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# Failed Back Surgery Syndrome: A Narrative Review

**João Batista Santos Garcia[1], José Osvaldo Barbosa Neto[1*], Érica Brandão de Moraes[2]**

[1]Experimental Laboratory to the Study of Pain, Federal University of Maranhão, Brazil

[2]Aurora de Afonso Costa School of Nursing, Federal Fluminense University, Brazil

[*]**Corresponding author:** José Osvaldo Barbosa Neto, Experimental Laboratory to the Study of Pain, Federal University of Maranhão, Rua dos Canários, n1. Apto 1002. Calhau. São Luis, Maranhão, 65071393, Brazil. Tel: +55-98991675217; Email: osvaldo1983@me.com

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## Abstract

**Background:** The prevalence of low back pain varies from 60-80% worldwide, which makes it one of the most common health problems. Spinal surgery is often indicated as treatment for low back pain, and, even though it is successful in at least 50% of cases, 10-40% of these patients develop Failed Back Surgery Syndrome (FBSS), presenting with a resurgence of symptoms or development of complications associated with the intervention.

**Objective:** The objective of this narrative review is to present current literature on FBSS and on strategies to prevent or treat the syndrome.

**Method:** For the narrative review of FBSS, a systematic search was performed using the databases of the United States National Library of Medicine at the National Institutes of Health (PubMed) using the MeSH terms "failed back surgery syndrome".

**Review:** The review gathered data on FBSS regarding epidemiological data, differential diagnosis that should be addressed during investigation of a patient with pain after back surgery, current data on surgical outcomes and perpetuation of pain, prevention strategies and pain management of the patients that might develop this syndrome.

**Conclusion:** In the face of the challenge of treating patients with failed back surgery, we should consider exhausting conservative and minimally invasive treatment before indicating surgery.

**Keywords:** Laminectomy; Failed back surgery syndrome; Chronic pain; Low back pain

## Introduction

The prevalence of low back pain varies from 60-80% worldwide, which makes it one of the most common health problems. Approximately 10% of patients have pain that persists for more than three months, and some of them do not respond to conservative treatment and are referred for surgical treatment [1].

Spinal surgery began in the 1960s, initially for treating deformities resulting from diseases such as tuberculosis, through the fusion of vertebral bodies. Thereafter, this approach was improved in order to be used to treat other conditions [2]. Laminectomy is a technique by which decompression of foraminal spaces is promoted by removing the lamina, one of the posterior spinal elements, and is used for treating disc herniation. This type of intervention is indicated when conservative treatment fails, and it may or may not be followed by treatment for spinal instability by fusion of the vertebral bodies [3].

Patients undergoing surgical intervention may develop persistent symptoms or complications due to the surgery or to changes in spinal biomechanics. Failed Back Surgery Syndrome (FBSS) encompasses cases in which the patient's and/or surgeon's expectations are not achieved by surgical treatment, but it does not specify the mechanism involved [4]. The perception of success is subjective and tends to differ between the patient and surgeon, especially when multiple interventions are necessary [5].

The term, initially proposed by Follet and Dirks, was defined as persistent or recurrent complaints in the lower back and/or pain in the lower limbs that required surgical treatment for symptom

relief [1]. The International Association for the Study of Pain (IASP), in turn, defines FBSS as undefined back (or neck) pain, whether persistent, despite surgical intervention, or that appears after surgery for prior axial pain with a similar topographic distribution [6,7].

This persistent low back pain may result from structural causes, such as changes in the vertebral discs, articular facets and sacroiliac joint; spinal instability; pseudoarthrosis; and tissue manipulation associated with the use of instrumentation in the vertebrae. The presence of pain with irradiation to the lower limbs may be caused by neuropathic pain, arachnoiditis, migration of the implants used in the procedure, vertebral disc herniation, facet and sacroiliac pain, pain referred to the ipsilateral limb, foraminal or spinal stenosis, and epidural fibrosis. Surgical complications may also be involved in the resurgence of symptoms, such as loosening of the material used and pedicle or facet fracture, as well as cases of failed surgical technique, such as insufficient opening of the vertebral foramen [8]. The main risk factors associated with the onset of FBSS are previous severe pain, multiple surgeries, and severe residual pain [9].

