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A comparative study of postpartum hemorrhage severity in mothers with and without methylergometrine administration in normal labor

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Abstract

Background: Postpartum hemorrhage is a major cause of maternal morbidity and mortality, particularly in vaginal delivery, with uterine atony as the most common etiology. Therefore, the administration of uterotonic agents during the third stage of labor plays an important role in preventing postpartum hemorrhage. Methylergometrine is still widely used; however, data regarding its effect on the severity of postpartum hemorrhage in Indonesia remain limited.

Purpose: To compare the severity of postpartum hemorrhage among women with normal vaginal delivery who received and did not receive methylergometrine at RSUD Dr. Moewardi Surakarta.

Method: This study was an observational analytic study with a retrospective cohort design using secondary data from medical records. A total of 92 women with normal vaginal delivery who experienced primary postpartum hemorrhage during the period 2022–2024 were included and divided into groups receiving and not receiving methylergometrine. The severity of postpartum hemorrhage was classified into mild–moderate and severe. Data were analyzed using univariate and bivariate analyses with the Fisher's exact test at a significance level of $p < 0.05$.

Results: All women who received methylergometrine experienced mild–moderate postpartum hemorrhage, whereas 9.5% of severe postpartum hemorrhage cases were found in the group that did not receive methylergometrine. There was a significant association between methylergometrine administration and the severity of postpartum hemorrhage ($p = 0.026$), with an odds ratio of 0.905 (95% CI: 0.820–0.998).

Conclusion: Methylergometrine administration was significantly associated with a reduced severity of postpartum hemorrhage in women with normal vaginal delivery.

Keywords: Methylergometrine; Normal Vaginal Delivery; Postpartum Hemorrhage; Uterotonic Agents.

INTRODUCTION

Childbirth is a complex physiological process that may lead to various complications, one of which is postpartum hemorrhage (PPH). Postpartum hemorrhage is defined as blood loss exceeding 500 mL following vaginal delivery within the first 24 hours after birth. This complication remains a leading cause of maternal morbidity and mortality worldwide, including in Indonesia. Globally, approximately 5% of women giving birth experience PPH, and nearly one quarter of maternal deaths are attributed to postpartum bleeding (World Health Organization,

2020). In low-income countries, PPH is the primary cause of maternal mortality. Although the number of maternal deaths due to pregnancy and childbirth complications declined from 443,000 in 2000 to 260,000 in 2023, PPH continues to be a major contributor (World Health Organization, 2025).

In Indonesia, the Maternal Mortality Ratio (MMR) decreased from 600 to 189 per 100,000 live births during the period 1990–2020; however, obstetric hemorrhage remains the leading cause of maternal death (30–35%), followed by hypertensive disorders

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of pregnancy and infection (Ministry of Health of the Republic of Indonesia, 2023). In Central Java, the MMR in 2023 was recorded at 76.15 per 100,000 live births, showing a decline compared to 2022, with maternal deaths still predominantly caused by obstetric hemorrhage and hypertensive pregnancy disorders (Central Java Provincial Health Office, 2024). A study conducted at Dr. Moewardi Regional Hospital Surakarta during 2022–2024 reported that postpartum hemorrhage occurred in approximately 50% of delivering mothers, with uterine atony identified as the primary cause in 71–80% of cases (Utami & Rahayuningsih, 2025; Wormer, Jamil, & Bryant, 2024).

One of the main preventive strategies for postpartum hemorrhage is the active management of the third stage of labor through the administration of uterotonics. In addition to oxytocin, several studies have shown that methylergometrine can significantly reduce the volume of postpartum bleeding compared to oxytocin (Srinivasan & Swarnamukhi, 2021). In line with this, the Ministry of Health of the Republic of Indonesia has emphasized the importance of ensuring the availability of injectable methylergometrine in healthcare facilities as part of efforts to reduce maternal complications and deaths caused by postpartum hemorrhage (Ministry of Health of the Republic of Indonesia, 2023).

