

# Avoidable Emergency Department Utilization Within 6 Months Following Elective Thoracolumbar Spine Surgery for Degenerative Pathologies

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## Abstract

**Study Design:** Retrospective study.

**Objective:** To identify prevalence of, reasons for, and predictors of emergency department (ED) utilization 6 months following elective thoracolumbar spine surgery.

**Methods:** A retrospective review of a patient database was conducted (N = 577). Visits were divided by orthopedic spinal surgeons into (1) avoidable ED visit, (2) appropriate/no visit, and (3) unrelated visit.

**Measures:** Demographics, pain scores, patient characteristics, and surgical factors.

**Results:** A total of 14.38% of patients made an ED visit the majority for avoidable reasons (11.43%). Avoidable ED visits were predominately attributed to pain (45.5%) and physiology-related issues (50.0%). Significant differences in the Numerical Rating Scale–leg pain (NRS-L);  $U = 13\,931$ ,  $P = .031$  were found. Patients with avoidable visits had higher leg pain prior to surgery than those without an avoidable visit. Marital status was also statistically significant,  $\chi^2(2, N = 535) = 8.189$ ,  $P = .017$ . Patients were more likely to make an avoidable postoperative ED visit if they were either single or divorced/separated compared to patients who were married. A multivariate logistic regression model including NRS-L and marital status was statistically significant,  $\chi^2(3) = 10.14$ ,  $P = .017$ ; however only explained 3.7% of the variance.

**Conclusion:** A large percentage of elective thoracolumbar surgery patients returned to the ED within 6 months for avoidable reasons. Patients likely to make avoidable visits could not be identified prior to surgery in a clinically meaningful way. Reasons for patients returning to the ED for avoidable reasons focused on pain management and minor physiological symptoms. Enhanced presurgical education may manage postsurgical expectations helping to prevent avoidable ED visits.

## Keywords

spine surgery, outcomes, emergency department utilization, avoidable visits, complications

## Introduction

From 2001 to 2010, the number of spinal fusions in the United States rose from 97 to 151 per 100 000 citizens, an increase of more than 55%.<sup>1</sup> In the same time period, estimated national costs for spinal fusion-related admissions increased from 10 to 46.8 billion dollars (a 275% increase).<sup>1</sup> Complications associated with spinal fusions have the potential to affect a significant portion of the population and represent a substantial percent of national health care expenditure.

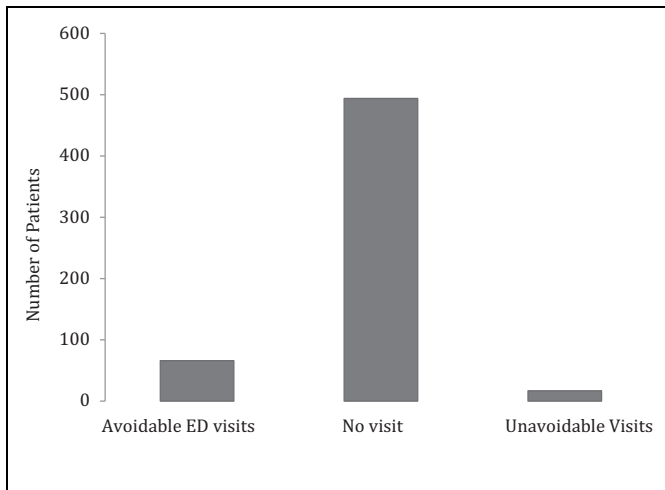
Several previous studies of spinal surgery outcomes have found successful postoperative outcomes<sup>2,3</sup> whereas others

