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Clinical Study

Incidence and risk factors for perioperative visual loss after spinal fusion

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Abstract

BACKGROUND CONTEXT: Perioperative visual loss (POVL) is a rare but devastating complication that may follow spinal surgeries. The incidence of POVL after spinal fusion is not well characterized during the past decade.

PURPOSE: A population-based database was analyzed to characterize the incidence and risk factors for POVL associated with spinal fusion surgery on a national level.

STUDY DESIGN: This study consisted of a retrospective database analysis.

PATIENT SAMPLE: A total of 541,485 patients from the Nationwide Inpatient Sample (NIS) database were included in the study.

OUTCOME MEASURES: Study outcome measures included incidence of POVL, length of stay (LOS), in-hospital costs, mortality, and POVL risk factors.

METHODS: Data from the NIS were obtained from 2002 to 2009. Patients undergoing spinal fusion for degenerative pathologies were identified. Patient demographics, comorbidities, LOS, costs, and mortality were assessed. Statistical analyses were conducted using an independent *t* test for discrete variables and the chi-square test for categorical data. Binomial logistic regression was used to identify independent predictors of POVL. A p value of less than or equal to .001 was used to denote statistical significance. No funds were received by any of the authors for production of this study.

RESULTS: A total of 541,485 spinal fusions were identified in the United States from 2002 to 2009. The overall incidence of POVL was 1.9 events per 10,000 cases. Of patients who had POVL, 56.2% underwent surgery for a diagnosis of spinal deformity. Patients with POVL were significantly younger on average compared with unaffected patients (37.6 years vs. 52.4 years; $p<.001$). Length of stay and hospital costs doubled for patients with POVL ($p<.001$). Logistic regression analysis demonstrated that independent predictors of visual loss were deformity surgery (odds ratio [OR]=6.1), diabetes mellitus with end organ damage (OR=13.1), and paralysis (OR=6.0, $p<.001$).

CONCLUSIONS: Our findings demonstrated an overall POVL incidence of 1.9 events per 10,000 spinal fusions. Patients undergoing thoracic fusion for deformity correction accounted for the majority of cases of POVL. Despite being a rare complication after spinal fusion, POVL is an adverse event that may not be entirely preventable. Patients undergoing long-segment fusions for deformity and those with certain risk factors should be counseled regarding the risks of POVL.

Keywords: Perioperative visual loss; Spinal fusion; Nationwide inpatient sample; Risk factors; Spinal deformity; Ischemia optic neuropathy; Complications

FDA device/drug status: Not approved for this indication (rhBMP-2 use as a graft extender in the setting of an MIS TLIF).

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

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Introduction

Visual loss is a rare but potentially catastrophic complication that has been reported after spinal surgeries [1]. In 1948, Slocum et al. [2] described the first case of blindness after spinal surgery and concluded improper head positioning as the likely etiology. In a 1954 report by Hollenhorst et al. [3], perioperative visual loss (POVL) was attributed to improper headrest positioning of patients in the prone position. As a result of these studies, inadvertent pressure on the orbital contents became linked to the increased intraocular pressures and hypoperfusion responsible for POVL.

Spine surgery is a leading cause of POVL, particularly when patients are in the prone position [4–6]. Earlier studies have demonstrated incidences of POVL to be as high as 1% after spine surgery [7]. Visual loss can be secondary to ischemia to the optic nerves (anterior or posterior), postchiasmal cerebral blindness, retinal artery occlusion, or ophthalmic venous obstruction [8]. Ischemic optic neuropathy (ION) is among the most common diagnoses associated with POVL in nonophthalmologic surgery [7]. A 1997 study demonstrated multiple intraoperative risk factors, including long operative times, hypotension, anemia, and blood transfusion [6]. In the same year, Myers et al. [7] reviewed 37 cases of visual loss after spine surgery and determined preoperative risk factors to include smoking, chronic hypertension, diabetes, and peripheral vascular disease.

Given the rarity of POVL, its incidence has proved difficult to quantify on a national level. In a study of nonophthalmologic surgeries, Roth et al. [5] concluded the incidence of POVL to be 1 per 61,000 procedures. In a retrospective study of a large noncardiac surgical population, Warner et al. [9] demonstrated that the percentage of patients with POVL lasting more than 30 days was very small. Furthermore, they reported no incidences of POVL in more than 12,000 spine surgeries. Other studies have demonstrated the incidence of POVL in patients undergoing spine surgery to be as high as 0.2% [10]. Although POVL is rare, the severity of the complication was enough to prompt the American Society of Anesthesiologists (ASA) to create a POVL registry to determine whether there are common risk factors that make an individual more susceptible to postoperative visual loss [11].

Much of the literature on visual loss associated with spine surgery has consisted of individual case reports or small series of patients with optic neuropathies after various types of noncardiac surgery [12]. Because the incidence of visual loss after spinal fusion is not well characterized in the current literature, a nationwide population-based database was analyzed to identify the incidence and risk factors for POVL in spine surgeries performed from 2002 to 2009. The purpose of this study is to provide additional epidemiological data, to identify risk factors for POVL specific to spinal fusion, and to improve physician awareness of this potentially devastating complication.

EVIDENCE & METHODS

Context
Postoperative visual loss (POVL) following spine surgery is a rare but devastating event. Identifying patients at risk for this complication is important for the purposes of preoperative counseling and risk modulation.

Contribution
In this retrospective review of the NIS, the authors evaluated incidence and risk factors for the development of POVL among 541,485 spinal fusion procedures. POVL occurred at a rate of 1.9 events per 10,000 fusions, with the majority of cases occurring in individuals undergoing thoracic fusion for deformity correction. Independent predictors of POVL included the presence of diabetes and surgery for the correction of deformity.

Implications
The results of this study reinforce findings presented in prior work conducted among smaller populations. The current findings amount to Level IV evidence generated from the analysis of an administrative dataset that was not designed to support determinations regarding POVL. This is a challenge inherent to the use of most administrative databases. In addition, given the large number of predictor variables analyzed, some of the statistically significant associations encountered may be present solely due to chance. While providing some useful information that can support preoperative counseling and awareness regarding the incidence of POVL, only large prospective and patient-centered studies are undoubtedly necessary to provide higher quality evidence in regard to this topic.

—The Editors

Materials and methods

As the largest all-payer database in the United States, the Nationwide Inpatient Sample (NIS) contains data from nearly eight million discharges each year from 45 states and represents approximately 20% of all U.S. hospital discharges [13]. Each entry in the NIS represents data gathered during a single hospital admission. These data points include information on patient demographics, comorbidities, diagnoses, procedures performed, hospital characteristics, and measurable outcomes of the admissions (eg, length of stay [LOS], in-hospital costs). National estimates can be calculated using weighted values assigned to each hospital discharge. The diagnosis and procedure codes found in the NIS use the International Classification of Disease, 9th Revision, Clinical Modification (ICD-9-CM). According to the NIS terms of use, data points that include 10 or fewer entries cannot be published in the literature [13].