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Original Research Article

EFFICACY AND SAFETY OF INTRAVENOUS CARBETOCIN VERSUS OXYTOCIN FOR PROPHYLAXIS OF POSTPARTUM HEMORRHAGE

Boini Chiranjeevi[1], Sarpatwar Sailesh[2], Valishetti Manoj Kumar[3]

[1]*Assistant Professor, Department of Anesthesia and Critical Care, Government Medical College, Mancherial, Telangana, India.*
[2]*Assistant Professor, Department of Anesthesia and Critical Care, Government Medical College, Mancherial, Telangana, India.*
[3]*Assistant Professor, Department of Pharmacology, Government Medical College, Mancherial, Telangana, India.*

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Corresponding Author:
Dr. Sarpatwar Sailesh,
Assistant Professor, Department of Anesthesia and Critical Care, Government Medical College, Mancherial, Telangana, India.
Email: saileshsarpatwar1@gmail.com

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ABSTRACT

Background: Postpartum hemorrhage (PPH) is a major contributor to maternal morbidity and mortality worldwide, with uterine atony being the most common cause. Oxytocin is routinely used for prophylaxis; however, its short half-life and need for continuous infusion may limit effectiveness. Carbetocin, a long-acting oxytocin analogue, provides sustained uterine contraction after a single dose and may offer advantages in PPH prevention. The study aimed to compare the efficacy and safety of intravenous carbetocin with intravenous oxytocin in the prevention of postpartum hemorrhage following delivery.

Materials and Methods: A prospective comparative study was conducted at Government Medical College, Mancherial, from January 2024 to June 2025. One hundred women with singleton term pregnancies were enrolled and allocated into two groups: Group A received 100 µg intravenous carbetocin (n=50) and Group B received 10 IU intravenous oxytocin (n=50) after delivery. Hemodynamic parameters and hemoglobin levels were assessed pre- and post-operatively. Postpartum blood loss, need for blood transfusion, additional uterotonics, uterine tone at 5 minutes, and adverse effects were recorded.

Results: Baseline demographic and obstetric characteristics were comparable between groups. The incidence of blood loss ≥1000 ml was significantly lower in the carbetocin group (8.0%) compared with the oxytocin group (18.0%). The requirement for blood transfusion and additional uterotonics was also significantly reduced with carbetocin. Uterine tone at 5 minutes was significantly better in the carbetocin group. Hemodynamic parameters and hemoglobin levels did not differ significantly between groups. Adverse effects were infrequent and comparable in both groups.

Conclusion: Carbetocin was more effective than oxytocin in reducing postpartum blood loss and the need for additional interventions, while maintaining a similar safety profile.

Keywords: Postpartum hemorrhage; Carbetocin; Oxytocin; Uterine atony; Maternal outcomes.

INTRODUCTION

Postpartum hemorrhage (PPH) remains one of the leading causes of maternal morbidity and mortality worldwide, particularly in low- and middle-income countries.[1] Uterine atony is responsible for the majority of PPH cases and can occur even in women without identifiable risk factors.[2] Active management of the third stage of labor, which includes the routine administration of uterotonic agents after delivery, is a proven strategy to reduce the incidence and severity of PPH.[3] Oxytocin has traditionally been the first-line uterotonic used for this purpose due to its rapid onset of action and favourable safety profile.[4]

Despite its widespread use, oxytocin has several limitations. It has a short half-life, requiring continuous infusion to maintain adequate uterine contraction, and its effectiveness may be reduced when cold-chain storage is inadequate or when

receptor desensitization occurs with prolonged use.[5] Moreover, in some cases, oxytocin alone may be insufficient to prevent excessive postpartum blood loss, necessitating the use of additional uterotonic agents or blood transfusion.[6] These challenges have prompted the search for alternative uterotonics with longer duration of action and improved efficacy.

Carbetocin is a long-acting synthetic analogue of oxytocin that produces sustained uterine contractions after a single intravenous dose.[7] Its prolonged half-life allows effective uterine contraction without the need for continuous infusion.[8] Several studies have suggested that carbetocin may be more effective than oxytocin in reducing postpartum blood loss and the need for additional uterotonics, particularly in high-risk deliveries and cesarean sections.[9,10] However, concerns regarding its cost and limited availability have restricted its routine use in many healthcare settings, and evidence comparing its effectiveness with oxytocin in diverse populations remains limited. Given the continued burden of postpartum hemorrhage and the need for reliable uterotonic agents that are both effective and safe, further comparative studies between carbetocin and oxytocin are warranted. Understanding their relative efficacy in controlling postpartum bleeding and maintaining uterine tone can help guide clinical decision-making and optimize maternal outcomes. The study aimed to compare the efficacy and safety of intravenous carbetocin with intravenous oxytocin in the prevention of postpartum hemorrhage following delivery.

