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Review of psychiatric comorbidities and their associations with opioid use in elective lumbar spine surgery

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Abstract

The opioid epidemic is an ongoing concern in the United States and efforts to ameliorate this crisis are underway on multiple fronts. Opiate use is an important consideration for patients undergoing lumbar spine surgery with concurrent psychiatric diagnoses and more information is needed regarding the factors involved in these patients. That information may help guide opioid prescribing practices for individual patients with certain psychiatric conditions that are undergoing these procedures. This study was done to identify psychiatric conditions that are associated with preoperative and postoperative opioid use in this cohort of veteran patients undergoing elective lumbar spine surgery.

A 3 month preoperative and 3 month postoperative chart review was conducted on 25 patients per year who underwent elective lumbar spine surgery over a 16-year period at the Veterans Affairs Nebraska-Western Iowa Healthcare Center (n = 376 after exclusion criteria applied). The association between psychiatric comorbidities and use of opioids during the 90-day period after surgery was assessed using a linear model that adjusted for surgical type, opioid use prior to surgery, and other relevant comorbidities.

Patients are more likely to use opioids preoperatively if they have major depression ($P = .02$), hepatitis C ($P = .01$), or musculoskeletal disorders ($P = .04$). PTSD ($P = .02$) and lumbar fusion surgery ($P < .0001$) are associated with increased postoperative use, after adjusting for preoperative use and other comorbidities.

Certain psychiatric comorbidities are significantly correlated with opioid use for this cohort of lumbar spine surgery patients in the preoperative and postoperative periods. Awareness of an individual's psychiatric comorbidity burden may help guide opioid prescription use.

Abbreviations: AOR = adjusted odds ratios, BMI = body mass index, CI = confident interval, CPRS = Computerized Patient Record System, CPT = Current procedural terminology, IRB = Institutional review board, OEF/OIF = Operation Iraqi Freedom, PTSD = Post traumatic stress disorder, SE = standard errors, VA = Veterans Affair.

Keywords: lumbar spine surgery, opioids, psychiatric comorbidities, veterans

1. Introduction

Opioid abuse is a significant current public health concern in the United States. Opioids are commonly prescribed after lumbar spine surgery for pain control. Boakye et al noted that spine disorders in veteran patients have a severe impact on both physical and emotional health-related quality of life and that spine disorders are associated with severe disability and an unusually high prevalence of depressive symptoms. That study highlighted the need for research to quantify the health resource utilization and effectiveness of spine surgery outcomes in veteran patients.[1]

Veteran patients present a unique population in this discussion of opioid use due to several factors including an increased prevalence of psychiatric conditions,[2–4] increased non-psychiatric comorbidities,[5,6] and the preponderance of veteran patients obtaining their medications through the Veteran Affairs (VA) system.[7] These considerations present an opportunity to further investigate the relationship between opioid use and psychiatric conditions in elective lumbar spine surgery patients.

The Department of VA has taken some action against generalized opioid overuse. In 2017, the VA and Department of Defense revised VA guidelines concerning opioid use in chronic pain and the VA Opioid Safety Initiative was initiated in 2013.[7] As with the general population, there are ongoing attempts to further define factors that contribute to opioid use with the overall goal of reducing overuse and addiction.

We posited that psychiatric disorders are associated with opioid use in our veteran patient's lumbar spine surgery population. This single-site VA study of opioid use in elective lumbar spine surgery was undertaken to identify psychiatric comorbidities that are linked to opioid use in this population.

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The authors have no conflicts of interest to disclose.

The datasets generated during and/or analyzed during the present study are not publicly available, but are available from the corresponding author on reasonable request.

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2. Methods

We performed a single institution systematic chart review of patients who underwent elective lumbar spine surgery at the VA hospital during a 16-year period spanning from January 1, 2000 through July 1, 2015 by selecting the first 25 patients from each calendar year. Prior to chart review initiation, this project was approved in 2015 by the Veterans Affairs Nebraska-Western Iowa Healthcare system institutional review board (IRB# 01006).

