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REVIEW ARTICLE

Understanding Post Spine Surgery Pain: Review of Literature

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Abstract

Background: Failed Back Surgery Syndrome is an unsatisfactory outcome of a patient who underwent spiral surgery irrespective of type or intervention area with persistent pain in the lumbosacral region with or without it radiating to the leg. The multifactorial etiology of this condition makes it challenging for the clinicians to completely treat this. Some of the causes like poor patients selection for surgery, incorrect diagnosis, suboptimal selection of surgery, poor technique, failure to achieve surgical goals, and/or recurrent pathology, pre-surgical mental status of patient.

Methods: This non systemic review searched databases including medline via PubMed. The Cochrane Library and Embase using the terms Failed Back Syndrome. Post spine surgery, chronic pain, clinical trials, cohort studies, scientific reports were reviewed of last 15 years.

Conclusion: A multidisciplinary approach is most appropriate for patients who are unlikely to benefit from further formal surgical intervention. Team work including physicians, psychologists, physiotherapists, and other allied health professionals is essential in improving outcomes for patients with failed back surgery syndrome.

Key words: Failed back syndrome, Post spine surgery syndrome, Chronic pain

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Introduction

One of the most common symptoms persisting in today's population is low back pain. The prevalence of this symptom varies from country to country, and the exact percentage is difficult to understand. The spectrum of low back pain ranges from mild to moderate to severe and from nociceptive to neuropathic to a combination of both. This wide spectrum makes it difficult for the physicians to understand the mechanism and pathophysiology of pain. Each element from the spine itself is a pain generator ranging from nerves, discs, joints (facet joint and sacroiliac joints), and myofascial components. The lack of highly specific and sensitive tests for low back evaluation makes the confirmation of diagnosis difficult. Failure to make an appropriate diagnosis is one of the potential sources for undergoing spine surgeries with failure. Surgery is one of the highly appreciated treatments for low back pain with a success rate of almost 50%, and the other half of people fall in the category of chronic persistent pain after surgery. The other half of the population eventually leads to a state of no or minimal pain relief. This state has been given multiple nomenclatures, such as failed back syndrome, post spine surgery pain, chronic spine pain, and post laminectomy pain. Multiple studies have been performed to identify the cause, but lack of feasibility of these studies has proven to be not as much use even after three decades of research. There is no definite term to describe persistent pain after surgery, and all the terms used in the past have their own drawbacks and limitations. Persistent or recurrent pain and other symptoms following spinal surgery are common, affecting between approximately 20% and 40% of patients[1,2].

Methods

Understanding the meaning, nomenclature and limitations.

Meaning:

The outcome of lumbar spine surgery does not meet the presurgical expectations of both the patient and surgeon or new or recurrent low back and/or lower extremity pain following one or more spine surgeries or chronic radicular pain that persists or recurs in the same distribution despite anatomically satisfactory previous spinal surgery[3,4,5].

Nomenclature:[6]

1. In 1934, the importance of spine surgery for sciatica pain was realized, and spine surgeries came into prevalence. After the popularity of spine surgeries, the failure to relieve the spine was identified, and this condition was described as "post-laminectomy syndrome".
2. Burton introduced the term "Failed Back Surgery (FBS)" in his publication.
3. The International Classification of Disease (ICD-11) introduced the term chronic pain after spinal surgery (CPSS), which was also accepted by the World Health Organizaton (WHO).
4. Chronic spinal pain after surgery - Pain that develops or increases in intensity after a surgical procedure or a tissue injury.
5. Postsurgical spine syndrome (PSSS).
6. Persistent Spinal Pain Syndrome - This term is suggested by the authors Nick Christelis and Brian Simpson in their recent articles.

Limitations:

1. Failure to differentiate between the failure of surgery to relieve the target symptoms and surgery being the direct cause.
2. Failed Back Surgery Syndrome (FBSS) does not differentiate symptoms caused by the surgery from those that were simply not relieved by it. They may coexist.
3. Lack of clarity about cases where late relapse/ recurrence occurred after initially successful surgery.

Etiology:

Failed Back Surgery Syndrome remains one of the most underdiagnosed conditions leading to persistent disability affecting physical, biophysicosocial and emotional abilities. Due to multifactorial involvement, understanding the causes of persistent pain post surgery is of prime importance.

The factors contributing to Failed Back Surgery (FBS) can be classified into Preoperative factors: Depression and smoking obesity are few strong predictors of going into FBS.

Operative Factors: Incorrect level and side of surgery, inappropriate surgery and misplaced interbody fusion grafts and implants.Postoperative Factors[7]: Early causes of failure can be attributed to nerve injury, haematoma formation, infection, anes-

thesia complications, and excessive resection. Late causes: Alteration in the biomechanics of the spine leads to altered load distribution and accelerated degeneration in the adjacent structures, leading to transition syndrome, and the adjacent structure becomes a potential source of pain.