MATERIALS AND METHODS

This prospective comparative study was conducted in the Department of Obstetrics and Gynecology at Government Medical College, Mancherial from January 2024 to June 2025. The study was designed to compare the efficacy and safety of intravenous carbetocin and intravenous oxytocin for the prevention of postpartum hemorrhage. A total of 100 women were recruited and equally allocated into two groups: Group A (carbetocin, n = 50) and Group B (oxytocin, n = 50). Approval was obtained from the Institutional Ethics Committee, and written informed consent was secured from all participants prior to enrollment.

Women aged 18–40 years with singleton term pregnancies undergoing delivery and requiring prophylactic uterotonic therapy were included in the study. Patients with known coagulation disorders, placenta previa, placental abruption, multiple gestation, uterine anomalies, severe anemia, or hypersensitivity to oxytocin or carbetocin were excluded. Baseline demographic and obstetric characteristics, including age, body weight, gestational age, and parity, were recorded for all participants at the time of admission to ensure comparability between the two groups.

Following delivery of the baby, participants in Group A received 100 µg of intravenous carbetocin diluted in 10 ml of normal saline administered immediately after birth. Participants in Group B received 10 IU of intravenous oxytocin diluted in 500 ml of normal saline administered immediately after delivery. Hemodynamic parameters, including systolic and diastolic blood pressure, were recorded before and after drug administration. Laboratory investigations such as hemoglobin levels were measured preoperatively and postoperatively. Postpartum blood loss was assessed clinically, and the requirement for additional uterotonics or blood transfusion was documented. Uterine tone was evaluated at 5 minutes after drug administration using a standardized uterine firmness scoring system.

Data were entered into a structured proforma and analyzed SPSS v26. Continuous variables were expressed as mean ± standard deviation and compared between groups using Student's t-test. Categorical variables were presented as frequency and percentage and analyzed using the Chi-square test. A p-value of less than 0.05 was considered statistically significant.

RESULTS

The baseline demographic and obstetric characteristics were comparable between the carbetocin and oxytocin groups. The mean age, body weight, and gestational age at delivery did not differ significantly between the two groups. Similarly, the distribution of parity was comparable, with primigravida constituting 42.0% in the carbetocin group and 36.0% in the oxytocin group, while multigravida accounted for 58.0% and 64.0%, respectively. No statistically significant difference was observed in any baseline variable, indicating adequate group comparability prior to intervention. [Table 1]

Table 1: Baseline Demographic and Obstetric Characteristics

Parameter	Carbetocin (n=50)	Oxytocin (n=50)	p-value
Age (years), mean ± SD	25.0 ± 3.6	25.0 ± 3.6	0.846
Weight (kg), mean ± SD	80.1 ± 5.5	80.1 ± 5.3	0.644
Gestational age (weeks), mean ± SD	38.1 ± 0.9	38.8 ± 0.9	0.417
Primigravida, n (%)	21 (42.0%)	18 (36.0%)	
Multigravida, n (%)	29 (58.0%)	32 (64.0%)	0.098

Preoperative and postoperative hemodynamic parameters showed no significant differences between the two groups. Both systolic and diastolic blood pressures were comparable preoperatively and postoperatively. Hemoglobin levels before surgery and after delivery were also similar between the

carbetocin and oxytocin groups, demonstrating that neither drug caused significant alterations in perioperative hemodynamic stability or hematological status. These findings suggest equivalent physiological and laboratory profiles in both study arms. [Table 2]

Table 2: Hemodynamic and Laboratory Parameters

Parameter		Carbetocin (n=50)	Oxytocin (n=50)	p-value
Systolic BP (mmHg)	Pre-operative	120.5 ± 8.3	119.8 ± 9.1	0.318
	Post-operative	118.2 ± 7.9	116.4 ± 8.5	0.430
Diastolic BP (mmHg)	Pre-operative	78.3 ± 6.7	77.9 ± 7.2	0.390
	Post-operative	75.8 ± 6.4	73.5 ± 7.0	0.662
Hemoglobin (g/dl)	Pre-operative	11.05 ± 1.2	11.11 ± 1.0	0.838
	Post-operative	10.20 ± 1.07	10.15 ± 1.1	0.251

