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Clinical Study

Anterior and posterior cervical fusion in patients with high body mass index are not associated with greater complications

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Abstract

BACKGROUND CONTEXT: Obesity has been associated with adverse surgical outcomes; however, limited information is available regarding the effect of obesity on cervical spinal fusion outcomes.

PURPOSE: To determine the effect of obesity on complication rates after cervical fusions.

STUDY DESIGN/SETTING: Retrospective cohort analysis of prospectively collected data on cervical fusion surgeries.

PATIENT SAMPLE: Patients in the ACS-NSQIP database from 2005 to 2010 undergoing cervical anterior or posterior fusion.

OUTCOME MEASURES: Primary outcome measures were 30-day postsurgical complications, including mortality, deep-vein thrombosis, pulmonary embolism, septic complications, system-specific complications, and having ≥1 complication overall. Secondary outcomes were time spent in the operating room, blood transfusions, length of stay, and reoperation within 30 days.

METHODS: Patients undergoing anterior or posterior cervical fusions in the 2005–2010 *American College of Surgeons National Surgical Quality Improvement Program* were selected using Current Procedural Terminology codes. Anterior cervical fusion patients were categorized into four groups on the basis of body mass index (BMI): nonobese (18.5–29.9 kg/m^2), obese I (30–34.9 kg/m^2), obese II (35–39.9 kg/m^2), and obese III (≥40 kg/m^2). Posterior cervical patients were categorized into two groups based on the basis of BMI: nonobese (18.5–29.9 kg/m^2) and obese (≥30 kg/m^2) due to the smaller sample size. Patients in the obese categories were compared with patients in the nonobese categories by the use of χ^2, Fisher's exact test, Student *t* test, and analysis of variance. Multivariate linear/logistic regression models were used to adjust for preoperative comorbidities. The authors report no sources of funding or conflicts of interest related to this study.

RESULTS: Data were available for 3,671 and 400 patients who underwent anterior or posterior cervical fusion, respectively. Obese class III patients only showed a greater incidence of deep-vein thrombosis after anterior fusions on univariate analysis. Obese patients only showed longer mean surgical times and total operating room times after posterior fusions on univariate analysis. On multivariate analyses, these differences did not remain significant. There were also no differences in multivariate analyses for overall and system-specific complication rates, lengths of hospital stay, reoperation rates, and mortality among the obesity groups when compared with the nonobese groups with anterior or posterior cervical fusions.

CONCLUSIONS: High BMI, regardless of obesity class, does not appear to be associated with increased complications after cervical fusion in the 30-day postoperative period.

Keywords: Obesity; Cervical spinal fusion; Complications; Database; Outcomes; ACS NSQIP

FDA device/drug status: Not applicable.

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The disclosure key can be found on the Table of Contents and at www.TheSpineJournalOnline.com.

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EVIDENCE & METHODS

Context
Obesity is commonly felt to be a general risk factor for surgical complications. The authors aimed to see if this holds true for cervical fusions.

Contribution
Using the NSQIP database, they found that obesity does not appear to be associated with more complications during the first 30 days postop.

Implications
While the cases may be technically more demanding, the findings suggest that cervical spinal fusion is not significantly impacted by obesity from the patient aspect regarding perioperative complications. Importantly, clinical outcomes were not assessed, nor were late complications such as pseudarthrosis. There is some concern that early serious complications are uncommon, so greater numbers might be needed to discover the differences between groups.
—*The Editors*

Introduction

Obesity is growing problem that has reached epidemic levels in the United States. According to the Centers for Disease Control and Prevention, 78 million of US adults are currently obese (body mass Index [BMI] $\geq$30 kg/m^2) [1]. Obese patients are at risk for comorbid medical conditions such as heart disease, hypertension, stroke, diabetes, and certain cancers—which subsequently increase medical costs [1,2]. Not only is obesity associated with more expensive medical care but also with more expensive surgical care, given its associations with longer hospitalizations and greater rate of complications [3,4].

Aside from increased costs, the prevalence of obesity in the population is driving a growing interest for understanding the predictors of surgical outcomes in these patients—particularly after spine surgery. Most studies on the impact of obesity on spine surgery outcomes have focused on lumbar surgery and have noted an association between high BMI and an increased risk of complications [3,5–12].

Despite the existing literature on lumbar surgical outcomes, there is a paucity of literature on outcomes after anterior and posterior cervical fusions in patients with high BMI. One single institution study found that the thickness of subcutaneous fat was a significant risk factor for surgical-site infections after posterior cervical fusion, whereas obesity (BMI$\geq$30 kg/m^2) was not [13]. Aside from this study, one large multi-institutional study has characterized the in-hospital outcomes of patients after cervical anterior and posterior fusions in morbidly obese patients (BMI$\geq$40 kg/m^2) [3]. Although this study from California showed an increased risk for in-hospital complications after anterior cervical fusions and no increased risk after posterior cervical fusions, it could not provide information on postdischarge complications and did not provide information on obese patients with a BMI between 30 and 39.9 kg/m^2. One other recent study that included patients undergoing cervical, thoracic, and lumbar fusions using a prospectively collected database noted an increase in 30-day complications with increasing BMI but did not separate its results by procedure nor stratify patients into obesity categories, making unclear the contribution of high BMI to adverse outcomes in the cervical spine [14].

The current study aims to characterize the 30-day clinical outcomes and economic considerations of patients with high BMIs undergoing anterior and posterior cervical fusion procedures using the multi-institutional American College of Surgeons National Surgery Quality Improvement Program (ACS-NSQIP) database. Results are compared with currently available literature.

Methods

Data source/study population

The *American College of Surgeons National Surgical Quality Improvement Program (*ACS-NSQIP) is a prospectively collected, risk-adjusted, multi-institutional outcomes program whose details of data collection strategies, inclusion criteria, sampling procedures, and outcomes measured have been reported [15–18]. The ACS-NSQIP collects data on more than 135 variables compliant with the *Health Insurance Portability and Accountability Act*, including preoperative comorbidities, intraoperative variables, and 30-day postoperative morbidity and mortality outcomes for patients undergoing major surgical procedures in both the inpatient and outpatient settings.

The ACS-NSQIP database from 2005 to 2010 was used for this study. Using Current Procedural Terminology (CPT) codes, we identified all patients who underwent anterior fusion (CPT 22551, 22554) or posterior (CPT 22600) cervical fusion in any of the 21 CPT fields available in NSQIP. Because CPT coding for anterior cervical fusion and discectomy changed in 2011 [19], cases with CPT code 22551 were rare in NSQIP 2005–2010. To optimize capture of patients undergoing anterior fusion, we included those with CPT code 63075 (anterior discectomy) in our anterior cervical fusion cohort. Careful review of CPT codes in NSQIP showed that many cases with CPT 63075 had additional codes suggestive of fusion (bone graft, instrumentation, etc) indicating that the discectomy occurred with fusion despite the absence of fusion codes (22551, 22554). There were some cases in which only CPT 63075 was listed but because NSQIP requires at least a primary code field per case, it is possible that associated codes were not always included. Given that cervical discectomy rarely occurs without fusion, we thus included those cases with primary CPT code of 63075 in our anterior cervical fusion cohort.

To focus on the typical adult patient undergoing cervical spine surgery, we excluded patients who underwent