

Trends in the prescription of opioids and gabapentinoids in patients with failed back surgery syndrome in Korea: a population-based study

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ABSTRACT

Background: Failed back surgery syndrome (FBSS) is a chronic condition that is characterized by persistent back pain following one or more spinal surgeries. Pharmacological interventions, such as the use of opioids and gabapentinoids, are frequently used in the treatment of FBSS. However, prolonged and excessive use of these medications can lead to dependence and adverse effects. This study investigates trends in opioid and gabapentinoid prescriptions among patients with FBSS in Korea from 2016 to 2020.

Methods: Data from the Health Insurance and Review Agency were analyzed, and claims listing FBSS were selected for the study. Prescription patterns of opioids and gabapentinoids were classified based on the number of days prescribed per year.

Results: Of the 390,095 patients diagnosed with FBSS, 41.6% of the patients were prescribed gabapentinoids, and 42.0% of them were prescribed opioids, while 10.6% of the patients were classified as long-term gabapentinoid users, 11.4% as long-term opioid users, and 7.4% of the patients were found to have long-term prescriptions for both drugs. The proportion of patients who received both gabapentinoid and opioid prescriptions increased annually. The doses of opioids prescribed have also increased along with the increase in the number of patients receiving opioid prescriptions.

Conclusions: The prescription rates of opioids and gabapentinoids among patients with FBSS in Korea continue to increase steadily, posing potential risks of addiction and adverse effects. Further research is needed to better understand the actual status of addiction in patients with FBSS.

Keywords: Analgesics, Opioid; Big Data; Drug-Related Side Effects and Adverse Reactions; Failed Back Surgery Syndrome; Gabapentin; Insurance, Health; National Health Programs; Pregabalin; Prescriptions.

Received August 28, 2023; Revised December 6, 2023; Accepted December 6, 2023

Handling Editor: Kyung Hoon Kim

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INTRODUCTION

The most common musculoskeletal condition is low back pain, and its global burden is increasing [1]. As the number of patients with low back pain increased, spine surgeries also increased [2,3]. Spine surgery, particularly in Korea, is the second most common surgery and increases by 2.8% every year [3].

Failed back surgery syndrome (FBSS) is the term used to describe chronic back pain following one or more spine surgeries. It is defined by the International Association for the Study of Pain (IASP) as “lumbar spinal pain of unknown origin either persisting despite the surgical intervention or appearing after surgical intervention for spinal pain originally in the same topographical location” [4]. A more functional definition is “when the outcome of the lumbar spinal surgery does not meet the patient’s and surgeon’s pre-surgical expectations” [5]. Despite advances in surgical interventions, the incidence of FBSS is higher than expected 2 years after surgery, ranging from 5% to 36% [6]. Conservative therapy, pharmacological management, interventional pain procedures, and surgical revision are all used to treat FBSS. Pharmacological management includes the use of antiepileptics, nonsteroidal anti-inflammatory drugs, oral steroids, antidepressants, and opioids. Opioids can be easily prescribed to patients with FBSS for pain management; however, prolonged use of opioids may result in opioid use disorder [7]. Patients with low back pain are commonly given gabapentinoids (gabapentin and pregabalin) as antiepileptics to alleviate neuropathic pain [8]. When combined with opioids, gabapentinoids can produce euphoric feelings and enhance analgesic effects [8]. This has abuse potential and increases the mortality rate from opioid overdose [9].

In light of these considerations, the authors undertook an investigation into the trends of opioid and gabapentinoid prescriptions in patients with FBSS in the Korean population from 2016 to 2020. This study aims to shed light on the potential risk of abuse among FBSS patients, based on trends in medication prescriptions. Through these findings, the authors aspire to contribute valuable insights into the landscape of opioid and gabapentinoid usage among patients with FBSS.

MATERIALS AND METHODS

1. Data collections

We used the claims dataset held by the Health Insurance and Review Agency (HIRA) of the National Health Insurance Service (NHIS) in South Korea. The NHIS is a government-operated and mandatory nationwide insurance system that provides coverage for most (97%) of the South Korean population. All healthcare utilization data submitted by medical facilities for billing purposes are registered in HIRA’s comprehensive claim and reimbursement database. It includes patient demographics, primary diagnosis, comorbidities (coded by the International Classification of Disease, 10th revision [ICD-10]), prescriptions, emergency room visits, hospitalizations, and surgeries. Informed consent was waived because there are no personal identifiers. The authors’ protocol was approved by the Kyungpook National University Chilgok Hospital Institutional Review Board (2021-08-034) and HIRA (M20210831472).

