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Use of Carbetocin vs Oxytocin in Prevention of Postpartum Haemorrhage: A Comparative Study

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Abstract: ***Background: Postpartum hemorrhage (PPH) is a leading cause of maternal morbidity and mortality worldwide. Uterotonics such as oxytocin are routinely used for its prevention; however, carbetocin, a long-acting analogue, may offer improved efficacy. Aim: To compare the effectiveness of carbetocin and oxytocin in the prevention of postpartum hemorrhage. Methods: This prospective comparative study included 100 women undergoing vaginal delivery or cesarean section, randomly divided into two groups: Group A received carbetocin (100 µg IV) and Group B received oxytocin (10 IU IV infusion). Outcomes assessed included mean blood loss, need for additional uterotonics, hemoglobin drop, and incidence of PPH. Results: The mean blood loss was significantly lower in the carbetocin group compared to the oxytocin group (450 ± 120 mL vs 620 ± 150 mL). Requirement for additional uterotonics was reduced (10% vs 30%), as was the mean hemoglobin drop (0.9 ± 0.4 g/dL vs 1.5 ± 0.6 g/dL). The incidence of PPH was also lower in the carbetocin group (6% vs 18%). All differences were statistically significant ($p < 0.05$). Conclusion: Carbetocin is more effective than oxytocin in reducing blood loss and preventing postpartum hemorrhage. However, cost considerations may influence its routine use in clinical practice.***

Keywords: Carbetocin, Oxytocin, Postpartum hemorrhage, Uterotonics, Maternal

1. Introduction

Postpartum hemorrhage (PPH) continues to be one of the leading causes of maternal morbidity and mortality worldwide, accounting for nearly 25–30% of maternal deaths, particularly in low- and middle-income countries [1]. It is commonly defined as blood loss of ≥500 mL following vaginal delivery or ≥1000 mL after caesarean section, though clinical significance often depends on the hemodynamic status of the patient rather than absolute volume alone [2]. Despite advances in obstetric care, PPH remains a major challenge due to its unpredictable nature and rapid progression.

Uterine atony is the most common cause of PPH, responsible for approximately 70–80% of cases [2]. Effective uterine contraction after delivery is essential to compress uterine blood vessels and prevent excessive bleeding. Active management of the third stage of labour (AMTSL), which includes the prophylactic use of uterotonic agents, controlled cord traction, and uterine massage, has been shown to significantly reduce the incidence of PPH [3].

Oxytocin is currently recommended as the first-line uterotonic agent for the prevention of PPH due to its efficacy, safety profile, and cost-effectiveness [3]. However, oxytocin has a relatively short half-life of approximately 4–10 minutes, necessitating continuous intravenous infusion or repeated dosing to maintain uterine tone [4]. This requirement can limit its effectiveness in settings where continuous monitoring or infusion facilities are not readily available.

Carbetocin, a synthetic long-acting analogue of oxytocin, has been developed to overcome these limitations. It has a prolonged half-life of approximately 40 minutes, allowing for sustained uterine contraction with a single intravenous dose [4]. Several studies have demonstrated that carbetocin is associated with reduced blood loss, lower need for additional uterotonic agents, and decreased incidence of PPH when compared to oxytocin, particularly in caesarean deliveries [1,4,5]. Its heat-stable formulation further enhances its utility in resource-limited settings where cold chain maintenance may be problematic.

However, despite its pharmacological advantages, the higher cost of carbetocin compared to oxytocin remains a significant barrier to its widespread use, especially in developing countries [5]. Therefore, comparative studies evaluating its clinical efficacy and potential benefits over oxytocin are essential to guide evidence-based clinical practice and policy decisions.

Hence, the present study aims to evaluate and compare the efficacy of carbetocin and oxytocin in the prevention of postpartum hemorrhage among women undergoing delivery. Specifically, the study seeks to assess and compare the mean blood loss associated with each drug, determine the requirement for additional uterotonic agents, and evaluate the change in hemoglobin levels before and after delivery in both groups. Furthermore, the study intends to analyses the incidence of postpartum hemorrhage in patients receiving carbetocin versus those receiving oxytocin, thereby providing a comprehensive comparison of their clinical effectiveness.

2. Materials and Methods

This prospective comparative study was conducted in the Department of Obstetrics and Gynecology at a tertiary care hospital over a period of 12 months after obtaining approval

from the Institutional Ethics Committee. Written informed consent was obtained from all participants.

A total of 100 pregnant women undergoing vaginal delivery or caesarean section were included and randomly divided into two groups of 50 each using a computer-generated randomization method. Group A received carbetocin, while Group B received oxytocin. Women aged 18–40 years with singleton term pregnancy (≥37 weeks) undergoing delivery were included. Patients with coagulation disorders, placenta previa/accreta, severe anemia (Hb <7 g/dL), multiple pregnancy, hypersensitivity to uterotonics, or major medical comorbidities were excluded.

Group A received a single intravenous dose of carbetocin 100 µg immediately after delivery. Group B received oxytocin 10 IU diluted in 500 mL normal saline administered as intravenous infusion over 30 minutes. All patients received standard active management of the third stage of labor.

The primary outcome was estimated blood loss during and within 24 hours after delivery, assessed by calibrated collection, gravimetric method, and clinical evaluation. Secondary outcomes included need for additional uterotonics, change in hemoglobin levels (pre-delivery and 24 hours post-delivery), and incidence of postpartum hemorrhage.

