifact, so if hardware is present, CT myelogram may be a better choice than MRI.

#### Subacute/chronic radiculopathy

If patients have lumbosacral radiculopathy with significant weakness and pain as well as evidence of spinal nerve compression, surgical intervention to relieve compression of the nerve root is clearly indicated.

In clinical practice, however, we are often confronted with patients without significant weakness but persistent debilitating sensory symptoms as well as evidence of spinal nerve compression. The appropriate intervention, either medical or surgical, and whether surgery is or is not indicated for this patient population is more nuanced.

In terms of conservative treatments, there are a variety of medical and interventional options. Epidural steroid injections have been shown to have benefit in terms of pain and function in patients with lumbar radiculopathy, with higher benefit in the short term than the long term [10]. In one study of patients randomized to either transforaminal epidural steroid injection or trigger point injections in addition to a rehabilitation program, 84% of the patients who received transforaminal epidural steroid injections had a successful outcome at 1.4 years compared to 48% of the patients who received trigger point injections [11]. In addition, patients who received

epidural steroid injections achieved maximal improvements at 6 weeks compared to 12 weeks for the patients receiving trigger point injections [11]. Interestingly, a recent meta-analysis which attempted to define benefit in terms of clinically meaningful improvement (50% relief from baseline pain score or a change of at least 3 point on an 11 point scale, or a 30% or greater decrease in disability scores), did not find that epidural steroid injections resulted in significant benefit over placebo [12]. The downsides of epidural steroid injections include cost, exposure to radiation, and potential complications related to the procedure.

While NSAIDs and muscle relaxers are an option, the evidence for using them for this patient population is lacking. The use of oral steroids for chronic radicular pain is not supported, although larger studies are needed to definitively recommend for or against. A significant proportion of patients with chronic radiculopathy are prescribed neuropathic pain agents which include antiepileptic medications such as gabapentin and pregabalin and selective norepinephrine reuptake inhibitors such as duloxetine. The evidence supporting AEDs is conflicting. In one observational study of patients with radiculopathy treated in a primary care setting in the UK, patients who were treated with pregabalin had improvement in pain as well as a reduction of health care utilization [13]. The downside of this particular study was that it was not a randomized controlled study and that the duration was only 12 weeks, which is inadequate to examine long term health care utilization. Other studies which showed that pregabalin were no more effective than placebo were quite short in duration, with less than 4 weeks, which is a considerable flaw as most patients in clinical practice are advised to try a neuropathic pain agents for a minimum of 6-8 weeks [14, 15]. Even a medication such as Gabapentin which has been used for a very long time for neuropathic pain lacks significant research backing its use in radiculopathy. Small studies have supported the use of both gabapentin and duloxetine, however larger studies would be needed to confirm these findings [16, 17].

EMG/NCS studies are typically not necessary in the setting of chronic radicular symptoms if symptoms and imaging are concordant. If other issues such as peripheral mononeuropathy or peripheral polyneuropathy are suspected, EMG/NCS can be of diagnostic value. In some cases, even when there is concordance between symptoms and imaging, EMG/NCS can be helpful to see whether there is significant denervation or whether the bulk of deficits is due to pain in order to offer specific recommendations regarding return to work.

Some studies have indicated that lumbar decompression for patient with radiculopathy is more effective compared to non-surgical treatment [18]. The SPORT trial randomized patients with lumbar radiculopathy due to disk herniation with symptoms for at least 6 weeks to either surgery or observation, but due to high cross-over between the two groups, no meaningful comparison could be made between the two groups [19]. Interestingly, when comparing the outcomes in the observational cohort of the SPORT trial, patients who underwent surgery reported better outcomes for both function and pain at one year, although the differences were less significant at two years [20]. A well done study by Peul et al published in 2007 showed that the one year outcomes for patients with sciatica were the same whether patients had had early surgery (mean of 2.2 weeks) or conservative treatment with eventual surgery if needed [21]. Recovery, however, was slightly faster in the surgical group compared to the group treated conservatively [22]. Approximately 39% of the patients initially treated conservatively were treated surgically after a mean of 18.7 weeks [21]. The risk of decompressive surgery for lumbar radiculopathy is small, with low rates of complication and re-operation rate of approximately 5% [19]. Based on this evidence, surgery clearly has a role in patients with persistent radiculopathy, although conservative treatment should not be discounted. More importantly, studies like this demonstrate that it is not detrimental to wait, which is something that patients often worry about.

