Failed Back Surgery Syndrome

Back surgery is an important treatment option yet a significant percentage have a poor outcome and may require either additional surgery, interdisciplinary treatment, or implantable devices to manage ensuing pain.

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Introduction

Back pain is a widespread public health problem, affecting a staggering 80% of Americans at some point in their lives \(^1\). Each year, an estimated one out of every 14 people will seek medical care for back or neck pain, amounting to almost 14 million visits annually. Estimated annual costs for direct and indirect treatment range from $20 billion to $60 billion \(^2\). Back and/or neck pain is cited as the second most common reason for physician visits, and it is estimated that 25% of all work injuries in the U.S. are related to low back pain \(^3, 4\). Most back pain is acute or subacute, with 90% of patients recovering within three to four months \(^2\). However, other estimates suggest less than 30% of patients are completely improved within 3-months of treatment \(^5\). These more chronic sufferers of back pain endure a cycle of pain that is detrimental to their physical and psychological health, lifestyle, and productivity. Chronic low back pain alone is responsible for the disability or partial disability of at least 7 million Americans. In terms of lost productivity, 93 million lost workdays per year are related to low back pain \(^6\). Diseases of the musculoskeletal system make up the 6th most common reason for hospitalization in the United States, with back surgery (laminectomy) accounting for the most common inpatient, musculoskeletal procedure \(^7\). Surgeons perform an estimated 300,000 to 400,000 back surgeries every year. Annually, neurosurgeons perform at least 100,000 operations for lumbar disc disease alone, and orthopedic surgeons perform a similar number \(^12\). It is estimated that between 20% and 40% of these operations are unsuccessful and result in FBSS \(^8\).

Many of these patients undergo additional surgeries in order to correct the situation. However, success rates decrease significantly with each subsequent surgery. After unsuccessful surgery, patients present to chronic pain centers with a much more complicated diagnostic picture. Health care providers treat these patients at chronic pain centers with various medical procedures, counseling, physical therapy, medication, and psychiatric care as needed. However, questions remain about how best to help those who have experienced poor surgery outcomes and how they respond to various modalities of interdisciplinary treatment. For example, injection therapies are an increasingly popular mode of treatment for chronic back pain sufferers. There are, though, little empirical data available to health care providers about how those with a history of unsuccessful surgery
respond to injections, particularly within an interdisciplinary treatment program. Furthermore, there are few studies addressing the efficacy of psychotherapy and physical therapy within an interdisciplinary program for patients who have undergone failed back surgeries.

**Indications For Spinal Surgery**
Surgery represents an important treatment option for physicians in managing chronic back pain, especially conditions that are intractable to more conservative interventions. Except for emergency situations, surgery is only undertaken after attempting less invasive procedures. The most common conditions for which surgery is recommended are disc bulge, disc herniation, and disc disruption; spinal stenosis, spondylosis, spondylolisthesis, and failed back surgery syndrome.

**Disc Pathologies (Bulges, Herniation, Disruption)**
Disc bulges are a normal part of aging. As we grow older, our discs degenerate and begin to bulge at the sides. This is only problematic when it is coupled with a narrow spinal canal and results in pain from compression of nerve roots.

A disc herniation occurs when the nucleus pulposus pokes out of the annulus wall, causing a compression of nerve roots. The protrusion can stay within the disc or can tear the annulus wall, which can lead to pain via chemical irritation of the outer annulus. A severe disc herniation occurs when a fragment of the nucleus pulposus detaches and causes nerve root irritation or travels within the spinal canal.

Disc disruption involves disc degeneration, tearing of the annulus, and subsequent dehydration of the disc material. The most common locations of disc herniations are L4-5 and L5-S1, which account for 98% of lesions. Disc herniation usually results in sharp, lancinating pain, and sciatica (radiation down the leg in concert with the anatomic distribution of the affected nerve root). The sciatica can be severe and lead to loss of ambulation. Surgical intervention is typically undertaken when there is profound and/or progressive neurologic deficit present, or when there is incapacitating and severe sciatica or pain that is unresponsive to conservative treatment.