The objective of this narrative review is to present literature data regarding the incidence of FBSS, its impact on the main quality of life indicators, and the main treatment strategies.

### Materials and Methods

For the narrative review of FBSS, a systematic search was performed using the databases of the United States National Library of Medicine at the National Institutes of Health (PubMed) using the MeSH terms “failed back surgery syndrome”.

## Review

### Epidemiology

The number of surgeries for treating low back pain has grown significantly since the 1990s. Up until 2000, there was a 220% increase in the number of spinal arthrodesis procedures performed in the United States, with a peak in growth occurring after 1996, when cages were introduced in the American market for intervertebral fusion [10]. In 2007, more than 37,000 decompressive laminectomies were performed in the US to treat spinal canal stenosis [11]. In the UK, 5 of 10,000 people undergo surgical treatment for low back pain [7].

Although surgical treatment is widely used in managing low back pain, studies have described failure rates ranging from 10-40%, with patients presenting with a resurgence of symptoms or development of complications associated with the intervention [12,13]. Primary spinal surgery is successful in at least 50% of cases, but this rate decreases progressively with the number of reoperations, not exceeding 30%, 15% and 5% after the second, third, and fourth surgeries, respectively [1]. The prevalence and incidence of FBSS are similar to those of rheumatoid arthritis and ten times higher than those of complex regional pain syndrome [7].

A multicenter study including patients from nine institutions showed a reoperation incidence of 1.6% within the first 30 days after surgery, which was more frequent in cases in which there was instrumentation of the spine [12]. In Japan, a population study based on an online questionnaire, which included 1842 patients undergoing spinal surgery, showed a FBSS prevalence above 20%. The prevalence of low back pain, dull ache, numbness, cold sensations, and paresthesia after surgery was 94%, 71.1%, 69.8%, 43.3%, and 35.3%, respectively [9].

A British study showed that the rate of patients undergoing lumbar surgery doubled in the 15 years observed, rising from 2.5 to 4.9 for every 10,000 adults. Criteria for FBSS were identified in approximately 20.8% of operated patients. The cost involved in care is much higher in these patients. Two years after the primary surgery, a difference of just over 5,000 pounds was estimated between patients with FBSS and patients without the syndrome. After 10 years, this difference exceeded 14,000 pounds. An estimate based on the data obtained in the study shows that approximately 5000 adults suffer from persistent pain after spinal surgery in the United Kingdom [14]. In the US, the cost involved in treating these patients varies from $12-90 billion dollars per year [15].

The data are even more alarming in developing countries. The prevalence of FBSS in northeastern Brazil was 60% in one study. Most of these patients had a family income of up to one minimum wage, the mean age was 45 years, and the average pain duration was 7.22 years. Neuropathic pain was present in approximately 90% of the patients studied [16].

The incidence of micro discectomy failure after surgery was lower than that after conventional surgery in a retrospective study that included 501 cases, occurring in 8.38% of operated patients, and complete symptom resolution occurred in 79% of the patients [17]. When surgical treatment was compared with conservative treatment in patients with sciatica, symptomatic improvement was significantly faster in patients treated surgically, but the results of this group resembled those of the conservative group after six months, and the difference was no longer significant and progressively decreased up to two years. At the end of this period, 20% of the patients presented FBSS [18].

