The Journal of Teachers Association
ISSN 1019-8555 (Print) & ISSN 2408-8854 (Online)
Frequency: Bi-Annual
DOI: https://doi.org/10.62469/taj.v037i02.0404

OPEN ACCESS
Website: www.tajrmc.com
Email: editor@tajrmc.com
Volume-37 | Issue-2 | Jul-Dec 2024

# Advantages of Intramyometrial Carbetocin and Oxytocin in Cesarean Delivery: Preventing PPH While Reducing Ergometrine Use

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**Abstract:** ***Background:*** Postpartum hemorrhage (PPH), primarily caused by uterine atony, remains a leading contributor to maternal mortality. Carbetocin, a long-acting oxytocin analogue, provides sustained uterine contraction with a favorable side effect profile. Intramyometrial administration enhances drug efficacy by ensuring rapid and targeted uterine action. ***Objectives:*** To assess the efficacy of intramyometrial Carbetocin and Oxytocin in preventing PPH during cesarean sections by evaluating intraoperative blood loss, uterine tone, and the requirement for Ergometrine. ***Methods:*** A prospective comparative study was conducted on 58 patients undergoing cesarean section at Ad-din Sakina Medical College Hospital and Kings Hospital, Jashore, from January to December 2024. Participants were randomized into two equal groups: Group I received I/V oxytocin and intramyometrial Carbetocin and Oxytocin; Group II received intravenous Oxytocin only. Outcomes measured included estimated blood loss, uterine tone, need for Ergometrine, and side effects. Data were analyzed using SPSS v23. ***Results:*** The mean age of participants was 28.9 ± 4.1 years, with previous cesarean being the most common indication (41.4%). Ergometrine was required in 20.7% of cases, all from Group II. In Group I, 58.6% experienced blood loss <500 ml and 79.3% maintained stable vitals. Uterine contraction was adequate for 10–20 minutes in 58.6%. Minimal side effects were observed, with 77.6% reporting none. ***Conclusion:*** Intramyometrial administration of Carbetocin and Oxytocin in cesarean delivery significantly reduces blood loss and eliminates the need for Ergometrine, ensuring better uterine tone and maternal stability with minimal adverse effects.

**Keywords:** Intramyometrial Injection, Carbetocin, Oxytocin, Cesarean Delivery, Postpartum Hemorrhage, Uterotonic Agents, Ergometrine Reduction.

**Original Researcher Article**

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***How to cite this article:***
Khan MAH, Dhali R, Hasan M, Golder D; Advantages of Intramyometrial Carbetocin and Oxytocin in Cesarean Delivery: Preventing PPH While Reducing Ergometrine Use. TAJ 2024; 37 (1): 514-521

***Article history:***
*Received: July 28, 2024*
*Accepted: September 09, 2024*



## INTRODUCTION

Postpartum hemorrhage (PPH) remains a leading cause of maternal morbidity and mortality worldwide, with uterine atony accounting for approximately 80% of all cases.[1] Active management of the third stage of labour, including uterotonic agents, is essential to reduce PPH risk.[2] Oxytocin, a naturally occurring peptide that stimulates uterine contractions, is widely used prophylactically during cesarean sections. However, its short half-life and need for continuous infusion can lead to hemodynamic instability and inconsistent uterine tone.[3, 4] Carbetocin, a long-acting synthetic analog of oxytocin, has been introduced to overcome these limitations. It displays a prolonged half-life (85–100 minutes) and single-dose administration is enough and have fewer side effects.[5, 6] While intravenous administration of carbetocin has been extensively studied, the use of intramyometrial injection is relatively novel. Intramyometrial delivery provides direct uterine access, leading to rapid onset of action, potentially reducing the need for additional uterotonics like ergometrine.[7] Several randomized studies have compared Intramyometrial oxytocin with intravenous routes, demonstrating faster contraction response and reduced blood loss.[8, 9]

More recently, Intramyometrial carbetocin has been evaluated against Intramyometrial oxytocin, showing highest efficacy in contraction induction and less need for supplementary uterotonics.[10] We used Intramyometrial administration of both agents within a controlled comparative framework. Moreover, heat-stable carbetocin formulations show promise in low-resource settings, offering logistical advantages without compromising efficacy.[11] It has very low side effects whereas ergometric has lot of side effects like vomiting, headache, increased blood pressure and rupture cerebral aneurysm etc.