Inclusion criteria were patients who underwent lumbar spine surgery (Current Procedural Terminology [AMA 2018] codes 63030/63042 [laminectomy/discectomy], 22558/22612/22619/22630/22830/22840/22857 [lumbar fusion], and 63047 [lumbar decompression]) and who had a neurosurgeon as the primary surgeon. Exclusion criteria were surgery performed for tumor, infection, or fracture. Appropriate charts were identified through a search using the above CPT codes. A total of 400 charts were abstracted and 24 were excluded based on the exclusion criteria.

Chart information was abstracted from the Computerized Patient Record System (CPRS) for demographic and medical data. Demographic data collected included age, race, and gender. Medical information collected included body mass index (BMI), psychiatric conditions, comorbidities common in the veteran patient population and likely associated with opioid use and opioid medication prescriptions.

Opioid pain medication prescriptions for the 90 days preceding surgery were recorded. This time period prior to surgery was chosen in an attempt to most accurately identify opioid use pertaining to the patient's lumbar pathology. The specific data collected was type of opioid prescribed (codeine, hydrocodone, hydromorphone, methadone, morphine, oxycodone, tramadol), duration of prescription (days), and amount prescribed (mg). All opioid use data was converted into morphine equivalents with relative strength to morphine as follows: codeine 0.1×, hydrocodone 1×, hydromorphone 4×, methadone 3.5×, oxycodone 1.5×, tramadol 0.1×. Opioid use was calculated by multiplying the morphine equivalence of the dose by the number of days that dose was prescribed (morphine-equivalent-days). This information was cross-referenced with outpatient pharmacy records within the 90-day period prior to surgery. The same opioid use data was also collected for the 90-day postoperative period using neurosurgery clinic visit notes that were cross-referenced with the outpatient pharmacy record. "Morphine use" as reported in this study is defined by prescribed morphine, not actual consumption.

2.1. Statistical analysis

Pre-operative opioid use was classified as a dichotomous variable (i.e., yes/no) when considered as an outcome variable due to the large number of patients who did not use prior to their surgery, which resulted in an extremely skewed, non-normal distribution of the continuous data. Chi-square tests were used to assess associations between variables of interest and pre-operative dichotomous morphine use. To study the change in opioid use from pre to post, opioid use for both the pre- and post-operative periods was summarized using medians of morphine-equivalent-days due to the non-normal distribution of the data at these individual time points. The amount of morphine used pre-operatively was subtracted from the amount of morphine used post-operatively to calculate change scores for each patient. Wilcoxon Rank Sum or Kruskal–Wallace tests were used to assess differences in morphine change scores between categories of the demographic/clinical characteristics, to be able to identify variables associated with increased (or decreased) postoperative morphine use relative to preoperative use. For a significant a Kruskal–Wallace test, post hoc pairwise comparisons were made with Wilcoxon Rank Sum tests using a Bonferroni correction on the *P*-values (i.e., *P*-values presented for post hoc pairwise comparisons for the procedure type variable have been multiplied by 3).

Models were generated to assess the association of psychiatric conditions with preop and postop morphine use. In addition to all of the psychiatric condition variables being forced in each model, the comorbid conditions of interest were also forced based on the clinical judgement of the authors that these variables are known to be associated with morphine use. Any demographic or basic clinical characteristic with a univariate *P*-value $<.05$ was also included in the respective model to be able to compute

1. adjusted odds ratios (AORs) and associated 95% confidence intervals (CIs) for pre-operative opioid use using a logistic regression, or
2. model adjusted coefficients and associated standard errors using linear regression for post-op opioid use.