### Etiology of FBSS

As discussed previously, FBSS is a generic name that encompasses different etiologies to explain the permanence or recurrence of the painful symptom. Identifying the origin of the pain is not always possible, and up to 11% of patients do not receive a specific diagnosis [4]. In the remaining 89%, it was possible

to establish at least one most likely cause for surgical failure. Together, foraminal stenosis and discogenic and neuropathic pain accounted for more than 50% of cases considered unsuccessful [4] (Table 1).

| | |
|---|---|
| **Preoperative Causes** | **Factors related to the patient** |
| | Psychological |
| | Social |
| | **Factors related to the surgical indication** |
| | Inadequate patient selection |
| | Reoperation |
| | Inadequate surgical planning |
| **Surgical Causes** | Incomplete decompression of lateral recesses and conjugation foramen |
| | Instability due to excessive decompression |
| | Surgery at the wrong spinal level |
| **Postoperative Causes** | Recurrent disc herniation |
| | Discogenic pain |
| | Adjacent segment degeneration |
| | Sagittal balance-related problems |
| | Mechanical changes of the pelvis and lumbar spine |
| | Spinal root entrapment syndrome |
| | Infection |

**Table 1:** Most common causes of failed back surgery [19,20].

During the evaluation of these patients, it is important to identify signs of systemic impairment (red flags), which may indicate severe central nervous system involvement or infection that requires immediate intervention, as well as psychological causes (yellow flags), such as anxiety and depression, which can enhance the painful condition by feeding a vicious cycle, which is often found in patients with low back pain [1,19,20].

## Surgical Outcomes

Despite the significant increase in the number of surgeries performed worldwide for managing back pain and the high percentage of patients experiencing failure with different types of treatment, as discussed previously, few studies have been carried out to evaluate the impact on the quality of life of patients undergoing this type of intervention.

In patients with chronic pain, the prospect of hospital admission and surgical treatment is associated with the development (or worsening) of depression, the consequences of which are greater pain intensity, a decreased ability to walk and less satisfaction with the surgical results [21-23].

A study comparing operated patients who developed FBSS with nonoperated (nonspecific low back pain) patients showed that patients undergoing surgical treatment had more pain, more depression, and less physical capacity, although there was no significant difference in the impact on quality of life [24]. In the Japanese study referenced above, the authors detected the presence of recurrent low back pain (94%), dull ache (71%), numbness (69.8%), cold sensations (43.3%) and paresthesia (35.3%) after back surgery, and these symptoms had an impact on quality of life, evaluated through the EuroQol-5D questionnaire, and caused greater psychological distress. Despite the data presented, 78% of the patients surveyed stated that they were satisfied with their surgical procedure [9].

### FBSS Prevention

As previously seen, despite the increasing number of surgical indications for resolving low back pain and despite the technological innovations employed in the materials used in these procedures, the rate of patients with FBSS has remained stable. To the date this review was made, no therapy was proven successful in preventing FBSS.

Patient related factors that may have influence over surgical outcome should be addressed. The symptoms associated with anxiety and depression are linked to a higher incidence of failure of the surgical treatment and should be treated preoperatively [23,24].

The surgical indication may play a part in reducing FBSS. Evidence suggests benefits of surgical treatment for disc herniation in patients who did not respond adequately to conservative treatment, whereas surgery was not beneficial in patients with discogenic pain [25-27]. More conservative surgeries, in which vertebral fusion was not performed, and minimally invasive surgeries were also superior [28,29]. These data reinforce the notion that both patient selection and the definition of the most appropriate surgical strategy may reduce failure.

## Treatment

Patients submitted to surgical treatment for low back pain that presents with recurring pain should undergo extensive reevaluation for causes of emergency reoperation, such as infections, new neurological deficits, and malignancy. A detailed imaging tests study will demonstrate the existence of other factors that may imply surgical correction, such as screw or graft loosening.

Once these surgical complications are avoided, the next step is to introduce patients to a multidisciplinary treatment program, including attention to the psychological aspects of the case.

