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Case study

Post-operative delirium is an independent predictor of 30-day hospital readmission after spine surgery in the elderly (≥65 years old): A study of 453 consecutive elderly spine surgery patients

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ABSTRACT

In the last decade, costs of U.S. healthcare expenditures have been soaring, with billions of dollars spent on hospital readmissions. Identifying causes and risk factors can reduce soaring readmission rates and help lower healthcare costs. The aim of this is to determine if post-operative delirium in the elderly is an independent risk factor for 30-day hospital readmission after spine surgery. The medical records of 453 consecutive elderly (≥65 years old) patients undergoing spine surgery at Duke University Medical Center from 2008 to 2010 were reviewed. We identified 17 (3.75%) patients who experienced post-operative delirium according to DSM-V criteria. Patient demographics, comorbidities, and post-operative complication rates were collected for each patient. Elderly patients experiencing post-operative delirium had an increased length of hospital stay (10.47 days vs. 5.70 days, $p = 0.009$). Complication rates were similar between the cohorts with the post-operative delirium patients having increased UTI and superficial surgical site infections. In total, 12.14% of patients were re-admitted within 30-days of discharge, with post-operative delirium patients experiencing approximately a 4-fold increase in 30-day readmission rates (Delirium: 41.18% vs. No Delirium: 11.01%, $p = 0.002$). In a multivariate logistic regression analysis, post-operative delirium is an independent predictor of 30-day readmission after spine surgery in the elderly ($p = 0.03$). Elderly patients experiencing post-operative delirium after spine surgery is an independent risk factor for unplanned readmission within 30-days of discharge. Preventable measures and early awareness of post-operative delirium in the elderly may help reduce readmission rates.

1. Introduction

In the last decade, costs of U.S. healthcare expenditures have dramatically increased, with billions of dollars spent on hospital readmissions. Centers for Medicare & Medicaid Services (CMS) estimates that in 2004, over $17 billion was spent on potentially preventable, unplanned readmissions [1]. In 2013, approximately 18% of Medicare patients were readmitted to the hospital within 30 days, amounting to almost $26 billion billed towards Medicare [2,3]. Under the Patient Protection and Affordable Care Act, the Hospital Readmissions Reduction Program (HRRP) allows for CMS to penalize hospitals on Medicare reimbursements for 30-day readmission rates [3]. As a result, hospital administration now tracks 30-day readmission rates as a metric of clinical performance and quality of care. Identifying causes and risk factors of 30-day readmission in the elderly population is necessary to reduce soaring readmission rates and healthcare costs.

Post-operative delirium is a risk factor that has been associated with increased in-hospital mortality, complications, and length of hospital stay after surgery [4–6]. Hospitalized elderly patients have an increased susceptibility to neurocognitive disorders, such as delirium and dementia, which are frequently overlooked and commonly misdiagnosed [7,8]. Recently, there has been an increase in elderly patients undergoing elective spine surgery, as well as increased rates of postoperative delirium following spine surgery [9]. In a retrospective study of 578,457 patients who underwent lumbar spine surgery, Fineberg et al. found an overall incidence rate of post-operative delirium to be 8.4 events per 1000 and that older age (≥65 years old) was an independent predictor

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Table 1
Preoperative baseline variables for all patients.

Variable	Non-Delirium (n = 436)	Delirium (n = 17)	p-Value
Preoperative Baseline Variables			
Male (%)	46.56	47.06	0.96
White (%)	83.46	88.24	0.97
Age at Surgery (Years)	72.46 ± 5.78	74.35 ± 5.02	0.14
BMI (kg/m^2)	28.38 ± 5.55	28.86 ± 8.63	0.82
Diabetes (%)	19.95	23.53	0.75
Smoker (%)	11.70	0.00	0.23
COPD (%)	2.98	5.88	0.41
CHF (%)	5.505	17.65	0.06
CAD (%)	19.04	41.18	0.05
AFib (%)	8.26	17.65	0.17
HTN (%)	66.97	47.06	0.11
Hypercholesterolemia	13.76	23.53	0.27
Operative Variables			
Median # of Fusion Levels [IQR]	2[1–4]	3[2–6]	0.08
Operative Time (min)	233.13 ± 110.26	258.41 ± 81.23	0.23
EBL (mL)	599.53 ± 953.07	1150.00 ± 1706.82	0.21
UOP	582.99 ± 486.344	786.56 ± 606.86	0.20
Postoperative Variables			
LOS (Days)	5.70 ± 6.33	10.47 ± 6.65	**0.009**
UTI (%)	11.70	47.06	**0.0005**
Pneumonia (%)	3.67	11.76	0.14
Deep Surgical Site Infection (%)	2.75	11.76	0.09
Superficial Surgical Site Infection (%)	1.15	11.76	**0.02**
Other Infection (%)	8.72	23.53	0.06
Sepsis	3.44	5.88	0.46
Acute Renal Failure (%)	0.69	0.00	0.73
DVT (%)	0.23	5.88	0.07
PE (%)	0.92	5.88	0.17
MI (%)	3.44	5.88	0.46
Cardio Pulmonary Arrest (%)	0.92	0.00	0.69
30-Day Readmission rate (%)	11.01	41.18	**0.002**

