



## Patient Body Mass Index is an Independent Predictor of 30-Day Hospital Readmission After Elective Spine Surgery

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■ **BACKGROUND:** Hospital readmission within 30 days of index surgery is receiving increased scrutiny as an indicator of poor quality of care. Reducing readmissions achieves the dual benefit of improving quality and reducing costs. With the growing prevalence of obesity, understanding its impact on 30-day unplanned readmissions and patients' perception of health status is important for appropriate risk stratification of patients. The aim of this study was to determine if obesity is an independent risk factor for unplanned 30-day readmissions after elective spine surgery.

■ **METHODS:** The medical records of 500 patients (non-obese,  $n = 281$ ; obese,  $n = 219$ ) undergoing elective spine surgery at a major academic medical center were reviewed. Preoperative body mass index (BMI) was measured on all patients. BMI that was  $\geq 30$  kg/m<sup>2</sup> was classified as obese. Patient demographics, comorbidities, and postoperative complication rates were collected. The primary outcome investigated was unplanned all-cause 30-day hospital readmission. The association between preoperative obesity and 30-day readmission rate was assessed via multivariate logistic regression analysis.

■ **RESULTS:** Baseline characteristics and operative variables and complication profiles were similar between both cohorts. Overall, 8.6% of patients were readmitted within 30 days of discharge; obese patients experienced a 2-fold increase in 30-day readmission rates (obese 12.33% vs. nonobese 5.69%,  $P = 0.01$ ). In a multivariate logistic

regression analysis, preoperative obesity (BMI  $\geq 30$  kg/m<sup>2</sup>) was found to be an independent predictor of 30-day readmission after elective spine surgery ( $P = 0.001$ ).

■ **CONCLUSIONS:** Preoperative obesity is an independent risk factor for readmission within 30 days of discharge after elective spine surgery. In a cost-conscious health care climate, preoperative BMI can identify patients at risk for early unplanned hospital readmission.

### INTRODUCTION

Unplanned hospital readmissions within 30 days of surgery can lead to negative consequences for patients and providers and are costly for public and private payers. According to the Centers for Medicare and Medicaid Services, inpatient readmissions within 30 days of discharge accounted for approximately \$17 billion in Medicare spending.<sup>1,2</sup> The U.S. government, through the Affordable Care Act of 2010, introduced several initiatives aimed at decreasing inpatient hospital readmissions. Understanding the patient-level factors contributing to higher readmission rates is integral for appropriate preoperative risk stratification.

Obesity is a modifiable risk factor that is associated with increased surgical morbidity and health care resource utilization. Despite the link between obesity and increasing postoperative complications after spine surgery, not much is known about the link between obesity and readmission rates.<sup>3,4</sup> The aim of this

### Key words

- 30-Day readmission
- BMI
- Body mass index
- Obesity
- Spine
- Surgery

### Abbreviations and Acronyms

**BMI:** Body mass index  
**SSI:** Surgical site infection

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study was to determine if obesity is an independent risk factor for unplanned 30-day readmissions after elective spine surgery.

## MATERIALS AND METHODS

This ambispective study comprised 500 patients undergoing elective spine surgery at a major academic medical center during the period 2008–2010. Institutional review board approval was obtained before study initiation. Included patients were 18–70 years old 1) with low back pain and/or radiculopathy, 2) with magnetic resonance imaging evidence of grade I–II spondylolisthesis with central or foraminal stenosis, 3) who failed at least 6 weeks of nonsurgical treatment, and 4) who underwent lumbar spinal decompression and fusion. Patients were excluded if they had 1) prior back surgery or 2) severe coexisting pathology that could confound the assessment of operative outcome (e.g., rheumatoid arthritis, osteoarthritis, metabolic bone disease). Additional exclusion criteria were traumatic and neoplastic etiologies.

Demographic variables evaluated included patient age, sex, body mass index (BMI), and smoking status. Comorbidities included hyperlipidemia, chronic obstructive pulmonary disease, congestive heart failure, coronary artery disease, and atrial fibrillation. Surgical variables included length of surgery, number of vertebral levels involved, estimated blood loss, use of packed red blood cells, and urinary output. Postoperative complications included length of stay, urinary tract infection, pneumonia, deep and superficial surgical site infections (SSIs), deep venous thrombosis, pulmonary embolism, cardiopulmonary arrest, and 30-day readmission rate.