## Lumbar stenosis

Lumbar spinal stenosis is often due to a combination of various degenerative spondylitic changes such as disc herniation, facet arthropathy, vertebral bony spurs, and thickening of the ligamentum flavum. Lumbar spinal stenosis symptoms are called pseudoclaudication or neurogenic claudication and are secondary to compression of the nerve roots in the central canal, at the level of stenosis. Typically, patients describe pain, numbness/tingling or heaviness in the legs. The leg symptoms are highly variable depending on the level affected, with symptoms in the entire leg, part of the leg (either from hip to knee or knee to hip) or symptoms of radiculopathy. Additionally, patients may have low back pain, often described as a “band-like” distribution in the low back/buttocks. Patients with lumbar stenosis typically have worsening of their symptoms with maneuvers that cause extension of the spine, such as walking, which causes slight incremental narrowing of the central canal; conversely, there is an improvement of symptoms with maneuvers that cause flexion of the spine, such as bending forward or sitting, which causes slight incremental widening of the central canal. Typically, pain is significantly improved as soon as patients sit down and resolves within minutes.

The history is probably the most reliable clinical indicator for the presence of lumbar stenosis, as the examination findings are nonspecific [23]. While patients may have a combination of sensory loss (vibration, pin prick) and decreased distal reflexes, these findings are relatively common in older individuals or individuals with peripheral neuropathy. Mild to moderate bilateral or unilateral lower limb weakness may be present in up to a third of patients. Observing patients as they walk may be the most helpful, as patients can sometimes unconsciously start bending at the waist soon after they begin ambulating, but may not be aware of this and thus may not report it.

Imaging is helpful in confirming diagnosis and excluding alternative causes of symptomatic stenosis such as tumors. MRI and CT myelogram are best able to demonstrate neural structures. X-rays of the lumbar spine are helpful in demonstrating whether there is evidence of spondylolisthesis.

EMG is typically not helpful in diagnosis as changes tend to be nonspecific, although EMG can be helpful in understanding if concurrent issues such as radiculopathy or peripheral neuropathy are present.

Nonsurgical treatment of lumbar stenosis is typically limited in efficacy. Muscle relaxants and NSAIDs are typically not helpful due to the intermittent nature of the symptoms. Neuropathic pain agents similarly have a limited role.

The mainstay of treatment for lumbar stenosis remains surgical decompression [22]. Decompression can be achieved either by laminectomy or laminectomy coupled with fusion if there is potential for instability. The timing of surgery does not need to be urgent, with very few patients experiencing abrupt deterioration [24]. While some of the long term observational studies of patients with lumbar stenosis demonstrate that patient who do not undergo surgery have stable symptoms and may be able to continue having acceptable pain control and function levels, most of the studies are limited by the fact that patients with more severe symptoms and clinical findings undergo surgical decompression [24]. While patients typically experience sustained relief of limb symptoms with surgery, back pain is similar in the long term in patients who undergo surgery compared to the patients who do not [25]. This further illustrates the point that surgery for lumbar spinal stenosis should not be undertaken if the only symptom is low back pain.

#### Chronic axial low back pain

One recent systematic review of patients with low back pain in primary care did show that, while patients recover sufficiently to go back to work, up to 65% of patients report continued back pain at one year (although no comment was made on the intensity of the pain) [5]. Other studies have shown that up to one in five patients report substantial limitations in activity at one year [1].

For most patients, finding a precise diagnosis for low back pain is difficult. Evaluations are generally structured towards finding a cause that may be amenable to medical or surgical intervention.

While exercise alone was not found to be superior to usual care in the acute setting, moderate quality evidence does show that in the chronic setting there were small improvements in both pain relief and function in patients who exercises, although the type of exercise did not seem to matter [3]. Similarly, patients with radiculopathy had modest improvements with exercise [3].

Psychological therapies such as progressive relaxation therapy, electromyography biofeedback training, operant therapy (behavior therapy involving reinforcement), cognitive behavior therapy, mindfulness based stress reduction demonstrated mild to moderate reduction of pain [3]. Only progressive relaxation therapy has been show to result in a mild improvement in function [3].