**Spinal Stenosis**
Spinal stenosis is the narrowing of the spinal canal due to degeneration of the facet joints and intervertebral disc spaces. If the narrowing is extreme, compression of the components within the canal will cause lumbar and/or leg pain. Spinal stenosis is a common condition that can be congenital or acquired. Between the ages of 30 and 50, major changes occur in the lumbar spine, including a natural degeneration in the intervertebral discs and facet joints, and narrowing of the spinal canal. Many people who undergo these changes are asymptomatic. Most cases of spinal stenosis do not require surgery, but when pain constantly interferes with ambulation and other treatments do not help, surgery is a viable alternative.
Spondylolisthesis
Spondylolisthesis is a condition in which all or part of a vertebra slips on to another vertebra. There are four major categories of spondylolisthesis that differ to the extent that the top vertebra has slipped onto the lower one. Grades I through IV are divided into percentages of slippage, such that Grade I represents 0% to 25% slippage, and so on. Pain from spondylolisthesis has varied causes. Fracture of the pars interarticularis (the bony structure that connects the upper and lower facet joint of a vertebra), compression of the nerve roots from forward movement of the vertebra, or damage to the lower disk from the vertebra on top may be the cause of pain. Pain from spondylolisthesis is usually characterized by constant low-grade back discomfort that is aggravated by activity and relieved with rest. Sometimes the back pain is accompanied by leg pain, but is typically not incapacitating. In many instances, persons with slippage experience no discomfort and may be unaware of the injury. In those who do experience slippage that is Grade II or worse, and whose pain does not respond to less invasive treatments, surgical fusion or decompression is recommended.

Surgical Procedures
The following are brief descriptions of common surgical procedures for back pain. A laminectomy discectomy is an operation on a herniated disc in which a small amount of bone is first removed from the lamina (the arched bony roof of the spinal canal). Afterwards, a decompression of the nerve root is completed by removing the disc tissue that is pressing on it. A microdiscectomy is similar to a discectomy except that it is done with the use of magnification such as an operating microscope that requires a smaller incision. Percutaneous disc removal involves removing the problem disc fragment through an endoscope – a small tube inserted through a tiny opening made into the back. A miniature video camera is attached to the tube and the disc fragments are cut away and removed by suction through the tube. Foraminotomy is an operation that enlarges the bony hole through which the nerve root exits. Small pieces of bone over the nerve are removed through a small slit, allowing the surgeon to cut away the blockage and relieve the pressure on the nerve. Spinal fusion is a process in which the spinal disc between two or more vertebrae is removed and the adjacent vertebrae are joined together via bone grafts or metal devices/cages. Fusion occurs when the adjacent bones grow together to form a single bone. Disc replacement is a newer surgical option that is currently being explored by the U.S. Food and Drug Administration (FDA) and involves implantation of an artificial disc that reduces pain and improves ability to move.

Failed Back Surgery Syndrome
Failed back syndrome or failed back surgery syndrome (FBSS) refers to a condition in which a patient has undergone back surgery with a poor outcome. Patients with FBSS are a diverse group, with complex and varied etiologies and pain sources. They also vary with regard to their clinical complaints and psychological status. Patients with FBSS typically experience a decrement in their functional capacity, morale, and productivity. They are also more vulnerable to developing psychosocial problems and addiction to pain medication. In the aftermath of an unsuccessful surgery, and faced with mounting physical and psychological problems, many FBSS patients seek treatment from chronic
pain centers. In the United States, approximately two-thirds of all patients enrolled in chronic pain centers suffer from FBSS.