Other factors:

Sacroilliac joint stress[8]: Reduced sacral tilt after surgery leads to loss of natural lumbar lordosis with a resultant increase in stress transfer to the sacroiliac joints, and loss of sagittal balance in multiple level surgeries leads to sciatic joint stress, leading to persistent pain. Facet joint stress[9,10]: Studies showed that 8 to 32 percent of postfusion surgery cases lead to increased stress on the facet joint due to restricted motion in the fused segment, thereby accelerating the process of degeneration. Reduction of the intervertebral space in the case of discectomy also enhances the mechanical stress on the facet joint, leading to the release of pro-inflammatory substances such as substances P, calcitonin and neuropeptide Y, accelerating further damage.

Assessment of the patient: Proper assessment in the form of history taking, physical examination, psycological examination and imaging plays an important role in determining the further management of the condition.

Initial History taking: Starting the history taking back from the start is mandatory. Few important questions that need to be addressed are differentiating back pain, back and leg pain and only leg pain. Changes in the intensity of pain, differences in pain relief pre and postsurgery, pain-free period postsurgery, other causes of low back pain, other nonspine causes of back pain, aggravating and relieving factors for the pain. Understanding the type of nociceptive pain, neuropathic pain and the combination of nociceptive and neuropathic pain is of paramount importance.

Obtaining the relevant records regarding previous treatments, including details of spinal operations, from other departments or hospitals, as these details often provide important clues regarding management.

Red flags such as bladder bowel incontinence, weakness of limbs, and sudden increase in pain score need extensive evaluation. Validated pain assessment tools to assess pain severity, physical disability and psychological distress (Brief Pain Inventory, Oswestry Disability Index, Hospital Anxiety and Depression Scale, EQ-5D) can be used[11].

Physical assessment: History taking gives good information about the source of persistent pain generator; it is to be followed by thorough examination of the spine for an appropriate approach towards the diagnosis. Posture analysis, sagittal and coronal balance, vertebral range of motion, and gait analysis must be done thoroughly. Sensory and motor examination is incomplete without eliciting reflexes. This is to be followed by examination of the presence of peripheral pulses to rule out vascular causes of pain. All lower limb joints, such as the ankle joint, knee joint and hip joints, are also evaluated.

The aim of physical examination is to identify whether the pain is only in the back or is associated with leg pain. Sometimes isolated leg pain presenting as neurogenic claudication needs to be differentiated from vascular claudication.

Low back evaluation is performed to differentiate the myofascial component, discogenic component and facet joint and sacroiliac joint components. Various provocative tests can be performed to differentiate the various causes[12,13,14].

Low back pain with leg pain points towards nerve compression due to prolapsed discs, entrapments of nerves in epidural fibrosis or foraminal stenosis.

Psychological assessment

Optional questionnaires can be used to assist the psychological assessment. The most recognized questionnaire in this context is the Minnesota Multiphasic Personality Inventory 2 Restructured (MMPI-2-RF). The Hospital Anxiety and Depression Scale (HADS) allows the detection of various states of depression (HADS-D) and anxiety (HADS-A), and the Fear Avoidance Beliefs Questionnaire Work and Activity (FABQ) measures patients' fear of pain[15,16].

Imaging:

History taking and physical examination do provide a great deal of insight towards the diagnosis, but imaging in the form of radiography, MRI, and CT-Scan helps in confirming the differential diagnosis for the pain.

Plain radiography in both flexion and extension give details about the vertebral alignment, extent and placement of the surgery and the implant and presence of degenerative changes.

MRI Spine-MRI spine remains the gold standard for evaluation and confirmation of prolapsed discs and ligaments. Comparison of preoperative and postoperative MRI can provide important clues towards the diagnosis. Occasionally contrast-enhanced MRI may be required to confirm the presence of epidural fibrosis and is considered to be the best imaging modality for detecting spondylodiscitis[16].

CT Scan- This does not have much role but is required in cases where MRI are contraindicated. Additionally, in cases of suspected joint arthropathy or arthrosis, it may be superior to MRI scans.

Management of FBSS: A multidisciplinary approach for the treatment of FBSS is the only key for better results. The International Association for the Study of Pain (IASP) recommended that "clinicians who assess and treat patients in a pain center should include physicians, nurses, mental health professionals (e.g., clinical psychologist and psychiatrist), and physical therapists"[17].

Once the aetiology of the persistent pain is understood, conservative management is the first step followed by minimally invasive techniques such as epidural injections, radiofrequency ablations, and neuromodulation, followed by the last resort of redo surgeries. However, there is no rule for the same. After the repeat surgeries, 30%, 15%, and 5% of the patients experience a successful outcome after the second, third, and fourth surgeries, respectively[18].

