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ORIGINAL ARTICLE

Onset of mental disorders in patients who developed failed back surgery syndrome

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Abstract

Purpose Failed back surgery syndrome (FBSS) is a complex and multifaceted condition associated with significant disability and morbidity. The purpose of this study was to investigate the association between FBSS with new incidences of mental health disorders.

Methods Our cohort included patients diagnosed with FBSS within 12 months of a posterior fusion, laminectomy, or discectomy, identified using The International Classification of Disease, both Ninth and Tenth Revisions (ICD-9 and ICD-10). In the next step, both non-FBSS and FBSS-diagnosed patients were queried for the diagnosis of first-time occurrence of mental health disorders. The incidence of new mental health disorders was determined within 12-months following FBSS diagnosis.

Results FBSS patients were significantly at greater risk than non-FBSS patients of developing all included mental health pathologies: Depression: OR 1.9, 95% CI 1.8–2.0, $p < 0.0001$); Anxiety: OR 1.5, 95% CI 1.4–1.6, $p < 0.0001$; Sleep Disorder: OR 1.9, 95% CI 1.7–2.0, $p < 0.0001$; Bipolar Disorder: OR 1.7, 95% CI 1.5–2.0 $p < 0.0001$; PTSD: OR 1.5, 95% CI 1.3–1.8, $p < 0.0001$; Panic Disorder: OR 1.8, 95% CI 1.5–2.1, $p < 0.0001$; Suicidal Disorder: OR 1.7 95% CI 1.4–2.0, $p < 0.0001$, ADHD: OR 1.3, 95% CI 1.0–1.5, $p = 0.0367$.

Conclusions In the current study, patients diagnosed with FBSS were at a significantly greater risk of developing mental health pathologies. While other studies have suggested pre-surgical psychological support and treatment, the current results suggest that a post-operative psychologic care may also be warranted. By identifying potential psychosocial unforeseen obstacles that occur in patients diagnosed with FBSS, more precise treatment pathways can be developed leading to improved patient outcomes.

Keywords Failed back surgery syndrome · Postlaminectomy syndrome · Spine fusion · Mental health · Decompression

Introduction

Despite advances in technologies and efforts to improve treatments, low back pain remains a leading cause of disability worldwide, estimated to being responsible for 83 million years lived with disability in 2010 [1]. It is also a significant economic burden on the economy, costing the US over $100 billion per year [2]. Given the impact of low back pain on both quality of life and on the healthcare system, efforts to surgically treat low back pain have increased. From 2004 to 2015, there was a 138% increase in the volume of lumbar fusion procedures alone in people over 65 [3]. However, despite the rise in lumbar fusions, an estimated 10–46% of surgeries still result in worsened or novel spine pathology [4].

Failed back surgery syndrome (FBSS) is a complex and multifaceted condition related to such surgical failures. While in the literature FBSS has been estimated to result from as much as 20–40% of surgical interventions to treat low back pain [4], there is a paucity of data to support this statistic. FBSS, also known as postlaminectomy syndrome, encompasses a range of lumbar-fusion-related complications that cause persistent and debilitating lumbar pain

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post-surgery [5]. There is a lack of consensus and understanding of the accurate reporting of FBSS, as well as its manifestations and associated pathologies [6]. Some argue that a diagnosis FBSS can in fact often be narrowed down to more specific pathologies, including foraminal stenosis, painful disc, pseudarthrosis, neuropathic pain, recurrent disc degeneration, facet joint pain, and sacroiliac joint pain [7]. These complications in diagnosis and reporting have made efforts to elucidate the syndromic effects of FBSS particularly difficult.

Certain patient and preoperative factors have been evaluated in relation to likelihood of post-surgical psychological morbidity [6, 8]. Studies have also shown that regardless of preoperative psychosocial status, surgical complications are significantly associated with poor long-term psychosocial outcomes [9]. Although preoperative and patient risk factors and complications have been analyzed, there is a severe lack in data on new incidences of mental health pathologies *following* FBSS diagnosis. The aim of this study is to investigate the incidences of various mental health disorders associated with the diagnosis of FBSS in comparison with non-FBSS patients using a large cohort.