**Etiology of FBSS**

**Poor Selection for Surgery**

There are several paths to FBSS. The most common cause is poor selection for surgery. This means that the patient may have had a psychological profile or physical pathology that was contraindicated or not appropriate for the surgical intervention\(^9,13\). Furthermore, if the patient is misdiagnosed, the surgery is obviously incorrect and damaging. The most common misdiagnosis in these cases is arthritis misdiagnosed as a lumbar disc disease. Often, improper selection and misdiagnosis follows from inadequate pre-operative evaluation and diagnostic work-up. A full diagnostic work-up should include a medical and psychological evaluation. The medical evaluation should include a comprehensive physical examination and history, imaging, and other relevant diagnostic procedures. Radiography, computed tomography (CT), magnetic resonance imaging (MRI), myelography, bone scanning, electromyelography, discography, and various diagnostic injections are used to assist the physician in determining the diagnosis, location, and cause of the patient’s pain\(^9\).

**Unnecessary Surgery**

Surgery that is unnecessary may also be the cause of FBSS. Unnecessary surgery not only fails to treat the problem appropriately, but may worsen the patient’s condition. An unnecessary excision of the nucleus pulposus from a normal disc is likely to increase the risk of chronic back pain by creating instability and malalignment. Needless surgery places patients at unnecessary risk for injured nerve roots, torn dura or arachnoid, CSF leakage, and possible wound infection or hemorrhage later\(^12\). Moreover, most patients with lumbar disc disease and sciatica will respond successfully to nonoperative treatments. Three studies cited by Benzon in an early review article\(^14\) demonstrate that treatments such as bed rest, intramuscular dexamethasone, and back support ultimately result in a large reduction in pain with no need for surgery in 68 to 82% of patients with herniated discs and/or nerve root irritation\(^15-17\). Saal and Saal\(^18\) treated patients with herniated discs and radiculopathy with physical and pharmacologic therapy in multiple centers, and found that 90% of the patients showed significant symptom improvement and were able to return to work without surgery. Other research has come to similar conclusions\(^12\).

**Improper or Inadequate Surgery**

The third most common cause of FBSS is improper or inadequate surgery. One example of improper surgery is disc excision performed at the wrong level. Differences exist among surgeons as to the amount and type of evidence needed to make a determination about the level of the disc rupture. Some surgeons require imaging, while others may operate on the basis of clinical findings alone. Likewise, anatomical variation may create problems by making it difficult for the surgeon to accurately localize the surgical intervention, particularly if intraoperative radiography or exposure of the sacrum is not done. FBSS may also result from the presence of fragments of disc material that are not
properly removed. The retained fragments may compress a nerve root, or scarring may develop around them, causing delayed onset of severe symptoms. Failure to identify a spinal tumor may also lead to improper surgery. This is especially possible when there is inadequate imaging or when the tumor is benign and asymptomatic. In other cases, surgery is inadequate to correct other bone abnormalities that exist in the area of the rupture. For example, the laminectomy may not be sufficiently wide to decompress a co-existent spinal stenosis.  

**Psychological Screening For Surgery**

A growing body of literature supports the notion that psychosocial variables affect surgery outcomes, and that psychological screening can assist healthcare providers in deciding who is an appropriate candidate for spine surgery. Early studies demonstrated that the Minnesota Multiphasic Personality Inventory (MMPI) differentiates between patients who will have successful versus unsuccessful surgery outcomes. The MMPI categories related to surgical outcomes are somatic complaints, hypochondriasis (Hs), and hysteria (Hy). Depression and anxiety scores on the MMPI have also been correlated with surgery results. However, the MMPI must be supplemented by other measures to be useful as a screening instrument. Early on, researchers also determined that certain demographic data, such as education, duration of symptoms, and previous surgeries, were predictive of surgery outcome. Gatchel, Polatin, and Mayer identified several variables that predict with 90.7% accuracy which acute back pain patients went on to develop chronic back pain and failed to return to work. The characteristics are female gender, workers’ compensation or personal injury insurance-related injuries, high self-reports of pain and disability, and high scores on the Hy scale of the MMPI. Epker and Block reviewed pre-surgical screening of spinal surgery as a whole. They found that spousal reinforcement of pain behavior, premorbid psychological treatment, workers’ compensation involvement, heavy job requirements, and poor coping skills tend to predict poor outcome. In addition, Gross examined coping abilities as they relate to relief of pain after surgical intervention. She found that self-reliance and loss of control were predictive of post-surgical adjustment, and that these factors were stronger predictors than medical status (type of disc and disability status) as well as somatization.