All claims from 2016 to 2020 that included diagnosis code M96.1 (ICD-10 code of postlaminectomy syndrome) were included in the dataset. Claims with M96.1 as the primary diagnosis were selected for analysis to exclude claims for other conditions as far as possible. And then, the claims including prescription of gabapentinoids and opioids are extracted for the analysis. The data analysis focused on the variables of year and individual patients. First, the extracted claims were categorized by year based on claim dates. Second, the authors examined how long each patient received prescriptions for gabapentinoids and opioids each year.

2. Drugs

1) Gabapentinoids

Twenty-two prescription codes (6 for gabapentin, 16 for pregabalin) were used for searching gabapentinoid prescriptions. Based on the number of prescribed days throughout the year, the prescription pattern of gabapentinoids was classified into three categories: naïve (no prescriptions for gabapentinoids were observed during the year), episodic (gabapentinoids were prescribed for over one day but less than 120 days during the year), and long-term (gabapentinoids were prescribed 120 days or more during the year) [10].

Table 1. The cases for the postlaminectomy syndrome as a primary diagnosis from 2016 to 2020

Year	2016	2017	2018	2019	2020
The number of claims	381,705	394,419	399,747	447,676	416,549
The number of patients	70,729	72,817	76,477	86,917	83,155

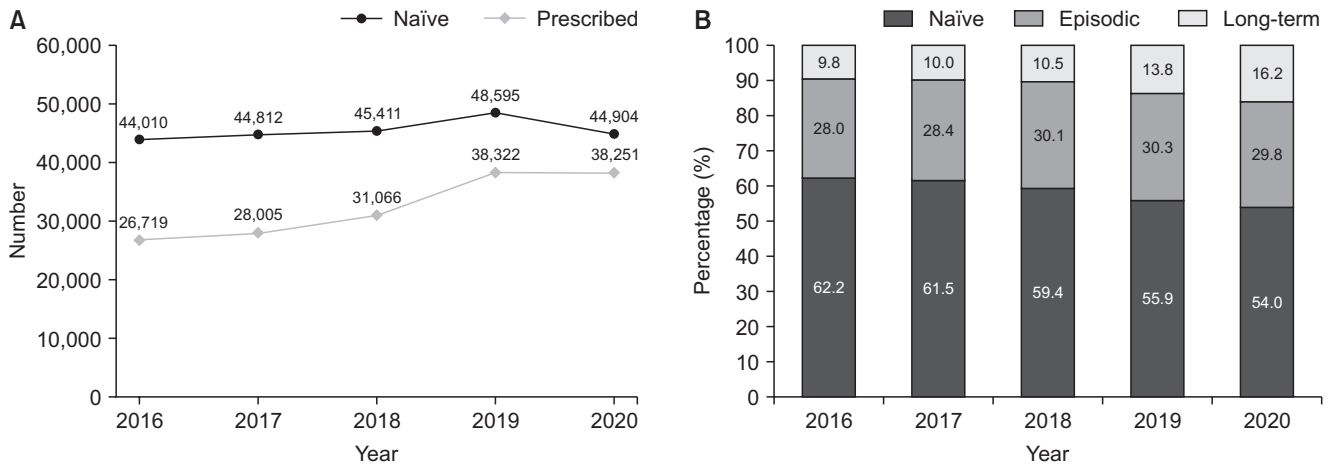


Fig. 1. Yearly trends of patients prescribed gabapentinoids. (A) The number of patients who have never been prescribed gabapentinoid (naïve) or who have been prescribed it at least once (prescribed). (B) Percentage of patients by the degree of gabapentinoid prescription duration. Naïve: not prescribed gabapentinoids in the year. Prescribed: prescribed the gabapentinoids at least once in the year. Episodic: days for gabapentinoid prescription is more than a day and less than 120 days in the year. Long-term: days for gabapentinoid prescription is 120 days or more in the year.

2) Opioids

Tramadol, codeine, dihydrocodeine, hydrocodone, fentanyl, morphine, oxycodone, hydromorphone, and tapentadol were included as opioids. Tramadol, codeine, dihydrocodeine, and hydrocodone were considered weak opioids, while fentanyl, morphine, oxycodone, hydromorphone, and tapentadol were considered strong opioids [11]. Prescribed opioid doses were converted to morphine equivalent doses (MED) [12]. The prescription pattern of opioids was classified similar to that of gabapentinoids [10].

3. Statistical analysis

The number and proportion of patients who received prescriptions for gabapentinoids and opioids by year were analyzed. Statistical analysis was performed using the R (version 4.1.3).