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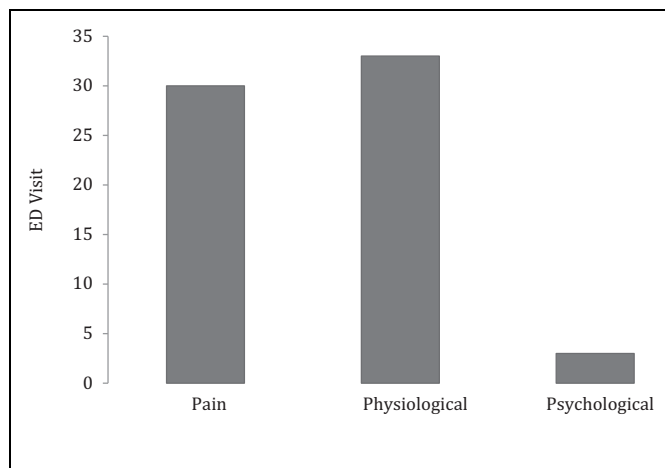
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**Figure 1.** Breakdown of emergency department (ED) visits. Sixty-six patients made avoidable visits, 494 patients did not visit the ED, and 17 patients made appropriate ED visits.



**Figure 2.** Emergency department (ED) visits by primary purpose of visit, whether for pain-related reasons, physiological reasons, or psychological reasons.

have indicated a number of postoperative adverse events.<sup>4</sup> Several studies, including Campbell et al,<sup>5</sup> found that the number of comorbidities were significantly correlated with both major and minor complications in patients undergoing thoracolumbar spine surgery. Comorbidities such as diabetes,<sup>4</sup> cardiac disease,<sup>6</sup> and renal disease<sup>1,7</sup> have been found to play a role in postsurgical complications. Surgical factors such as intervention type,<sup>7</sup> procedure time,<sup>7</sup> previous surgery,<sup>8</sup> and surgical approach<sup>8</sup> have also been shown to affect postoperative results.

In a study by Chaichana et al,<sup>9</sup> somatic awareness was correlated with the extent of improvement in disability and quality of life. Other patient-related qualities such as level of education,<sup>8</sup> body mass index,<sup>4,8</sup> age,<sup>8</sup> and gender<sup>6</sup> have also been found to play a role in recovery. These previously described studies suggest a complex combination of physical, surgical and psychological factors may predispose a patient for complications following surgery.

Dr Abraham and Dr Manson recently conducted a study that examined emergency department visits as a method of capturing postoperative adverse events in patients after discharge. An incidental finding was that up to 35% of patients presented to the emergency department (ED) following surgery; however, reasons behind these visits were not explored.<sup>10</sup> Mezei and Chung<sup>11</sup> measured ED presentation within 30 days after hospital discharge following ambulatory surgery. Over 3 years, 17 638 cases were assessed and 193 (1.1%) were found to result in an emergency room visit.<sup>11</sup> Lang et al<sup>12</sup> found that common reasons for hospital presentation within 30 days following thoracolumbar spine surgery included pain, infection, worry of infection, urinary retention and medical complications.

The primary objective of this study was to determine the prevalence of ED utilization, and to explore if patient or surgical characteristics predict visits to the ED for an avoidable reason postoperatively. The secondary objective was to determine if the orthopedic surgery department at the Saint John Regional Hospital was appropriately consulted when postoperative patients visited the ED for surgery-related complaints. It was hypothesized that (1) many postsurgical ED visits are avoidable, (2) patient characteristics can be used to identify patients who are likely to use the ED postsurgically for an avoidable reason, and (3) orthopedic surgery will not be consulted for every case in which a consult was appropriate.

## Methods

A retrospective chart review of patients who had received elective thoracolumbar surgery performed by 2 fellowship-trained orthopedic spine surgeons from 2008 to 2013 and who had participated in a prospective database was conducted (N = 586). All participants had surgery at least 6 months prior to study start. Six months was chosen as a follow-up time to be comparable to other studies, and to capture insidious complications.<sup>2</sup> Exclusion criteria included previous spinal surgery, a history of spine-related litigation, and Worker's Compensation status leaving a study group of N = 577.