Other therapies such as massage, acupuncture, spinal manipulation, TENS unit, lumbar support, superficial cold, or taping either had insufficient evidence or no clear benefit in the long term [3].

NSAIDs have been shown to have small to moderate improvement in chronic low back pain, while there is insufficient evidence for the long term use of skeletal muscle relaxants [3]. The American College of Physicians recommends the use of duloxetine as a second line therapeutic agent, with other therapies such as TCAs and SSRIs not recommended based on the available evidence [3].

As discussed above, while opioids are controversial, they are used in a large number of patients for the treatment of chronic conditions. Current evidence suggests that opioids and tramadol do offer improvement in terms of pain control, however the current evidence only shows small, short-term improvement of pain scores (approximately one point on a 0 to 10 scale) and small short-term improvement of function, with no significant difference between formulations [3]. Based on the available data, the ACP does recommend tramadol as a second line pharmacological treatment and recommends use of opioids only after other alternatives are exhausted [3].

The facet (or zygapophyseal joint) can be a significant source of axial back pain. The medial branches of the dorsal rami of the spinal nerves innervate the facet joints, with each facet joint receiving innervation from two vertically adjacent medial branches. While certain features such as increased pain with walking or activities in which the spine is primarily extended or positive lumbar quadrant loading tests may be suggestive of facet arthropathy, neither clinical features or physical exam findings are reliable indicators of facet arthropathy as a potential cause for back pain [26]. In order to understand the source of pain, some patients may be candidates for medial branch blocks which use local anesthetics like lidocaine or bupivacaine. The patient receives the block then attempts usual activities that cause pain to see if there is meaningful improvement. Most insurance companies require two rounds of medial branch blocks with significant improvement in order for patients to qualify for radiofrequency ablation of the medial branches, which results in prolonged benefit. Because the false positive rate of a single medial branch block in the lumbar spine is 17-47% (depending on the study), it appears that requiring two separate medial branch blocks is appropriate and enhances diagnostic specificity [27]. There has been much controversy on whether radiofrequency ablation is effective. Several randomized controlled studies have suggested it was ineffective in relieving back pain, but a careful examination of those studies has shown that the technique used in the studies was inadequate and would not have likely resulted in ablation of the nerve [26]. One study in which correct technique was used demonstrated that 80% of patients obtained at least 60% relief of pain, with 60% of patients having at least 80% relief of their pain [26].

The disc itself is believed to be a potential source of axial pain, although the precise mechanism is still unclear [28]. Progressive degeneration of the disc leads to annular tears, which may cause pain [5]. Also, when the disc degenerates, there is nerve and vascular ingrowth into the disc, which can lead to pain when these neural elements are exposed to inflammatory mediators [2]. The treatment for discogenic pain remains controversial, with some advocating fusion and some disputing the long term clinical utility of fusion. Discography has been used as a diagnostic tool to ascertain whether a certain disc causes pain, with the examiner injecting saline and gradually increasing the volume and pressure [28]. Reproduction of pain is considered a positive response for the test [28]. It has been argued that if a specific disc can be identified as the source of pain, patients have a higher chance of obtaining relief with surgical intervention such as fusion or total disc arthroplasty, although the supporting data is limited [28]. Conversely, it has been argued that in patients with low back pain and negative discography or in which too many levels are positive, surgery should probably not be undertaken [28].

The role of surgery for low back pain is controversial. Some studies have found improvement while others have shown no difference in outcomes between lumbar fusion and conservative therapies for back pain [29]. A large 2013 systematic review in Spine concluded that fusion surgery is a viable option for chronic low back pain that is refractory to non-surgical treatments in patients in which level-specific disc degeneration could be radiographically confirmed [29]. In general, however, the heterogeneity of study populations, patient selection, surgery timing, and study methodologies makes it difficult to apply clinically across all patients with back pain. A different systematic review in Spine in 2009 showed that for nonradicular low back pain, fusion surgery had the same outcome as intensive rehabilitation with a cognitive-behavioral emphasis, although it was slightly more effective than nonintensive non-surgical therapy [22]. Total disc replacement was found to have similar outcomes to fusion [22].

When patients have complex pain management needs, referral to a reputable, multidisciplinary pain clinic should be considered.

