

Association of general anesthesia with postpartum hemorrhage following cesarean delivery among patients who did not attempt labor: a single center retrospective study

Isabella Hardej,^a Taylor Hartshorne,^a Hope Scherger,^a Diana Villazana-Kretzer,^b Michael Hofkamp,^b Allison Mootz^c

a. Baylor College of Medicine – Temple, b. Department of Anesthesiology, Baylor Scott & White Medical Center-Temple, c. Department of Anesthesiology, University of Texas Southwestern Medical Center

Background

- Postpartum hemorrhage (PPH): leading cause of maternal morbidity worldwide
- GA prior to CD incision has been associated with increased PPH risk in pre-labor patients

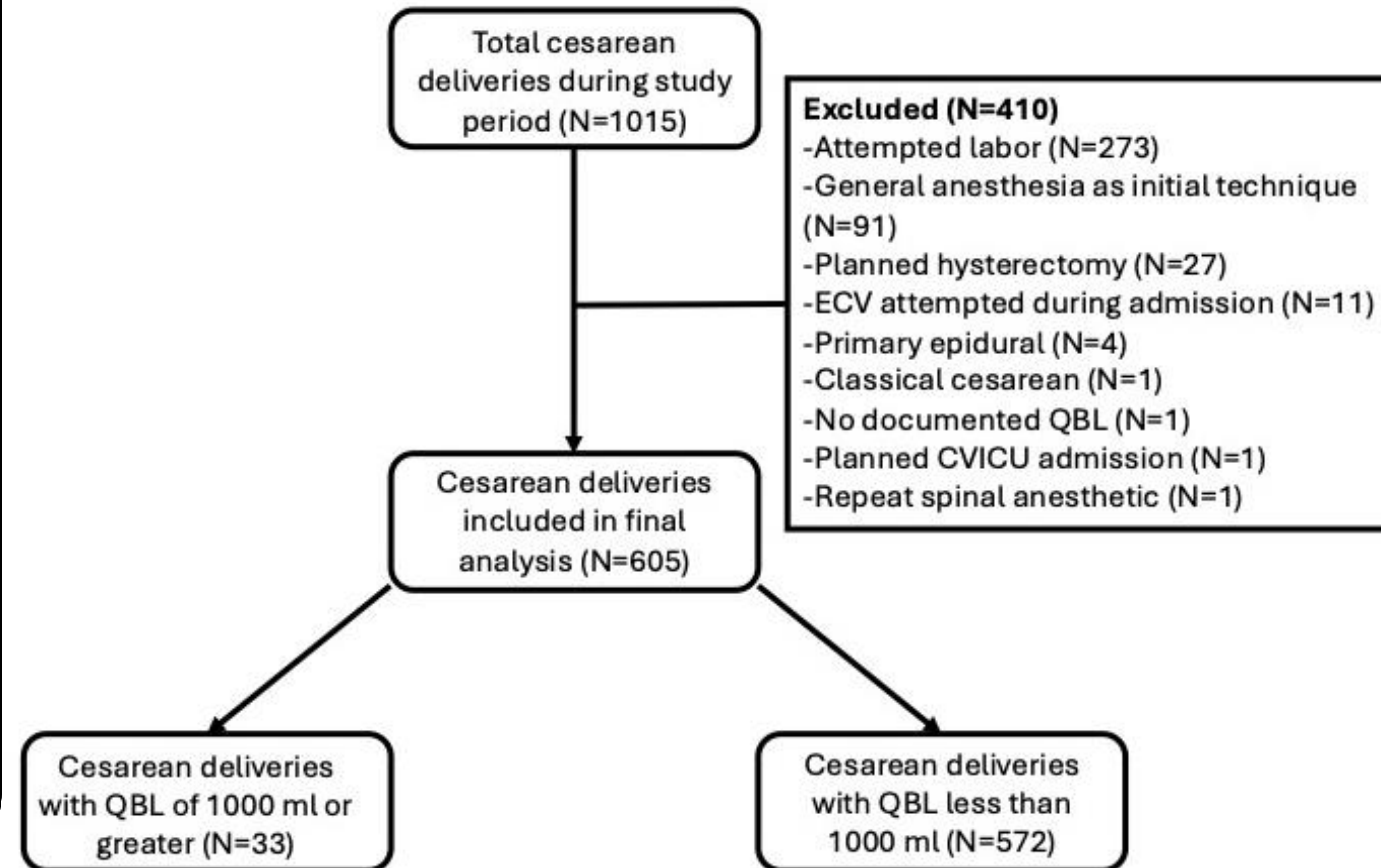
Study aim: To determine whether conversion to **general anesthesia** (GA) is associated with PPH among patients who did not labor and identify **characteristics** associated with PPH.

