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BRIEF COMMUNICATION

Epidemiology of postoperative visual loss for non-ocular surgery in a cohort of inpatients

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Postoperative visual loss (POVL) is a rare but serious occurrence that follows non-ocular surgeries, often caused by retinal vascular occlusion (RVO) and ischemic optic neuropathy (ION) [1]. However, the most recent study on all causes of POVL was conducted twelve years ago [2]. Other than being dated, previous studies also used the United States (US) National Inpatient Sample (NIS), which does not differentiate between patients with pre-existing vision loss who underwent surgery and patients who developed vision loss postoperatively [2].

In this study, we identified characteristics and predictors of developing POVL among inpatients who underwent non-ocular surgery.

The 2017 Florida State Inpatient Database (SID) contains all in-state hospital inpatient stays for that year. The SID is a limited dataset that does not require institutional board review (IRB) under US law; [3] review was waived by Northwestern University IRB.

International Classification of Diseases, 10th Revision (ICD-10) codes were used to identify POVL diagnoses and non-ocular surgical procedures. Given the variability among ICD-10 codes and hospital documentation practices, we included all relevant variations for procedure and diagnostic codes. χ^2 and student t-tests were used to analyze differences between inpatients with and without POVL, and odds ratios (OR) were calculated using logistic regression. All analyses were conducted using Stata; significance levels were set at $p < 0.05$.

In 2017, there were 630,439 inpatients who underwent surgery in Florida hospitals in the SID. There were 76 cases of POVL: 46 attributed to RVO, 24 to ION, and 6 to sudden visual loss. Most cases occurred among patients who were older than 65 years, male, or White. There were 1.21 cases per 10,000 hospitalizations involving non-ocular surgeries.

Inpatients with POVL were older and more likely to have been male, underwent cardiac or spinal procedures, or diagnosed with hypotension or hyperlipidaemia (Table 1). Factors associated with POVL in multivariate logistic regression were hyperlipidaemia and spinal, cardiac, and orthopaedic surgery (Table 2).

The most recent population-level POVL study revealed a prevalence of 2.5 per 10,000 hospitalizations in the US from 1996 to 2005 [2]. Direct comparison with our results, however, is not possible since the NIS study included both old and new cases. Their definition of POVL—unlike ours—also included cortical blindness [2]. The NIS study found a higher risk of POVL among older, anaemic, and male patients who underwent cardiac, spinal, and orthopaedic surgery. These findings were not confirmed, possibly due to insufficient statistical power.

We found a significant association between hyperlipidaemia and POVL. Other studies have shown that hyperlipidaemia, an important predisposing factor for atherosclerosis, a risk factor for non-arteritic ION and RVO [4, 5]. Its association with POVL is thus biologically plausible [4, 5].

This study is susceptible to the limitations of large administrative datasets [6]. Additionally, Florida inpatients are older and more ethnically diverse than the general US population, which may limit this study's generalisability to other populations.

In summary, patients with hyperlipidaemia who underwent spinal, cardiac, or orthopaedic operations were at greater risk of developing POVL. Most POVL cases are caused by RVO in this population. Although POVL following non-ocular surgery is uncommon, identification of modifiable risk factors will require additional study.

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Table 1. Patient characteristics of POVL.