Physical therapy:

Physical therapy can help patients optimize their gait and posture and can improve muscle strength and physical function[19].

There is no Level I evidence for exercise, physical therapy, and behavioural modification FBSS treatments, but there is strong Level II evidence to support these treatments.

Pharmacotherapy:

No gold standard drug is available for this condition. Optimization of pharmacotherapy covering the nociceptive and neuropathic components needs to be kept in the clinicians' mind before deciding on the medications. Clinicians must also weigh adverse events and individual patient responses when selecting specific medications or combinations. Lack of supporting data regarding the efficacy of only pharmacotherapy have been reported for the same[20,21].

Nonsteroidal anti-inflammatory drugs, anti-neuropathic drugs, oral steroids, antidepressants, and opioids have been used in different combinations, but their efficacy remains only supportive with other modalities. Antiepileptics such as gabapentin and pregabalin can be used to treat neuropathic pain with FBSS and may play a role in preventing pain after surgery. The evidence for the use of medications in FBSS is weak to moderate, with the exception of one Level I study[14].

Interventions:Pain physicians have a definite strong role in the assessment and management of such cases. The bird's eye view in assessing the main source of pain generator and then the use of available interventions for the local site pain remains important.Level I evidence suggested that caudal epidurals were similar or less expensive than reoperation, manipulation, and medical management[22].

Level II evidence supported epiduroscopy as part of the treatment algorithm[23].

Level III studies supported adhesiolysis for longer-term pain relief over ESI24, as well as medial branch neurotomy for axial pain.

Epidural injections:

Failure of radicular symptoms, new onset of radicular components due to herniated disc, postoperative adhesions, a thickened ligamentum flavum, spondylolisthesis responds well to epidural steroid injections (ESIs), which are the most commonly performed procedure in pain clinics around the world25. Using any one of the approaches, transforaminal, interlaminar, or caudal can be chosen according to the unilateral or bilateral nature of the pain.

A recent meta-analysis suggests that between one-third and one-half of patients considering surgery for spinal pain can avoid it in the short term with ESI, although the evidence for this is stronger in patients who have not had prior surgery[26].

Adhesiolysis:

The incidence of epidural fibrosis is approximately 20%–36% of FBSS cases according to studies[27]. The adhesions inside the posterior dural compartment and anterior dural compartment may lead to entrapment of the nerve leading to radicular symptoms or may present without radicular symptoms as well, reduced spine movements, and pain in the spine with move-

ments. Postoperative scar formation is a natural part of tissue healing after any surgery. One of the reasons for failure of epidural steroid injections is the presence of adhesions, thereby preventing the steroid from reaching the exact place.

Racz et al. rationalized percutaneous lysis of epidural adhesions on the basis that inflammation, edema, fibrosis, and venous congestion; mechanical pressure on posterior longitudinal ligaments, annulus fibrosus, and spinal nerve; reduced or absent nutrient delivery to the spinal nerve or nerve root; and central sensitization may be present in patients with chronic back pain and/or radiculopathy.

The use of a Racz catheter for epidurocopy and the release of adhesions have been performed for a long time, and the adhesions are cleared with the help of local anesthesia, normal saline, steroids and hylase. A new system of disposable epiduroplasty. The Racz system uses a catheter to be introduced through the caudal space and can be reached up to the site of surgery. This system can be rotated on the eighter side to also reach the foramen and clear any adhesions at the foramen level. There is level I evidence for the role of lysis of adhesions in the treatment of FBSS[28].

Radiofrequency Ablation:

RFA of nerves is often used to provide sustained relief that a diagnostic block or therapeutic injection cannot provide. Successfully targeting the intended nerve is achieved, maximizing the size of the lesion. This can be done by performing multiple RFA in different locations, increasing the temperature and time of the ablation, using bipolar RF or cooled RF[29].

Neuromodulation:

Trials of conventional spinal cord stimulators should be encouraged if the pain is predominantly neuropathic and localized to the buttock and leg. The trial before implantation is in line with the recommendation of current guidelines from NICE[13] and the British Pain Society. The prospective randomized controlled multicenter trial of the effectiveness of spinal cord stimulation demonstrated improved outcomes with SCS compared with conventional medical medicine (CMM) alone in the treatment of neuropathic pain from FBSS. Improvement in measures includes pain scores, quality of life, functional capacity, and patient satisfaction[30].

The major advantage of the success of implantable devices is the mechanism of action, which causes induced analgesia to occur not only by its effects on the spinal cord but also by the supraspinal components of the central nervous system as well as by inducing descending inhibitory pathways and inhibiting pain facilitation[31].