Materials and methods

We hypothesized that patients with FBSS are significantly more likely to develop mental health pathologies. To test this, data were obtained by retrospectively identifying patients undergoing lumbar spine surgery from January 2010 through quarter 3 of 2020 from the M91Ortho database. M91Ortho is a subset of the PearlDiver national database, a publicly available insurance database that contains 91 million patients and their records. PearlDiver collects data on commercial, Medicare, Medicaid, cash, and government payments to healthcare providers and M91Ortho specifically includes patients who have undergone an orthopedic procedure.

The study cohort included patients who underwent posterolateral lumbar fusion (PLF), posterior lumbar interbody fusion (PLIF), laminectomy, laminotomy, and discectomy. Patients were identified using the corresponding Current Procedural Technology (CPT) codes found in Table 1. Next, patients were analyzed to determine if they were diagnosed with FBSS within twelve months of the index procedure. Patients were identified using The International Classification of Disease, both Ninth and Tenth Revisions (ICD-9

Table 1 ICD-9 and ICD-10 Codes Used to Extract Patient Data from the M53Ortho Database (2010–2019)

Description/code type	Codes
Failed back surgery syndrome	ICD-9-D-72281, ICD-9-D-72282, ICD-9-D-72283, ICD-10-M961
Laminectomy/laminotomy/discectomy (CPT)	CPT-63030, CPT-63005, CPT-63042, CPT-63047, CPT-63012, CPT-63017
Posterior, posterolateral, or lateral transverse process fusion approach (CPT)	CPT-22612, CPT-22630, CPT-22633
Mental health disorder	ICD-9-D-311, ICD-10-D-F329, ICD-9-D-30000, ICD-10-D-F419, ICD-9-D-78052, ICD-9-D-3004, ICD-10-D-F341, ICD-10-D-G4700, ICD-9-D-29680, ICD-9-D-30002, ICD-10-D-F411, ICD-10-D-F319, ICD-9-D-29632, ICD-10-D-F331, ICD-9-D-29620, ICD-10-D-F329, ICD-9-D-29630, ICD-10-D-F339, ICD-9-D-30981, ICD-10-D-F4310, ICD-9-D-29633, ICD-10-D-F332, ICD-9-D-30001, ICD-10-D-F410, ICD-9-D-V6284, ICD-10-D-R45851, ICD-9-D-30928, ICD-10-D-F4323, ICD-9-D-30742, ICD-10-D-F5101, ICD-9-D-31400, ICD-10-D-F900
Depressive disorder	ICD-9-D-311, ICD-10-D-F329, ICD-9-D-3004, ICD-10-D-F341, ICD-9-D-29632, ICD-10-D-F331, ICD-9-D-29620, ICD-10-D-F329, ICD-9-D-29630, ICD-10-D-F339, ICD-9-D-29633, ICD-10-D-F332
Anxiety disorder	ICD-9-D-30000, ICD-10-D-F419, ICD-9-D-30002, ICD-10-D-F411
Sleep disorder	ICD-9-D-78052, ICD-10-D-G4700, ICD-9-D-30742, ICD-10-D-F5101
Bipolar disorder	ICD-9-D-29680, ICD-10-D-F319
PTSD	ICD-9-D-30981, ICD-10-D-F4310, ICD-9-D-30928, ICD-10-D-F4323
Panic disorder	ICD-9-D-30001, ICD-10-D-F410
Suicidal disorder	ICD-9-D-V6284, ICD-10-D-R45851
ADHD	ICD-9-D-31400, ICD-10-D-F900

and ICD-10, Table 1). The FBSS and non-FBSS populations were matched for age, gender, and Charlson Comorbidity Index (CCI) using PearlDiver's MATCH function. The MATCH function performs exact matching concurrently on all populations such that the resulting new populations are created with the same proportional makeup for each defined characteristic, and they are proportional to each other.