RESULTS

Between 2016 and 2020, 390,095 patients were diagnosed

with postlaminectomy syndrome as the primary disease. There were 2,040,096 cases claimed (Table 1). The number of claims and patients increased during the study period, except during 2020. There has been a higher proportion of women than men, but the proportion of cases in men has been increasing. The average age of the patients has gone up over the years.

1. Gabapentinoid prescription pattern

Gabapentinoids were prescribed to 162,363 (41.6%) patients diagnosed with FBSS. The number of patients with gabapentinoid prescriptions increased consistently each year (Fig. 1, Table 2). In 2020, 38,251 patients received prescriptions for gabapentinoids, representing a 43.2% increase in gabapentinoid prescriptions as compared to 2016. The proportion of long-term gabapentinoids prescribed to patients was 12.2%. The percentage of the long-term group increased significantly, rising from 9.8% in 2016 to 16.2% in 2020.

2. Opioid prescription pattern

Opioids were prescribed to 164,077 (42.0%) patients di-

Table 2. Number of patients with FBSS prescribed gabapentinoids

Year	Naïve	Gabapentinoid-prescribed patients		
		Total	Episodic	Long-term
2016	44,010 (62.2)	26,719 (37.8)	19,822 (28.0)	6,897 (9.8)
2017	44,812 (61.5)	28,005 (38.5)	20,692 (28.4)	7,313 (10.0)
2018	45,411 (59.4)	31,066 (40.6)	23,042 (30.1)	8,024 (10.5)
2019	48,595 (55.9)	38,322 (44.1)	26,351 (30.3)	11,971 (13.8)
2020	44,904 (54.0)	38,251 (46.0)	24,809 (29.8)	13,442 (16.2)
Total	227,732 (58.4)	162,363 (41.6)	114,716 (29.4)	47,647 (12.2)

The number of patients is expressed as the number (percent).

Episodic: days for gabapentinoid prescription is more than a day and less than 120 days in the year. Long-term prescription: days for gabapentinoid prescription is 120 days or more in the year. Naïve: not prescribed gabapentinoids in the year.

FBSS: failed back surgery syndrome.

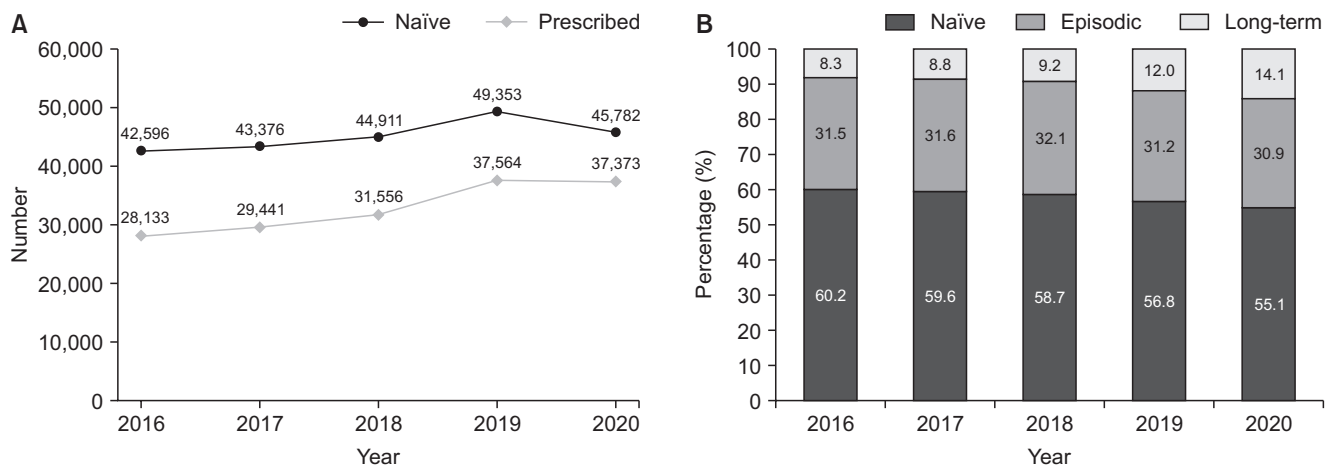


Fig. 2. Yearly trends of patients prescribed opioids. (A) The number of patients who have never been prescribed opioids (naïve) or who have been prescribed it at least once (prescribed). (B) Percentage of patients by the degree of opioids prescription duration. Naïve: not prescribed opioids in the year. Prescribed: prescribed the opioids at least once in the year. Episodic: days for opioid prescription is more than a day and less than 120 days in the year. Long-term: days for opioid prescription is 120 days or more in the year.

agnosed with FBSS. The proportion of patients with FBSS receiving opioids showed a consistent increase every year (**Fig. 2, Table 3**). In 2016, 39.8% of patients with FBSS were prescribed opioids, which increased to 44.9% in 2020.