The strongest evidence for FBSS treatment with implantable technology exists for SCS. Recent Level I data demonstrated robust results for high-frequency SCS at 10 kHz[32].

Surgery:

Usually, the last resort for treating FBSS is the absence of Red Flags. The presence of red flags requires redo surgery depending on the patient's condition. The redo surgery can be immediate postoperative period or late. The role of surgery is important if obvious signs of spinal instability and/or acute nerve root compromise unresponsive to more conservative interventions.

Surgical revision for FBSS is associated with high morbidity with corresponding low rates of success.

Discussion

Failed back sugery syndrome is a challenging condition to treat for clinicians as well difficult situation for the patient to cope up with. Not only does the physical pain bothers the patient but the associated psychological impact is no less. There seems to be no doubt in the interdisciplinary role for management of failed back surgery syndrome. A Cochrane review has found intensive interdisciplinary rehabilitation to be effective for chronic low back pain. There was strong evidence that function improved with intensive interdisciplinary rehabilitation with functional restoration.

Physical therapy by an expert therapist should be done in holistic approach involving physiotherapist, psychologist, occupational therapist. Patient's pathology, strengths, and limitations should be kept into consideration before applying any therapy. Cognitive behaviour therapy or other psychiatric therapy can lead to better outcomes in patients with FBSS and may enhance the efficacy of interventional treatments for patients' pain.[33]

The conservative management in form of common pharmacologic treatments include non-steroidal anti-inflammatory drugs (NSAIDs), opioids, anticon-

vulsants, and antidepressants. Though it does not suffice completely but does play important role in management. NSAIDs helps in taking care of the nociceptive components but need to be given in dose compatible with the patient general health condition. Role of opioids is limited in FBBS as the risk of dependence and resultant substance use disorder have higher chances. Strong Level II (small randomized controlled trial [RCT]) evidence exists for the efficacy of active physical therapy in patients with gabapentinoids.

Interventions should be considered when deemed necessary. Manchkanti et al. found that in FBSS, caudal epidural injection caused improving functional status in 55% and pain reduction in 60% to 70% of patients[34].

A study by Jae Hwan Cho et al[35]. comprising of Twenty-three articles, concluded that epidural adhesiolysis showed a short-term (6 to 24 months) effect (grade A) and spinal cord stimulation showed a mid-term (2 or 3 years) effect (grade B). Epidural injections showed a short-term (up to 2 years) effect (grade C).

A systematic review of 5 randomized controlled trials and 2 observational studies by Standiford Helm Ii et al[36]. identifying the role of percutaneous adhesiolysis in the treatment of refractory low back and leg pain due to post lumbar surgery syndrome or spinal stenosis. The study concluded is fair evidence that percutaneous adhesiolysis is effective in relieving low back and/or leg pain caused by post lumbar surgery syndrome.

In a study by Salim M Hayek et al[37]. which included 13 studies, one randomized trial and 5 observational studies met inclusion criteria for evidence synthesis based on the inclusion criteria and methodologic quality scores of 50 or more. The indicated level of evidence for endoscopic adhesiolysis is Level II-1 or II-2 evidence for short- and long-term relief.

Multiple studies on effect of Neuromodulation have been done for identifying the role of neuromodulation in failed back surgery syndrome.

In a study by Kumar et al[38]. on 100 patients, supported the role of spinal cord stimulators in favour of FBSS.

Another study by Zucco et al[39]. studied on 80 patients of radicular pain in failed back syndrome also favoured the role of SCS for FBBS and suggested it to be cost effective. A cohort of 16,455 patients with FBSS including 395 undergoing SCS Study by Lad et al.[40] concluded that SCS remains underused in FBSS. Decreased complications and improved outcomes compared to reoperation make SCS appealing.

Conclusion

Extensive work of three decades has been invested to identify the pathophysiology and treatment options for FBS, but it still remains the most understood pain condition requiring a multidisciplinary team work for the best interest of the patient. Every department plays its own role in motivating the patient, mobilizing the patient, and taking care of pain, although the patient may not reach a state of preoperative stage.

The strongest, long-term level of evidence is for SCS, specifically high-frequency SCS at 10 kHz. Active exercise and rehabilitation have Level II evidence with long-term efficacy for their utilization in the FBSS patient population. Moreover, specific interventional procedures have demonstrated strong Level I and II evidence up to 1 year. The weakest level of evidence was found for medications and reoperation, demonstrating their general lack of efficacy in Failed back surgery syndrome.

Declaration

Ethics approval:
Not applicable
Author Contributions:
Conception and development of the idea: SDData collection: MC and RV
Data analysis: SD, MC and RV
Writing - Original Draft Preparation: SDReview & Editing: SD, MC and RV
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