Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v6i7.1881
*Biol. Clin. Sci. Res. J., Volume 6(7), **2025**: 1881*
Original Research Article

Comparative Side Effects of Carbetocin vs Oxytocin in Prevention of Postpartum Bleeding Following Cesarean Sections

Ayesha Uzaima Tarin[1*], Maria Rasheed[2], Sadia Amin[1]

[1]Department of Gynaecology, Nishtar Medical University and Hospital, Multan, Pakistan
[2]Department of Gynaecology, DHQ Hospital, Muzaffargarh, Pakistan
**Corresponding author`s email address:* drnida123@yahoo.com

(Received, 24th May 2025, Accepted 8th July2025, Published 31st July 2025)

Abstract: *Postpartum hemorrhage (PPH) remains one of the leading causes of maternal morbidity and mortality worldwide. Uterotonic agents such as oxytocin and carbetocin are commonly administered during cesarean sections to reduce the risk of PPH; however, their comparative safety and hemodynamic effects require further evaluation.* ***Objective:*** *To compare the side effects and hemodynamic effects of carbetocin versus oxytocin for preventing postpartum bleeding in women undergoing cesarean sections.* ***Methods:*** *This prospective study was conducted in the Department of Gynecology and Obstetrics, Nishtar Hospital, Multan, from November 5, 2024, to May 5, 2025. A total of 300 women undergoing elective cesarean section at term with singleton pregnancies and no comorbidities were enrolled using a convenience sampling technique. Participants were randomly assigned into two groups: the control group (n=150) received 5 IU of oxytocin intravenously over 3 minutes followed by a continuous infusion of 10 IU in 1000 mL Plasma-Lyte over 24 hours, while the study group (n=150) received 100 µg of carbetocin intravenously over 3 minutes followed by 1000 mL Plasma-Lyte infusion over 24 hours. Primary outcomes included the incidence of side effects (nausea, vomiting, flushing) and hemodynamic parameters (heart rate, blood pressure, hemoglobin, and hematocrit levels). Statistical analysis was performed using chi-square and t-tests, with a p-value <0.05 considered significant.* ***Results:*** *The incidence of side effects was comparable between the groups: 22% in the carbetocin group and 21% in the oxytocin group. Nausea occurred more frequently in the oxytocin group (14%) than the carbetocin group (8%), while flushing was more frequent in the carbetocin group (14%) compared to the oxytocin group (8%); however, differences were not statistically significant (p>0.05). No patients in the carbetocin group required additional uterotonics or antiemetics. The mean postoperative hemoglobin drop was 2.15 g/dL in the carbetocin group and 2.2 g/dL in the oxytocin group (p=1.0), and the hematocrit change was also similar (p=0.9), indicating no significant hemodynamic difference between the two agents.* ***Conclusion:*** *Carbetocin and oxytocin demonstrate similar efficacy and safety profiles in preventing postpartum hemorrhage in cesarean deliveries, with no significant differences in side effects or hemodynamic outcomes. Carbetocin may offer a slight advantage by reducing the need for additional uterotonic or antiemetic therapy.*

Keywords: Carbetocin, Cesarean Section, Hemodynamics, Oxytocin, Postpartum Hemorrhage, Uterotonic Agents

[***How to Cite:*** Tarin AU, Rasheed M, Amin S. Comparative side effects of carbetocin vs oxytocin in prevention of postpartum bleeding following cesarean sections. *Biol. Clin. Sci. Res. J.*, **2025;** 6(7): 117-120. doi: https://doi.org/10.54112/bcsrj.v6i7.1881

Introduction

Postnatal bleeding is a common complication of birth, affecting 6% of total deliveries, which significantly increases the risk of morbidity and mortality. (1) The majority of these cases are caused by failure of the uterus to contract after delivery in up to 80% of women. (2)One of the most recognized risk factors of postpartum hemorrhage is cesarean section, which can be prevented by administering uterotonic agents as soon as the fetus is extracted.