The majority of prescribed opioids are weak opioids. About 90% of the patients in the episodic prescription group and about 80% of the patients in the long-term prescription group only received weak opioids (**Fig. 3, Table 4**). The proportion of long-term opioids prescribed to patients was 11.4%. In the long-term prescription group, the number of patients prescribed opioids increased by 100% between 2016 and 2020. In addition, the proportion of patients who received strong opioids also increased over the 5 years. Especially noteworthy was the rapid growth

in patients receiving strong opioids in the long-term group. Oxycodone and fentanyl accounted for the majority of strong opioid prescriptions.

A corresponding increase in prescribed MED occurred when the percentage of prescribed opioids in patients with FBSS. In 2016, the sum of MED prescribed was 44,934,772, which grew to 79,884,021 in 2020, indicating a 77.8% increase. Moreover, MED per opioid-prescribed patient also exhibited an upward trajectory. In 2016, MED per opioid-prescribed patient was 1,597.2, which increased to 2,918.4 in 2020, indicating an 82.7% increase. Additionally, the proportion of strong opioids in the total number of prescribed MED also demonstrated an upward trend. In 2016, strong opioids accounted for 46.4% of the prescribed MED; in 2020, this proportion increased

Table 3. Number of patients with FBSS prescribed opioids

Year	Naïve	Opioid-prescribed patients		
		Total	Episodic	Long-term
2016	42,596 (60.2)	28,133 (39.8)	22,288 (31.5)	5,845 (8.3)
2017	43,376 (59.6)	29,441 (40.4)	23,045 (31.6)	6,396 (8.4)
2018	44,911 (58.7)	31,566 (41.2)	24,522 (32.0)	7,034 (9.2)
2019	49,353 (56.8)	37,564 (43.2)	27,124 (31.2)	10,440 (12.0)
2020	45,782 (55.1)	37,373 (44.9)	25,670 (30.8)	11,703 (14.1)
Total	226,018 (57.9)	164,077 (42.0)	122,649 (31.4)	41,418 (10.6)

The number of patients is expressed as the number (percent).

Episodic prescription: days for opioid prescription is more than a day and less than 120 days in the year. Long-term prescription: days for opioid prescription is 120 days or more in the year. Naïve: not prescribed gabapentinoids in the year.

FBSS: failed back surgery syndrome.

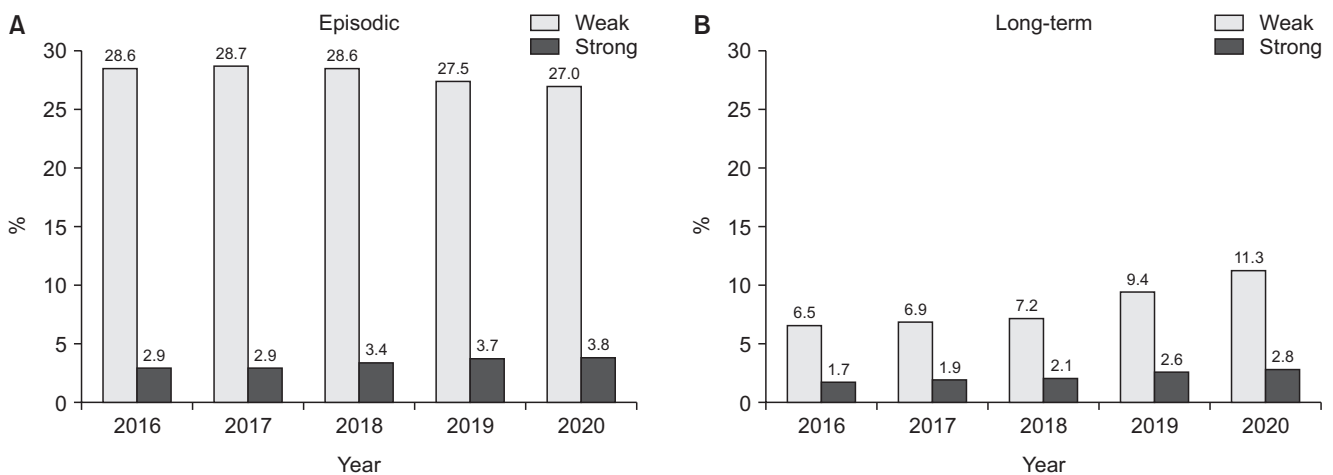


Fig. 3. Yearly trends in opioids prescription patterns. (A) Proportion of weak only and strong in the patients episodic (less than 120 days in the year) prescribed opioids. (B) Proportion of weak only and strong in the patients long-term (120 days or more in the year) prescribed opioids. Weak: prescribed only weak opioids, Strong: prescribed strong opioids with or without weak opioids. Weak opioids include tramadol, codeine, dihydrocodeine, and hydrocodone. Strong opioids include fentanyl, morphine, oxycodone, hydromorphone, and tapentadol.

to 53.1% (Fig. 4, Table 5).