Linear regression with a normal distribution and identity link was selected over other possible distributions (e.g., log, gamma, beta, etc [of shifted data where negative outcome values cannot be used]) and their associated links due to linear regression having the best appearing residual plots (i.e., lowest heteroscedasticity, most normally distributed residuals, etc). Despite the skewed nature of the opioid measures at either time point, the postop measure adjusted for the preop measure was relatively normally distributed, and thus preop opioid use was also forced into the postop linear regression. Any categorical variables with more than two groups (e.g., procedure type) with a significant *P*-value in the model had post hoc pairwise comparisons performed with a Tukey's adjustment. All statistical analyses were performed using SAS software version 9.4 (SAS Institute Inc, Cary, NC).

3. Results

3.1. Population characteristics

A total of 376 patients were included in this study, 93.9% of whom were male. Most patients were Caucasian (89.4%), 53.8% of patients were non-obese (BMI <30), and 54.0% of patients fell between the ages of 45 and 65 years. The most common procedure patients had performed in this sample was laminectomy/discectomy (47.6%), followed by lumbar fusion (33.8%), and the rest had lumbar decompression (18.6%).

3.2. Preoperative opioid use

Statistics on presurgical opioid use are presented in Table 1. In the 90 days prior to surgery, 51% of patients in the sample used opioids. Based on univariate analyses, variables associated with preoperative morphine use included having major depression or depressive disorder ($P=.02$), having hepatitis C ($P=.01$), and having a degenerative joint disease or musculoskeletal disorder ($P=.04$). Although not statistically significant, other notable variables potentially associated with opioid use prior to surgery included obesity (BMI >30; $P=.06$) and bipolar disorder ($P=.07$).

Table 1

Dichotomized presurgical morphine use by basic demographics, clinical characteristics, psychiatric comorbidities, and comorbidities potentially associated with opioid use.

		Opioids used prior to surgery (n = 192)		Opioids not used prior to surgery (n = 184)		
		n	% of patients using morphine	n	% of patients not using morphine	Chi-square *P*-value
Basic demographics						.59
Sex	Female	13	6.8	10	5.4	
	Male	179	93.2	174	94.6	
						.87
Race	White	170	88.5	166	90.2	
	African American	11	5.7	9	4.9	
	Other	11	5.7	9	4.9	
Age						.15
	<45	36	18.8	48	26.1	
	45–65	112	58.3	91	49.5	
	> 65	44	22.9	45	24.5	
Clinical characteristics						
BMI*						.06
	<30	105	58.7	80	48.5	
	30+	74	41.3	85	51.5	
Procedure type						.39
Lumbar fusion		61	31.8	66	35.9	
Lumbar decompression		33	17.2	37	20.1	
Laminectomy/discectomy		98	51.0	81	44.0	
Psychiatric comorbidities						
Major depression/depressive disorder						**.02**
	No	145	75.5	157	85.3	
	Yes	47	24.5	27	14.7	
Anxiety/panic disorder						.40
	No	175	91.2	172	93.5	
	Yes	17	8.9	12	6.5	
Bipolar						.07
	No	179	93.2	179	97.3	
	Yes	13	6.8	5	2.7	
PTSD						.38
	No	162	84.4	161	87.5	
	Yes	30	15.6	23	12.5	
Other comorbid conditions						
Cancer						.76
	No	171	89.1	162	88.0	
	Yes	21	10.9	22	12.0	
Hepatitis C						**01**
	No	181	94.3	182	98.9	
	Yes	11	5.7	2	1.1	
Degenerative joint disease + musculoskeletal disorders						**.04**
	No	139	72.4	150	81.5	
	Yes	53	27.6	34	18.5	

Demographic and comorbid characteristics were collected for each patient. Univariate analysis was performed on the dichotomous variables demonstrated above. A significant association between preoperative opioid use and each of depressive conditions, cancer, and hepatitis C was demonstrated. Codes 22558/22612/22619/22630/22830/22840/22857 (lumbar fusion), 63047 (lumbar decompression) and 63030/63042 (laminectomy/discectomy). Significant *P*-values are bolded.