A paper chart review using ED charts from EDs throughout the Horizon Health Network was conducted. The Horizon Health Network includes 11 different hospitals within Saint John and outlying regions. Data collected included comprehensive details of the patient's visit reason(s) and whether an orthopedic, or spine surgeon was consulted. Data collected included gender, age, body mass index, marital status, living situation, SF-36 (36-item Short Form Health Questionnaire) Physical Component Summary (PCS) scores and Mental Component Summary (MCS) scores, modified Oswestry Disability Index scores (mODI), Numerical Rating Scale for Back Pain and Leg Pain scores (NRS-B and NRS-L, respectively), primary pathology, primary symptom, comorbid conditions, type of surgery, levels of intervention, family doctor status at time of surgery, and preoperative medication use. Visit reasons were then reviewed by 2 fellowship-trained orthopedic spine surgeons to determine (1) whether the visits were related to the spine surgery, and if so (2) whether they were avoidable or

**Table 1.** Baseline Patient Demographics.

Measure	Sample Total	Patients With an Avoidable Visit	Patients Without an Avoidable Visit	P
Age, years, mean (SD)	57.26 (14.66)	57.86 (15.09)	57.18 (14.61)	.65
Female, %	51.5	57.6	50.7	.41
Body mass index, kg/m <sup>2</sup> , mean (SD)	29.72 (6.13)	30.77 (6.45)	29.60 (6.08)	.91
Body mass index category, %				
Underweight	1.1	0.0	1.2	
Normal	19.4	20.0	19.3	
Overweight	37.4	33.3	37.9	
Obese	42.1	46.7	41.6	
Marital status, %				.03*
Single	11.4	15.9	10.8	
Married/Engaged	78.3	65.1	80.1	
Divorced/Separated	10.3	19.0	9.1	
Living arrangement, n				.61
Alone	86	11	75	
Other	26	5	21	
Lives with others	458	50	408	
Work status, n				.65
Currently working	180	20	160	
Disabled	88	8	80	
No employed	83	6	77	
Retired	188	26	162	
Other	31	5	26	
Charleston Comorbidity Index Score, %				.57
0	64.0	59.1	64.6	
1	22.0	25.8	21.5	
2	7.9	6.1	8.2	
3	3.9	6.1	3.6	
4	1.4	1.5	1.4	
5	0.5	1.5	0.4	
8	0.2	0.0	0.2	
11	0.2	0.0	0.2	
Primary symptom, %				.90
Back pain	1.60	3.00	1.40	
Back and leg pain	60.20	62.10	60.00	
Neurologic deficit	1.93	1.50	2.00	
Neurogenic claudication	2.30	33.30	34.10	
Deformity	0.02	0.00	2.60	
Primary pathology, %				.88
Disc pathology	37.0	33.3	37.5	
Spondylothesis/Instability	58.9	62.1	58.5	
Deformity	4.1	4.5	4.0	
Family doctor, %				.80
Yes	71.0	69.7	71.2	
No	29.0	30.3	28.8	
Medication use: Over the counter, n				.99
Never use	84	10	74	
Intermittently use	192	23	169	
Use daily	281	32	249	
Medication use: Muscle relaxants, n				.28
Never use	349	44	305	
Intermittently use	99	8	91	
Use daily	48	9	39	
Medication use: Narcotics, n				.80
Never use	309	40	269	
Intermittently use	73	9	64	
Use daily	131	14	117	
Medication use: Antidepressants, n				.35

(continued)

**Table 1.** (continued)

Measure	Sample Total	Patients With an Avoidable Visit	Patients Without an Avoidable Visit	P
Never use	389	43	346	
Intermittently use	15	3	12	
Use daily	95	16	79	
Medication use: Neuroleptics, n				.88
Never use	370	45	325	
Intermittently use	22	3	19	
Use daily	112	11	101	
Oswestry Disability Index, n				.96
Minimally disabled	15	1	14	
Moderately disabled	176	21	155	
Severely disabled	278	34	244	
Crippled	93	8	85	
Bedridden or exaggerating symptoms	12	2	10	
Short Form-36, median score				.51
Physical Component Summary		29.85	31.78	
Mental Component Summary		41.26	43.44	

\*Statistically significant ( $P < .05$ ).

appropriate and finally, (3) whether these visits required consultation. The operational definition of an appropriate visit was dependent on the acuity of the problem (ie, whether patients would be adversely affected by waiting 24 hours to be seen in a clinical setting).<sup>13,14</sup> In the case of a disagreement between the 2 spine surgeons, the most conservative rating was used. Eighty-three patients who met criteria visited the ED within 6 months postoperatively.

