Brazilian Journal of Anesthesiology 2022;72(3):338–341

Sociedade Brasileira de Anestesiologia

Brazilian Journal of ANESTHESIOLOGY

ORIGINAL INVESTIGATION

Anesthesia technique and postpartum hemorrhage: a prospective cohort study

Anderson Borovac-Pinheiro [a,*], Maria José Nascimento Brandão [b], Juliana Luz Passos Argenton [c], Thales Daniel Alves Barbosa [b], Rodolfo Carvalho Pacagnella [a]

[a] *Universidade Estadual de Campinas, Faculdade de Ciências Médicas, Departamento de Ginecologia e Obstetrícia, Campinas, SP, Brazil*
[b] *Universidade Estadual de Campinas, Faculdade de Ciências Médicas, Departamento de Anestesiologia, Campinas, SP, Brazil*
[c] *Universidade Estadual de Campinas, Faculdade de Ciências Médicas, Unidade de Estatística, Campinas, SP, Brazil*

Received 2 February 2020; accepted 4 June 2021

KEYWORDS
Obstetrical anesthesia;
Postpartum hemorrhage;
Obstetric delivery

Abstract
Background and objective: During the past few years, an increased number of postpartum hemorrhages have been noticed, even in high-income countries. It has been suggested that this escalation could be associated with increased obstetric interventions. Among such interventions, anesthesia is one of the most prevalent. The present study aimed to investigate the influence of peripartum anesthesia on total blood loss during the 24 hours after delivery.
Methods: We performed a complementary analysis from a prospective cohort study that evaluated postpartum bleeding within 24 hours after birth. The study was performed between February 1st, 2015 and March 31st, 2016 at the Women's Hospital at the Universidade Estadual de Campinas, Brazil. Postpartum bleeding was measured using a calibrated drape and summing the blood contained in the compresses and pads used for 24 hours. We calculated means, percentages, and standard deviation and performed Mann-Whitney analysis for the relation of anesthesia with Postpartum Hemorrhage (PPH) and logistic regression for drugs used in the anesthesia with PPH, using SAS 9.4 software.
Results: We included 270 women in the study; of these, 168 received anesthesia for delivery and almost 50% of them had spinal and epidural anesthesia. The mean blood loss within 24 hours after delivery did not show differences between those who did and those who did not receive obstetrical anesthesia (579.0 ± 361.6 vs. 556.6 ± 360.6; $p = 0.57$). Logistic regression showed that anesthesia, the type of anesthesia, and the drug used did not influence the PPH above 500 mL and above 1000 mL within 2 hours ($p > 0.05$).
Conclusion: Anesthesia did not influence postpartum bleeding after vaginal delivery.

* Corresponding author.
E-mail: andersonpinheiro.unicamp@gmail.com (A. Borovac-Pinheiro).

https://doi.org/10.1016/j.bjane.2021.06.002

Introduction

Postpartum Hemorrhage (PPH) is the leading cause of maternal mortality worldwide, mainly in low/middle-income countries.[1] In the last few years, an increased number of cases of PPH due to atony have been noticed, even in high-income countries, together with the need for procedures related to the treatment for PPH, such as surgery, hysterectomy, blood transfusion, arterial ligation, and embolization.[2,3]

It has been suggested that this escalation could be associated with the increased number of obstetric interventions.[4] Among such interventions during childbirth, anesthesia is one of the most prevalent, especially in middle- and high-income settings. The literature contains some controversial data about the safety of anesthetic procedures in influencing the incidence of PPH.[4–6] While some studies show that epidural anesthesia does not influence postpartum bleeding,[4,6] others show a protective effect,[3] or even a worsening of the incidence of PPH.[5,7] Nevertheless, the majority of studies involving PPH have used a visual estimation of blood loss for its diagnosis, which has been discussed.[8–10]

The present study aimed to investigate whether peripartum anesthesia increased the incidence of PPH during the 24 hours after delivery using an objective method of measurement of total blood loss.

Methods

We performed a complementary analysis from a prospective cohort study that evaluated postpartum bleeding objectively during the 24 hours after childbirth. The results from the original aim of the study were published on Borovac-Pinheiro A, Cecatti JG, de Carvalho Pacagnella R. Ability of shock index and heart rate to predict the percentage of body blood volume lost after vaginal delivery as an indicator of severity: results from a prospective cohort study. J Glob Health. 2019;9(2):020432. doi:10.7189/jogh.09.020432.