Currently, recommended high-dose oxytocin regimen for the prevention of postpartum hemorrhage (PPH) following cesarean delivery (CD) is associated with maternal side effects frequency of which is greater with a higher cumulative dose and rapid administration of oxytocin (Cecilia, Vijayaselvi, Bansal, Lakshmi, & Jose, 2018). Postpartum haemorrhage (PPH) is the leading cause of maternal

mortality worldwide. Prophylactic uterotonic agents can prevent PPH, and are routinely recommended. The current World Health Organization (WHO) recommendation for preventing PPH is 10 IU (international units) of intramuscular or intravenous oxytocin. There are several uterotonic agents for preventing PPH but there is still uncertainty about which agent is most effective with the least side effects (Gallos, Papadopoulou, Man, Athanasopoulos, Tobias, Price, & Coomarasamy, 2018).

RESEARCH METHOD

This study employed an analytic observational design with a cross-sectional approach, using secondary data obtained from the medical records of delivering mothers at Dr. Moewardi Regional Hospital Surakarta during the period 2022–2024. A total of 92 mothers who underwent normal vaginal delivery and experienced postpartum hemorrhage were selected through purposive sampling based on inclusion and exclusion criteria.

The independent variable was the administration of intramuscular methylergometrine, while the dependent variable was the severity of postpartum hemorrhage, classified as mild–moderate (<1000 mL) and severe (>1000 mL) based on visual estimation. Data analysis was conducted using univariate and bivariate methods. Fisher's Exact Test was applied to assess the association between methylergometrine administration and the severity of postpartum hemorrhage, with a significance level of $p < 0.05$. The strength of the association was measured using the odds ratio (OR). This study received ethical approval under the reference number 2.332/XI/HREC/2025.

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RESEARCH RESULTS

Tabel 1. Characteristics of Respondent

Variable	Results	OR	P-Value
Age (Mean±SD) (Years)	(20.0±0.00) (18-40)		
Young (<20)	2/2.2		
Reproductive age (>20)	90/97.8		
Parity (n/%)			
Primiparous	59/64.0		
Multiparous	33/36.0		
Gestational Age (n/%)			
Preterm (<36 weeks)	0/0		
Aterm (37-24 weeks)	92/100		
Postterm (>42 weeks)	0/0		
Type of Care (n/%)			
Inpatient	92/100		
outpatient	0/0		
Methylergometrine Administration (n/%)			
Yes	50/96.0	0.905	0.040
No	42/4.0	(0.820-0.998)	
Postpartum Hemorrhage Severity (n/%)			
Mild-Moderate	88/96.0		
Severe	4/4.0		

Based on the respondent characteristics table, most respondents were within the reproductive age group, totaling 90 respondents (97.8%), while only 2 respondents (2.2%) were classified as young mothers. This indicates that the majority of mothers included in the study were within the optimal reproductive age range. In terms of parity, most respondents were primiparous, with 59 respondents (64.1%), whereas multiparous mothers accounted for 33 respondents (35.9%). These findings suggest that more than half of the participants were experiencing their first delivery. Regarding gestational age, all respondents were categorized as term pregnancies, with 92 respondents (100%), and no cases of preterm or postterm deliveries were identified. This demonstrates that all deliveries occurred at full-term gestation. Based on the type of care, all respondents received inpatient treatment, totaling 92 respondents (100%), and none were treated as outpatients. most respondents received methylergometrine (50 subjects; 54.3%), while 42 respondents (45.7%) did not. This suggests that methylergometrine was more frequently administered in this study population., respondents experienced mild-moderate postpartum hemorrhage, totaling 88 respondents (95.7%). Meanwhile, only 4 respondents (4.3%) experienced severe postpartum hemorrhage.

The association between methylergometrine administration and postpartum hemorrhage severity was analyzed using Fisher's Exact Test, yielding a p-value of 0.040 (<0.05), indicating a statistically significant relationship. The Odds Ratio (OR) of 0.905 (95% CI: 0.820–0.998) suggests that methylergometrine has a protective effect, meaning that mothers who received methylergometrine had a lower risk of experiencing severe postpartum hemorrhage compared to those who did not receive it.

