

# Chapter 2

## Role of Spinal Surgery in Pain Management

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### Key Points

- The most common pathologies addressed with spinal surgery are compressive in etiology, and the goal of surgery is decompression of the neural elements.
- Neuropathic pain is complex, often encountered with dysesthetic pain and allodynia. This is indicative of pathology of the central or peripheral nervous tissue, or both.
- While radicular and claudicant-type symptoms are most often associated with compressive lesions of a peripheral nerve, the origin of axial back pain can be multifactorial, which necessitates appropriate work-up.
- Spinal decompression and stabilization are unlikely to adequately relieve neuropathic pain symptoms.
- A high prevalence of failed back surgery syndrome approaching 40 % suggests that a multidisciplinary approach may be needed to triage candidates appropriately to targeted surgical and nonsurgical pain treatments.

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## Introduction

Back pain due to spinal etiologies accounts for the second most common reason for a patient consultation in the primary care setting [1]. Furthermore, while most back pain is transient, and the time course is self-limiting, the estimated lifetime prevalence of low back pain (LBP) is estimated to be greater than 90 %, which means that nearly all patients will suffer from this ailment at some point in their lives leading to medical consultation [2]. The prevalence and incidence of chronic back pain are even less well understood, in part due to the lack of agreement on the minimum duration of pain that is required in order to meet the definition of chronic pain—often in as few as 7 weeks. The most general definition of chronic pain is where the pain persists beyond the expected time period for a given pathology.

For most patients, symptoms subside after the first-time onset. For the less fortunate, LBP persists after a trial of analgesic medication, and physical therapy, leading to consultation with a spine specialist. Further complicating spinal pain is the large number of patients thought to seek treatment for chronic LBP due to psychiatric, work-related/socioeconomic, or any kind of secondary gain issue [1]. Regardless of the stated reason, longitudinal studies link chronic spinal pain with depression and disability [2, 3]. Obtaining a proper diagnosis of spinal pain is difficult, and requires a careful history from the patient.

As highlighted in Chap. 1, “Identification of Pain Patients,” the efficient design of the neurologic or orthopedic surgery practice in patient selection is to maximize appropriate candidates for surgical treatment. Often, those that are given an appointment with a spine surgeon have undergone evaluation by a primary care doctor or clinician with painful symptomatology and have obtained diagnostic imaging suggestive of a corresponding compressive lesion. The authors will highlight in this chapter that not all of these patients may require surgical decompression for neural compromise. Evidence of the complexity of pain generators that are initially overlooked and do not respond to surgical decompression alone is illustrated by the high prevalence of failed back syndrome (FBSS).

As a result, appropriate triage in the spinal practice is needed to ensure that patients with chronic pain without neural element compression may need one or more less invasive alternative interventional and nonsurgical techniques that will be outlined later in this chapter and in more detail in subsequent chapters.

## Identification

The most basic definition of FBSS has been the persistence of LBP following spinal surgery [4]. An argument can be made that the higher the percentage of FBSS in a particular clinic, the more the surgeons should be asking themselves if they have appropriately identified candidates for decompressive surgery or adequately exhausted interventional pain management options prior to surgery. Further

confounding the issue is the dynamic nature of overstimulation of preoperative nociceptive pathways that may result in a shift of pain generators from the acute pathology to chronic pain. This too can lead to an elevated rate of FBSS.

## ***Nonoperative Measures***

A complete in-depth discussion of the various nonsurgical treatment modalities can be found in the subsequent chapters of this book. Overall, the predictors of success for nonsurgical therapies for LBP are not well understood [5, 6]. This is not surprising for many reasons. In the literature, there is a paucity of placebo-controlled randomized studies. When analyzing the prospective studies, the most obvious difficulty in generalization across studies is the lack of standardization of selection criteria, definitions of pain, and validated objective outcome measures for pain. The criteria for diagnosis and inclusion in most studies for facet and epidural injection differ, as well as the criteria for success ranging from 50 % or greater. Chapters 12, 13, and 14 will discuss in more detail the specifics of interventional, neuromodulation, and intrathecal drug therapies available for the nonsurgical treatment of LBP, respectively. However, the authors will highlight below some key points regarding patient selection and nonsurgical treatment of LBP below.

## ***Facet Blocks***

One common contributor to axial back pain LBP is facet arthropathy. The facet joints are richly innervated by a dual innervation of somatic, nociceptive, and autonomic pain fibers. Therefore, somatic fibers at each facet level are responsible for characteristically localized pain in tandem with referred pain due to a convergence of pathways with autonomic fibers either in the dorsal horns or thalamus in the second- or third-order ascending pathways, respectively [7]. It is important to consider facet arthropathy as a source of pain, particularly in the setting of axial LBP, without radicular symptoms. The diagnosis of facet joint pain is typically made by an interventional facet nerve block yielding symptomatic relief of LBP in the absence of radiculopathy [8]. Facet pain has been shown in studies by Manchikanti and colleagues to have a prevalence ranging from 20 to 40 % of all LBP [8–15]. There are no class A recommendations for the management of “facet-joint”-type pain. Instead, level II evidence supporting lumbar facet joint nerve blocks [8, 16, 17] and radiofrequency neurotomy [18, 19] has been previously published supporting these modalities of pain mediation. Furthermore, only level III evidence exists in support of intraarticular corticosteroid injections for chronic LBP

thought to be due to facet arthropathy [20, 21]. Long-term benefit has been noted with the injection of anesthetics and most recently in 2014 the addition of corticosteroids yielded no added long-term pain relief beyond that provided by local anesthetics [8]. Overall, when facet joint pain is overlooked as an etiology of axial LBP, painful symptoms can persist after surgical decompression.