Descriptive statistics were used to summarize patient characteristics, demographic information, surgical consults, and reason for the ED visit. Continuous demographic and clinical variables were compared using independent *t* test, or the Mann-Whitney *U* statistic. Categorical variables were analyzed using a chi-square test, or chi-square with rates correction when appropriate. These univariate analyses were conducted to determine significant associations between patient/surgical factors and avoidable ED visits. Significant factors ( $P < .05$ ) were entered in to a multivariate binary logistic regression.

## Results

Eighty-three elective thoracolumbar spine surgery patients used the ED within the 6 months following surgery. Sixty-six (38 female and 28 male) engaged in an avoidable, surgery-related ED visit following hospital discharge, 17 made an appropriate visit to ED and 494 patients did not visit the ED following surgery (Figure 1). The avoidable ED visits were further categorized by the physicians based of the emergency doctors notes as primarily for pain-related reasons (45.5%), physiology-related issues (50.0%), or for psychological-related reasons (4.5%, Figure 2). The most common pain complaints included neck pain, lower extremity pain, and buttock pain. Physiology-related reasons included constipation, diarrhea, general weakness, nausea, vomiting, and dizziness. Psychology-related reasons included anxiety and drug-seeking behavior. Demographic information is summarized in Table 1.

For patients who made visits deemed to be avoidable, examining consults found 7 were requested that were deemed unnecessary. One of the consults was not requested when it was necessary, and 58 consults were appropriately not sought.

No significant differences between patients who made avoidable and appropriate ED visits were found for gender, attending surgeon, medication use, surgical type (open versus minimally invasive), number of levels operated on, family doctor status, current living arrangements, work status, primary pathology, primary indicator, adverse events, ODI, body mass index, SF-36 PCS, SF-36 MCS, the Charlson Comorbidity Index, age and NRS-B (see Tables 1 and 2).

Marital status was statistically significant,  $\chi^2(2, N = 535) = 8.189, P = .017$ . Patients were more likely to make an avoidable postoperative ED visit if they were either single or divorced/separated compared with patients who were married. NRS-L was also statistically significant ( $U = 13\,931, P = .031$ ), with patients with avoidable visits having higher leg pain prior to surgery than those without an avoidable visit.

Marital status and NRS-L was inputted into a binary multivariate logistic regression, with the likelihood of patients making an avoidable visit as the outcome variable. The overall model was statistically significant,  $\chi^2(3) = 10.14, P = .017$ . The model explains 3.7% (Nagelkerke  $R^2$ ) of the variance in making an avoidable visit and correctly classified 88.1% of cases. The model was fit to the data well, with goodness of fit of  $\chi^2(7) = 10.210, P = .177$ . Patients who were divorced/separated had a 2.55 times increased likelihood of making an avoidable ED visit than patients who were married,  $\chi^2(1) = 6.461, P = .01, 95\% \text{ CI} = 1.239 \text{ to } 5.234$ . NRS-Leg was not significant when controlling for marital status,  $\chi^2(1) = 2.503, P = .114, 95\% \text{ CI} = 0.974 \text{ to } 1.276$ .

