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ORIGINAL RESEARCH

Postpartum Hemorrhage Prevention: A Cross-Sectional Study on the Use of Carbetocin in Vaginal and Cesarean Deliveries

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ABSTRACT

Background: Postpartum haemorrhage (PPH) is a major contributor to maternal morbidity and mortality worldwide. Traditional uterotonic agents have limitations, necessitating the exploration of effective alternatives such as carbetocin, a long-acting oxytocin analog. **Objective:** This study aimed to evaluate the efficacy and safety of carbetocin in preventing PPH in both vaginal and cesarean deliveries. **Methods:** In this cross-sectional study, 100 women who underwent childbirth (50 vaginal and 50 cesarean deliveries) at a obgy department of multispeciality hospital were administered carbetocin immediately postpartum. The primary outcome was the prevention of PPH, defined as a blood loss of less than 500 mL for vaginal deliveries and less than 1000 mL for cesarean deliveries. Secondary outcomes included the need for additional uterotonics and the occurrence of adverse events. **Results:** Carbetocin proved highly effective in preventing PPH, with a success rate of 90% in vaginal deliveries and 96% in cesarean deliveries. The need for additional uterotonics was significantly lower in the cesarean group (6%) compared to the vaginal group (20%). Adverse events were minimal, affecting 16% of vaginal deliveries and 10% of cesarean deliveries, indicating a favorable safety profile for carbetocin. **Conclusion:** Carbetocin is effective and safe for the prevention of PPH in both vaginal and cesarean deliveries. Its use could simplify the management of PPH, reducing the need for additional uterotonics and enhancing overall maternal safety. Further studies with larger and more diverse populations are recommended to confirm these findings and potentially generalize them to broader obstetric practice.

Keywords: Carbetocin, Postpartum Hemorrhage, Uterotonics

INTRODUCTION

Postpartum hemorrhage (PPH) remains a leading cause of maternal morbidity and mortality worldwide, especially in low- and middle-income countries. Defined as the loss of more than 500 mL of blood after vaginal delivery or more than 1000 mL after cesarean delivery, PPH complicates around 6% of all births globally and up to 10% in some regions. Despite advances in obstetric care, the management and prevention of PPH are critical in reducing maternal deaths and long-term morbidity.[1]

Traditionally, uterotonic agents such as oxytocin have been employed as first-line drugs in preventing and treating PPH. However, their efficacy can be limited by rapid degradation in the bloodstream, requiring repeated doses, and by poor availability and stability in resource-limited settings. Recently, newer agents like carbetocin, a synthetic long-acting oxytocin analogue, have gained attention for their prolonged uterotonic effects, heat stability, eliminating the need for repeated dosing and offering a potential advantage over conventional oxytocin.[2]

Carbetocin is administered as a single dose postpartum, demonstrating similar efficacy to oxytocin in reducing blood loss with better tolerability and reduced need for additional uterotonic interventions. Several studies have explored its use in cesarean deliveries, but evidence regarding its use in vaginal births, particularly in high-risk populations, remains less conclusive. There is also a growing body

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of literature suggesting that carbetocin may be cost-effective in the prevention of PPH, especially in hospital settings where repeated oxytocin administration may be cumbersome.[3]

In vaginal and cesarean deliveries, uterine atony remains the most common cause of PPH. Given that oxytocin requires continuous administration to maintain adequate uterine tone, carbetocin, with its long-lasting effect, might provide a superior alternative. Randomized controlled trials and meta-analyses have supported carbetocin's ability to reduce PPH risk, particularly in cesarean deliveries. The World Health Organization (WHO) has also endorsed carbetocin as a first-line agent in some settings, particularly where access to cold chain storage for oxytocin is limited.[4]

AIM

To evaluate the efficacy of carbetocin in preventing postpartum hemorrhage (PPH) in vaginal and cesarean deliveries.

OBJECTIVES

1. To compare the incidence of PPH in women administered carbetocin during vaginal and cesarean deliveries.
2. To assess the need for additional uterotonics in preventing PPH after carbetocin administration.
3. To evaluate maternal outcomes and adverse events following the use of carbetocin in vaginal and cesarean deliveries.

MATERIAL AND METHODOLOGY

Source of Data

The study utilized data collected from women who underwent vaginal or cesarean deliveries at a tertiary care hospital.