3. Trends in concurrent prescription of gabapentinoids and opioids

Among patients with FBSS, 24.4% were prescribed with both opioids and gabapentinoids concurrently. During the course of the study, the proportion of concurrent prescriptions increased gradually and consistently, with 7.4% of patients receiving long-term prescriptions for both drugs. The proportion of long-term prescriptions for both drugs increased from 5.67% in 2016 to 10.10% in 2020. In addition, long-term gabapentinoid prescriptions in combination with long-term strong opioids accounted for 1.32%, with a steady annual increase in this proportion

(Table 6).

DISCUSSION

The term “failed back surgery syndrome” is considered derogatory. It implies that the previous surgery and subsequent care have failed. It presents significant ethical issues such as stigma and marginalization and says nothing about how pain works or how it affects the patient [13]. In ICD-10, “postlaminectomy syndrome” is a synonym for FBSS. This term is used to claim the payers for patients in order to access advanced pain treatments such as medications, neuromodulation, and interventional treatment. However, minimally invasive spine surgery without

Table 4. Number of patients with FBSS prescribed opioids by strength of opioid prescribed and duration of prescription

Year		Episodic	Long-term
2016	Total	22,288 (31.5)	5,845 (8.3)
	Weak	20,205 (28.6)	4,626 (6.1)
	Strong	2,083 (2.9)	1,219(1.7)
2017	Total	23,045 (31.6)	6,396 (8.8)
	Weak	20,930 (28.7)	4,988 (6.9)
	Strong	2,115 (2.9)	1,408 (1.9)
2018	Total	24,472 (32.0)	7,094 (9.3)
	Weak	21,870 (28.6)	5,488 (7.2)
	Strong	2,602 (3.4)	1,576 (2.0)
2019	Total	27,124 (31.2)	10,440 (12.0)
	Weak	23,870 (27.5)	8,197 (9.4)
	Strong	3,254 (3.7)	2,243 (2.6)
2020	Total	25,670 (30.9)	11,703 (14.1)
	Weak	22,483 (27.0)	9,370 (11.3)
	Strong	3,187 (3.8)	2,333 (2.8)

The numbers are the number of patients (percent of patients included in the study in the year).

Episodic: days for opioid prescription is more than a day and less than 120 days in the year. Long-term: days for opioid prescription is 120 days or more in the year. Weak: the number of patients (%) prescribed only weak opioids. Weak opioids included tramadol, codeine, dihydrocodeine, and hydrocodone. Strong: the number of patients (%) prescribed strong opioids with or without weak opioids. Fentanyl, morphine, oxycodone, hydromorphone, and tapentadol are strong opioids. FBSS: failed back surgery syndrome.

laminectomy has become more common, and it has been suggested that postlaminectomy syndrome is an inaccurate term for persistent pain following spinal surgery. IASP replaced FBSS with chronic pain after spinal surgery in ICD-11 [14].

The number of spine surgeries in South Korea gradually increased from 2016 to 2020, with 168,836 cases performed in 2016 and 188,394 cases performed in 2020 [3]. However, in the present study, the number of patients coded with postlaminectomy syndrome decreased in 2020. It is yet unclear if this decline represents an isolated event or is indicative of a sustained trend. Alternatively, it can be the result of patients who had FBSS, but whose principal diagnosis code was not entered as FBSS (M96.1) on the claim.

Patients with FBSS experience more significant pain, impairment, and lower quality of life than those with other musculoskeletal conditions [15]. Surgeons, pain physicians, and primary care providers find it challenging to manage FBSS. Patients with FBSS sought various therapies, hoping to recover from the pain. Treatment of FBSS includes conservative management (medication, exercise, and psychotherapy), interventions (spinal cord stimulation [SCS], epidural adhesiolysis, or injections), and surgery as a last line of therapy.