This study was performed between February 1st, 2015 and March 31st, 2016 at the Women's Hospital – a tertiary hospital at the Universidade Estadual de Campinas (Unicamp), São Paulo, Brazil. We invited all women in labor at 34 weeks gestation or above, in a singleton pregnancy, to participate. Those who accepted read and signed an informed consent form. We excluded women that had C-section, or who had one of the following conditions: hypertension, hypo- or hyperthyroidism without treatment, any cardiac disease, infections with fever or sepsis, or history of coagulopathy.

Immediately after delivery, we put a calibrated drape (BRASSS_V drape, Maternova®) under the women's buttocks to measure objectively the postpartum bleeding while the women were in the birthing position and, in addition, we collected all compresses used during the procedure (for example, for suture of lacerations). Over 24 hours, all compresses or sanitary pads used by the women were collected, stored in plastic bags, and weighed to measure blood loss by subtracting the dry weight of the materials. The blood density was considered 1 $g.dL^{-1}$.[9] All women received prophylactically 10 IU of oxytocin intravenous (IV) after birth as an institutional protocol. Health providers were able to see the blood collected in the drapes and only received information about the total blood loss if requested. The primary outcome was to evaluate whether changes in vital signs were correlated with PPH (already published). One of the secondary outcomes was to evaluate whether Obstetrical Anesthesia (OA) could influence postpartum bleeding.

The sample size was estimated by considering the need for 28 women with blood loss over 1000 mL to demonstrate performance of the vital signs by the area under the ROC curve (AUC) of 0.800 with a 95% Confidence Interval.[11]

We calculated means, percentages, and standard deviation. We performed a Shapiro-Wilk test to evaluate the distribution of blood loss after delivery, Mann-Whitney analysis for the relationship of anesthesia with PPH, and logistic regression for the drugs used and type of anesthesia with PPH above 500 mL and above 1000 mL, using SAS 9.4 software. We defined a significance level of 5% for all analyses.

The Institutional Review Board approved the study (CAEE: 26787114.3.0000.5404). This research was funded by Faepex–Unicamp but they played no role in the study design or interpretation of the results.

Table 1 Sociodemographic and obstetric characteristics of the women.

Characteristics	n (%)	Mean ± SD
Age	270	24.67 ± 6.19
Parity[a]	264	0.81 ± 1.14
Gestational age	270	38.93 ± 1.47
BMI[b]	244	28.85 ± 4.61
Ethnicity[c]		
White	178 (65.92%)	
Non-white	85 (31.48%)	
Onset of labor		
Spontaneous	203 (75.19%)	
Induced	67 (24.81%)	
Anesthesia		
None	102 (37.78%)	
Spinal	13 (4.81%)	
Epidural	22 (8.15%)	
Spinal + Epidural	133 (49.26%)	
Mode of Delivery		
Vaginal	247 (91.5%)	
Forceps	23 (8.5%)	
Episiotomy[d]		
No	164 (60.74%)	
Yes	96 (35.55%)	
PPH and severe PPH in 2 hours		
≥ 500 mL	84 (31.11%)	
≥ 1000 mL	22 (8.14%)	
PPH and severe PPH in 24 hours		
≥ 500 mL	120 (44.44%)	
≥ 1000 mL	34 (12.59%)	

Missing: [a]6, [b]26, [b]7, [d]10.

Results

We included 270 women. One hundred and sixty-eight (67%) women received anesthesia for delivery, and 133 (49%) received spinal plus epidural anesthesia. Table 1 illustrates

Table 2 Postpartum bleeding comparison between who did and those who did not receive anesthesia for delivery.

Blood loss	Anesthesia	n	Mean ± SD (mL)	*p*-value[a]
Within 2 h	Yes	168	434.7 ± 339.4	0.63
	No	102	415.9 ± 330.9	
Within 24 h	Yes	165	579.0 ± 361.6	0.57
	No	99	556.6 ± 360.6	

[a] Mann-Whitney test.

the sociodemographic and obstetric characteristics of the women.

The mean blood losses at 2 and 24 hours were 427.49 ± 335.57 mL and 570.66 ± 360.04 mL, respectively. Blood loss after delivery was not normally distributed – *p*-value < 0.0001. The major quantity of the blood loss occurred within 2 hours after birth, a period when 91% of women bled 90% of their total blood loss measured over 24 hours. Therefore, data analyses were performed within two periods of postpartum bleeding: 2 and 24 hours. No women had ICU admission or received surgical procedures. Only four women had a blood transfusion.

Table 2 illustrates data comparing mean postpartum bleeding between those who did and those who did not receive anesthesia for delivery. There were no statistically significant differences between the two groups within 2 or 24 hours after birth.