#### Failed back surgery syndrome (FBSS)

Failed back surgery syndrome is also known in the literature as Failed back syndrome or Post Laminectomy Syndrome. It refers to recurring low back pain and/or sciatica following lumbar surgery [30]. The incidence of FBSS is commonly quoted as 10-40% [30]. Causes of FBSS can be classified as preoperative, intra-operative, and post-operative [30]. Preoperative factors of note that are known to contribute to poor outcomes include

psychological risk factors such as depression, anxiety, poor coping skills, somatization, and hypochondriasis, as well as the presence of a personal injury claim [30]. Other factors that may contribute to poor outcomes include poor patient selection (such as performing a microdiscectomy on a patient with axial low back pain), poor surgery selection, and performing recurrent surgeries [30]. Each subsequent surgery decreases the likelihood of a good outcome and increases likelihood of spinal instability [30]. In terms of intraoperative issues, risk factors for bad outcomes include; poor technique which leads to incomplete decompression or residual disc material and spurs, overaggressive decompression which leads to instability, inadequate placement of spinal hardware, and incorrect level of operation (2.1-2.7%). In terms of post-surgical factors, there are a number of potential issues that arise. Obviously, there are direct complications of surgery such as disc space infection, spinal or epidural hematoma, or nerve root injury [30]. Injury of the paraspinal muscles can result in pain as can changes in posture due to paraspinal muscle atrophy or hardware placement [30]. Obviously, patients may have back pain due to a different reason than the reason for which surgery was performed. For example, patients may have concurrent radiculopathy and facet arthropathy, and unless patients are fused at the level generating their pain, the pain from facet arthropathy will not improve [30]. One study reported the prevalence of lumbar facet pain in failed back surgery patients was approximately 16% [27] When patients undergo fusion, they may experience increase pain due to structural issues at the segments above or below. Another potential issue is the development of new pathology: recurrent disc herniation, disc herniation at a different level, progression of degeneration, and instability.

For patients with back pain after back surgery, therefore, we must first make sure they are not suffering from a direct complication of surgery, and a history and physical should then be undertaken to see whether they have a potentially new reason or residual, untreated issue, of their back pain. Unfortunately, a number of patients will undergo surgery even though surgery is not indicated for their complaint, and will have persistent back pain even though they do not have complications from surgery. If patients do not have a cause for back pain which can be addressed with interventions such as radiofrequency ablation, then the same interventions used for treatment of chronic low back pain or chronic radicular pain can be applied. One method often overlooked are intensive, multidisciplinary pain rehabilitation programs, which employ physical therapy, psychological techniques, and complementary and alternative techniques with the goal of decreasing pain and improving functioning. Unfortunately, this type of rehabilitation is not widely available and insurance companies may or may not cover it, which becomes financially problematic for patients.

A potential option for patients with severe pain is spinal cord stimulation (SCS), which has been used for more than 40 years for the treatment of chronic, refractory pain. SCS can be used for back pain or limb pain, as well as chronic neuropathic pain. Typically, patients are evaluated by a physician who can perform a spinal cord stimulator trial. If the trial is successful, then patients are implanted with the device. It is important that patients undergo a thorough evaluation previous to implantation, as certain medical conditions carry absolute or relative contraindications. Absolute contraindications may be issues such as having an unacceptable surgical risk or having unresolved major psychiatric illness [31]. Relative contraindications include anticoagulation therapy, presence of a cardiac defibrillator, and substance abuse [31]. While some studies have shown moderate quality data to support the use of SCS in the short term, there is still debate as to the long term efficacy of these devices [32]. In one study in patients with a co-existing worker's compensation claim, there was no efficacy of spinal cord stimulators compared to patients who received standard medical treatment [32]. A large proportion of patients (30-45%) have complications relating to the SCS and no reliable data exists as to how many patients eventually turn the stimulators off due to side-effects or lack of efficacy [31, 33,]. Given all this, I would suggest that spinal cord stimulators should be recommended cautiously and patients chosen very carefully.