Neuropathic pain is a relatively common condition in FBSS patients. Antineuropathic medications were administered to 38% of patients with FBSS [15]. Gabapentinoids, a representative of the antineuropathic drug class, act on

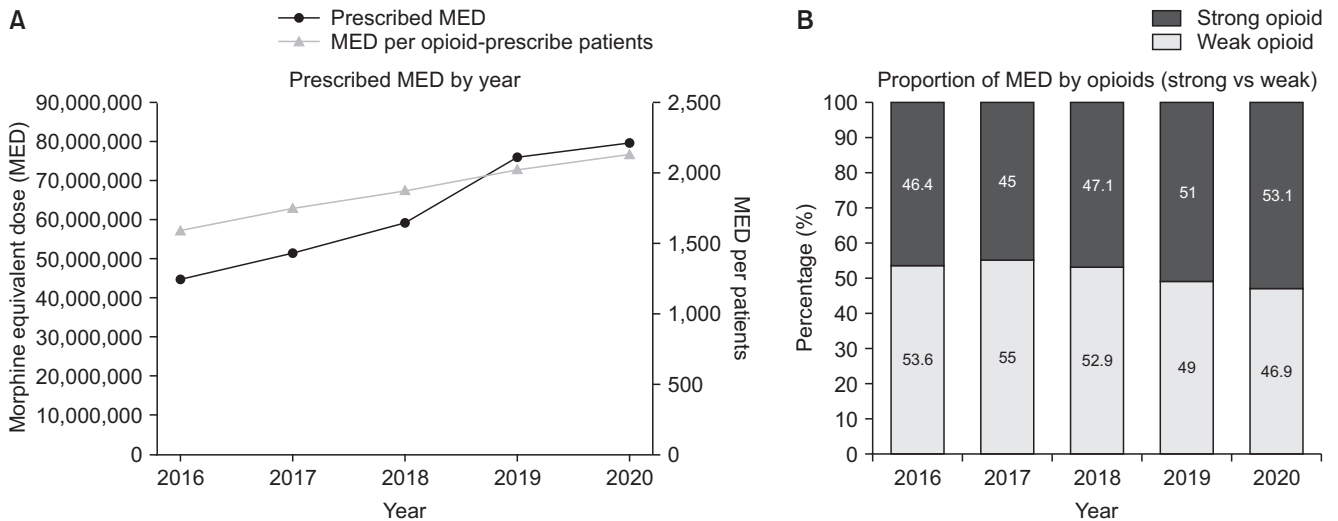


Fig. 4. Yearly trends in morphine equivalent doses (MED) of prescribed opioids. (A) Total MED of prescribed opioids and MED per opioid-prescribed patients in the year. MED per opioid-prescribed patients was calculated by dividing the total MED of narcotic analgesics prescribed in the year by the number of patients prescribed opioids. (B) The proportion of the total MED prescribed in the year accounted for by the MED of weak opioids and strong opioids.

the $\alpha 2\delta$ subunit of the voltage-dependent calcium channels and modulate the enhanced neurotransmission at the level of presynaptic receptors of the afferent neurons [16]. Gabapentin and pregabalin are both widely used gabapentinoids for various neuropathic pain conditions. Gabapentin was approved for the treatment of seizures and postherpetic neuralgia. Pregabalin was also approved to treat conditions like seizures, postherpetic neuralgia, diabetic neuropathy, fibromyalgia, and spinal cord injury. Gabapentinoids are recommended as the first-line treatment for neuropathic pain after obtaining these approvals and are considered effective for chronic sciatica [17,18]. Although the Food and Drug Administration has only approved gabapentinoids for these specific indications, the number of prescriptions of gabapentinoids has increased thrice in the last 15 years in the United States [19]. In this study, gabapentinoids were prescribed to 41.6% of patients, with the number of patients receiving gabapentinoid prescriptions increasing yearly. The

proportion of long-term gabapentinoid prescribers was 12.2%, demonstrating a significant increase of 63% over 5 years. These findings suggest that neuropathic pain among patients with FBSS was being assessed and treated well during the study period. In South Korea, health insurance covers gabapentinoids for patients diagnosed with FBSS. This policy could contribute to the increase in gabapentinoid prescriptions.

Back pain is the primary cause of chronic opioid treatment in patients with non-cancer pain [20,21]. Opioids, however, lack long-term effectiveness data, have low to moderate quality of evidence for short-term effectiveness and possess less conclusive evidence for functional improvements for patients with chronic back pain [22,23]. However, patients with FBSS have limited treatment options other than long-term opioid treatment, which increases the number and duration of opioid prescriptions [24,25]. In the present study, 41% of patients with FBSS received at least one opioid prescription, and 11.4% of patients with FBSS received opioids more than 120 days a year, with a consistent annual increase in the number and proportion. These findings suggest that patients with FBSS are more likely to be prescribed opioids than other patients with chronic non-cancer pain [26].