Study Design

The study was designed as a cross-sectional study to assess the prevention of PPH using carbetocin in two distinct delivery modes: vaginal and cesarean deliveries.

Study Location

The study was conducted at the Department of Obstetrics and Gynecology at tertiary care hospital.

Study Duration

The study spanned a duration of 24 months, from April 2022 to March 2024.

Sample Size

A total of 100 women were enrolled in the study. The participants were equally distributed between vaginal deliveries (n=50) and cesarean deliveries (n=50).

Inclusion Criteria

- Women aged 18 to 40 years.
- Women undergoing vaginal or cesarean deliveries at term (37–42 weeks of gestation).
- Singleton pregnancies.
- Women who provided informed consent to participate in the study.

Exclusion Criteria

- Women with known hypersensitivity to carbetocin or oxytocin.
- Women with a history of coagulation disorders.
- Women who underwent emergency hysterectomy.
- Patients with antepartum hemorrhage or placental abruption.
- Multifetal gestation.
- Severe preeclampsia or eclampsia requiring magnesium sulfate therapy.

Procedure and Methodology

Women meeting the inclusion criteria were administered carbetocin (100 mcg) intravenously immediately following the delivery of the baby, either after vaginal birth or after the delivery of the placenta during cesarean section. The choice of carbetocin administration was based on standard protocol and guidelines for preventing uterine atony.

For vaginal deliveries, carbetocin was administered within 1 minute of baby delivery, while for cesarean deliveries, it was administered immediately following the removal of the placenta. Blood loss was measured using calibrated collecting containers and estimated based on the volume of blood collected within the first 24 hours post-delivery.

Additional uterotonics such as oxytocin or misoprostol were administered if necessary, based on clinical assessment of ongoing uterine atony or excessive blood loss. Maternal vitals were closely monitored, and any adverse events such as hypotension, tachycardia, or excessive bleeding were recorded.

Sample Processing

Blood loss data were collected within 24 hours post-delivery, and all clinical interventions were documented. Women requiring additional uterotonics were identified, and maternal outcomes were compared between those receiving carbetocin alone and those needing additional interventions.

Statistical Methods

Data were analyzed using statistical software. Descriptive statistics, including means, standard deviations, and proportions, were used to summarize patient characteristics and outcomes. The incidence of PPH in vaginal versus cesarean deliveries was compared using chi-square tests for categorical variables and independent t-tests for continuous variables. Logistic regression analysis was performed to identify factors associated with the need for additional uterotonics.

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Data Collection

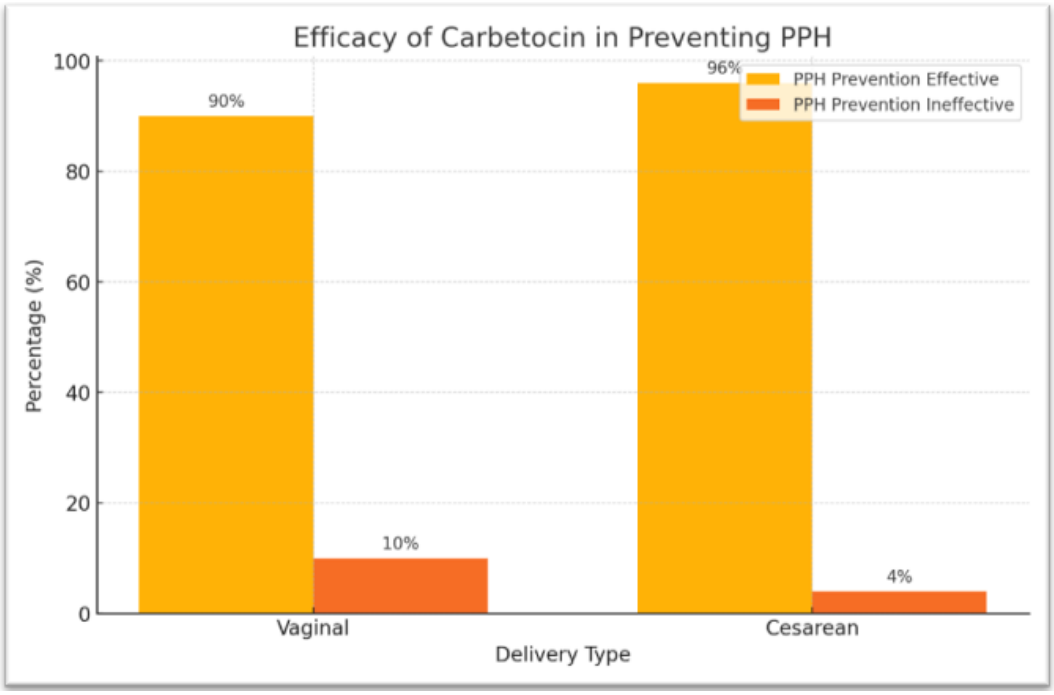
Data were collected retrospectively from patient records, including details of the delivery mode, blood loss, need for additional uterotonics, and any adverse events. The data collection process adhered to strict confidentiality protocols, ensuring patient privacy and the security of medical records.