**Objectives**

**General Objective**

To evaluate the advantages of intramyometrial administration of Carbetocin and Oxytocin in preventing postpartum hemorrhage (PPH) during cesarean delivery, with a focus on reducing the need for Ergometrine.

**Specific Objectives**

To compare intraoperative blood loss between patients receiving intramyometrial Carbetocin and Oxytocin versus intravenous Oxytocin only.

To assess the requirement for additional uterotonic agents, particularly Ergometrine, in both groups.

To evaluate the duration and adequacy of uterine contraction following intramyometrial administration of Carbetocin and Oxytocin.

To monitor maternal hemodynamic stability and side effects associated with the use of these uterotonics.

## METHOD AND MATERIALS

**Study Design**

This was a prospective, interventional comparative study conducted in the Department of Anesthesiology at Ad-din Sakina Medical College Hospital (ASMCH), Pulerhat, Jashore and Kings Hospital, Jessore. The study population included 58 patients who underwent elective or emergency cesarean sections. The study was conducted over a 12-month period, from January 2024 to December 2024.

**Sampling Formula**

The sample size was calculated using the formula for two proportions comparison:

$$n = \frac{(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta})^2 [P_1(1-P_1) + P_2(1-P_2)]}{(P_1 - P_2)^2}$$

Where,

$Z_{1-\frac{\alpha}{2}}$= 1.96 for 95% confidence level

$Z_{1-\beta}$= 0.84 for 80% power

$P_1$= expected response rate in Carbetocin plus oxytocin Intramyometrial group

$P_2$= expected response rate in Oxytocin Intravenous group

n= minimum sample required per group

**Data Collection Procedure**

Data were collected from eligible patients undergoing cesarean section under spinal anesthesia. After obtaining informed consent, patients were randomly assigned to receive Oxytocin Intravenously immediately after fetal delivery. "Then one group received Carbetocin and Oxytocin (as intra-myometrial injection), and the other group received no uterotonic drug except intravenous Oxytocin. Data on demographic profile, surgical indication, drug administered, intraoperative blood loss, uterine contraction response, need for additional uterotonics, hemodynamic parameters, and adverse effects were recorded using a structured data collection form by trained anesthesiology personnel. Follow-up was done during the intraoperative and early postoperative period for assessment.

**Inclusion Criteria**

This clinical study aims to include pregnant women aged between 18 and 35 years who are scheduled to undergo an elective or emergency lower segment cesarean section (LSCS). Eligible participants must be classified as ASA physical status I or II, indicating that they are either healthy or have only mild systemic disease. Furthermore, participants must be willing to provide written informed consent after a thorough explanation of the study procedures, risks, and benefits. These inclusion criteria are designed to ensure that the study population is relatively homogenous and medically stable, which enhances the reliability of the results while minimizing potential risks.

**Exclusion Criteria**

Participants will be excluded from the study if they have a history of bleeding disorders or

coagulopathy, as these conditions could pose a safety risk and confound the study outcomes. Additionally, women with known allergies to Carbetocin or Oxytocin will not be enrolled, given the potential for adverse drug reactions. Severe obstetric complications, such as placenta accreta or uterine rupture, will also serve as exclusion criteria due to the complex medical management they require, which could interfere with the study protocol and compromise patient safety. These exclusion measures are essential for protecting participants and ensuring the integrity of the study data.

**Statistical Analysis**

Collected data were entered and analyzed using SPSS version 23.0. Continuous variables such as age and blood loss were expressed as mean ± standard deviation, while categorical variables such as type of uterotonic, ergometrine use, and side effects were presented as frequencies and percentages. The Chi-square test or Fisher's exact test was used for categorical comparisons between groups, and independent t-tests were used for continuous variables. A p-value < 0.05 was considered statistically significant.