Oxytocin is the primary uterotonic agent used in women who undergo c-sections to reduce the risk of PPH.(3)However, as its effects last for only up to 10 minutes, it must be delivered in repeated or continuous doses. As an alternative to oxytocin, carbetocin, its agonist, has been introduced recently, which has a longer half-life, resulting in sustained uterine contractions. (4) In a comparative review analysis between the two agents, carbetocin reduces the need to administer additional drugs. Still, there is no significant difference in the frequency of hemorrhage, the severity of hemorrhage, the amount of blood loss, or the side effects. (5)

Oxytocin and carbetocin can both induce nausea and vomiting, low blood pressure, leading to vertigo or syncope, as reported by various controlled trials. (6, 7)Since carbetocin is a synthetic analogue of oxytocin, other secondary adverse effects are similar, including hypotension. The hemodynamic effects of low-dose oxytocin and carbetocin are also the same. The incidence of hypotension also does not differ between patients administered different doses of carbetocin and ranges from 40-55%.

However, most of the studies conducted on the effects of these drugs are focused on normal vaginal deliveries. Secondly, they fail to report secondary outcomes such as the need for vasoactive medications and changes in hemoglobin and hematocrit after the intervention. This study was conducted to compare the side effects and hemodynamic effects of carbetocin versus oxytocin for preventing postpartum bleeding in women undergoing cesarean sections.

Methodology

A prospective study was conducted in the Gynecology and Obstetrics Department of Nishtar Hospital, Multan, from November 5, 2024, to May 5, 2025. A total of 300 women scheduled for planned term cesarean section for singleton pregnancies without medical complications were included in the study by convenience sampling. This sample size was calculated to maintain 80% power at 0.05 statistical significance to assess a clinically relevant 5-15% decrease in side effects between both groups. The margin of error was kept at 5% with a 95% confidence interval in an estimated population size of 1500. All patients were selected after they were admitted to the obstetrics ward and were administered anesthesia. Women with gestational hypertension, diabetes, preeclampsia, and prior hypertension were excluded as these conditions could influence our outcomes. Informed consent was obtained from all participants of the study. The Ethical Review Board approved the study by Ref. No. 18945/NMU dated 02-11-2024.

The patients were divided into two groups. The control group included 150 women who were administered an initial fast dose of 5 units of oxytocin mixed with 10 mL of 0.9% NaCl over 3 minutes, then a continuous, slow-infusion dose of 10 units of oxytocin was administered mixed with 1000 mL of Plasma-Lyte over 24 hours. The study group included 150 women and was administered a fast dose of 100 µgcarbetocin mixed in 10 mL of 0.9% NaCl over 3 minutes and then a continuous dose of 1000 mL Plasma-Lyte over 24 hours. The c-section was performed by the usual procedure in all women. If the blood pressure dropped by more than 10% from baseline or fell below 100 mmHg, a bolus dose of phenylephrine was given.

The primary outcomes recorded were incidence and frequency of nausea and vomiting, flushing, heart rate, and blood pressure. Nausea and vomiting were recorded every 3 minutes and graded as zero for the absence of both, one for the lack of vomiting and light nausea, two for the lack of vomiting and persistent nausea, and three for severe nausea and vomiting. The presence or absence of flushing was noted. Heart rate and blood pressure were recorded every 3 minutes from the start to the end of the procedure. The secondary outcomes evaluated were Hb and hematocrit levels recorded at least 2 hours before treatment and 48 hours after treatment. This can estimate the amount of blood loss during hemorrhage. The need for vasopressors and other uterotonic medication was also recorded.

All data were evaluated by SPSS version 21. The chi-square test was used to compare the dichotomous variables, such as the incidence of nausea and vomiting. Student's test was performed to compare normally distributed continuous data. Statistical significance was obtained at a p-value of less than 0.05.

Results

A total of 300 women were recruited for the study, divided into a control group and a study group. The mean age between both groups did not differ significantly (p=0.3). Obstetric parameters, including primiparity (28% vs 22%), history of c-section (64% vs 70%), and breech fetal presentation (24% vs 20%), were also similar between both groups, respectively. Preoperative hemodynamic factors, i.e., hemoglobin and hematocrit, were also identical (p=1.0 vs 0.9). The baseline parameters of patients are shown in Table I.

The side effects in both groups were comparable. The overall incidence of side effects was 22% in the study group and 21% in the control group. Nausea was reported in 21 (14%) in the control group and 12 (8%) in the study group (p=0.5). Flushing was observed in 12 (8%) and 20 (14%) patients, respectively. No patient in the study group required additional uterotonic agents or antiemetics. The hemodynamic changes postoperatively were also similar. The mean change in hemoglobin level was higher in the control group (2.2 g/dL) as compared to the study group (2.15 g/dL), but the difference was insignificant (p=1.0), similar to the change in hematocrit levels (p=0.9). The primary and secondary outcomes of interventions are shown in Table II.