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Table 2. Volume of Postpartum Hemorrhage

Severity of Hemorrhage	n	Minimum (ml)	Maximum (ml)	Mean (ml)
Ringan–Sedang	88	100	300	110,23
Berat	4	1100	1300	1150

Based on the descriptive analysis of 92 subjects, most respondents experienced mild–moderate postpartum hemorrhage, with a bleeding volume ranging from 100–300 mL and an average of 110.23 mL. Severe hemorrhage occurred only in a small proportion of subjects, with volumes ranging from 1100–1300 mL and a mean of 1150 mL. These findings indicate that the majority of mothers experienced relatively low-volume bleeding.

DISCUSSION

Previous researchers reported that most cases of postpartum hemorrhage were classified as mild–moderate, while severe bleeding occurred in only a small proportion. A similar distribution pattern was also observed in this study, where mild–moderate bleeding was the dominant event. This similarity may be influenced by the implementation of active management in the third stage of labor, close monitoring during and after delivery, and the readiness of health care providers and medical interventions that allow early detection of bleeding. However, there are differences in the definition and threshold for severe bleeding. applied a limit of ≥ 1500 mL to a larger, higher-risk population, whereas this study used a lower volume classification, with a mean volume of severe bleeding of 1150 mL (Barth, Klapdor, Brodowski, Hillemanns, von Kaisenberg, & Dütemeyer, 2025). Variations in study design, population characteristics, obstetric risk factors, and methods of measuring blood loss can lead to differences in the proportion and magnitude of severe bleeding identified (Barth et al., 2025; Liu, Yu., Xu, Li, Guan, Sun, & Chen, 2021).

Furthermore, this study found that most respondents received methylergometrine (54.3%), consistent with Dhore et al., who reported that methylergometrine is still frequently used as a uterotonic agent during the management of the third stage of labor due to its ability to induce strong and sustained uterine contractions. The similarity lies in the main clinical objective, namely the prevention and control of postpartum hemorrhage, while the difference is related to the study design, as the present study was descriptive and did not directly compare methylergometrine with other uterotonics. Nevertheless, some respondents did not receive

methylergometrine, which may be explained by clinical contraindications such as hypertension or preeclampsia, variations in facility protocols, or the preference for oxytocin as the first-line uterotonic. In accordance with WHO, FIGO, and RCOG recommendations, uterotonic administration during the third stage of labor remains the primary standard for preventing postpartum hemorrhage caused by uterine atony. Therefore, the high proportion of mild–moderate hemorrhage in this study may reflect the clinical effectiveness of methylergometrine in reducing severity rather than eliminating the occurrence of hemorrhage altogether (Dhore, Munshi, Gaitonde, Chaudhary, Gala, Muchhala, & Kotak, 2025; Wiciak, Strózik, & Smereka, 2025).

The results of this study indicate that mothers who did not receive methylergometrine tended to experience severe postpartum hemorrhage, whereas those who received methylergometrine predominantly experienced mild–moderate hemorrhage. These findings are consistent with the theory of active management of the third stage of labor, which emphasizes that uterotonic administration plays a crucial role in preventing postpartum hemorrhage through uterine contraction and accelerated uterine involution. Other study demonstrated that methylergometrine is one of the effective uterotonics in reducing blood loss during the third stage of labor. In that study, the group receiving methylergometrine had an average blood loss of 164.02 ± 9.36 mL, which was statistically lower than the misoprostol group (Alam, Shyam, & Goswami, 2017).

These results also align with the physiological theory of childbirth, which states that strong uterine contraction and retraction after delivery are essential

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for compressing blood vessels at the placental implantation site, thereby preventing postpartum hemorrhage. Experimental research conducted provides strong scientific support for these findings. Their study showed that ergometrine significantly increased the amplitude, frequency, and motility index of human myometrial contractions in term pregnancies not in labor. Enhanced uterine contraction is the primary mechanism in preventing uterine atony, which is the most common cause of postpartum hemorrhage. The study further noted that ergometrine remains effective as an additional uterotonic when uterine contractions are inadequate with oxytocin alone, strengthening the association between the present findings and previous evidence (Fanning, Sheehan, Leyden, Duffy, Iglesias-Martinez, Carey, & O'Connor, 2017).