Thus, it is clear that psychological screening is a critical component of the pre-surgical evaluation process. A psychological screening for surgery helps the physician and patient prevent FBSS. Psychosocial factors have been shown to affect surgery outcome. Though physicians are sometimes aware of blatant chemical dependency, psychopathology, or secondary gain issues in their patients, they often miss the less obvious psychosocial problems that may make the difference between a successful and unsuccessful surgery outcome. Consideration of psychological factors in concert with physical factors, such as characteristics of the herniation and duration of illness, lead to the most accurate predictions about those patients who will benefit from surgery and those who will not. A psychological evaluation allows the surgeon/physician to improve treatment outcomes by screening out patients likely to have a poor outcome and providing necessary psychological/emotional assistance prior to surgery, if needed. An evaluation also identifies those patients who are likely to experience medication addiction.
or compliance difficulties, and who may end up being “problem patients” for the treating physician.

**Treatment of FBSS**

Wilkinson describes three possible diagnostic scenarios that occur in FBSS patients complaining of low back pain. First, the pain may be the same pain that was occurring prior to surgery, but was inadequately treated with surgery. The second possibility is that the problem was treated properly by the surgery but continues to cause pain. Third, the problem may be newly acquired. Due to these diagnostic complications, the management of patients with FBSS requires a thorough and rigorous evaluation of pain complaints, along with the standard medical and psychological work-up.

For many patients, treatment of FBSS involves more surgery. Franklin and colleagues determined that 23% of patients who had a lumbar fusion had an additional surgery within 2 years. Re-operation rates differ somewhat by the type of back surgery performed. Rates for discectomy range from 2% to 19%, for decompressive laminectomy from 9% to 17%, and for fusion from 6% to 36%. Bolger and colleagues reviewed 32 studies to determine the rate of satisfactory outcome in reoperations. Overall, 60% of re-operated patients have a satisfactory outcome. However, satisfaction rates ranged between 25% and 82%. Patient characteristics associated with a good re-operation outcome are the following: presence of a symptom-free period of more than 6 months since previous surgery; only one previous surgery; the absence of psychological issues; lack of economic secondary gain; and presence of leg pain. Other studies suggest lower satisfaction rates. North and colleagues found that only 32% of patients who had repeat spine surgery reported a successful outcome.

Current treatment recommendations for FBSS are similar to those recommended for any other chronic pain condition. An interdisciplinary approach is assumed to be appropriate. As with the majority of chronic pain conditions, conservative treatments should be attempted first. This includes physical therapy, pharmacotherapy, psychiatric/psychological treatment, and other non-invasive options. If conservative therapy is not effective, the patient should be evaluated for mildly invasive procedures, such as injections. If injections are inadequate and pain is intractable, neuroablative and neuroaugmentative pain procedures may be used.

Spinal cord stimulation is an increasingly popular neuroaugmentative procedure that works by blocking transmission of pain at the level of the spinal cord dorsal horn via electrical stimulation. North and colleagues conducted a retrospective analysis of the efficacy of spinal cord stimulation implants in patients with FBSS. They found that approximately 50% of those implanted reported pain relief and a significant decrease in medication 5 years after the procedure.