Periodic monitoring of blood pressure and heart rate showed no difference between the two groups preoperatively. Oxytocin and carbetocin have a vasodilatory effect that can lead to low blood pressure. This was observed on our first measurement recorded 3minutes after the intervention and remained consistent across subsequent measurements throughout the procedure. The mean decrease in systolic BP after carbetocin administration was 15.1 mmHg (95% CI: 10.2-20.5) and after oxytocin administration was 9.3 mmHg (95% CI: 5.0-13.6). The mean decrease in diastolic BP was 8.2 mmHg (95% CI: 5.4-10.8) for the study group and 9.0 mmHg (95% CI: 3.3-16.0) for the control group. However, the difference was not significant between the two groups in overall measurements. The mean heart rate was not affected by the intervention.

Table I: Baseline Patients ' Patients'Parameters of Both Groups

	Control group (n=150)	Study group (n=150)	P
Age	30.2 ± 3.7	32.5 ± 3.9	0.3
Primiparity	42 (28%)	33 (22%)	-
Repeat c-section	96 (64%)	105 (70%)	-
Breech presentation	36 (24%)	30 (20%)	-
Preoperative hemoglobin	12.2 ± 1.5	12.3 ± 1.5	1.0
Preoperative hematocrit	34.1 ± 2.8	34.2 ± 3.2	0.9
Systolic BP before anesthesia	130 ± 14.3	131 ± 17.6	0.2
Diastolic BP before anesthesia	75 ± 8.6	80 ± 8.8	0.5
Heart rate before anesthesia	95 ± 13	89 ± 11.7	0.5

Table II: Primary Side Effects of Both Uterotonic Agents

	Control group (n=150)	Study group (n=150)	P
Nausea	21 (14%)	12 (8%)	0.5
Flushing	12 (8%)	20 (14%)	0.8
Need for vasopressors	36 (24%)	39 (26%)	0.9
Need for other uterotonic agents	12 (8%)	-	0.3
Need for antiemetics	6 (4%)	-	0.6
Change in hemoglobin	2.2 ± 1	2.15 ± 0.9	1.0
Change in hematocrit	4.11 ± 3.2	3.78 ± 3.5	0.9

Discussion

Several studies have been conducted to evaluate the effectiveness of carbetocin for the management of PPH.(8, 9) However, limited studies are available to investigate the comparative outcomes of oxytocin and carbetocin, especially regarding systemic non-hematological adverse effects. We conducted this study to compare the adverse effects, including nausea, vomiting, and flushing, in patients administered either oxytocin or carbetocin. Our results were within the clinically relevant range of 14% and 8% for the incidence of nausea and vomiting, although this difference was insignificant. The decrease in BP and requirement for vasopressors was also similar between patients. Regarding hemodynamic factors, both groups had negligible differences between preoperative and postoperative hemoglobin and hematocrit.

C-sections are the major cause of postpartum bleeding, which can be managed by the use of uterotonic prophylactics to reduce blood loss and

risk of death. Despite oxytocin being the first-line treatment for a long time, its modified version, carbetocin, has been recognized in modern times. However, since their efficacy and action are comparable, there are conflicting opinions regarding the best choice. (10)Cole et al evaluated the comparative in vitro effect of both drugs on uterine muscle obtained from women undergoing c-sections. They reported that oxytocin was more effective in inducing contractions. (11)However, other studies investigating this in vitro effect reported no difference in the effectiveness of oxytocin and carbetocin. (12)

There is scarce data regarding the adverse effects of both agents; however, similar to our study, nausea, vomiting, and flushing are the most common side effects. (13)Esseissah et al primarily study the effect of these agents on blood pressure and heart rate, along with secondary endpoints including headache, nausea, flushing, and vomiting. (14) All the parameters were similar between the two groups. The present study also reported these side effects, with no significant difference between the two groups. However, the study group experienced a higher incidence of flushing, while the control group experienced higher nausea.