[10]. However, the effects of post-operative delirium on 30-day readmission rates in the elderly remain relatively unknown.

The aim of this is to determine if post-operative delirium in the elderly is an independent risk factor for 30-day hospital readmission after spine surgery.

2. Methods

In this retrospective study, 453 medical records of consecutive elderly (≥65 years old) patients undergoing spine surgery at Duke University Medical Center from 2008 to 2010 were reviewed. Institutional Review Board approval was obtained prior to study initiation. We identified 17 (3.75%) patients who experienced post-operative delirium according to DSM-V criteria (Non-Delirium: 436, Delirium: 17). We identified all unplanned readmissions within 30 days of discharge after index spine surgery.

Demographic variables evaluated included patient age, gender, race and Body Mass Index (BMI). Co-morbidities included diabetes, chronic obstructive pulmonary disease (COPD), congestive heart failure (CHF), coronary artery disease (CAD), atrial fibrillation (AFib), hypertension (HTN), hypercholesterolemia, and smoking status. Preoperative psychiatric history and home-medication use were evaluated for patients who experienced post-operative delirium. Operative variables included number of vertebral levels involved, length of operation, estimated blood loss (EBL), and urinary output (UOP).

Post-operative complications included length of hospital stay (LOS), urinary tract infection (UTI), pneumonia, deep and superficial surgical site infections (SSI), sepsis, acute renal failure (ARF), deep venous thrombosis (DVT), pulmonary embolism (PE), myocardial infarction (MI), cardio-pulmonary arrest, and 30-day readmission rate. For patients who experienced post-operative delirium, the number of post-operative days to delirium and treatment plan were recorded.

Parametric data were expressed as means ± standard deviation (SD) and compared using the Student's t-test. Nonparametric data were expressed as median [interquartile range] and compared via the Mann–Whitney U test. Nominal data were compared with the Chi-square test. Relationship between independent variables and 30-day readmission rates was assessed using a multivariate logistic regression model. All tests were two sided and were statistically significant if the p-value was less than 0.05. Statistical analysis was performed using JMP-12 by SAS.

3. Results

453 elderly (≥65 years old) patients (*Non-Delirium cohort: n = 436, Delirium cohort: n = 17*) were included in this study. The proportion of men (46.56% vs. 47.06%, $p = 0.96$) and white (83.46% vs. 88.24%, $p = 0.97$) patients were similar between non-delirium and delirium cohorts, respectively, Table 1. There was no significant difference in age between both cohorts (*Non-Delirium cohort: 72.46 ± 5.78 years vs. Delirium cohort: 74.35 ± 5.02 years, p = 0.14*), Table 1. No significant differences in BMI between both groups were observed (*Non-Delirium cohort: 28.38 ± 5.55 kg/m^2 vs. Delirium cohort: 28.86 ± 8.63 kg/m^2, p = 0.82*), Table 1. There were no significant differences between both groups in the prevalence of other co-morbidities such diabetes, COPD, CHF, CAD, AFib, hypercholesterolemia and smoking status, Table 1.

The mean ± SD length of operation (min) for the Non-Delirium and Delirium-cohort was 233.13 ± 110.26 min and 258.41 ± 81.23 min ($p = 0.23$), respectively, Table 1. The mean ± SD estimated blood loss (mL) for the Non-Delirium and Delirium-cohort was 599.53 ± 953.07 mL and 1150.00 ± 1706.82 mL ($p = 0.21$), respectively, Table 1. The mean ± SD intra-operative