Characteristic/outcome	No POVL ($n = 630439$)	POVL ($n = 76$)	Test statistic, p-value
Age, mean (SD)	52.18 (25.48)	65.25 (17.42)	**$t = -4.47$, $p < 0.001$**
18–44, *n* (%)	220697 (35)	11 (14)	**$\chi^2 = 24.41$, $p < 0.001$**
45–64	164331 (26)	15 (20)	
65+	245398 (39)	50 (66)	
Sex, *n* (%)			**$\chi^2 = 6.89$, $p = 0.009$**
Male	287023 (46)	46 (61)	
Female	343416 (54)	30 (39)	
Race/Ethnicity, *n* (%)			$\chi^2 = 3.25$, $p = 0.197$
White	365249 (61)	51 (71)	
Black	116576 (19)	11 (15)	
Hispanic	121275 (20)	10 (14)	
Type of procedure, *n* (%)			**$\chi^2 = 109.29$, $p < 0.001$**
Spinal operation	24070 (4)	10 (13)	
Cardiac operation	88766 (14)	38 (50)	
Orthopaedic operation	73164 (12)	9 (12)	
Other operation[a]	444439 (70)	19 (25)	
Blood transfusion, *n* (%)			$\chi^2 = 2.02$, $p = 0.155$
Absent	576289 (91)	66 (87)	
Present	54150 (9)	10 (13)	
Anaemia, *n* (%)			$\chi^2 = 0.21$, $p = 0.649$
Absent	454395 (72)	53 (70)	
Present	176044 (28)	23 (30)	
Diabetes, *n* (%)			$\chi^2 = 2.64$, $p = 0.104$
Absent	458740 (73)	49 (64)	
Present	171699 (27)	27 (36)	
Hypotension, *n* (%)			**$\chi^2 = 4.85$, $p = 0.028$**
Absent	598827 (95)	68 (89)	
Present	31612 (5)	8 (11)	
Hyperlipidaemia, *n* (%)			**$\chi^2 = 32.36$, $p < 0.001$**
Absent	463541 (74)	34 (45)	
Present	166898 (26)	42 (55)	
History of smoking, *n* (%)			$\chi^2 = 0.61$, $p = 0.436$
Absent	448561 (71)	51 (67)	
Present	181878 (29)	25 (33)	
Overweight/Obese, *n* (%)			$\chi^2 = 0.27$, $p = 0.601$
Absent	86530 (14)	12 (16)	
Present	543909 (86)	64 (84)	
Median area household income quartile, *n* (%)			$\chi^2 = 1.06$, $p = 0.786$
First Quartile	264133 (43)	27 (37)	264133 (43)
Second Quartile	193124 (31)	25 (34)	193124 (31)
Third Quartile	119360 (19)	16 (22)	119360 (19)
Fourth Quartile	38877 (6)	5 (7)	38877 (6)

CB cortical blindness, *ION* ischemic optic neuropathy, *PA* pituitary apoplexy, *POVL* perioperative visual loss, *RVO* retinal vascular occlusion.
Statistically significant relationships are bolded.

Table 2. Odds associated with POVL in inpatients undergoing non-ocular surgery.

Characteristics	Univariate odds ratio (95% CI)	Multivariate adjusted odds ratio (95% CI)
Age		
18–44	1 [reference]	1 [reference]
45–64	1.83 (0.84–3.99)	0.80 (0.35–1.83)
65+	**4.09 (2.13–7.85)**	1.59 (0.77–3.32)
Sex		
Female	1 [reference]	1 [reference]
Male	**1.83 (1.16–2.91)**	1.37 (0.86–2.18)
Race		
White	1 [reference]	
Black	0.68 (0.35–1.30)	
Hispanic	0.59 (0.30–1.16)	
Type of procedure		
Spinal operation	**9.72 (4.52–20.90)**	**9.60 (4.45–20.72)**
Cardiac operation	**10.01 (5.77–17.37)**	**7.26 (4.08–12.91)**
Orthopaedic operation	**2.88 (1.30–6.36)**	**2.44 (1.09–5.46)**
Other operation[a]	1 [reference]	1 [reference]
Blood transfusion		
Absent	1 [reference]	
Present	1.61 (0.83–3.14)	
Anaemia		
Absent	1 [reference]	
Present	1.12 (0.69–1.83)	
Diabetes		
Absent	1 [reference]	
Present	1.47 (0.92–2.36)	
Hypotension		
Absent	1 [reference]	1 [reference]
Present	**2.23 (1.07–4.64)**	1.34 (0.64–2.82)
Hyperlipidaemia		
Absent	1 [reference]	1 [reference]
Present	**3.43 (2.18–5.39)**	**2.00 (1.21–3.31)**
History of smoking		
Absent	1 [reference]	
Present	1.21 (0.75–1.95)	
Overweight/Obese		
Absent	1 [reference]	
Present	0.85 (0.46–1.57)	
Median area household income quartile		
First Quartile	1 [reference]	
Second Quartile	1.27 (0.74–2.18)	
Third Quartile	1.31 (0.71–2.43)	
Fourth Quartile	1.26 (0.48–3.27)	

POVL postoperative visual loss.
Statistically significant relationships are bolded.
[a]Abdominal, thoracic, obstetrics, gynaecological, otolaryngology, urology, and miscellaneous non-ocular operations.

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AUTHOR CONTRIBUTIONS

All authors were responsible for research design; JCL, DDF, and PBG were involved in data acquisition and research execution; JCL and DDF conducted the data analysis; all authors worked on data interpretation and manuscript preparation.

COMPETING INTERESTS

The authors declare no competing interests.

ADDITIONAL INFORMATION

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