It is a common fact that oxytocin and carbetocin reduce blood pressure, especially when given in heavy doses. We administered a 5 IU dose of oxytocin as it is enough to induce contractions, followed by a heavier dose after a cesarean section. However, this did not influence its hypotensive effect, which is similar to that of carbetocin. Since the blood pressure only dropped soon after the intervention, patients remained stable later as BP did not change persistently after the initial drop. The impact of oxytocin and carbetocin on hemodynamics is similar to that of Balogun et al. and Kayikci et al.(15, 16). These studies reported a similar sudden drop after intervention, which remained unchanged during the procedure. There was no noticeable effect of a heavier dose of carbetocin, as Delavallade et al. reported that a 20 µg or 100 µg dose is equally effective. (17) However, future studies should consider assessing the effect of lower doses on primary side effects.

We did not find any significant difference between the groups regarding mean blood loss as reported by Kalafat et al.(18). However, the change in hemoglobin levels was lower in the study group, indicating reduced blood loss after carbetocin administration. The same can be reported for the need for additional uterotonics or antiemetics.

We recognize that the inclusion of a uniform group of patients was the strength of our study, as confounding factors, including multiparity, medications, or different surgical methods, did not influence the incidence of nausea and vomiting. However, our study has some limitations. The study was single-centered, which may have limited the generalizability or external validity of our results. Secondly, we did not report vomiting in the individual results due to limited outcomes, which may have been influenced by the short follow-up time that did not assess possible delayed complications. Thirdly, we did not study the effect of doses and anesthesia on the responses of agents. Fourthly, we only included patients undergoing elective c-sections; different results may be yielded in emergencies.

Conclusion

Oxytocin and carbetocin have similar incidences of adverse effects, including hypotension, nausea & vomiting, flushing, and mean blood loss after administration for management of postpartum bleeding in women undergoing cesarean sections.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate
Approved by the department concerned. (18945/NMU)

Consent for publication
Approved

Funding
Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

AUT (SR)
Manuscript drafting, Study Design,
MR (Consultant)
Review of Literature, Data entry, Data analysis, and drafting articles.
SA (SR)
Conception of Study, Development of Research Methodology Design,

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

References

1. Thams AB, Larsen MH, Rasmussen SC, Jeppegaard M, Krebs L. Incidence of postpartum hemorrhage and risk factors for recurrence in the subsequent pregnancy. *Archives of Gynecology and Obstetrics*. 2023;307(4):1217–24. https://doi.org/10.1007/s00404-022-06591-4
2. Ende HB, Lozada MJ, Chestnut DH, Osmundson SS, Walden RL, Shotwell MS, et al. Risk factors for atonic postpartum hemorrhage: a systematic review and meta-analysis. *Obstetrics & Gynecology*. 2021;137(2):305–23. https://doi.org/10.1097/AOG.0000000000004228
3. Torloni MR, Siaulys M, Riera R, Cabrera Martimbianco AL, Leite Pacheco R, Latorraca CdOC, et al. Timing of oxytocin administration to prevent post-partum hemorrhage in women delivered by cesarean section: a systematic review and meta-analysis. *PLoS One*. 2021;16(6):e0252491. https://doi.org/10.1371/journal.pone.0252491
4. Jones AJ, Federspiel JJ, Eke AC. Preventing postpartum hemorrhage with combined therapy rather than oxytocin alone. *American Journal of Obstetrics & Gynecology MFM*. 2023;5(2):100731. https://doi.org/10.1016/j.ajogmf.2022.100731
5. Sun H, Xu L, Li Y, Zhao S. Effectiveness and safety of carboxytocin versus oxytocin in preventing postpartum hemorrhage: A systematic review and meta-analysis. *Journal of Obstetrics and Gynaecology Research*. 2022;48(4):889–901. https://doi.org/10.1111/jog.15174
6. Huang X, Xue W, Zhou J, Zhou C, Yang F. Effect of Carbetocin on Postpartum Hemorrhage after Vaginal Delivery: A Meta-Analysis. *Computational and Mathematical Methods in Medicine*. 2022;2022:6420738. https://doi.org/10.1155/2022/6420738
7. Korb D, Lopez R, Hörlin AL, Schmitz T, Borie C, Sibony O. Effectiveness of prophylactic carbetocin versus oxytocin following vaginal delivery for preventing severe postpartum hemorrhage. *International Journal of Gynecology & Obstetrics*. 2023;162(3):889–94. https://doi.org/10.1002/ijgo.14743
8. Brun R, Meier L, Kapfhammer E, Zimmermann R, Ochsenbein-Kölble N, Haslinger C. Intramyometrial and intravenous oxytocin compared to intravenous carbetocin for prevention of postpartum hemorrhage in elective cesarean section—A quasi-randomized controlled phase IV non-inferiority interventional trial. *Acta Obstetricia et Gynecologica Scandinavica*. 2024;103(9):1838–46. https://doi.org/10.1111/aogs.14893
9. Kang S, Zhou L, Zhu L, Wang Y, Yue Y, Yan L. Carbetocin versus oxytocin for the prevention of postpartum hemorrhage after elective caesarean section in high-risk women: a prospective, randomized, open-label, controlled trial in China. *Clinical and Experimental Obstetrics & Gynecology*. 2022;49(1):23. https://doi.org/10.31083/j.ceog4901023