In both the non-FBSS and FBSS-diagnosed cohorts, patients were identified who received a first-occurrence diagnosis of a mental health disorder overall, depressive disorder, anxiety disorder, sleep disorder, bipolar disorder, post-traumatic stress disorder (PTSD), panic disorder, suicidal disorder, and/or attention-deficit/hyperactivity disorder (ADHD), within twelve months of the FBSS diagnosis. Twelve months were selected as a follow-up period based on previous published literature [10–12]. Patients were identified with these pathologies using ICD-9 and ICD-10 codes (Table 1). Any patients with previous mental health diagnoses were excluded. Exclusion was achieved using special coding targeted for the Pearl Diver database. Chi squared analysis was carried out using an integrated R package within PearlDiver to find relative risk of mental health problems between the matched patient cohorts with and without FBSS, therefore the statistics were controlled for age, gender, and CCI at the matching step.s Institutional Review Board approval was not required as all patient information was de-identified.

Results

General sample overview

From 2010 to 2019, 680,638 patients (51% female, 49% male) underwent a decompression and/or posterior fusion procedure (60% decompressions, 40% posterior fusions). Of these patients, 53,477 (7.9%) patients were diagnosed with FBSS within a year of the index procedure with non-FBSS patients constituting the remainder. The most common age group associated in both those with and without FBSS diagnosis was 70–74 years old. After matching, each of the two groups, FBSS and non-FBSS, had 53,470 patients (54% female, 46% male). In both the FBSS and non-FBSS matched cohorts, the most common age group was again 70–74 years old.

Mental health disorders

The overall rate of any mental health disorder in our patient population was 19% in FBSS patients and 12% of non-FBSS patients within 12 months of the index procedure (OR 1.7, 95% CI 1.7–1.8, $p < 0.0001$, Fig. 1). There was a significantly greater incidence of each of the mental health disorders in the FBSS cohort compared with the non-FBSS. The FBSS versus non-FBSS patients demonstrated: more depression (8.9% vs. 4.4%, OR 1.9, 95% CI 1.8–2.0, $p < 0.0001$), anxiety (5.2% vs. 3.6%, OR 1.5, 95% CI 1.4–1.6, $p < 0.0001$), and sleep disorders (4.2% vs. 2.5%, OR 1.9, 95% CI 1.7–2.0, $p < 0.0001$). The mental health diagnoses were more frequent in females in both cohorts, except for ADHD, which varied slightly according to FBSS status (Fig. 2, Table 2). The age group with the greatest number of mental health diagnoses was 50–54 (Fig. 3).

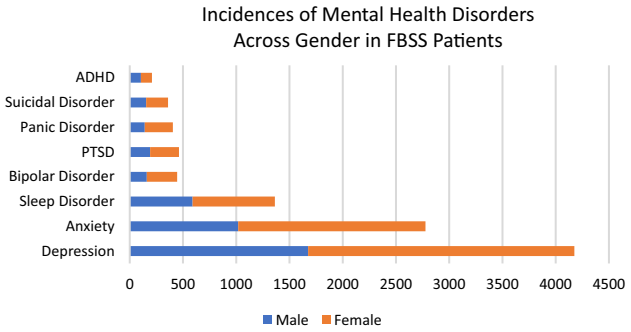

Fig. 1 Incidences of mental health disorders across gender in FBSS patients

The remaining disorders, PTSD, panic disorder, suicidal disorder, bipolar disorder, and ADHD, had incidence rates below 1%, yet all were consistently higher in the FBSS population in comparison with the non-FBSS group. All these mental health disorders were significantly ($p < 0.05$) more likely to occur in patients with FBSS than those without (Bipolar Disorder: OR 1.7, 95% CI 1.5–2.0, $p < 0.0001$; PTSD: OR 1.5, 95% CI 1.3–1.8, $p < 0.0001$; Panic Disorder: OR 1.8, 95% CI 1.5–2.1, $p < 0.0001$; Suicidal Disorder: OR 1.7 95% CI 1.4–2.0, $p < 0.0001$, ADHD: OR 1.3, 95% CI 1.0–1.5, $p = 0.0367$, Table 2).

Discussion

In the current study, FBSS patients were almost two times more likely to develop a mental health diagnosis than non-FBSS patients. The most common mental health disorders acquired post-FBSS diagnoses were depression, followed by anxiety and then sleep disorder. While the highest incidence rate of FBSS diagnoses was 70–74 years old, the highest incidence of mental health diagnoses was in those 50–54 years old, suggesting that this group warrants particular attention and preventive psychosocial intervention.