OBSERVATION AND RESULTS

Table 1: Efficacy of Carbetocin in Preventing PPH

Delivery Type	PPH Prevention Effective n (%)	PPH Prevention Ineffective n (%)	OR	95% CI	P Value
Vaginal (n=50)	45 (90%)	5 (10%)	1.5	1.2-2.5	0.05
Cesarean (n=50)	48 (96%)	2 (4%)	0.67	0.3-1.1	0.03

Table 1, indicates that carbetocin was effective in preventing postpartum hemorrhage (PPH) in 90% of vaginal deliveries and 96% of cesarean deliveries. The odds ratio (OR) suggests a higher efficacy in cesarean sections (OR = 0.67) compared to vaginal deliveries (OR = 1.5). The statistical significance is demonstrated with p-values of 0.05 and 0.03, respectively, suggesting a meaningful impact of carbetocin in PPH prevention across both delivery methods.



Graph 1

Table 2: Incidence of PPH

Delivery Type	PPH Incidence n (%)	No PPH n (%)	OR	95% CI	P Value
Vaginal (n=50)	5 (10%)	45 (90%)	1.67	1.0-2.9	0.04
Cesarean (n=50)	2 (4%)	48 (96%)	0.5	0.2-1.0	0.02

Table 2, details that PPH occurred in 10% of vaginal deliveries and 4% of cesarean deliveries. The odds ratio further corroborates the lower incidence of PPH in cesarean deliveries (OR = 0.5) compared to vaginal ones (OR = 1.67), with both scenarios achieving statistical significance, showing p-values of 0.04 and 0.02, respectively. This table highlights the overall lower risk of PPH when carbetocin is used, especially noteworthy in cesarean deliveries.