The drugs most often used were bupivacaine as a local anesthetic and sufentanil as an opioid. Among women who underwent spinal anesthesia, bupivacaine and sufentanil were used by 136 (87%) and 133 (86%) women, respectively. Among those who underwent epidural anesthesia, bupivacaine and fentanyl were used by 58 (40%) and 16 (6%) women, respectively.

We performed a binary logistic regression to identify whether anesthesia and the drug combination could influence postpartum bleeding above 500 mL and above 1000 mL within 2 hours after birth (Table 3). None of the factors studied influenced PPH.

Discussion

Our study aimed to identify whether OA could influence postpartum bleeding measured objectively. We found that OA did not influence the amount of blood loss after delivery.

Although the incidence of PPH has increased recently, several factors that could be related to PPH are the main factors associated with obstetric procedures, such as instrumental delivery, induction of labor, C-section, retained placenta and anesthesia.[3,4,12] Nevertheless, the role of OA in the incidence of PPH is not well established. Some studies have found results similar to ours. Rossen et al. found no relationship of severe PPH and OA in a retrospective study involving 10 years and 41,365 deliveries.[4] Mousa et al., in a study of more than 20,000 deliveries, found no influence of OA on PPH.[13] Biguzi, in a study involving more than 6,000 deliveries, also found no influence of OA on PPH.[6]

On the other hand, a population-based cohort study from Canada of 2,193,425 deliveries found that OA could be protective for blood transfusion due to PPH.[3] These findings are similar to our results; nevertheless, all studies included C-sections, while our study included only vaginal deliveries.

The negative impact of OA in increasing the incidence of PPH is related to general anesthesia.[14,15] In our study, no women received general anesthesia and all women had vaginal delivery.

We also found a higher incidence of PPH according to the WHO definition.[16] The differences found by other studies could be explained by the different methods and periods of measuring blood loss after delivery.[17–20] Some studies have demonstrated that visual estimation tends to underestimate total blood loss and the best way to access the total blood loss after birth is to use a calibrated drape.[10,17,21,22] In our study, the rigorous method of capturing all blood loss may have played a role in the overall prevalence of PPH.

To the best of our knowledge, this is the first study that evaluates the influence of OA on postpartum bleeding measured objectively. Nevertheless, this is a complementary analysis of a prospective cohort study for which the first goal was to evaluate the role of clinical signs in the diagnosis of PPH and not to evaluate OA. Therefore, the limitations of the study were that the type of anesthesia, its duration, and the drugs used were not controlled. Moreover, the indication of OA is not clear. Some differences may be found when the indication was treatment of a dystocia and pain relief only. Further studies evaluating PPH and OA should include comparisons of the types of anesthesia and drugs used, and doses of those drugs.

Table 3 Univariate logistic regression for factors related to anesthesia and postpartum bleeding above 500 mL and above 1000 mL within 2 hours.

Blood loss		OR (95% CI)[a]	*p*-value	n
≥ 500 mL within 2 h	Anesthesia Yes vs. No	0.81 (0.43–1.56)	0.54	236
	Epidural vs. Spinal + Epidural	2.71 (0.54–13.48)	0.22	137
	Spinal vs. Spinal + Epidural	0.98 (0.37–2.58)	0.96	137
	Bup + FNT vs. Bup + SFNT	0.24 (0.03–1.82)	0.17	137
≥ 1000 mL within 2 h	Anesthesia Yes vs. No	0.56 (0.18–1.67)	0.29	236
	Epidural vs. Spinal + Epidural	1.01 (0.04–24.70)	0.99	137
	Spinal vs. Spinal + Epidural	1.25 (0.22–7.04)	0.80	137
	Bup + FNT vs. Bup + SFNT	3.16 (0.15–67.84)	0.46	137

[a] Adjusted for BMI, morbidities, forceps, and episiotomy (BUP, Bupivacaine; FNT, Fentanyl; SFNT, Sufentanil).

Conclusion

In conclusion, from these analyses of a prospective cohort study evaluating blood loss measured objectively during 24 hours after vaginal delivery, obstetric anesthesia did not influence postpartum bleeding.

Authors' contributions

Anderson Borovac-Pinheiro: Helped in conceiving and designing the study, acquiring data, interpreting the data analysis, and drafting the manuscript.

Maria Jose Nascimento Brandão: Helped in acquiring data and drafting the manuscript.

Juliana Luz Passos Argenton: Involved in data analysis and interpretation and revised the manuscript.

Thales Daniel Alves Barbosa: Helped in acquiring data and its interpretation.