Postpartum outcomes demonstrated significant differences between the two groups. The incidence of blood loss ≥1000 ml was significantly lower in the carbetocin group compared to the oxytocin group. Likewise, the requirement for blood transfusion and additional uterotonic agents was significantly reduced among women who received carbetocin. Assessment of uterine tone at 5 minutes revealed significantly better uterine contraction scores in the carbetocin group, indicating superior uterine response and improved control of postpartum bleeding compared to oxytocin. [Table 3]

Table 3: Postpartum Hemorrhage and Uterine Response

Parameter	Carbetocin (n=50)	Oxytocin (n=50)	p-value
Blood loss ≥1000 ml	4 (8.0%)	9 (18.0%)	0.001
Blood transfusion required	1 (2.0%)	4 (8.0%)	0.033
Additional uterotonics required	3 (6.0%)	6 (12.0%)	0.039
Uterine tone at 5 min (score, mean ± SD)	4.43 ± 0.52	4.59 ± 0.52	0.003

The frequency of adverse effects such as nausea, vomiting, chest discomfort, and hypotension was low and comparable between the two groups. No statistically significant difference was observed for any recorded adverse event, suggesting that both carbetocin and oxytocin were well tolerated with similar safety profiles in the study population. [Table 4]

Table 4: Adverse Effects

Adverse effect	Carbetocin (n=50)	Oxytocin (n=50)	p-value
Nausea	3 (6.0%)	2 (4.0%)	0.804
Vomiting	2 (4.0%)	3 (6.0%)	0.585
Chest discomfort	1 (2.0%)	1 (2.0%)	1.000
Hypotension	2 (4.0%)	2 (4.0%)	0.777

DISCUSSION

Baseline demographic and obstetric variables were comparable between the carbetocin and oxytocin groups, indicating adequate matching of study participants. Maternal age, body weight, gestational age, and parity distribution did not show statistically significant differences, ensuring that the observed outcomes were not influenced by population imbalance. Similar demographic profiles have been reported in previous comparative trial evaluating uterotonic agents, including those by Maged et al. where maternal age and gestational parameters were evenly distributed between study arms.[11] The parity pattern observed in the present study also corresponds with earlier report by Theunissen et al., who noted that minor variations in gravidity do not significantly affect the comparative efficacy of uterotonics.[12]

A significant reduction in major postpartum blood loss was observed in women receiving carbetocin compared with those receiving oxytocin, as evidenced by the lower incidence of blood loss ≥1000 ml. Furthermore, the requirement for blood transfusion and additional uterotonic agents was significantly lower in the carbetocin group, reflecting improved clinical control of postpartum bleeding. These findings are consistent with those of Gallos et al. and Abdel Fatah et al., who demonstrated that the prolonged uterotonic action of carbetocin results in more sustained uterine contraction and superior prevention of postpartum hemorrhage compared with oxytocin.[4,13] The longer half-life of carbetocin likely contributes to its enhanced efficacy by maintaining uterine tone during the critical early postpartum period.

Hemodynamic stability was maintained in both treatment groups, with no significant differences in systolic or diastolic blood pressure before or after drug administration. Similarly, laboratory parameters, particularly hemoglobin levels, showed comparable perioperative changes, suggesting that neither agent was associated with excessive blood loss or hematological compromise. These results are in agreement with study by Bekkenes et al., which reported minimal cardiovascular effects and stable hematological profiles with carbetocin use.[14] The comparable physiological responses observed in the present study further support the clinical safety of

both uterotonic agents when administered for postpartum hemorrhage prophylaxis.

Assessment of uterine tone demonstrated that carbetocin produced significantly stronger uterine contractions at 5 minutes after administration compared with oxytocin, although both groups achieved satisfactory uterine firmness overall. This early and sustained uterine response is clinically relevant, as the immediate postpartum period carries the highest risk for hemorrhage. Similar observation has been reported by Theunissen et al., who found that carbetocin provides prolonged uterine contractility compared with oxytocin, contributing to improved hemostasis after delivery.[12] The safety profile of both drugs was comparable, with low and similar rates of adverse effects such as nausea, vomiting, chest discomfort, and hypotension, consistent with previous finding reported by Al Zubaidi et al.[15]

CONCLUSION

Carbetocin demonstrated superior efficacy compared with oxytocin in reducing postpartum blood loss and the need for additional uterotonic therapy and blood transfusion, while maintaining comparable hemodynamic stability and safety. The sustained uterine contraction achieved with carbetocin in the early postpartum period appears to contribute to improved control of bleeding without increasing adverse maternal effects. These findings support the use of carbetocin as an effective alternative to oxytocin for the prevention of postpartum hemorrhage, particularly in clinical settings where prolonged uterotonic action is desirable.

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