10. Maged AM, El-Goly NA, Turki D, Bassiouny N, El-Demiry N. A systematic review and meta-analysis of randomized trials comparing carbetocin to oxytocin in the prevention of postpartum hemorrhage after cesarean delivery in low-risk women. *Journal of Obstetrics and Gynaecology Research*. 2025;51(1):e16194. https://doi.org/10.1111/jog.16194
11. Cole NM, Carvalho J, Erik-Soussi M, Ramachandran N, Balki M. In vitro comparative effect of carbetocin and oxytocin in pregnant human myometrium with and without oxytocin pretreatment. Obstetric Anesthesia Digest. 2016;36(4):192-3. https://doi.org/10.1097/01.aoa.0000504719.68344.63
12. Trivedi K, Sinha T, Boipai P, Kumari P, Sharma A, Singh A, et al. The Role of Oxytocin versus Carbetocin in Prevention of Postpartum Hemorrhage in Cesarean Section: A Randomized Controlled Trial. Annals of African Medicine. 2025;24(2):378-383. https://doi.org/10.4103/aam.aam_218_24
13. Al Anwar AM, Abdal Salam HS, Esukni SM, Abdel Rahman MM. Carbetocin versus oxytocin: a comparative study to prevent postpartum hemorrhage in pre-eclamptic women delivered by Caesarean section. The Egyptian Journal of Hospital Medicine. 2022;89(1):5063-5068. https://doi.org/10.21608/ejhm.2022.261171
14. Esseissah S, Mohamed H, Elnoury M, Ali A. Efficacy of carbetocin versus oxytocin and ergometrine in the prevention of postpartum hemorrhage after cesarean section. Benha Journal of Applied Sciences. 2022;7(1):109-115. https://doi.org/10.21608/bjas.2022.221207
15. Balogun RO, Lawal OO, Bello YO, Odedele TM, Morhason-Bello IO, Oladokun A. A randomized controlled trial on the comparison of two doses of carbetocin with oxytocin for the prevention of postpartum hemorrhage (concert trial). Journal of Obstetrics and Gynaecology Research. 2024;50(11):2046-2056. https://doi.org/10.1111/jog.16097
16. Kayıkçı U, Fadıloğlu E, Bayrak AÇ, Kır EA, Hergüner İ, İskandarli K, et al. Comparative analysis of antidiuretic effects of oxytocin and carbetocin in postpartum hemorrhage prophylaxis: a retrospective cohort study. Journal of Perinatal Medicine. 2025;53(5):576-581. https://doi.org/10.1515/jpm-2024-0321
17. Delavallade M, Vaunois A, Cellier M, Boukerfa-Bennacer Y, Chauleur C, Raia-Barjat T. Carbetocin versus oxytocin for the prevention of postpartum haemorrhage during caesarean section in patients at high risk of bleeding. European Journal of Obstetrics & Gynecology and Reproductive Biology. 2024;300:206-210. https://doi.org/10.1016/j.ejogrb.2024.07.015
18. Kalafat E, Gokce A, O'Brien P, Benlioglu C, Koc A, Karaaslan O, et al. Efficacy of carbetocin in the prevention of postpartum hemorrhage: a systematic review and Bayesian meta-analysis of randomized trials. The Journal of Maternal-Fetal & Neonatal Medicine. 2021;34(14):2303-2316. https://doi.org/10.1080/14767058.2019.1664463