FBSS remains a difficult entity to diagnose, and subsequently, to treat. However, it has been reported that with accurate and precise history taking, examination, psychological evaluation, and imaging, a more specific diagnosis

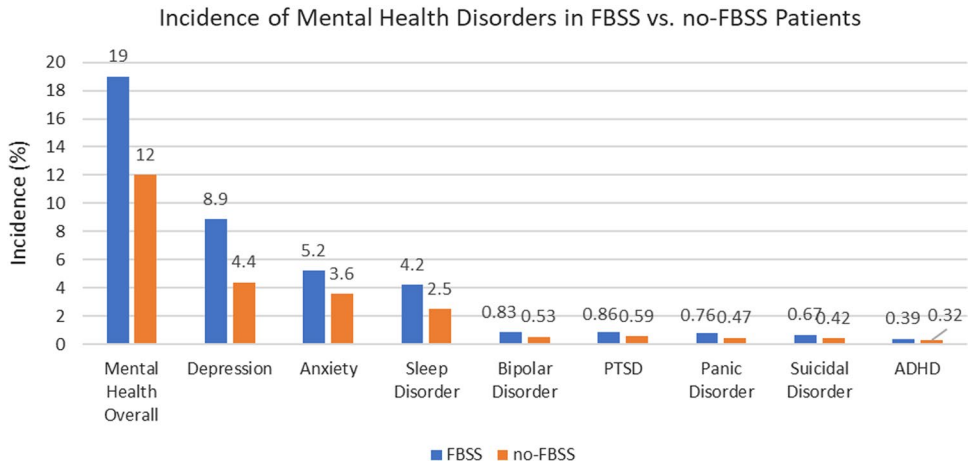

Fig.2 Incidence of mental health disorders in FBSS vs. no-FBSS patients

and thus treatment strategy can be reached in over 90% of patients. These diagnoses are almost always accompanied by concurrent psychological disorders, most commonly depression, anxiety, and substance use disorder [7].

Currently, much of the literature has investigated the relationship between a pre-existing mental health diagnosis and poor spine-related surgical outcomes. Prior studies have reported that mood disorders, particularly depression and

Table 2 Incidence rates of new mental health disorders at 12 months post-FBSS diagnosis and likelihood of mental health diagnosis according to FBSS status

Rates of new mental health disorders			Odds ratio	95% CI	*p*-value
Complication	FBSS 12 M	No FBSS 12 M			
Mental health overall	10,176 (19%)	6437 (12%)	1.7	[1.7, 1.8]	***p* < 0.0001**
Male	4241 (42%)	2586 (40%)			
Female	5935 (58%)	3851 (60%)			
Depression	4175 (8.9%)	2352 (4.4%)	1.9	[1.8, 2.0]	***p* < 0.0001**
Male	1675 (40%)	899 (38%)			
Female	2500 (60%)	1453 (62%)			
Anxiety	2777 (5.2%)	1935 (3.6%)	1.5	[1.4, 1.6]	***p* < 0.0001**
Male	1018 (37%)	693 (36%)			
Female	1759 (63%)	1242 (64%)			
Sleep disorder	2264 (4.2%)	1363 (2.5%)	1.9	[1.7, 2.0]	***p* < 0.0001**
Male	1035 (46%)	590 (43%)			
Female	1229 (54%)	773 (57%)			
Bipolar disorder	445 (.83%)	286 (.53%)	1.7	[1.5, 2.0]	***p* < 0.0001**
Male	160 (36%)	93 (33%)			
Female	285 (64%)	193 (67%)			
PTSD	462 (.86%)	314 (.59%)	1.5	[1.3, 1.8]	***p* < 0.0001**
Male	191 (41%)	117 (37%)			
Female	271 (59%)	197 (63%)			
Panic disorder	405 (.76%)	249 (.47%)	1.8	[1.5, 2.1]	***p* < 0.0001**
Male	141 (35%)	76 (31%)			
Female	264 (65%)	173 (69%)			
Suicidal disorder	360 (.67%)	222 (.42%)	1.7	[1.4, 2.0]	***p* < 0.0001**
Male	154 (43%)	106 (48%)			
Female	206 (57%)	116 (52%)			
ADHD	208 (.39%)	173 (.32%)	1.3	[1.0, 1.5]	**0.0367**
Male	105 (50%)	72 (42%)			
Female	103 (50%)	101 (58%)			