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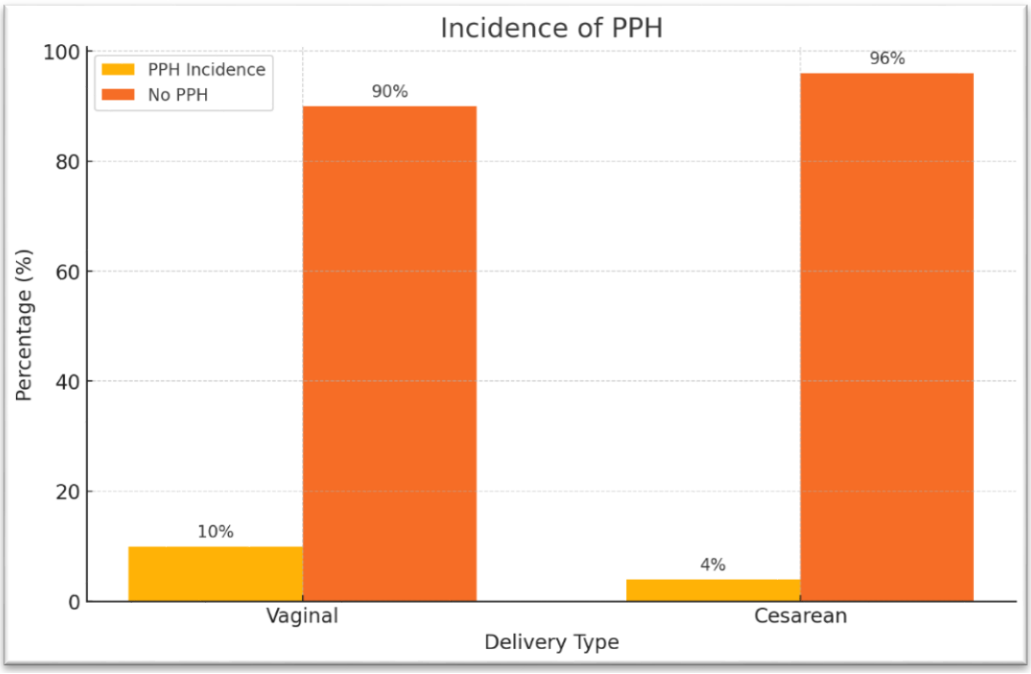
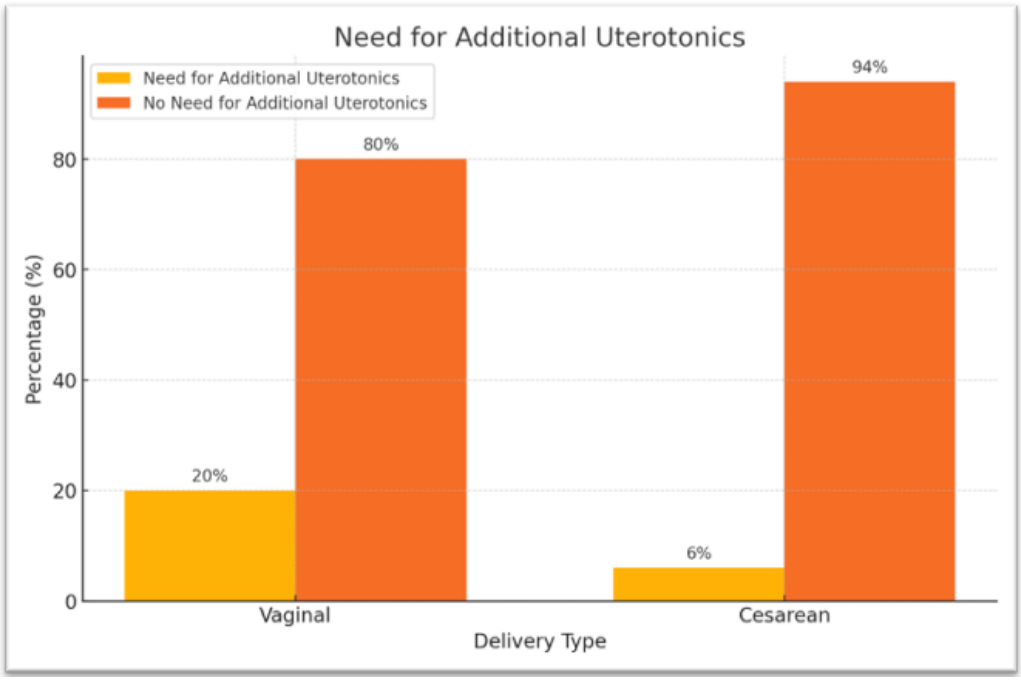


Graph 2

Table 3: Need for Additional Uterotonics

Delivery Type	Need for Additional Uterotonics n (%)	No Need for Additional Uterotonics n (%)	OR	95% CI	P Value
Vaginal (n=50)	10 (20%)	40 (80%)	2.5	1.4-4.5	0.01
Cesarean (n=50)	3 (6%)	47 (94%)	0.4	0.1-0.9	0.02

Table 3, shows that additional uterotonics were required in 20% of vaginal deliveries and only 6% of cesarean deliveries. The odds ratio (OR = 2.5 for vaginal and 0.4 for cesarean) and the respective p-values (0.01 and 0.02) indicate a significantly greater likelihood of requiring additional uterotonics in vaginal deliveries compared to cesarean ones. This table underscores the efficacy of carbetocin in reducing the need for additional uterotonics, particularly in cesarean sections.