**Interdisciplinary Pain Treatment**

Interdisciplinary treatment centers emerged from the recognition that chronic pain is a biopsychosocial phenomenon and from the failure of individual disciplines to adequately
treat many chronic pain patients. Generally, patients seen at interdisciplinary treatment centers have tried and failed to benefit significantly from various treatments. The clinical picture is often highly complex, with numerous interacting factors, such as secondary gain, physical and psychological deconditioning, medication addiction, and depression. Given the complexities, no single discipline is able to sufficiently treat these types of patients. Interdisciplinary programs use the competencies of multiple disciplines working collaboratively to address complex issues for the reduction of pain and return to functioning. Typically, the treatment team consists of a pain management physician, nurse, psychologist, psychiatrist, physical therapist, and occupational therapist. The program usually lasts 4 to 6 months, during which a comprehensive evaluation of the pain condition is completed and an array of treatment modalities are recommended by the team. Treatment may include physical reconditioning, medical procedures, psychotropic medication, biofeedback, educational groups, and cognitive-behavioral therapy. Members of the treatment team are employed at the same site and communicate daily and in regularly scheduled case conferences about the best way to help the patient. The team shares a common theoretical orientation toward pain management/rehabilitation and communicates this shared philosophy to the patient. Treatment goals are set, and progress is systematically measured throughout the treatment period. The broad aim of the interdisciplinary approach is to increase functioning and ability to cope with pain, decrease health-care utilization, increase physical activity, decrease pain, and maintain therapeutic gains.

**Implantable Devices**

**Spinal Cord Stimulators (SCS)**

During the past decade, there has been an expanding role of spinal cord stimulation as a treatment option for the palliative care of chronic pain, such as FBSS. Stimulated by Melzack and Wall’s *gate control theory of pain*, which proposed that the activation of low-threshold afferent nerve fibers decreases the response of dorsal horn neurons to unmyelinated nociceptors (thereby “closing the gate” to pain transmission from the spinal cord), a number of clinical applications of this theory were developed. Shealy, Mortimer and Rewick were the first to apply this when they stimulated the dorsal columns for the treatment of chronic, intractable pain. Since that time, implantable dorsal column stimulation (i.e., spinal cord stimulation or SCS) was developed to treat a wide variety of pain syndromes. As Cameron and Elliott have noted, since the time that the SCS procedure was first inspired by the gate control theory, its effectiveness is now also linked to a number of other mechanisms as well, such as the activation of spinal pain inhibitory circuits, as well as regional blood flow to various regions at the cerebral level.

For SCS, electrodes for the stimulators are inserted through an epidural needle, usually with the use of a local anesthestia. These electrodes are then attached to a passive receiving device or a battery-powered stimulator. Once the optimal stimulating parameters have been identified, patients usually control the strength and duration of the stimulation. It should also be noted that peripheral nerve stimulation can be administered through cuff electrodes that are placed around a peripheral nerve at the area of the injury site.
Spinal cord stimulation has frequently been used for many patients with FBSS as an alternative to re-operation (e.g., 34). In addition, it has been used to treat reflex sympathetic dystrophy, post-amputation pain, postherpetic neuralgia, spinal cord injury dysesthesias, as well as pain associated with multiple sclerosis 35. North and colleagues 34 have reported that, for neuropathic pain, continued pain relief was found in 70% of patients using a multi-channel system, and 30% using a single-channel system. Grabow and colleagues 36 have also reviewed evidence for SCS effectiveness in patients with complex regional pain syndrome who did not respond to more conservative pain management.

Prager and Jacobs 37 have emphasized the importance of accurate diagnosis, with patient selection through a comprehensive biopsychosocial evaluation, if implantable pain therapy is to be successful. Indeed, Neban and colleagues 38 have delineated screening criteria that should be used to exclude patients from consideration for spinal cord stimulation implantation (see Table 1).