All psychiatric and relevant comorbid conditions were entered into a logistic regression model predicting dichotomous preoperative opioid use (see model results in Table 2). Only one psychiatric variable was significant; after adjusting for the other comorbidities in the model, patients with major depression or depressive disorder had 1.78 (95% CI for AOR: 1.02, 3.10; $P = .04$) times the odds of using opioids prior to surgery than patients without either of those conditions. Two of the non-psychiatric comorbidities were significantly associated with preoperative opioid use in the final model, after adjusting for the other conditions: having hepatitis C (AOR = 5.40; 95% CI: 1.16, 25.21; $P = .03$) or a degenerative joint disease/musculoskeletal disorder (AOR = 1.72; 95% CI: 1.04, 2.83; $P = .03$) were both associated with an increased odds of preoperative opioid use.

3.3. Postoperative opioid use

Median opioid use measured in morphine-equivalent days is presented separately for the preoperative and postoperative time periods in Table 3. Only one variable had a significant difference in opioid use change scores (i.e., pre-operative opioid use subtracted from post-operative), which was procedure type ($P < .0001$);

Table 2

Logistic model predicting dichotomized morphine use prior to surgery.

Outcome: presurgical opioid use (dichotomous—y/n)				
Variable	**Adjusted odds ratio (aOR)**	**95% confidence interval for aOR**		***P***
Major depression/depressive disorder	1.78	1.02	3.10	**.04**
Anxiety/panic disorder	1.08	0.48	2.46	.85
PTSD	0.95	0.50	1.79	.87
Bipolar	2.45	0.83	7.24	.11
Cancer	0.94	0.49	1.81	.86
Hepatitis C	5.40	1.16	25.21	**.03**
Degenerative joint disease/other musculoskeletal	1.72	1.04	2.83	**.03**

After adjusting for the other variables in the model, patients with major depression/depressive disorder had 1.78 times of the odds of using opioids prior to surgery than patients without major depression/depressive disorder ($P=.04$). Significant *P*-values are bolded.

patients with lumbar fusion showed a significantly higher increase in opioid use after surgery than patients with either lumbar decompression ($P=.001$) or laminectomy/discectomy ($P<.001$).

All comorbid conditions, as well as pre-operative morphine use (in morphine equivalent days) and procedure type, were included in a linear model (see Table 4). Model adjusted PTSD status was significant ($P=.02$), with PTSD patients using opioids an average of 673.64 (SE=281.42) morphine-equivalent-days more after surgery than patients without PTSD. Patients with major depression or depressive disorder used opioids an average of 475.30 (SE=248.02) morphine-equivalent-days more after surgery than those without either condition, however this difference was not significant at the 0.05 alpha level ($P=.06$). Procedural type continued to remain significantly associated with opioid use after adjusting for the other variables in the model ($P=.0001$), with patients having lumbar fusion using significantly more opioids after surgery, relative to laminectomy/discectomy (63030/63042) patients only ($P<.0001$).

4. Discussion

This retrospective study evaluated the association of psychiatric comorbidities with preoperative and postoperative opioid use in a cohort of veteran patients undergoing elective lumbar spine surgery at a VA hospital. We posited that psychiatric disorders are linked to opioid use in this cohort of veteran lumbar spine surgery patients in the preoperative and postoperative time periods.

The presence of chronic diseases has been linked to negative outcomes of surgical procedures including lumbar spine surgery.[8–13] Complications increase and treatment outcome worsens[10] and general health and disability index surveys worsen[12] after spine surgery in patients with chronic medical comorbidities. Data regarding chronic and possibly painful diseases common in the veteran population was also collected in order to control for those diseases in the statistical analysis.