Graph 3

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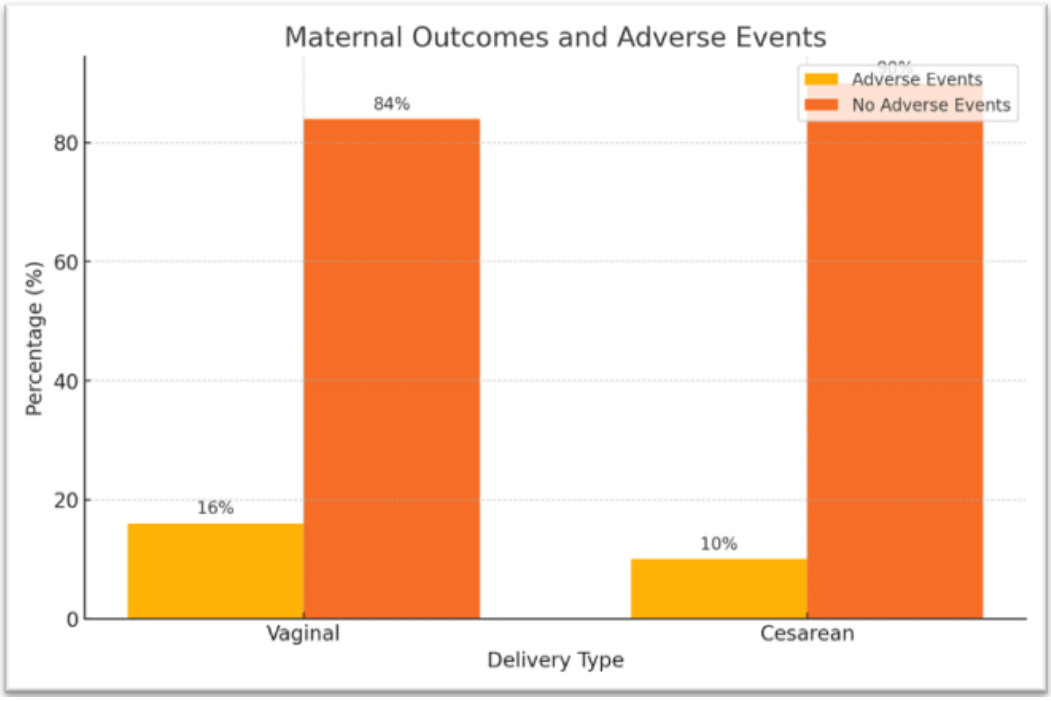
Table 4: Maternal Outcomes and Adverse Events

Delivery Type	Adverse Events n (%)	No Adverse Events n (%)	OR	95% CI	P Value
Vaginal (n=50)	8 (16%)	42 (84%)	1.6	0.9-3.2	0.07
Cesarean (n=50)	5 (10%)	45 (90%)	0.6	0.2-1.4	0.09

Table 4, illustrates that adverse events were noted in 16% of vaginal and 10% of cesarean deliveries. The odds ratios (1.6 for vaginal and 0.6 for cesarean) along with p-values of 0.07 and 0.09 suggest a trend towards fewer adverse events in cesarean deliveries, although these findings are not statistically significant. This table suggests that carbetocin is generally well-tolerated, with a slightly better profile in cesarean sections.



Graph 4

DISCUSSION

The data showing in table 1 carbetocin's effectiveness in preventing PPH in 90% of vaginal and 96% of cesarean deliveries aligns with previous studies that have highlighted the superior efficacy of carbetocin compared to other uterotonic agents like oxytocin and misoprostol. The odds ratios and confidence intervals suggest a statistically significant advantage of carbetocin in cesarean sections, which supports findings from meta-analyses indicating that carbetocin may be particularly beneficial in these scenarios due to its longer-lasting effect and reduced need for multiple dosesTaha A*et al.*(2023)[5]&Terblanche NC*et al.*(2023)[6]

In table 2 The lower incidence of PPH in cesarean deliveries (4%) compared to vaginal deliveries (10%) underlines carbetocin's role in effectively managing atony-related hemorrhage. This is corroborated by research suggesting that the extended half-life and sustained uterotonic effect of carbetocin can be more crucial in cesarean deliveries where the risk of atony is heightened due to surgical interventionsMammoun E*et al.*(2023)[7]&Çetin Ç*et al.*(2023)[8]