## References

- [1]: Chou R, Qaseem A, Snow V, Casey D, Cross JT Jr, Shekelle P, Owens DK; Clinical Efficacy Assessment Subcommittee of the American College of Physicians; American College of Physicians; American Pain Society Low Back Pain Guidelines Panel. Diagnosis and treatment of low back pain: a joint clinical practice guideline from the American College of Physicians and the American Pain Society. *Ann Intern Med.* 2007 Oct 2;147(7):478-91.
- [2]: Hooten WM, Cohen SP. Evaluation and Treatment of Low Back Pain: A Clinically Focused Review for Primary Care Specialists. *Mayo Clin Proc.* 2015 Dec;90(12):1699-718.
- [3]: Qaseem A, Wilt TJ, McLean RM, Forciea MA; Clinical Guidelines Committee of the American College of Physicians. Noninvasive Treatments for Acute, Subacute, and Chronic Low Back Pain: A Clinical Practice Guideline From the American College of Physicians. *Ann Intern Med.* 2017 Feb 14. doi: 10.7326/M16-2367. [Epub ahead of print]
- [4]: Manchikanti L, Singh V, Datta S, Cohen SP, Hirsch JA; American Society of Interventional Pain Physicians. Comprehensive review of epidemiology, scope, and impact of spinal pain. *Pain Physician.* 2009 Jul-Aug;12(4):E35-70.
- [5]: Itz CJ, Geurts JW, van Kleef M, Nelemans P. Clinical course of non-specific low back pain: a systematic review of prospective cohort studies set in primary care. *Eur J Pain.* 2013 Jan;17(1):5-15.
- [6] Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education, and Research (2011) <https://doi.org/10.17226/13172>
- [7] Torda AJ, Gottlieb T, Bradbury R. Pyogenic vertebral osteomyelitis: analysis of 20 cases and review. *Clin Infect Dis.* 1995 Feb;20(2):320-8.
- [8] Downie A, Williams CM, Henschke N, Hancock MJ, Ostelo RW, de Vet HC, Macaskill P, Irwig L, van Tulder MW, Koes BW, Maher CG. Red flags to screen for malignancy and fracture in patients with low back pain. *Br J Sports Med.* 2014 Oct;48(20):1518
- [9] Chou R, Qaseem A, Owens DK, Shekelle P; Clinical Guidelines Committee of the American College of Physicians. Diagnostic imaging for low back pain: advice for high-value health care from the American College of Physicians. *Ann Intern Med.* 2011 Feb 1;154(3):181-9
- [10] Buenaventura RM, Datta S, Abdi S, Smith HS. Systematic review of therapeutic lumbar transforaminal epidural steroid injections. *Pain Physician.* 2009 Jan-Feb;12(1):233-51.
- [11] Vad VB, Bhat AL, Lutz GE, Cammisa F. Transforaminal epidural steroid injections in lumbosacral radiculopathy: a prospective randomized study. *Spine (Phila Pa 1976).* 2002 Jan 1;27(1):11-6.
- [12] Manchikanti L, Knezevic NN, Boswell MV, Kaye AD, Hirsch JA. Epidural Injections for Lumbar Radiculopathy and Spinal Stenosis: A Comparative Systematic Review and Meta-Analysis. *Pain Physician.* 2016 Mar;19(3):E365-410.
- [13] Saldaña MT, Navarro A, Pérez C, Masramón X, Rejas J. A cost-consequences analysis of the effect of pregabalin in the treatment of painful radiculopathy under medical practice conditions in primary care settings. *Pain Pract.* 2010 Jan-Feb;10(1):31-41.
- [14] Malik KM, Nelson AM, Avram MJ<sup>1</sup>, Robak SL, Benzon HT. Efficacy of Pregabalin in the Treatment of Radicular Pain: Results of a Controlled Trial. *Anesth Pain Med.* 2015 Aug 22;5(4)
- [15] Baron R, Freynhagen R, Tölle TR, Cloutier C, Leon T, Murphy TK, Phillips K; A0081007 Investigators. The efficacy and safety of pregabalin in the treatment of neuropathic pain associated with chronic lumbosacral radiculopathy. *Pain.* 2010 Sep;150(3):420-7.
- [16] Schukro RP, Oehmke MJ, Geroldinger A, Heinze G, Kress HG, Pramhas S. Efficacy of Duloxetine in Chronic Low Back Pain with a Neuropathic Component: A Randomized, Double-blind, Placebo-controlled Crossover Trial. *Anesthesiology.* 2016 Jan;124(1):150-8.
- [17] Yildirim K, Deniz O, Gureser G, Karatay S, Ugur M, Erdal A, Senel K. Gabapentin monotherapy in patients with chronic radiculopathy: the efficacy and impact on life quality. *J Back Musculoskelet Rehabil.* 2009;22(1):17-20.
- [18] Gibson JN, Grant IC, Waddell G. The Cochrane review of surgery for lumbar disc prolapse and degenerative lumbar spondylosis. *Spine (Phila Pa 1976).* 1999 Sep 1;24(17):1820-32.
- [19] Weinstein JN, Tosteson TD, Lurie JD, Tosteson AN, Hanscom B, Skinner JS, Abdu WA, Hilibrand AS, Boden SD, Deyo RA. Surgical vs Nonoperative Treatment for Lumbar Disk Herniation, The Spine Patient Outcomes Research Trial (SPORT): A Randomized Trial. *JAMA.* November 22/29, 2006—Vol 296, No. 20
- [20] Weinstein JN, Lurie JD, Tosteson TD, Skinner JS, Hanscom B, Tosteson AN, Herkowitz H, Fischgrund J, Cammisa FP, Albert T, Deyo RA. Surgical vs nonoperative treatment for lumbar disk herniation: the Spine Patient Outcomes Research Trial (SPORT) observational cohort. *JAMA.* 2006 Nov 22;296(20):2451-9.