Study Design

Methods

- **Retrospective observational study**
- 1015 CDs performed (July 1, 2024 - June 30, 2025)
- **Inclusion criteria:** Patients who underwent CD without attempting labor and had QBL documentation
- Used descriptive and bivariate analyses to compare **PPH** and **no PPH cohorts**
- Significant variables were included in multivariate regression ($p < 0.05$)

Figure 1. Patient inclusion criteria flow diagram



Results

- CD urgency **not associated** with PPH (p=0.31)
- PPH cohort had **higher** rates of:
 - Multiple gestation (18% vs 4%, p<0.001)
 - Pre-operative anemia (45% vs 28%, p=0.03)
 - Initial anesthetic technique - combined spinal epidural (79% vs 52%, p=0.003)
- PPH cohort was **more** likely to receive:
 - GA at any time during the procedure (9% vs 2%, p=0.03)
 - Oxytocin boluses (p=0.02)
 - TXA (49% vs 10%, p<0.001)
- Average operative time was higher in PPH cohort (54 vs 45 minutes, p=0.02)

Table 1. Demographic and Clinical Characteristics Associated with Postpartum Hemorrhage

Variable	Postpartum hemorrhage (N=33)	No postpartum hemorrhage (N=572)	P value
Race			0.28
Age (years) (median (IQR))	31 (28-36)	30 (26-34)	0.20
Multiple gestation (yes)	6 (18%)	24 (4%)	<0.001***
In vitro fertilization used for current pregnancy (yes)	2 (6%)	9 (2%)	0.12
History of cesarean delivery (yes)	21 (64%)	404 (71%)	0.39
History of postpartum hemorrhage (yes)	2 (6%)	28 (5%)	0.68
Preeclampsia with current pregnancy (yes)	10 (30%)	102 (18%)	0.07
Anemia with current pregnancy (yes)	15 (45%)	158 (28%)	0.03*
Urgency			0.31
<i>Scheduled</i>	16 (48%)	313 (55%)	
<i>Add on</i>	7 (21%)	150 (26%)	
<i>Priority</i>	10 (30%)	98 (17%)	
<i>Emergent</i>	0	11 (2%)	
Initial anesthetic technique			0.003**
<i>Single injection spinal</i>	7 (21%)	274 (48%)	
<i>Combined spinal epidural</i>	26 (79%)	298 (52%)	
General anesthesia at any time during procedure (yes)	3 (9%)	10 (2%)	0.03*
Number of oxytocin 3 unit boluses (median (IQR))	2 (1-3)	2 (1-2)	0.02*
Received tranexamic acid (yes)	16 (49%)	59 (10%)	<0.001***
Time from incision to wound closure (minutes) (median (IQR))	54 (42-67)	45 (38-53)	0.02*
Quantitative blood loss (ml) (median (IQR))	1308 (1123-1779)	416 (282-580)	<0.001***

Results

Multivariate analysis

- **Increased association with PPH**
 - **Multiple gestation** (OR 5.32, CI 1.89-14.96, p=0.002)
 - **IVF** (OR 6.68, CI: 1.27-34.98, p=0.02)
 - Patients receiving **CSE** vs SIS (OR 2.65, CI: 1.09-6.43, p=0.03)
 - **Longer operative times** were associated (OR 1.15, 1.04-1.26, p=0.006)

- Conversion to **GA** was **not** associated with increased odds of PPH (OR 3.26, CI 0.69-15.39, p=0.14)

Table 2. Multivariate logistic regression without urgency

Variable	Units	Odds ratio	95% Confidence intervals		P value
Multiple gestation	Yes	5.32	1.89	14.96	0.002**
In vitro fertilization utilized for current pregnancy	Yes	6.68	1.27	34.98	0.02*
Preeclampsia	Yes	1.97	0.87	4.47	0.11
Anemia	Yes	1.86	0.86	4.02	0.11
Combined spinal epidural vs single injection spinal	N/A	2.65	1.09	6.43	0.03*
Conversion to general anesthesia	Yes	3.26	0.69	15.39	0.14
Time from incision to wound closure	5 minutes	1.15	1.04	1.26	0.006**

C statistic 0.79

Discussion

- Patient-specific risk factors
 - **Higher** odds of a PPH were **multiple gestation** pregnancies and those conceived via **IVF**
- General anesthesia
 - Bivariate analysis showed a higher rate of GA during CD in the PPH cohort
 - Multivariate analysis did **not** reveal increased odds of PPH with **GA**
 - Likely due to confounding factors such as comorbidities and case complexity
 - Adjusted for in the multivariate analysis
- Interestingly, patients who received a **CSE** (vs single injection spinal) had increased odds of PPH on multivariate analysis.
 - Prior studies have shown those receiving a CSE vs SIS may be more complex medically
 - There may have been other confounding factors that we did not adjust for to explain this finding.

CONCLUSION: Our findings suggest that conversion to GA is NOT associated with PPH. Patient-specific risk factors are likely a better predictor of PPH.

Resources

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3. Menard MK. Obstet Gynecol 2014;124:150-153
4. Madar H. Am J Obstet Gynecol 2026;233(6)
5. Mitts M. Am J Obstet Gynecol 2024;232:478.e1-478.e7
6. Borja A. Proc (Bayl Univ Med Cent) 2022;35(5):591-594