Several studies investigated the vulnerability to opioid addiction of patients with FBSS. In a retrospective study of 78 patients with FBSS, 54 (69.2%) subjects were taking higher-than-normal doses of opioids, 58 (74.4%) were misusing the drug, 9 (11.5%) were addicted, and 54 (69.2%) had a fear of withdrawal symptoms [27]. The PROCESS (Prospective Randomized Controlled Multicenter Trial of the Effectiveness of Spinal Cord Stimulation) study, a multicenter prospective study to evaluate the effectiveness of SCS for FBSS, revealed that opioids were the most commonly used pain medication

Table 5. Morphine equivalent doses and proportion of prescribed strong opioids in patients with FBSS

Year	Prescribed MED	Proportion of strong opioids	MED per opioid-prescribed patients
2016	44,934,772	46.4%	1,597.2
2017	51,597,636	45.0%	1,752.6
2018	59,299,503	47.1%	1,878.6
2019	76,208,177	51.0%	2,028.8
2020	79,884,021	53.1%	2,918.4

The numbers are the number of patients (percent).

Strong opioids: strong opioids included fentanyl, morphine, oxycodone, hydromorphone, and tapentadol.

FBSS: failed back surgery syndrome, MED: morphine equivalent doses.

Table 6. Prescription trends for concurrent utilization of gabapentinoids and opioids in patients with FBSS

Year	Prescription gabapentinoid		Prescription long-term gabapentinoid	
	With opioids	With strong opioids	With long-term opioids	Long-term strong opioids
2016	15,015 (21.2)	2,669 (3.8)	4,016 (5.67)	721 (1.02)
2017	16,375 (22.5)	2,845 (3.9)	4,321 (5.93)	814 (1.11)
2018	18,246 (23.9)	3,350 (4.4)	4,777 (6.25)	870 (1.12)
2019	23,289 (26.8)	4,742 (5.5)	7,305 (8.40)	1,305 (1.50)
2020	23,603 (28.4)	4,744 (5.7)	8,404 (10.10)	1,422 (1.71)
Total	96,528 (24.7)	18,350 (4.7)	28,823 (7.39)	5,132 (1.32)

The numbers are the number of patients (percent).

Long-term: days for drug prescription is 120 days or more in the year. Strong opioids: strong opioids included fentanyl, morphine, oxycodone, hydromorphone, and tapentadol.

FBSS: failed back surgery syndrome.

for patients with FBSS (62% of the patients were taking opioids). And it was in contrast to other chronic pain conditions such as osteoarthritis, rheumatoid arthritis, and fibromyalgia, where non-steroidal antiinflammatory drugs are most commonly prescribed. Quality of life was also significantly lower in patients with FBSS compared to patients with other chronic pain conditions [15]. Although the current rate of opioid prescription among FBSS patients in Korea in the present study (42%) is lower than that stated above, the increase in prescription rates as the years progress, especially the prescription of stronger opioids and the increase in long-term opioid prescriptions, is concerning. Despite the fact that opioids are known to cause addiction, the use of opioids does not necessarily lead to drug addiction. Risk factors for opioid dependence include adolescence, depression, substance use, high daily opioid use (MED > 120 mg), and long-term opioid use (> 3 months) [28]. Patients who received higher doses of opioids had a higher prevalence of psychiatric comorbidity, co-prescription of sedative-hypnotics, and greater use of health services [29]. Patients who received 100 MEDs or more had an 8.9-fold increase in overdose risk and a 1.8% annual overdose rate [30]. Recent guidelines on long-term opioid treatment for non-cancer pain recommended restricting the dosage for long-term opioid therapy to 90–150 MED/day [31–33]. In this study, a rapid increase in MED prescribed to patients with FBSS and MED per opioid prescribed to patients was observed, as well as a gradual increase in the proportion of strong opioids prescribed, and a significant escalation in long-term opioid users. These findings suggest that the potential risks associated with opioids may be increased in patients with FBSS.

The risk for drug abuse or physical dependence on gabapentinoids was considered low when approved. However, euphoria is reported as a frequent adverse event associated with gabapentinoids [9]. In 2010, 16 cases of gabapentinoids abuse were documented by the Swedish adverse event reporting system for the first time [34]. The proportion of adverse drug events was higher for pregabalin (1.77) than for gabapentin, but the estimated abuse potential was 19% for gabapentin and 15% for pregabalin [9,35]. Based on these reports, pregabalin and gabapentin are classified as Schedule 3 controlled drugs in the UK, and pregabalin is classified as a Schedule V drug under the Controlled Substances Act in the United States [36].