Siginificant p value was in bold

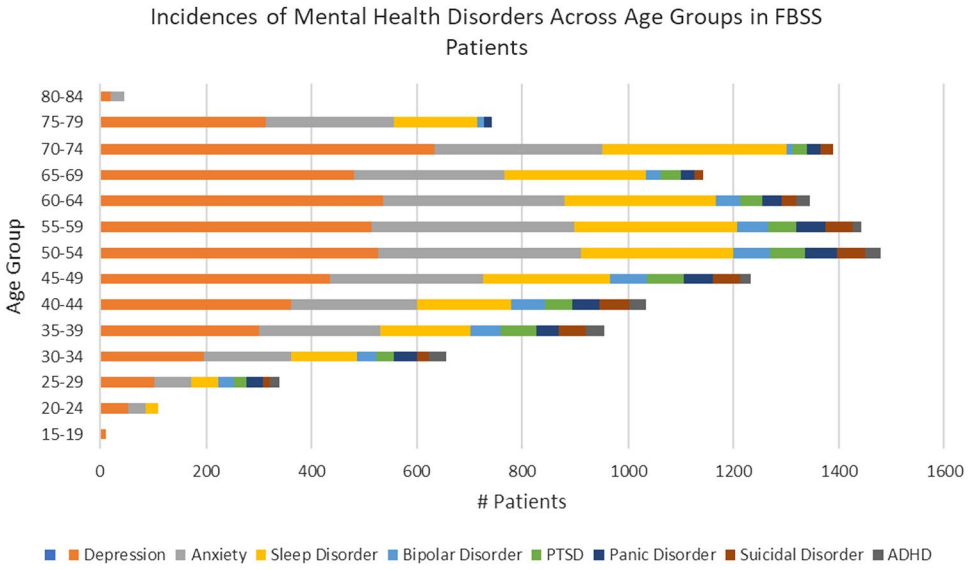

Fig. 3 Incidences of mental health disorders across age groups in FBSS patients

anxiety, have a strong relationship with and put the patient at risk for poor surgical and functional outcomes [13–20]. A prospective study on psychological predictors of lumbar surgery outcomes found that patients with presurgical anxiety and depression were more likely to fail to return to work or report improvement in pain or functional abilities [13]. Patients with presurgical depression have also been reported to have poorer symptom improvement, disability score, and walking capacity in comparison with patients without depression. Interestingly, patients who recovered from depression experienced similar postoperative improvement to the normal mood group [14].

There is a growing literature on the value of adopting a psychologically informed practice with a 17-item tool that assesses pain-associated psychological distress. With its high degree of accuracy, this tool enables proper pre-screening of patients to help doctors have a better understanding of the likelihood that a patient will have increased vulnerability to pain or decreased resilience. However, there were no studies that examined how this information might be used to predict onset of mental disorders [21].

Moreover, few studies have explicitly explored the new onset of psychological pathology that occurs following failed back syndrome. However, one study conducted a meta-analysis of 50 publications that investigated impact of complications in various surgical specialties on patient psychosocial well-being. They found that two thirds of the included studies reported that patients with surgical complications had worse postoperative psychosocial outcomes, regardless of preoperative psychosocial status [8]. These findings are consistent with our high rate of new mental health diagnoses within a year following a diagnosis of surgical failure. Other PearlDiver database studies have reported similarly high mental health rates of 26–40% in orthopedic surgery patients [22, 23]. In addition, a comprehensive Global Burden of Disease study in 2019 reported the global prevalence of mental health to be 0.97%, markedly lower than our post-operative new mental health diagnosis rate of 19% in FBSS patients [24]. These data emphasize the particular attention and support that is warranted for these patients in hopes of reducing the burden of psychological morbidity.