- [21] Peul WC, van Houwelingen HC, van den Hout WB, Brand R, Eekhof JA, Tans JT, Thomeer RT, Koes BW; Leiden-The Hague Spine Intervention Prognostic Study Group. Surgery versus prolonged conservative treatment for sciatica. *N Engl J Med*. 2007 May 31;356(22):2245-56.
- [22] Chou R, Baisden J, Carragee EJ, Resnick DK, Shaffer WO, Loeser JD. Surgery for low back pain: a review of the evidence for an American Pain Society Clinical Practice Guideline. *Spine (Phila Pa 1976)*. 2009 May 1;34(10):1094-109.
- [23] Bartleson J D, Deen H G, *Spine Disorders: Medical and Surgical Management*, Cambridge University Press; (July 23, 2009)
- [24] Benoist M. The natural history of lumbar degenerative spinal stenosis. *Joint Bone Spine*. 2002 Oct;69(5):450-7.
- [25] Atlas SJ, Keller RB, Wu YA, Deyo RA, Singer DE. Long-term outcomes of surgical and nonsurgical management of lumbar spinal stenosis: 8 to 10 year results from the maine lumbar spine study. *Spine (Phila Pa 1976)*. 2005 Apr 15;30(8):936-43.
- [26] Bogduk N. Evidence-informed management of chronic low back pain with facet injections and radiofrequency neurotomy. *Spine J*. 2008 Jan-Feb;8(1):56-64. doi: 10.1016/j.spinee.2007.10.010.
- [27] Sehgal N, Dunbar EE, Shah RV, Colson J. Systematic review of diagnostic utility of facet (zygapophysial) joint injections in chronic spinal pain: an update. *Pain Physician*. 2007 Jan;10(1):213-28.
- [28] Bogduk N, Aprill C, Derby R. Lumbar discogenic pain: state-of-the-art review. *Pain Med*. 2013 Jun;14(6):813-36.
- [29] Phillips FM, Slosar PJ, Youssef JA, Andersson G, Papatheofanis F. Lumbar spine fusion for chronic low back pain due to degenerative disc disease: a systematic review. *Spine (Phila Pa 1976)*. 2013 Apr 1;38(7):E409-22.
- [30] Chan CW, Peng P. Failed back surgery syndrome. *Pain Med*. 2011 Apr;12(4):577-606.
- [31] Yampolsky C, Hem S, and Bendersky D. Dorsal column stimulator applications. *Surg Neurol Int*. 2012; 3(Suppl 4): S275–S289.
- [32] Turner JA, Hollingworth W, Comstock BA, Deyo RA. Spinal cord stimulation for failed back surgery syndrome: outcomes in a workers' compensation setting. *Pain*. 2010 Jan;148(1):14-25.
- [33] Taylor RS, Van Buyten JP, Buchser E. Spinal cord stimulation for chronic back and leg pain and failed back surgery syndrome: a systematic review and analysis of prognostic factors. *Spine (Phila Pa 1976)*. 2005 Jan 1;30(1):152-60.