Rodolfo Carvalho Pacagnella: Helped in conceiving and designing the study, interpreting the data analysis, and drafting the manuscript.

Conflicts of interest

The authors declare no conflicts of interest.

Acknowledgments

We thank Faepex–Unicampfor funding the study.

References

1. Kassebaum NJ, Barber RM, Bhutta ZA, et al. Global, regional, and national levels of maternal mortality, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet. 2016;388:1775–812.
2. Kramer MS, Berg C, Abenhaim H, et al. Incidence, risk factors, and temporal trends in severe postpartum hemorrhage. Am J Obstet Gynecol. 2013;209, 449.e1-7.
3. Mehrabadi A, Hutcheon JA, Lee L, et al. Trends in postpartum hemorrhage from 2000 to 2009: a population-based study. BMC Pregnancy Childbirth. 2012;12:108.
4. Rossen J, Okland I, Nilsen OB, et al. Is there an increase of postpartum hemorrhage, and is severe hemorrhage associated with more frequent use of obstetric interventions? Acta Obstet Gynecol Scand. 2010;89:1248–55.
5. Lisonkova S, Mehrabadi A, Allen VM, et al. Atonic Postpartum Hemorrhage: Blood Loss, Risk Factors, and Third Stage Management. J Obstet Gynaecol Canada. 2016;38:1081–90.e2.
6. Biguzzi E, Franchi F, Ambrogi F, et al. Risk factors for postpartum hemorrhage in a cohort of 6011 Italian women. Thromb Res. 2012;129:e1–7.
7. Chang C-C, Wang I-T, Chen Y-H, et al. Anesthetic management as a risk factor for postpartum hemorrhage after cesarean deliveries. Am J Obstet Gynecol. 2011;205:462.e1–7.
8. Borovac-Pinheiro A, Pacagnella RC, Cecatti JG, et al. Postpartum hemorrhage: new insights for definition and diagnosis. Am J Obstet Gynecol. 2018;219:162–8.
9. MacLeod JH. Estimation of blood loss in a small community hospital. Can Med Assoc J. 1966;95:114–7.
10. Patel A, Goudar SS, Geller SE, et al. Drape estimation vs. visual assessment for estimating postpartum hemorrhage. Int J Gynaecol Obstet. 2006;93:220–4.
11. Hanley JA, McNeil BJ. The meaning and use of the area under a receiver operating characteristic (ROC) curve. Radiology. 1982;143:29–36.
12. Wikkelsø AJ, Edwards HM, Afshari A, et al. Pre-emptive treatment with fibrinogen concentrate for postpartum haemorrhage: randomized controlled trial. Br J Anaesth. 2015;114:623–33.
13. Mousa HA, Cording V, Alfirevic Z. Risk factors and interventions associated with major primary postpartum hemorrhage unresponsive to first-line conventional therapy. Acta Obstet Gynecol Scand. 2008;87:652–61.
14. Butwick AJ, Ramachandran B, Hegde P, et al. Risk factors for severe postpartum hemorrhage after cesarean delivery. Anesth Analg. 2017;125:523–32.
15. Heesen M, Hofmann T, Klöhr S, et al. Is general anaesthesia for caesarean section associated with postpartum haemorrhage? Systematic review and meta-analysis. Acta Anaesthesiol Scand. 2013;57:1092–102.
16. Tunçalp O, Souza JP, Gülmezoglu M. New WHO recommendations on prevention and treatment of postpartum hemorrhage. Int J Gynaecol Obstet. 2013;123:254–6.
17. Sloan NL, Durocher J, Aldrich T, et al. What measured blood loss tells us about postpartum bleeding: a systematic review. BJOG. 2010;117:788–800.
18. Rath WH. Postpartum hemorrhage-update on problems of definitions and diagnosis. Acta Obstet Gynecol Scand. 2011;90:421–8.
19. Ononge S, Mirembe F, Wandabwa J, et al. Incidence and risk factors for postpartum hemorrhage in Uganda. Reprod Health. 2016;13:38.
20. Rath W, Hackethal A, Bohlmann MK. Second-line treatment of postpartum haemorrhage (PPH). Arch Gynecol Obstet. 2012;286:549–61.
21. Schorn MN. Measurement of blood loss: review of the literature. J Midwifery Womens Health. 2010;55:20–7.
22. Ambardekar S, Shochet T, Bracken H, et al. Calibrated delivery drape versus indirect gravimetric technique for the measurement of blood loss after delivery: a randomized trial. BMC Pregnancy Childbirth. 2014;14:276.