As a result of the opioid epidemic, gabapentinoids have emerged as a relatively safer option than opioids and have been demonstrated to relieve neuropathic pain when used with opioids [37]. Therefore, healthcare pro-

viders have considered gabapentinoids as an alternative to opioids to manage pain. However, recent evidence suggests that concurrent use of gabapentinoids and opioids for back pain does not significantly reduce pain or opioid use [38]. Instead, it is associated with adverse events, the need for medical intervention, and an increased mortality risk [39].

This study shows that 24.7% of patients diagnosed with FBSS received concurrent opioid and gabapentinoid prescriptions. Moreover, the combination of these medications increased the number of patients with FBSS in a steady and gradual manner. According to a US study, less than 8% of patients across all conditions in their cohort received concomitant opioid and gabapentinoid prescriptions [40]. Results in the present study indicate that patients with FBSS have a higher likelihood of receiving concomitant prescriptions for opioids and gabapentinoids as compared to individuals with other conditions.

A study of patients with chronic pain with addiction reported that 33% had neuropathic pain and 21% had low back pain [41]. The authors' research demonstrates a concerning increase in the use of opioids and the simultaneous use of opioids and gabapentinoids in patients with FBSS, suggesting a potential vulnerability to addiction in this patient population. Although the proportion is small, it is important to pay attention to the steady increase in concurrent long-term prescriptions for gabapentinoids and strong opioids.

Therefore, in order to minimize the risk of addiction in patients with FBSS, it is essential to avoid prolonged and high-dose opioid use and instead implement a multidisciplinary treatment approach [28]. Moreover, the continued use of opioids and gabapentinoids should be based on clinical benefit, acceptable side effect profiles, and improvement in functionality without compromising patient quality of life [42].

Despite this need, it is not yet established how to reduce these drugs in FBSS. Some studies have suggested that non-pharmacologic interventions may reduce the need for opioids in patients with FBSS. The representative modality is SCS. A large number of observational studies have reported reduced opioid requirements after SCS [43–47]. Notably, a retrospective study reported that high opioid requirements prior to SCS may have a negative effect on SCS treatment outcomes, suggesting that SCS treatment may be needed as early as possible before opioid requirements are elevated [48]. However, the recently reported results of the PROCESS study showed that SCS was not significantly effective in reducing opioid requirements. Whether SCS is a treatment that can reli-

ably reduce opioid requirements in patients with FBSS is still to be evaluated [49]. Given that epidural fibrosis is responsible for a majority of pathophysiology of FBSS, Yousef et al. [50] showed that the addition of hyaluronidase to an epidural injection of a combination of steroid, local anesthetics and hypertonic saline for FBSS can reduce the opioid intake during the 1-year follow up period after treatment from a prospective randomized double-blinded trial. However, their study has the limitation of a small sample size and being a single center study, and so should be supported by a well-designed study with a larger sample size.

This study has several limitations. First, it focused only on cases reported to the HIRA. The authors may have missed patients with FBSS who were not diagnosed with postlaminectomy syndrome. Second, only patient prescriptions reported to the HIRA were included in this study. The authors did not have access to patient factors such as psychiatric comorbidity, use of sedatives, and use of health services. Therefore, they could not estimate the risk of addiction and addiction rates among patients with FBSS. Further research using a new dataset is needed to investigate the risk of addiction and actual addiction status in patients diagnosed with FBSS.

Amid the ongoing debate over the effectiveness of opioids and gabapentinoids for managing back pain, the authors' findings show a consistent upward trajectory in the prescription rates of these agents among patients diagnosed with FBSS. The prevalence of long-term use of opioids and gabapentinoids is consistently increasing, coupled with a progressive escalation in prescribed opioid dosages within the FBSS cohort. These findings highlight a growing concern about increased vulnerability to addiction and adverse effects in patients with FBSS. Multidisciplinary treatment and careful medication monitoring are essential to reduce this potential risk and optimize pain control in patients with FBSS. In addition, further research is needed to elucidate the extent of addiction susceptibility and its actual manifestation in patients with FBSS.

DATA AVAILABILITY

Data files are available from Harvard Dataverse: <https://doi.org/10.7910/DVN/QOWVGU>.

Further inquiries can be directed to the corresponding author.

ACKNOWLEDGMENTS

The authors thank the HIRA for providing their dataset.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

FUNDING

No funding to declare.

AUTHOR CONTRIBUTIONS

Jinyoung Oh: Investigation; Jinseok Yeo: Writing/manuscript preparation.

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