Conservative treatment planning should be widely discussed with patients and should be focused on overall improvement in the quality of life of these individuals, not just on pain management through pharmacological treatment. The combination of multimodal analgesic treatment with physical and psychological therapy is essential to improving the clinical picture. Within this strategy, the use of painkillers aims to facilitate participation in rehabilitation activities to improve functional capacity.

**Drug Treatment**

In general, there are few studies comparing drug treatments specifically to FBSS patients. Because of their physiopathologic similarities, pharmacological therapy derives from that one indicated for treating chronic low back pain, consisting of the combination of analgesics and adjuvants. In the updated National Institute for Health and Care Excellence (NICE) guidelines [30], the authors suggest the use of common analgesics and Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) in acute and chronic conditions. Weak opioids were reserved only for acute attacks, where NSAIDs were contraindicated or not tolerated. As the evidence for using opioids in chronic low back pain has been shown to be weak [31,32] and the harm appears to outweigh the benefits [33,34], these drugs are not indicated in this situation. The use of paracetamol alone is also no longer recommended [30,31].

Tapentadol represents a new analgesic class with mixed action, combining the opioid effect, through mu opioid receptor activation, with the inhibition of noradrenaline receptors [35]. The use of its extended release formulation has been shown to be beneficial as monotherapy in patients with chronic low back pain with a neuropathic component, thus dispensing with the need for combination with gabapentinoids [36]. In a phase 3 study in patients with low back pain, this drug was shown to be equivalent to strong opioids (morphine, oxycodone, buprenorphine, fentanyl) in an equianalgesic dose, but with a better tolerability profile [37]. Despite the promising results, this medication is not yet available worldwide, and there are still insufficient data for its inclusion in the recommendations of international guidelines.

The use of gabapentinoids was found to be effective for symptom control in FBSS patients. These anticonvulsants are known to have a role in the management of neuropathic pain and central sensitization [38-40]. Gabapentin promoted satisfactory analgesia that was superior to that provided by anti-inflammatories. Fewer studies were published using Pregabalin for these patients; however, similarly to gabapentin, it has been widely used in treating chronic low back pain. A systematic review and meta-analysis analyzed the data on these two drugs and found that gabapentin produced a minimal reduction in pain compared with placebo. Pregabalin was shown to be inferior to the other drug groups to which it was compared. Gabapentin was associated with a higher incidence of adverse effects such as dizziness (Number Necessary to Harm - NNH 7), fatigue (NNH 8), difficulty organizing thoughts (NNH 6), and visual disturbances (NNH 6) [41]. In a retrospective cohort study evaluating the prophylactic action of pregabalin, a lower incidence of neuropathic symptoms and less dysfunctionality were demonstrated six months after surgery [42]. Gabapentinoids, when administered preoperatively, were superior to placebo by reducing pain intensity, improving function, and decreasing analgesic consumption in the postoperative period following back surgery. But, its role in the prevention of FBSS is currently unknown [43]. The combination of pregabalin and transdermal buprenorphine (agonist/antagonist opioid), was effective in controlling pain and improving sleep patterns in patients with chronic low back pain, but in this study patients with FBSS were not enrolled, and although a positive result was found in low back pain, these results cannot be extended to them [44].

Tricyclic Antidepressants (TCAs) and Selective Serotonin and Noradrenaline Reuptake Inhibitors (SSRIs/SNRIs) are also recommended in guidelines, because its application to neuropathic pain and central sensitization [45,46]. Amitriptyline, which is a TCA, at low doses is associated with functional improvement and a reduction in pain intensity after three months of treatment [47]. However, in a systematic review, it was not possible to observe the effect of this drug class in the control of low back pain symptoms [31]. This drug class should be started at low doses and slowly increased due to its side effect profile. Duloxetine is an SNRI and was found to have little effect on pain reduction and functionality improvement, with a lower incidence of adverse effects in this patient profile according to a systematic review that included 47 published articles on the treatment of chronic low back pain [31]. There are no studies demonstrating the efficacy and safety of venlafaxine, although it has mechanisms similar to those of duloxetine; therefore, this drug is not recommended. Other antidepressants also do not present evidence supporting their use in these cases.