Psychiatric conditions are associated with the efficacy of low back pain opioid analgesia. Wasan et al stratified 60 patients into three groups of low, moderate, and high psychological symptom severity and noted that psychopathology comprised mainly of depression, anxiety, and high neuroticism diminishes the effectiveness of many chronic pain treatments and theorized that their findings have implications for prescribing of oral opioids to patients with chronic low back pain and psychopathology.[14]

Table 3

Preoperative and postoperative opioid use (in morphine equivalent days) by basic demographics, clinical characteristics, psychiatric comorbidities, and comorbidities potentially associated with opioid use.

	n	Preop morphine Median	Postop morphine Median	*P*-Value^ for differences in change in opioid use
Basic demographics				
Sex				.53
Female	(23)	300.0	750.0	
Male	(353)	90.0	799.8	
Race				.95
White	(336)	90.0	763.6	
African American	(20)	75.2	900.0	
Other	(20)	637.5	962.5	
Age				.17
1. <45	(84)	0.0	716.3	
2. 45–65	(203)	222.1	900.0	
3. >65	(89)	0.0	769.7	
Clinical characteristics				
BMI*				.77
<30	(185)	150.0	799.8	
30+	(159)	0.0	810.0	
Procedure type				<.0001
Lumbar fusion	(127)	0.0	1500.0	
Lumbar decompression	(70)	0.0	487.5	
Laminectomy/discectomy	(179)	180.0	599.4	
Psychiatric comorbidities				
Major depression/depressive disorder				.11
No	(302)	0.0	724.9	
Yes	(74)	450.0	900.0	
Anxiety/panic disorder				.11
No	(347)	90.0	749.6	
Yes	(29)	489.8	1500.3	
Bipolar				.92
No	(358)	30.2	774.8	
Yes	(18)	715.5	862.7	
PTSD				.14
No	(323)	60.3	750.0	
Yes	(53)	450.0	900.0	
Comorbidities potentially associated with opioid use				
Any cancer				.29
No	(333)	90.0	780.0	
Yes	(43)	0.0	799.8	
Hepatitis C				.62
No	(363)	0.0	750.0	
Yes	(13)	2100.0	4700.0	
Degenerative joint disease + musculoskeletal disorders				.32
No	(289)	0	650	
Yes	(87)	300	1020.15	

* Missing BMI for 32 patients.

^Wilcoxon Rank Sum tests were used to evaluate differences in the change scores of morphine use between subcategories within variables with only two categories, and Kruskal–Wallis tests for variables with three categories. Codes 63030/63042 (laminectomy/discectomy), 22558/22612/22619/22630/22830/22840/22857 (lumbar fusion) and 63047 (lumbar decompression).

Wasan et al later studied 81 patients with chronic low back pain prospectively and noted diminished opioid analgesia and increased opioid misuse in patients with high levels of depression and anxiety symptoms.[15]

Table 4

Linear model results predicting opioid use (in morphine equivalent days) after surgery.

Variable	Model adjusted estimate	Standard error	P
Procedure type			**.0001***
Lumbar fusion	1069.28	185.24	
Lumbar decompression	601.85	239.08	
Laminectomy/discectomy	173.40	161.24	
Opioid use prior to surgery (in morphine-equivalent-days)	0.67	0.04	<.0001
Major depression/depressive disorder	475.30	248.02	.06
Anxiety/panic disorder	−81.45	363.39	.82
PTSD	673.64	281.42	.02
Bipolar	479.61	450.06	.29
Cancer	546.83	301.61	.07
Hepatitis C	1050.87	527.91	.047
Degenerative joint disease/other musculoskeletal	188.44	223.70	.40

* Post hoc pairwise comparisons indicate that patients with the Lumbar fusion type procedure used significantly more morphine after surgery than the laminectomy/discectomy patients (adjusted $P < .0001$). There were no other significant differences for any other pairwise comparison of the procedure types. Codes 22558/22612/22619/22630/22830/22840/22857 (lumbar fusion), 63047 (lumbar decompression), and 63030/63042 (laminectomy/discectomy). Significant *P*-values are bolded.

Psychiatric conditions affect postoperative lumbar spine surgery pain. Trief studied 115 lumbar fusion patients who completed the pain, function, and Short Form Health Survey 36 (SF-36) surveys before, 12 months after, and 24 months after surgery and concluded that preoperative emotional health predicts long-term pain and function outcomes of fusion.[13] In a prospective study of 277 patients undergoing lumbar spinal surgery for radicular syndrome, den Boer et al noted that cognitive-behavioral factors independently contributed to disability and pain intensity.[9] Recent studies by Qureshi et al[16,17] identified depression and a study by Schoenfeld et al[18] identified depression and anxiety as psychiatric risk factors leading to prolonged opioid use after lumbar spine surgery.