Data were analyzed using SPSS version 25. Continuous variables were expressed as mean ± standard deviation and compared using the independent t-test, while categorical variables were analyzed using the chi-square test. A p-value <0.05 was considered statistically significant.

3. Results

A total of 100 women were included in the study and equally distributed into two groups: Group A (Carbetocin, n=50) and Group B (Oxytocin, n=50). The mean age, as shown in table 1, in both groups was similar (26.4 vs 27.1 years), indicating that age-related factors did not influence the outcomes. The proportion of primigravida women was also nearly equal (52% vs 48%), suggesting comparable parity distribution, which is important as uterine tone and risk of PPH can vary with parity.

The mean gestational age was almost identical (38.5 vs 38.3 weeks), showing that both groups had similar pregnancy maturity at delivery. Additionally, the rate of cesarean section was comparable (60% vs 58%), ensuring that the mode of delivery—a key factor affecting blood loss—was evenly distributed.

Since all p-values are greater than 0.05, none of these differences are statistically significant. This confirms that the groups were homogeneous at baseline, and therefore, any differences observed in outcomes can be reliably attributed to the effect of carbetocin versus oxytocin rather than confounding variables.

Table 1: Baseline Characteristics of Study Participants

Parameter	Carbetocin (n=50)	Oxytocin (n=50)	p-value
Mean Age (years)	26.4 ± 3.2	27.1 ± 3.5	>0.05
Primigravida (%)	52%	48%	>0.05
Mean Gestational Age (weeks)	38.5 ± 1.2	38.3 ± 1.4	>0.05
Cesarean Section (%)	60%	58%	>0.05

This table 2 highlights the comparison of primary and secondary outcomes between the two groups. The mean blood loss was significantly lower in the carbetocin group (450 ± 120 mL) compared to the oxytocin group (620 ± 150 mL), indicating better control of bleeding with carbetocin.

The requirement for additional uterotonic agents was also markedly reduced in the carbetocin group (10%) versus the oxytocin group (30%), suggesting that a single dose of carbetocin was more effective in maintaining uterine tone.

Similarly, the drop in hemoglobin levels was less in the carbetocin group (0.9 ± 0.4 g/dL) compared to the oxytocin group (1.5 ± 0.6 g/dL), reflecting reduced overall blood loss.

The incidence of postpartum hemorrhage (PPH) was significantly lower in patients receiving carbetocin (6%) than those receiving oxytocin (18%). Since all p-values are <0.05, these differences are statistically significant, indicating that carbetocin is more effective than oxytocin in reducing blood loss and preventing postpartum hemorrhage.

Table 2: Comparison of Primary and Secondary Outcomes

Outcome	Carbetocin (n=50)	Oxytocin (n=50)	p-value
Mean Blood Loss (mL)	450 ± 120	620 ± 150	<0.05
Additional Uterotonics Required (%)	10%	30%	<0.05
Hemoglobin Drop (g/dL)	0.9 ± 0.4	1.5 ± 0.6	<0.05
Incidence of PPH (%)	6%	18%	<0.05

4. Discussion

The present study demonstrates that carbetocin is more effective than oxytocin in the prevention of postpartum hemorrhage, as evidenced by significantly lower mean blood loss (450 ± 120 mL vs 620 ± 150 mL), reduced need for additional uterotonics (10% vs 30%), lesser hemoglobin drop (0.9 ± 0.4 vs 1.5 ± 0.6 g/dL), and lower incidence of PPH (6% vs 18%) ($p < 0.05$).

These findings are consistent with previous studies. Voon et al. reported a significant reduction in PPH with carbetocin compared to oxytocin (relative risk 0.79, $p = 0.009$) along with decreased requirement for additional uterotonics and blood transfusion [1]. Similarly, a meta-analysis by Jin et al. involving over 30,000 women showed that carbetocin significantly reduced the need for additional uterotonics (RR 0.57, $p < 0.001$), although no significant difference was observed in low-risk vaginal deliveries [4].

The reduced hemoglobin drop observed in the present study correlates with findings from other clinical trials, where improved uterine tone with carbetocin resulted in better preservation of hemoglobin levels and reduced overall blood loss [6]. Furthermore, recent comparative studies have

reported lower incidence of PPH and reduced intervention rates with carbetocin, particularly in caesarean sections [7].

The superior efficacy of carbetocin can be attributed to its longer half-life (~40 minutes) compared to oxytocin (4–10 minutes), providing sustained uterine contraction with a single dose [4]. This pharmacological advantage eliminates the need for continuous infusion and may improve compliance and effectiveness.

However, some large-scale analyses have shown comparable efficacy between the two drugs in low-risk populations, suggesting that the benefit of carbetocin is more pronounced in high-risk cases [4]. Additionally, the higher cost of carbetocin remains a limiting factor for its widespread use in resource-constrained settings [1].

The findings of the present study are in agreement with existing evidence, supporting the superiority of carbetocin over oxytocin in reducing blood loss and preventing postpartum hemorrhage, particularly in settings with higher risk of uterine atony.

5. Conclusion

Carbetocin was found to be superior to oxytocin in preventing postpartum hemorrhage, with significantly lower mean blood loss (450 ± 120 mL vs 620 ± 150 mL), reduced need for additional uterotonics (10% vs 30%), smaller hemoglobin drop (0.9 ± 0.4 vs 1.5 ± 0.6 g/dL), and lower incidence of PPH (6% vs 18%) ($p < 0.05$). These findings suggest that carbetocin provides more effective and sustained uterine contraction compared to oxytocin. However, its higher cost may limit widespread use, particularly in low-resource settings.

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