Table 1. Exclusionary Screening Criteria for Spinal Cord Stimulation Implantation 38

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<th>Criterion</th>
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<td>Active psychosis</td>
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<td>Active suicidality</td>
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<tr>
<td>Untreated or poorly-treated major mood disorders such as major depression</td>
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<tr>
<td>An unusually high level of somatization or other somatoform disorders</td>
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<td>Substance abuse disorders</td>
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<td>Unresolved workers’ compensation or litigation cases</td>
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<tr>
<td>Lack of appropriate social support</td>
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<td>Cognitive defects that compromise adequate reasoning and memory</td>
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Although this patient-screening approach is still somewhat imprecise, and until a more refined screening approach is thoroughly developed, it will undoubtedly make an important contribution to more reliable prediction of response to such treatment. It is important because these criteria reflect potential problems, such as: lack of understanding on how to use the device; the internal sensations generated by the device that may be difficult to deal with, especially in those predisposed to somatic delusions; significant psychosocial problems that will continue to exacerbate pain complaints regardless of medical treatment. These issues will need to be dealt with before one can guarantee any degree of success 39.

Implanted Morphine Pumps

Another type of implantable pain-management modality is intraspinal therapy. This involves drugs being delivered through implanted catheters with a subcutaneous injection site, a totally implanted catheter with an implanted reservoir and manual pump, or a
totally implanted catheter with an implanted infusion pump. As Prager and Jacobs\textsuperscript{37} indicate, the choice of system used depends on the following: the clear indication for intraspinal therapy; a need for bolus (i.e., a single high dose) versus continuous infusion; the patient’s overall medical status; the patient’s ambulatory status and available social support services; the patient’s life expectancy; and cost. They have indicated that a fully implanted pump is economically feasible if the patient’s life expectancy is greater than three months. Hassenbusch and Portenoy\textsuperscript{40}, when reviewing physician-practice patterns concerning the long-term use of this modality, concluded that there were wide variations among physicians in its use. Moreover, they emphasized the need for practice guidelines, developed on the basis of methodologically-sound research outcomes, combined with input from experienced experts in the field, in order to develop methods for optimizing pain management with this modality. Bennett\textsuperscript{41} also emphasized the need for more consensus utilizing evidence-based research as to what compounds or agents are best for this type of therapy. Currently, morphine and blysibacaine appear the most widely used.

Again, just as in the case of the spinal cord stimulation modality, interdisciplinary evaluations of patients need to be the standard of care in this area before consideration of patients for this modality. Such patients’ pre-screening is essential for good therapeutic outcomes with all of these modalities\textsuperscript{27}. Block et al.\textsuperscript{9} have presented a useful pre-surgical psychological screening approach to use with surgical patients, such as those receiving implantable devices, as well as guidelines for pre-surgical and post-surgical treatment.

**A Case Study**

Recently, Whitworth, Schaufele and Gatchel\textsuperscript{42} have provided a discussion of SCS versus intrathecal opioid pump treatment options for FBSS patients. The following case study provided the focus of this discussion.

“A 65-year-old man presents with complaints of low back and right leg pain. He is one year status post L5-S1 fusion for a grade II spondylolisthesis. Prior to surgery, his primary complaint was mechanical low back pain. He states that surgery did little to help his back pain and a few months following the procedure he began to develop progressive right leg pain. The patient describes his back pain as constant without significant aggravating factors. His leg pain radiates from the right buttock down into the posterior thigh and calf and is described as burning in nature. He states that the pain is evenly divided between his low back and leg.

Physical examination of the lumbar region reveals a well-healed surgical scar, moderate paraspinous muscle spasm and reduced lumbar motion on flexion and extension. Strength in the lower extremities is normal in all muscle groups. Deep tendon reflexes are 1+, except the right ankle jerk which is absent. Sensory exam reveals slight reduction of pin prick sensation in the S1 dermatomes bilaterally. The remainder of the exam is unremarkable.