Military conflicts around the world have resulted in significant psychopathology. In a 20-year longitudinal study of 664 war veterans from the 1982 Lebanon war, Ginzburg et al found that almost half of war veterans have a lifetime triple comorbidity of PTSD, anxiety and depression.[2] Bilic et al studied 406 war veterans from the 1991 to 1995 Croatian war and noted that patients with chronic PTSD had significantly higher total pain scores as well as affective and sensory pain components when compared to the patients without PTSD.[19]

United States veteran patients have a higher incidence of mental health diagnoses than the general population.[2–4] In a study of the VA records of 103,788 veterans of the Operation Enduring Freedom and Operation Iraqi Freedom (OEF/OIF) conflicts by Seal et al, a quarter received mental health diagnoses, and more than half of those veteran patients were dually or multiply diagnosed. When psychosocial problems were considered, nearly one-third of those Middle East conflict veteran patients were classified as having either mental health diagnoses and/or psychosocial problems.[4] Nazarian et al examined medical records of 73,720 OEF/OIF veterans and found evidence that suggested that PTSD and substance use disorder are associated with poorer physical health.[6]

Bohl et al suggested that certain patients who use opioids preoperatively should be the targets of efforts to reduce postoperative opioid use.[20] The Veterans Administration, as in academic and private health care systems, has worked at re-educating its staff concerning the rising opioid epidemic. In 2013, the VA initiated the Opioid Safety Initiative "with the aim of ensuring opioids are used in a safe, effective, and judicious manner."[7]

In our study, demographics including race, age, and sex were not associated with opioid use. Preoperative comorbid conditions that were associated with opioid use included hepatitis C and degenerative joint disease, both conditions that are accompanied by at least some chronic pain. We also identified depressive disorders as a condition associated with greater preoperative opioid use. This latter finding is consistent with other studies.[9,13]

Conditions that were associated with increased opioid use in the postoperative time period in our study included PTSD and procedure type. Although not statistically significant, patients with depressive type disorders used higher amounts of opioids, on average, in the postoperative period. The larger lumbar fusion surgeries resulted in increased opioid use compared to procedures requiring less operative time and no instrumentation, certainly an expected finding in view of the larger amount of surgical manipulation usually necessary for fusion operations.

The finding in this study that psychiatric comorbidities are associated with an increased use of opioids in both the preoperative and postoperative periods was a logical finding in this cohort of patients in view of previous studies showing poorer psychiatric health status[2–4] and worse long-term postoperative lumbar spine surgery pain outcomes for veteran patients.[9,13]

4.1. Limitations

Our study has some important limitations to recognize. We assumed that medications were taken in compliance with prescription directions and that all prescriptions were taken in full. It was also assumed that patients did not obtain medications outside the VA system. Comorbidities were collected in a retrospective manner making it difficult to ensure the accuracy of the information. These factors could impact opioid use in the study period. Also, this study was designed to study opioid use for 3-month preoperative and 3-month postoperative time periods, thus long-term consequences of opioid use after lumbar spine surgery were not studied. Finally, the study population was relatively homogenous with mostly white males represented, as in other veteran facilities across the country. Therefore, the results of this study may be more applicable to veteran populations seeking treatment through the VA system rather than the general population.

5. Conclusion

This study demonstrates that psychiatric conditions may be an important pain management consideration in relation to lumbar spinal surgery. Concern for increased opioid use does not necessarily preclude patients with specific psychiatric comorbidities from undergoing lumbar spine surgery. Instead, the specific psychiatric comorbid status of an individual patient may help predict opioid use in the preoperative and postoperative periods, information which may be useful in providing patient-specific care.

Author contributions

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