An innovative approach in treating chronic pain is the use of Palmitoylethanolamide (PEA), a signaling molecule that is part of the fatty acid amides family [48-51]. Its analgesic activity is mediated by the reduction in the release of pro-inflammatory substances from mast cells and the reduction in mast cell and microglial cell activation. Activation of the peroxisome proliferator-activated receptor alpha (PPAR-α) by PEA binding triggers its anti-inflammatory, analgesic, and neuroprotective effects [48]. To assess its effect in patients with FBSS, the authors assembled a group of 35 patients who had undergone therapy with tapentadol and pregabalin but who still had pain scores of 5 on the Visual Analogue Scale (VAS). PEA was added to their

treatment plan, promoting a reduction in the VAS score to 3 in the first month of treatment and to 2 in the following month without adverse effects [48]. The opioid crisis and the risk of prolonged use of anti-inflammatories bring urgency to the implementing new therapies for chronic pain. Despite having serious limitations, this study reports a result that warrants testing in a randomized clinical trial for data confirmation.

Other medications, such as muscle relaxants and benzodiazepines, do not present sufficient evidence to be indicated [31].

## Noninvasive and Nondrug Treatment

Like other chronic pain syndromes, physical rehabilitation has a central role in the therapeutic strategy, combating fear of movement, allowing gain in function and improving quality of life [30]. Exercise is associated with reduced pain intensity and improved function, with no difference between the available methods [52].

Exercise for motor control is a type of work that focuses on the recovery of the coordination, control and strength of the muscles responsible for controlling and supporting the dorsal spine, and this program achieved a reduction in pain and improvement in the performance of patients in both the short and long term [53]. Studies on Pilates are still insufficient to determine its efficacy in treating patients with chronic low back pain [52]. Patients who practiced Tai Chi also had more pain intensity reduction compared with others who either were on the waiting list to start this practice or who opted for walking or swimming [54,55]. A similar result occurred in patients who adopted the practice of yoga compared with those who remained in the conventional treatment [56-58]. The use of ultrasound and Transcutaneous Electrical Nerve Stimulation (TENS) was not beneficial in studies in patients with chronic low back pain [59,60]. Other techniques commonly used in physical therapy do not have enough studies to determine the strength of evidence [52].

Studies evaluating psychological treatment in patients with chronic low back pain are generally of poor quality, but the techniques used still demonstrate a minor effect on pain improvement and quality of life. Cognitive behavioral therapy, mindfulness stress management, and other combined psychological therapies can be used as part of a multi-professional treatment strategy [30,52].

A small reduction in pain intensity can also be obtained with acupuncture, which may be included in multimodal pain treatment, as demonstrated in a systematic review [61]. The analgesic effect of this therapy is immediate, but it can be felt for up to 12 weeks after the end of the sessions [62].

## Interventional Treatment

Interventional treatment is indicated when there is a well-defined etiology for the painful condition that is well mapped by imaging. Once the origin of the pain has been determined, the approach of the treatment is percutaneous and may be guided by fluoroscopy, computed tomography, or ultrasound to achieve corticoid injection into nerve roots, articular facets or sacroiliac joints; injection of a neurolytic agent such as absolute alcohol or 6% phenol (less common); or the use of radiofrequency for nerve damage in the structure responsible for the symptom. In the case of patients undergoing spinal surgery, there is still the possibility of attempting to release post laminectomy fibrosis through epidural injection.

### Epidural Infiltration with Corticoids

This is one of the more frequently performed interventional procedures and can be performed via the sacral hiatus or transforaminal or interlaminar routes, and it is indicated in patients who present with radicular pain due to disc herniation [30]. In this block, a particulate or nonparticulate corticoid is deposited in the epidural space to minimize the inflammatory reaction on the nerve root, with a consequent reduction in symptoms lasting from two to three months, up to 24 months [63]. A systematic review showed that epidural corticosteroid injection did not reduce pain in the acute phase but reduced the risk of surgery in the short term, even though this result cannot be sustained in the long term [64].