This finding is clinically important, as it indicates that methylergometrine serves as a protective factor against severe postpartum hemorrhage. The OR value of 0.905 suggests that mothers receiving methylergometrine had a substantially lower risk of severe bleeding compared with those who did not. The underlying mechanism may be explained by the pharmacological action of methylergometrine as an ergot alkaloid that produces strong and sustained uterine contractions. These contractions help compress blood vessels at the placental implantation site, thereby reducing postpartum blood loss. Methylergometrine has also been reported to shorten the duration of the third stage of labor and decrease the amount of bleeding (Alam et al., 2017). Methylergometrine increases uterine tone and continuous contraction, facilitating uterine involution and vascular compression at the placental site, thus preventing uterine atony and excessive postpartum bleeding (Putri & Megasari, 2022).

The findings of this study suggest that methylergometrine remains relevant as a uterotonic agent, particularly in cases where the uterine response to oxytocin is suboptimal or among mothers at high risk of uterine atony. Statistically, an OR of 0.905 (95% CI: 0.820–0.998; $p = 0.040$) demonstrates the protective effect of methylergometrine against severe postpartum hemorrhage. This is consistent with other research who reported that ergometrine exerts strong uterotonic effects through activation of α 1-adrenergic receptors, enhancing myometrial

contraction and preventing uterine atony. Therefore, the rational and selective use of methylergometrine may reduce the severity of postpartum hemorrhage and improve maternal safety (Fanning et al., 2017).

Overall, these findings are in accordance with obstetric theory emphasizing the importance of strong and sustained uterine contraction after childbirth in preventing postpartum hemorrhage. Methylergometrine functions as a uterotonic by rapidly increasing uterine muscle tone and supporting physiological hemostasis at the placental implantation site. The OR value of 0.905 (95% CI: 0.820–0.998; $p < 0.05$) confirms its protective role against severe postpartum hemorrhage. This evidence is consistent with previous studies reporting that methylergometrine effectively enhances uterine contractions and reduces blood loss, either as a single therapy or as an adjunct following oxytocin, thereby minimizing the risk of uterine atony. Thus, this study strengthens the empirical evidence supporting the role of methylergometrine in active management of the third stage of labor and postpartum hemorrhage prevention (Somanathan, Balu, Jacob, & Illickal, 2021).

Other research show prophylactic oxytocin at any dose decreases both PPH greater than 500 mL and the need for therapeutic uterotonics compared to placebo alone. Taking into account the subgroup analyses from both primary outcomes, to achieve maximal benefit providers may opt to implement a practice of giving prophylactic oxytocin as part of the active management of the third stage of labour at a dose of 10 IU given as an IV bolus. If IV delivery is not possible, IM delivery may be used as this route of delivery did show a benefit to prevent PPH greater than 500 mL and there was a trend to decrease the need for therapeutic uterotonics, albeit not statistically significant (Westhoff, Cotter, & Tolosa, 2013).

This study has several limitations. First, postpartum blood loss volume was measured using visual estimation, which may introduce measurement bias and may not accurately reflect actual blood loss. Second, oxytocin was more commonly used than methylergometrine, which could affect the interpretation of the association between methylergometrine administration and hemorrhage severity. Third, incomplete medical record documentation was identified in several cases,

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potentially influencing the completeness of the analysis and the generalizability of the findings.

CONCLUSION

Based on the results of this study, it can be concluded that there is a significant association between methylergometrine administration and the severity of postpartum hemorrhage among mothers undergoing normal vaginal delivery, as indicated by a $p\text{-value} < 0.05$. Furthermore, methylergometrine administration was shown to have a protective effect against severe postpartum hemorrhage in this population. Given the limitations of this study, future research is recommended to employ more objective methods of blood loss measurement, such as gravimetric techniques or standardized quantitative tools, to reduce bias from visual estimation. In addition, future studies should control for the type of uterotonic used or conduct balanced comparisons between oxytocin and methylergometrine in order to more accurately assess the effects of each drug on postpartum hemorrhage severity. Improvements in medical record documentation are also necessary to ensure better data quality, enhance validity, and increase the generalizability of research findings.

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