## ***Discogenic Pain***

Internal disc disruption (IDD) resulting in discogenic pain is thought to be the most common cause of axial LBP [7]. IDD is defined as degeneration of the disc, desiccation, and disc height collapse, with annular tears in the absence of disc herniation and neural compression [22]. In the absence of radicular symptoms, an associated herniated disc is rarely thought to be the cause of axial pain. The characteristics of discogenic pain are often ill defined and the relative benefits of open spinal surgery are not as clear compared to interventional or rehabilitative measures. In a systematic review comparing five RCTs, no significant difference in ODI was found between spinal fusion and nonsurgical management [23]. In a long-term follow-up of three RCTs by Mannion and colleagues, no significant difference was seen between the surgical and nonsurgical groups as well [24]. One flaw in these studies is the lack of concordance between choice of nonsurgical therapy and specific surgical intervention. Overall, discogenic pain remains as the most common cause of back pain and a uniform surgical approach may not be the answer for each patient. Appropriate localization of the pain generator in the case of multilevel degenerative disc disease is often required.

## **Evidence**

Spinal surgery is justified for a wide number of specific indications pertaining to pain due to neural compromise due to degenerative, oncologic, infectious, vascular, and traumatic indications and is beyond the scope of this chapter. Most of these indications present acutely with spinal pain, due to compression of the neural elements. As such, decompression of the neural elements through direct or indirect means as well as stabilization of the unstable spine are the mechanisms by which acute pain relief is given to the patient. Chronic stimulation of the peripheral nerve receptors by a noxious stimulus can lead the neurons to a state of hyperexcitability, and even lead to spontaneous firing [7]. This condition can lead to a state of hyperalgesia and allodynia not amenable to decompressive spinal surgery, even in the setting of a compressive lesion.

## ***Failed Back Surgery Syndrome***

As previously mentioned, up to 40 % of patients undergoing lumbar decompressive surgery with or without fusion do not obtain relief of painful lumbar leg and back symptoms [25]. As a result, patients often undergo evaluation for spinal cord stimulation (SCS) in the office, followed by a trial stimulation period using a less invasive percutaneous electrode stimulation system. With careful patient selection including a trial placement and often psychological screening, up to three-quarters of patients obtain symptomatic relief of chronic leg and back pain seen with a decrease in analgesic medication use and improvement in objective outcome measures of pain and quality of life [25]. One common complaint of SCS is the persistence of limb paresthesias as a result of high-frequency stimulation of the dorsal columns [7]. Technology with SCS is improving further, with a prospective randomized study comparing high-frequency (500 Hz) stimulation, burst stimulation, and placebo finding significant reduction in paresthesias with burst stimulation mode as well as improvement in painful lower extremity symptoms [26].

Most importantly, the successful use of SCS or any spinal intervention is predicated upon a clear definition of patient expectations in the office setting. SCS is highly unlikely to result in complete pain relief. Recent randomized prospective studies by Burchiel and colleagues define procedural success as 50 % reduction in painful leg and back symptoms, finding a positive result in 55 % of patients at 1 year [27]. These findings generally correlate with most modern studies that show that up to 60 % of patients obtain 50 % relief in painful leg and back symptoms [7, 28–33]. A more in-depth discussion of the usage of SCS will be outlined in Chaps. 15 and 16 in this text.

## ***Epidural Injections***

Epidural injections for axial LBP in the absence of a localizing finding on MRI can be confirmatory of pathology when followed by symptomatic relief. The route of approach is most commonly interlaminar, and less often transforaminal. However, epidural injections of either anesthetics or in combination with local anesthetics are utilized to provide symptomatic relief of LBP rather than as a diagnostic measure. A positive response from an injection often leads to significant pain reduction and ultimately a delay in the need for surgery, or in some cases obviates the need for additional treatment measures. Injections of glucocorticoids in the epidural space are thought to reduce inflammation of the nerve root, and ultimately pain. Addition of local anesthetics is thought to provide additive benefit by blockage of nociceptive afferent pathways [34, 35]. Evidence in the literature surrounding the use of epidural steroid injections for spinal stenosis is by way of level II and III

studies, and no well-designed, randomized, prospective placebo-controlled studies exist [36]. Most recently, a randomized double-blind trial comparing epidural injection of anesthetics with or without glucocorticoids found no additional benefit at 6 weeks with the addition of glucocorticoids [37]. Ultimately, many surgeons require a trial period of analgesic medication, physical therapy, and interventional techniques prior to the consideration of surgery in the absence of any urgent findings on exam or radiographic studies.

## Summary

Not all surgical indications are due to encroachment of the neural elements requiring decompression. The increased use of a number of less invasive alternative therapies prior to or in place of surgical decompression such as facet and epidural injections, spinal cord stimulation, radiofrequency neurolysis, and intrathecal pain pump placement serve as evidence of the efficacy of these therapies in treating different modalities of back pain. The key to triage is through an appropriate algorithm to diagnose different pain generators of the spine.

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