The relationship between chronic back pain and mental health, particularly depression, is complicated [25], and it is suggested that both chronic back pain can cause depression, and depression can also actually increase pain [26]. A review on surgery-related anxiety and depression found that pain, information, disability, employment, and pre-operative mental health are key factors in these post-operative mental health disorders [27]. Given these findings, it is possible that those with FBSS are likely experiencing greater pain, disability, inability to return to work, and overall mental distress in comparison to patients who did not develop FBSS. Another study on spine surgery patients demonstrated that psychological disturbance worsened in patients with a poor surgical outcome and improved in those with a good surgical outcome, suggesting that unremitting pain, as is seen with FBSS patients, can negatively impact mental health [28]. Results of these studies collectively support current study results that FBSS patients have a significantly greater likelihood of developing a mental health disorder following spine surgery. Our findings provide further evidence for the need for better psychologic management both pre- and post-operatively, particularly in those with continued spine morbidity following surgery.

Unsurprisingly, given the aforementioned associations between spine surgery and mental health disorders, antidepressant use is common in spine patients. These medicines can be useful in treating psychiatric and non-psychiatric

illnesses, including spinal disorders. However, chronic use might be detrimental due to depletion of bone mineral density and increased bleeding. Most SSRIs (selective serotonin reuptake inhibitors) were designed to be used to get patients through acute phases of depression or anxiety, but they often are kept on these medicines for much longer. Regardless, spine surgeons often are unfamiliar with the advantages and disadvantages of the use of them in the context of spine pathologies. Proactively treating depression and anxiety preoperatively may help spine patients achieve better outcomes postoperatively. Meanwhile, preoperative platelet function assay should be completed prior to major spine surgical procedures to protect against significant intraoperative blood loss, as SSRIs have been shown to increase intraoperative bleeding [29].

There are some limitations to consider when interpreting current study's findings. First, although using a database allowed for a large sample size and thus more accurate results, we did not have access to patient records and instead solely relied on valid reporting of ICD codes to gather data. Mental health diagnoses could have been underreported in the database postoperatively if patients never sought care and/or received a formal physician's diagnosis. In addition, due to the complexity of FBSS as a diagnostic tool with unclear inclusion/exclusion, there could have been under- or over-reported FBSS diagnoses by providers. Finally, we did not investigate other preoperative factors such as obesity, diabetes, and others that may influence our data and likelihood of mental health complications. However, although we did not match for these individual risk factors, we did match for CCI, thus reducing potential confounding. Despite these limitations, current analysis gives clinicians insight into understudied, yet greatly problematic complications that follow an already debilitating failed back surgery.

Conclusion

The current study suggests that FBSS patients are at significantly greater risk of developing all included mental health pathologies following surgery. While other studies have suggested pre-surgical psychological support and treatment, the current results indicate that improved post-operative psychologic care may also be warranted. Early intervention at first postoperative follow-up is warranted in order to rapidly identify and rectify any poor surgical and/or psychological outcomes. By identifying potential psychosocial unforeseen obstacles that occur in patients diagnosed with FBSS, more precise treatment pathways can be developed leading to improved patient outcomes.

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Availability of Data/Code No patient identifiers were collected, as we used a publicly available nationally-representative database purchased through PearlDiver. No unique code was developed, and standard statistical software (RStudio) and tests were used.

Declarations

Conflict of interest No conflict of interest. Disclosures outside of submitted work: JCW- Royalties – Zimmer Biomet, Seaspine, Depuy Synthes; Consulting: Precision OS (no money paid); Investments/Options – Bone Biologics, Pearldiver, Surgitech; Board of Directors—AO Foundation Board (honorarium), National Spine Health Foundation (non-financial, volunteer); Fellowship Funding (paid to institution): AO Foundation; Payment for expert testimony: various law firms. ZB- consultancy: Cerapedics (past), Research Support: SeaSpine (past, paid to the institution), Next Science (past, paid directly to institution), Medical Metrics (past, paid directly to institution), NIH SBIR grant (past, paid to institution); North American Spine Society: committee member; Lumbar Spine Society: Co-chair Educational Committee, AOSpine Knowledge Forum Degenerative: Associate member; AOSNA Research committee- committee member.

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