## Discussion

The current study demonstrates a significant portion (14.38%) of patients visit the emergency department following elective

**Table 2.** Surgical Factors.

Measure	Sample Total	Patients With an Avoidable Visit	Patients Without an Avoidable Visit	P
Surgical access, %				.84
Minimally invasive surgery	33.4	32.3	33.5	
Open	66.6	67.7	66.5	
Primary surgeon, %				.81
1	58.6	56.1	58.9	
2	41.4	43.9	41.1	
No. of levels, %				.26
1-3	84.9	89.4	84.3	
4+	15.1	10.6	15.7	
Surgery type, %				.99
Nonfusion	54.6	54.5	45.4	
Fusion	45.4	45.5	54.6	
No. of adverse events prior to discharge, %	10.1	4.8	10.7	0.21

thoracolumbar surgery, the majority for avoidable reasons (11.43%). This is significantly higher rate of return than those found following ambulatory surgeries. Previous research investigating rates of ED visits range from 1.1% to 3.2%.<sup>11,15,16</sup> The amount of ED visits for appropriate complication-related reasons is in line with previous research at 2.9%. Factors contributing to avoidable overutilization of the ED following spine surgery should be investigated. Of interest in future research would be the potential role of postsurgical expectation management. Most commonly cited reasons for avoidable ED visits were pain and physiological complaints. Given that spine patients are typically chronic pain sufferers, they are a unique population compared to other surgical groups. There is evidence to support that chronic pain sufferers are more likely to be among high utilizers of the ED,<sup>17,18</sup> likely due to limited knowledge of alternative coping strategies.<sup>17</sup> Intuitively, we can assume higher ED utilization postoperatively in a population already prone to higher ED use. Interventions targeting reduction in avoidable ED visits to date are inconsistent,<sup>17,19</sup> particularly in chronic pain populations. This would be an ideal avenue for pursuing a methodologically sound intervention examining expectation management for spine surgery patients.

Significant predictors were found in the current study; however, the model only explained 3.7% of the variance meaning that although statistically significant, the findings for predictors are not clinically important. Based on the current study, there are no strong predictors pre-surgically surgeons could manipulate to help decrease post-surgical utilization of the ED.

This study had some limitations that are important to note. One significant limitation to this study is that we were not able to identify patients who visited an emergency room outside of the Horizon Health Network. While this network covers half the province that patients received surgery in, it is possible that a small number of visits were missed. In addition, this study was a retrospective design that relied on information from patient records. This information was unable to be verified, and any issues with patient record keeping would affect results.

Another limitation of the present study is that we did not include patients with previous spine surgery. These patients'

experience with the postoperative process, and/or extended chronic pain might affect their ED use. Therefore, these results are not generalizable to patients who have had previous spine surgeries. We were also unable to quantify family doctor factors beyond simply whether the patient had one or not. The strength of a patients' relationship with their family physician, or their ability to obtain an appointment on short notice could be important variables that were beyond the scope of this study. Finally, this study simply dichotomized patients based on whether they had at least one avoidable ED visit. Multiple visits by one patient were not captured here.

Despite the limitations noted, to the best of our knowledge this was the first study assessing patient characteristics that might have affected ED use following elective spine surgery. It was also the first to classify visits as avoidable, or appropriate within an elective spine surgery sample. Patient visit reasons and consults were also examined in detail in order to better understand the patient presentation. The impact of this line of research could be significant. Emergency departments account for 5.3% of provincial hospital expenditures in New Brunswick, compared with the 4.3% national average.<sup>20</sup> On a scale of billions, that 1% difference represents a huge burden to the health care system. Further research on this topic should aim to quantify the economic burden of avoidable ED use, and the potential benefits of better patient education. A more comprehensive analysis of patient perceptions of surgical outcomes both pre- and postsurgery that lead to avoidable ED utilization would also be valuable. Multicenter studies across Canada would also help clarify regional differences and increase the generalizability of these results.

## Conclusion

A large percentage (14.38%) of elective surgery patients returned to the ED within 6 months for reasons relating to their surgery with 11.43% returning for avoidable reasons. Patients likely to make avoidable visits could not be identified prior to surgery using the measures collected in this study in a clinically meaningful way. Reasons for patients returning to the ED considered an avoidable reason focused on pain management and

minor physiological symptoms. It is possible that enhanced presurgical education to manage post-surgical expectations could help prevent avoidable ED visits. Decreasing avoidable ED visits could relieve a major burden to the health care system, both from an economic and a patient perspective.

### Declaration of Conflicting Interests

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