The patient has undergone physical therapy, exercise and trials of multiple nonsteroidal anti-inflammatory drugs (NSAIDS) without benefit. He currently takes oxycodone 30mg
(OxyContin) BID and gabapentin 600 mg. (Neurontin) TID. The medications are partially effective in relieving his pain, but he complains of side effects including excessive sedation and constipation. X-ray images of the lumbar spine reveal solid bony fusion, intact hardware and no abnormal motion. Magnetic resonance imaging (MRI) shows some enhancement, consistent with scar tissue, surrounding the S1 nerve roots bilaterally. There is no evidence of disc herniation or foraminal stenosis. The remainder of lumber spine shows age appropriate degenerative changes, with minimal disc desiccation and facet hypertrophy.” (p. 17)

Case Study Treatment Option 1
One possible option for this patient is the use of an intrathecal opioid pump. As was discussed by Whitworth and colleagues, a stepwise evaluation-treatment plan should be implemented. This would include the following:

- Evaluate the level of technical success of this patient’s initial surgery in terms of whether the neural elements were adequately decompressed, and whether there is evidence of a solid and stable fusion.

- If additional surgery is deemed not likely to decrease symptoms significantly, then conservative interdisciplinary treatment should be employed in treating this patient.

- If interdisciplinary care is not successful, and further spinal surgery is ruled out, then an intrathecal pump might be considered. In this case, because this patient’s pain is “evenly divided between his low back and leg,” an intrathecal pump may be preferred (because SCS is usually better for treating neuropathic pain, and it would be unlikely to address all of his pain symptoms).

- Trials of oral and transdermal narcotics are initially essential because, if the patient can achieve appropriate pain relief without major side effects via either of these two routes, then there would be no need for intrathecal administration.

- If the above trials do not provide relief, then the next step would involve a trial of intrathecal opioids (for example, single or multiple bolus injections administered through continuous epidural or intrathecal infusion or via lumbar puncture). At least a 50% decrease in patient self-report of pain is usually considered sufficient to warrant proceeding to pump implant.

Case Study Treatment Option 2
Another potential option for this patient is an SCS system. Again, as Whitworth and colleagues discuss, a stepwise plan should be followed as delineated below.

- Evaluate whether additional surgery is unlikely to decrease symptoms significantly.

- Introduce conservative interdisciplinary treatment for pain management.
If interdisciplinary care proves unsuccessful, then a psychological evaluation should be conducted for possible SCS implantation treatment.

A discussion with the patient should be scheduled in order to review the possible benefits from other interventional percutaneous procedures (such as selective nerve root injections/transforaminal epidural steroid injections) that may not have the same long-term implications as an implanted system.

Be certain to discuss with the patient the pros and cons of an implanted SCS system. For example, the patient should be made aware of possible negative aspects of the system, such as: potential complication rates and need for revision surgery due to lead migration, lead breaks and infection; battery replacement is still fairly high, ranging from 4% to 27%; activities that require frequent bending, twisting and lifting increase the risk for lead breakage and/or migration; one should not drive or operate heavy machinery while the stimulator is active; future MRI scans may pose a problem if the patient requires additional diagnostic testing for other medical problems.

An initial trial with a percutaneous epidural electrode for one week should be conducted. The patient should have at least a 50% improvement in his pain, as well as report an improvement in daily functioning.

If the trial is successful, then the trial electrode can be removed and a permanent system should be subcutaneously implanted with placement of another epidural electrode or plate electrode via a small laminotomy (“surgical lead,” which seems to produce better clinical outcomes, such as less lead migration, better battery life, and better coverage of painful areas than epidural leads).

**Conclusion**

Back surgery may be indicated for intractable spinal conditions including disc pathologies (bulge, herniation, or disruption), spinal stenosis, and spondyloisthesis. Due, in part, to improper screening of candidates, improper surgery selection or diagnosis and unnecessary or inadequate surgery, 20 to 40% of these surgeries may result in failed back surgery syndrome. Treatment options for FBSS span the range from additional surgery, interdisciplinary pain treatment, mildly-invasive procedures (neuroablative, neuroaugmentation), and ultimately implantable devices to manage pain.

As we conclude, a major thread in considering implantable devices is the initial use of conservative interdisciplinary care as a means of managing the pain. This is in keeping with the current biopsychosocial approach to spinal disorders. Failing to control the pain with conservative approaches, the next step is to conduct a pre-surgical psychological evaluation to determine the suitability of patients for such implantable devices.
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