**Ethical Consideration**

Prior to initiation, the study protocol was reviewed and approved by the Ethical Review Committee of Ad-din Sakina Medical College Hospital (ASMCH), Pulerhat, Jashore. Written informed consent was obtained from all participants after explaining the objectives, procedures, risks, and benefits of the study. Confidentiality of all data was maintained throughout the study, and participation was entirely voluntary with the right to withdraw at any time without affecting clinical care.

## RESULT

**Table 1: Demographic Distribution of the Study Population (n=58)**

| Variable | Frequency (n) | Percentage (%) |
|---|---|---|
| **Age Group (years)** | | |
| 18–24 | 12 | 20.7 |
| 25–30 | 26 | 44.8 |
| 31–35 | 14 | 24.1 |
| >35 | 6 | 10.4 |
| Mean Age ± SD | 28.9 ± 4.1 years | |
| **Gender** | | |
| Female | 58 | 100 |
| **Occupation** | | |
| Housewife | 48 | 82.8 |
| Service Holder | 6 | 10.3 |
| Others | 4 | 6.9 |

Table 1 shows Among the 58 female participants, the majority (44.8%, n=26) were aged between 25–30 years. The second most common age group was 31–35 years (24.1%, n=14), followed by 18–24 years (20.7%, n=12). Only 10.4% (n=6) were older than 35 years. All patients were female (100%), as expected in a study on cesarean deliveries. Most women were housewives (82.8%, n=48), while 10.3% (n=6) were service holders and 6.9% (n=4) were engaged in other occupations. The mean age was 28.9 years with a standard deviation (SD) of 4.1 years.

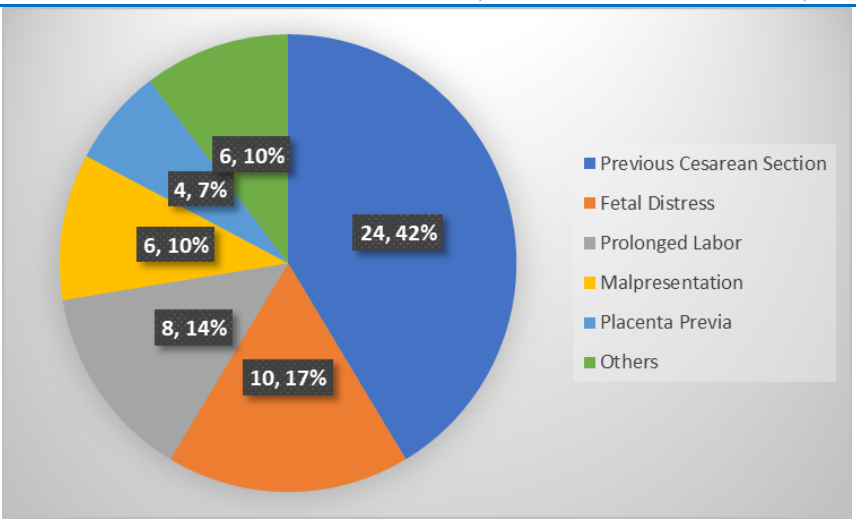


**Figure 1: Indications for Cesarean Section (n=58)**

Figure 1 shows the most frequent indication for cesarean delivery was a previous cesarean section, accounting for 41.4% (n=24) of the cases. This was followed by fetal distress (17.2%, n=10), prolonged labor (13.8%, n=8), and malpresentation such as breech presentation (10.3%, n=6). Placenta previa was responsible for 6.9% (n=4) of the surgeries, while 10.3% (n=6) fell into the "others" category, including conditions like cephalopelvic disproportion or maternal request.

**Table 2: Type of Uterotonic Used (n=58)**

| Group | Frequency (n) | Percentage (%) |
|---|---|---|
| Oxytocin & Carbetocin (intramyometrial) | 29 | 50 |
| Oxytocin (intravenous only) | 29 | 50 |

Table 2 shows the study equally divided patients into two groups for comparison. 29 women (50%) received intramyometrial Carbetocin and Oxytocin, and the other 29 women (50%) received only intravenous Oxytocin. This equal distribution helps provide a balanced view on the comparative efficacy and side effect profile of the two drugs.