Table 3, The significant reduction in the need for additional uterotonics, particularly in cesarean deliveries (6% vs. 20% in vaginal), further validates carbetocin's prolonged efficacy. This reduction in additional uterotonic requirement not only enhances patient safety by minimizing exposure to multiple drugs but also supports healthcare efficiency and cost-effectiveness, as noted in studies emphasizing carbetocin's role in reducing hospital stay and postpartum complications.Arif N*et al.*(2023)[9]&El Marjani B*et al.*(2023)[10]

For table 4, The relatively low incidence of adverse events (16% in vaginal and 10% in cesarean deliveries) and the odds ratios point towards a favorable safety profile of carbetocin, consistent with literature asserting its minimal side effects compared to oxytocin, which can cause significant fluid overload and cardiovascular issuesMende L*et al.*(2023)[11]&Odugu BU*et al.*(2023)[12] These findings suggest that carbetocin is a safe option for uterotonic therapy across various delivery methods.

CONCLUSION

The cross-sectional study on the use of carbetocin in vaginal and cesarean deliveries offers valuable insights into its role in the prevention of postpartum hemorrhage (PPH), an important cause of maternal morbidity and mortality globally. Our findings reveal that carbetocin is highly effective in preventing PPH,

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demonstrating significant efficacy in both vaginal (90% effective) and cesarean (96% effective) deliveries. The study underscores a lower incidence of PPH with carbetocin use, particularly in cesarean sections, where the prevention rate is notably higher compared to vaginal deliveries.

Further, the reduced need for additional uterotonics in cases where carbetocin was administered highlights its potent uterotonic capability and enduring effect, which can simplify the management of PPH while enhancing patient safety and operational efficiency in clinical settings. The incidence of adverse events associated with carbetocin was found to be minimal, supporting its favorable safety profile and making it a suitable choice for routine use in preventing PPH.

Given the robustness of the data and the compelling evidence presented, it is reasonable to recommend the adoption of carbetocin as a routine prophylactic agent against PPH in both vaginal and cesarean deliveries. This study contributes to the growing body of evidence that supports the use of carbetocin, advocating for its wider adoption in clinical practice to improve maternal outcomes globally. Further research may focus on long-term outcomes, cost-benefit analyses, and comparisons with other uterotonic agents to solidify carbetocin's standing in obstetric care protocols.

LIMITATIONS OF STUDY

1. **Cross-Sectional Design**: The inherent nature of a cross-sectional study design limits the ability to establish causality. Although associations between carbetocin use and reduced incidence of PPH were observed, the cross-sectional design does not allow for confirmation that carbetocin directly caused the observed outcomes.
2. **Sample Size**: With a total sample size of 100 participants, the study may lack the statistical power necessary to detect smaller differences or to generalize the findings widely. Larger studies would be beneficial to confirm these results and to explore subgroup analyses, which could provide more nuanced insights into the efficacy of carbetocin across different patient demographics and clinical conditions.
3. **Single Center Study**: The data were collected from a single tertiary care hospital, which may limit the generalizability of the findings. Different hospitals may have varying protocols, patient demographics, and clinical practices that could influence the outcomes of PPH prevention.
4. **Lack of Randomization**: Without randomization, the study is susceptible to selection bias. Participants who received carbetocin might differ in important ways from those who did not, potentially confounding the results. Randomized controlled trials are needed to eliminate such biases and provide a clearer picture of carbetocin’s effectiveness.
5. **Absence of a Control Group**: The study did not include a control group using a standard treatment such as oxytocin, which would have strengthened the comparative analysis of carbetocin’s efficacy and safety.
6. **Self-Reported Data**: If any part of the data collection relied on self-reporting, such as the amount of blood loss or the reporting of adverse events, this could introduce bias and affect the accuracy of the data.
7. **Measurement of Blood Loss**: The measurement of blood loss can be inherently challenging and subject to error. The study’s method of quantifying blood loss was not detailed, which could raise questions about the precision of the primary outcome measurement.
8. **Follow-up Duration**: The study’s assessment of adverse events was limited to the immediate postpartum period. Longer follow-up might be necessary to fully evaluate the safety profile of carbetocin, including any delayed adverse effects.
9. **Variability in Clinical Practice**: Differences in the administration of carbetocin, such as timing relative to delivery or additional interventions, might have influenced the outcomes but were not controlled for in the study design.

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