All patients received standard systemic antibiotic prophylaxis consisting of intravenous cefazolin within 1 hour of surgical incision followed by intravenous cefazolin every 8 hours for 1 day. Clindamycin was used if the patient was allergic to penicillin. Other intravenous antibiotics that were used infrequently included ciprofloxacin, piperacillin/tazobactam, and vancomycin. All patients were prepared with alcohol and chlorhexidine. Before skin closure, irrigation with saline by gravity was performed. Vancomycin powder was used in all open cases. The patients were divided into 2 cohorts by their obesity status with obesity defined as a BMI  $\geq 30$  kg/m<sup>2</sup> (nonobese cohort,  $n = 281$ ; obese cohort,  $n = 219$ ). We identified all unplanned readmissions for any reason within 30 days of discharge after indexed spine surgery.

Parametric data were expressed as mean  $\pm$  SD and compared via Student *t* test. Nominal data were compared with  $\chi^2$  tests. The relationship between independent variables and 30-day readmission rates was assessed using a multivariate logistic regression model. All tests were 2-sided and were statistically significant if the *P* value was  $< 0.05$ . Statistical analysis was performed using JMP (SAS Institute Inc., Cary, North Carolina, USA).

## RESULTS

The study comprised 500 adult patients (nonobese cohort,  $n = 281$ ; obese cohort,  $n = 219$ ). There was no significant difference in age between the groups (nonobese 56.74 years  $\pm$  15.13 vs. obese 56.23 years  $\pm$  13.34,  $P = 0.68$ ) (Table 1). An approximately equal proportion of men and women was included in both groups (nonobese cohort, 48.04% men; obese, 42.47% men) (Table 1).

**Table 1.** Preoperative, Intraoperative, and Postoperative Variables and 30-Day Readmission Rates

Variable	Nonobese ( $n = 281$ )	Obese ( $n = 219$ )	<i>P</i> Value
Preoperative baseline variables			
Male sex, %	48.04	42.47	0.21
Age at surgery, years	56.74 $\pm$ 15.13	56.23 $\pm$ 13.34	0.68
BMI, kg/m <sup>2</sup>	25.37 $\pm$ 3.18	36.60 $\pm$ 6.47	$< 0.0001^*$
Smoker, %	23.49	17.35	0.09
HLD, %	11.39	15.98	0.13
COPD, %	1.42	1.83	0.72
CHF, %	2.85	2.74	0.94
CAD, %	13.17	11.87	0.66
AFib, %	3.91	3.65	0.87
Operative variables			
Operative time, minutes	170.32 $\pm$ 72.28	179.95 $\pm$ 82.08	0.17
EBL, mL	453.91 $\pm$ 831.13	455.25 $\pm$ 698.49	0.98
PRBCs, %	14.23	10.96	0.27
UOP, mL	471.02 $\pm$ 493.66	432.84 $\pm$ 459.16	0.42
Number of fusion levels	2.12	1.89	0.15
Postoperative variables			
LOS, days	4.97 $\pm$ 5.35	4.59 $\pm$ 4.00	0.36
UTI, %	6.43	8.68	0.34
Pneumonia, %	3.93	0.91	0.03
Deep SSI, %	0.36	2.28	0.04
Superficial SSI, %	0.00	0.91	0.10
Other infection, %	5.69	6.39	0.74
DVT, %	0.00	0.00	1.00
PE, %	0.36	0.91	0.42
Cardiopulmonary arrest, %	0.36	0.46	0.85
30-Day readmission rate, %	5.69	12.33	0.01

Data expressed as mean  $\pm$  SD or % except where noted.

BMI, body mass index; HLD, hyperlipidemia; COPD, chronic obstructive pulmonary disease; CHF, congestive heart disease; CAD, coronary artery disease; AFib, atrial fibrillation; EBL, estimated blood loss; PRBCs, packed red blood cells; UOP, urinary output; LOS, length of stay; UTI, urinary tract infection; SSI, surgical site infection; DVT, deep vein thrombosis; PE, pulmonary embolism.

\*Value significant at  $P < 0.05$  level.

Smoking status was similar between cohorts (nonobese 23.49% vs. obese 17.35%,  $P = 0.09$ ) (Table 1). There were no significant differences in the prevalence of other comorbidities, including hyperlipidemia, chronic obstructive pulmonary disease, congestive heart failure, coronary artery disease, and atrial fibrillation (Table 1).

Duration of surgery was similar between cohorts (nonobese 170.32 minutes  $\pm$  72.28 vs. obese 179.95 minutes  $\pm$  82.08,

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