### Epidural Adhesiolysis

This procedure derives from the concept that the scar tissue formed after spinal surgery is responsible for perpetuating painful symptoms and is therefore a potentially treatable cause [63]. The formation of this fibrosis, although more commonly associated with surgery, may also result from extrusion of disc material, bleeding, or infection. For example, recurrent processes of micro bleeding, inflammation, and scarring, which occur due to the weakening of the epidural venous plexus, caused by the consequences of aging on spinal structures, such as facets and discs, seem to be involved in canal stenosis formation that occurs in some patients with chronic low back pain [65]. A systematic review of studies using this technique showed evidence of reduction in low back pain and sciatica in FBSS [65].

### Spinal Cord Stimulation

Spinal cord stimulation is a technique in which an electric pulse generated by a generator is applied to the spinal cord, blocking the transmission of pain information generated at the periphery. Currently, FBSS is responsible for the most indications for implantation of this type of device in the USA, and patients with chronic low back pain, despite receiving adequate conservative

treatment, with involvement of at least one leg are indicated [66]. Typically, patients go through an adaptation period, where they are given an external stimulator that reproduces the action of the implantable device. According to the American Academy of Pain Medicine, to be eligible to receive the implant, the patient must fully understand the method and use of the device and should have a sustained 50% reduction in pain, despite adequate rehabilitation and stable doses of analgesics [67].

After implantation, most of the patient's experience 50-70% pain reduction and 40-80% reduction in analgesic consumption, although 20-40% of the patients present a reduction in this percentage of improvement due to central nervous system tolerance to the method [66]. Compared with reoperation, in patients with FBSS, the use of spinal cord stimulation promoted significant pain relief in 39% of patients and a reduction in analgesic use in 87%, compared with pain relief in 12% and reduction in analgesic use in 58% of patients who underwent surgical treatment [68]. The efficacy of spinal cord stimulation in FBSS was confirmed in a systematic review and meta-analysis that found a 58% pain relief level in a follow-up period of up to 24 months [69]. The use of high frequency stimulation led to an improvement in back and leg pain scores, function and quality of life, over a seven month period evaluation [70].

An important limiting factor for the use of this technique is the cost of the device and the implantation. However, a cost-effectiveness study has shown that compared with conservative treatment, despite the immediate cost increase in the first year, there is a sustained reduction in expenses in patients who receive spinal stimulation, decreasing by 68% in the first year in the USA, and a reduction of more than 40% per year [71]. This study is important because, considering the superiority of this method to both conservative treatment and reoperation, health care managers should consider incorporating this mode of treatment.

### Other Invasive Treatments

Other treatments, such as facet rhizotomy and sacroiliac joint infiltration, should be guided by physical examination findings and radiological confirmation, as low back pain may be the result of different injuries. The use of diagnostic blocks should be considered in these situations, and they may serve as a bridge to nerve injury treatment by radiofrequency, for example [30,71].

## Conclusion

FBSS is a challenging disease with a high prevalence, a significant negative impact on quality of life, and it is difficult to treat. There for, it is necessary to reflect on the surgical indications, seeking conservative options whenever possible. Multimodal pharmacological and multi-professional treatment followed by minimally invasive pain approach should antecede surgical treatment for patients suffering from back pain. Literature suggests that among surgical treatments, those that avoided spinal fusion appeared safer, with fewer patients developing FBSS.

### Author Contributions

JBSG design the review, oversaw article selection and reviewed the manuscript. JOBN design the review, selected articles, reviewed data from the studies and wrote manuscript. EBM selected articles, reviewed data from the studies and wrote manuscript.

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