**Table 3: Need for Additional Uterotonic (Ergometrine Use) (n=58)**

| Ergometrine Use | Frequency (n) | Percentage (%) |
|---|---|---|
| Required | 12 | 20.7 |
| Not Required | 46 | 79.3 |

Table 3 shows A total of 12 patients (20.7%) required additional uterotonic support in the form of ergometrine, indicating insufficient uterine contraction post-delivery. However, the majority of the patients—46 women (79.3%)—did not require any additional uterotonic, suggesting that intramyometrial administration of either Carbetocin plus Oxytocin was largely effective in controlling uterine tone.

**Table 4: Intraoperative Blood Loss (Estimated) (n=58)**

| Blood Loss (ml) | Frequency (n) | Percentage (%) |
|---|---|---|
| <500 ml | 34 | 58.6 |
| 500–1000 ml | 18 | 31.0 |
| >1000 ml | 6 | 10.4 |

Table 4 shows regarding blood loss during surgery, 34 patients (58.6%) experienced less than 500 ml of estimated blood loss, while 18 women (31.0%) had blood loss between 500–1000 ml. A small fraction—6 patients (10.4%)—experienced blood loss exceeding 1000 ml, which could be linked to uterine atony or surgical complications. These findings support the effectiveness of the intramyometrial uterotonics used in the majority of cases.

**Table 5: Hemodynamic Stability Post-Delivery (n=58) with or without myometrial injection.**

| Stability Status | Frequency (n) | Percentage (%) |
|---|---|---|
| Stable | 46 | 79.3 |
| Mild Hypotension | 8 | 13.8 |
| Moderate Hypotension | 4 | 6.9 |

Table 5 shows After delivery, 46 patients (79.3%) maintained stable hemodynamic parameters. 8 women (13.8%) developed mild hypotension, and 4 women (6.9%) experienced moderate hypotension, which were managed conservatively.

**Table 6: Duration of Uterine Contraction (Clinically Assessed) (n=58) with or without intramyometrial injection.**

| Duration of Contraction | Frequency (n) | Percentage (%) |
|---|---|---|
| <10 minutes | 12 | 20.7 |
| 10–20 minutes | 34 | 58.6 |
| >20 minutes | 12 | 20.7 |

Table 6 shows Clinically assessed uterine contraction showed that 34 women (58.6%) had adequate contraction sustained for 10–20 minutes, which is optimal during the immediate postpartum period. 12 patients (20.7%) showed a quick contraction response lasting under 10 minutes, and another 12 patients (20.7%) had contractions sustained beyond 20 minutes mostly with intramyometrial injection.

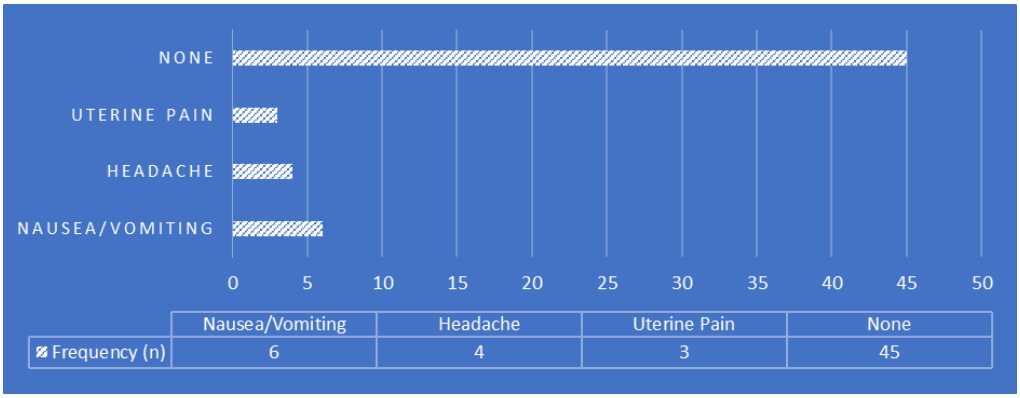


**Figure 2: Adverse Effects Noted (n=58)**

Figure 2 shows most patients (77.6%, n=45) reported no side effects after intramyometrial administration. The most common adverse effect was nausea or vomiting, seen in 6 patients (10.3%). Headache occurred in 4 women (6.9%), and uterine pain was reported by 3 women (5.2%).

**Table 7: Blood Loss and Duration of Uterine Contraction**

| Parameter | Intramyometrial Uterotonic Injection Group (n=29) | Only IV Oxytocin Group (n=29) |
|---|---|---|
| Blood Loss | <500 mL | 500–1000 mL |
| Duration of Uterine Contraction | ≥20 minutes | <20 minutes |

Table 7 shows that the intramyometrial uterotonic group had better outcomes, with blood loss <500 mL and uterine contractions lasting ≥20 minutes. In contrast, the IV oxytocin group had higher blood loss (500–1000 mL) and shorter contraction duration (<20 minutes), indicating less effectiveness.

## DISCUSSION

In this study, the most common age group among participants was 25–30 years (44.8%), and the majority were housewives (82.8%). This demographic pattern aligns with the obstetric population in rural and semi-urban Bangladesh, where childbearing frequently occurs during the mid to late twenties. A similar age distribution was reported by Wang *et al*., who found the mean age of cesarean patients to be around 28.5 years in a multi-center study conducted in Southeast Asia.[12] The most frequent indication for cesarean section in our study was a previous cesarean (41.4%), followed by fetal distress (17.2%) and prolonged labor (13.8%). This is consistent with trends observed in developing countries, where repeat cesareans often dominate elective cases.[13] A retrospective analysis by Jamieson *et al*., confirmed that a prior cesarean remains the leading contributor to rising cesarean rates worldwide.[14] Our study equally divided participants between Carbetocin Oxytocin intramyometrial and Oxytocin I/V only administration groups. The need for additional uterotonic (ergometrine) was only 20.7% overall, indicating adequate uterine tone with the initial intramyometrial administration. These findings also support intramyometrial Carbetocin & oxytocin showed superior to intravenous Oxytocin in minimizing the need for additional drugs.[15] Estimated intraoperative blood loss in most patients was below 500 ml (58.6%), with only 10.4% experiencing loss over 1000 ml. This reflects the hemostatic efficiency of intramyometrial uterotonics. A 2024 study by Nair *et al*., found Carbetocin reduced mean blood loss compared to Oxytocin when administered intramyometrially during cesarean.[16] Postoperative hemodynamic stability was maintained in 79.3% of patients, with only mild to moderate hypotension in 20.7%. This favorable safety profile aligns with the pharmacologic profile of Carbetocin, which has less vasodilatory effect than high-dose Oxytocin.[17] A comparative study in India confirmed fewer hypotensive episodes in the Carbetocin group.[18] Regarding uterine contraction duration, 58.6% had contractions lasting 10–20 minutes, while 20.7% had sustained contraction over 20 minutes. This pattern supports the long-acting nature of Carbetocin, which maintains tone for up to an hour post-injection.[19] Adverse effects were minimal; 77.6% of patients reported none. The most common were nausea (10.3%), headache (6.9%), and uterine pain (5.2%). These findings are consistent with the safety outcomes reported by Lemoine *et al*., where side effects were mild and infrequent for both drugs.[20] A large-scale pharmacovigilance report published in 2023 supports this, noting carbetocin's tolerability across global settings.[21]

## CONCLUSION

This study demonstrates that intramyometrial administration of both Carbetocin and Oxytocin during cesarean sections is effective in achieving adequate uterine contraction and minimizing the need for additional uterotonic agents such as ergometrine. Carbetocin, with its longer duration of action and lower requirement for supplementary drugs, shows promising results in reducing intraoperative blood loss and maintaining hemodynamic stability. Adverse effects were minimal and comparable between both groups, highlighting the safety of intramyometrial delivery.

### Limitations of the study

The study was limited by a relatively small sample size of 58 patients, which may affect the generalizability of the results. It was conducted at two centers within a single region, which might not

reflect practices and outcomes in other geographical or healthcare settings.

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