http://www.banglajol.info/index.php/JNINB

*Original Article*

DOI: https://doi.org/10.3329/jninb.v9i2.70884

**Journal of National Institute of Neurosciences Bangladesh,**
*July 2023, Vol. 9, No. 2, pp. 141-146*

ISSN (Online) 2518-6612
ISSN (Print) 2410-8030

# Effects of Carbetocin and Oxytocin on Haemodynamic among Women with Post-Partum Hemorrhage after Caesarean Section: A Single Blind Parallel Arm Randomized Controlled Trial

Farhana Haque Choudhury[1], Shahnaz Ahmed[2], Syeda Tania Tanzin[3], Silvia Rahman[4], Naheed Fatema[5], Kashifa Khatun[6]

[1]Assistant Professor, Department of Obstetrics & Gynaecology, Monno Medical College, Manikganj, Bangladesh; [2]Assistant Professor, Department of Obstetrics & Gynaecology, Sir Salimullah Medical College, Mitford, Dhaka, Bangladesh; [3]Assistant Professor, Department of Obstetrics & Gynaecology, Monno Medical College and Hospital, Manikganj, Bangladesh; [4]Assistant Professor, Department of Obstetrics & Gynaecology, Monno Medical College and Hospital, Manikganj, Bangladesh; [5]Assistant Professor, Department of Obstetrics & Gynaecology, Bangladesh Medical Studies and Research Institute, Dhaka, Bangladesh; [6]Professor, Department of Obstetrics & Gynaecology, Chattogram Medical College, Chattogram, Bangladesh

**Abstract**

**Background:** Management of haemodynamic among women with post-partum hemorrhage after caesarean section. **Objective:** The purpose of the present study was to compare the effect of carbetocin and oxytocin on haemodynamic among women with post-partum hemorrhage after caesarean section. **Methodology:** This randomized controlled trial was conducted in the Department of Obstetrics and Gynaecology at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh from July 2015 to December 2015 for a period of six months. Pregnant women diagnosed on the standard criteria admitted in BSMMU, Dhaka, Bangladesh were selected as study population by consecutive type of sampling. Randomization was performed according to computer generated simple random sampling method. An Uterotonic was an agent used to induce contraction or greater tonicity of the uterus. Then the patients were monitored per operatively and post operatively. All the information was recorded in data collection sheet. Main outcome variables were estimated blood loss. **Results:** A total number of 96 pregnant women were recruited for this s tudy of which 48 cases were enrolled in group I and the rest of 48 case were enrolled in group II. The mean age with SD of the group I and group II were 24.4±4.7 years and 24.7±3.7 years (p=0.729). Before administration of drug, mean systolic blood pressure was found 115.6±5.8 mmHg in group I and 114.8±7.8 mmHg in group II. At 24 hours after caesarean section, mean systolic blood pressure was found 116.9±5.8 mmHg in group I and 113.9±8.8 mmHg in group II (p>0.05). Before administration of drug, mean diastolic blood pressure was found 75.8±7.9 mmHg in group I and 76.9±9.9 mmHg in group II. At 24 hours after caesarean section, mean diastolic blood pressure was found 76.7±6.6 mmHg in group I and 76.1±7.2 mmHg in group II (p>0.05). Before administration of drug, mean maternal blood loss was found 376.4±110.4 ml in group I and 439.4±199.9 ml in group II. At 24 hours after caesarean section, mean maternal blood loss was found 468.2±121.9 ml in group I and 532.6±243.0 ml in group II (p>0.05). **Conclusion:** In conclusion the systolic blood pressure, diastolic blood pressure and blood loss are not significantly varied in group I and II. *[Journal of National Institute of Neurosciences Bangladesh, July 2023;9(2):141-146]*

**Keywords:** Carbetocin; oxytocin; haemodynamic; caesarean section; post-partum hemorrhage

## Introduction

The administration of uterotonic drugs widely prevents the post-partum hemorrhage and it significantly decreases the incidence of post-partum hemorrhage[1]. Therefore, it is the main point of active management. Oxytocin (10 IU) is administered intramuscularly and is the preferred medication for the prevention of low risk vaginal and caesarean deliveries[2]. Oxytocin is relatively safe when used at recommended doses, and side effects are uncommon[3]. The hemodynamic effects of an oxytocin bolus consist of systemic vasodilatation, with hypotension, tachycardia, and an increase in cardiac output and pulmonary artery pressure, resulting in brief hypotension and tachycardia in a dose dependent manner[4-5]. It is an effective drug for the control of post-partum hemorrhage, but the disadvantage is its short

**Correspondence:** Dr. Farhana Haque Choudhury, Assistant Professor, Department of Obstetrics & Gynaecology, Monno Medical College, Monno City, Gilando Bazar, Manikganj, Bangladesh; Email: mahbub7907@yahoo.com; Cell No.: +8801914878977;
ORCID: https://orcid.org/0009-0006-7282-7439

half-life of 4 to 10 minutes, regularly requiring a continuous intravenous infusion or repeated intramuscular injections[6].

Endogenous and synthetic oxytocin has a half-life of approximately 3.5 minutes[7]. Carbetocin, in comparison, has a much longer half-life ranging from 85 to 100 minutes[8]. The bioavailable dose is around 80%. The elimination half-life following intravenous administration is around 40 minutes[9]. Conventional uterotonics like oxytocin has used for preventing post-partum hemorrhage but it has some limitations like shorter half-life, less contraction time and more side effects like fluid overload, convulsion, arrhythmia and pulmonary edema[10]. Carbetocin is a synthetic analogue of oxytocin with a long half-life approximately 4 to 10 times longer than oxytocin. Moreover, carbetocin significantly reduces the need for additional uterotonic agents or uterine message to prevent excessive bleeding compared to oxytocin[11].

By using this promising uterotonic, it can be prevented severe blood loss and it will help to reduce maternal morbidity and mortality[12]. As this type of study is not common in the perspective of Bangladesh, the present study will be conducted in tertiary level hospital to find out the best drug for the prevention of postpartum haemorrhage after caesarean section. By proper prevention of post-partum hemorrhage maternal morbidity and mortality can be reduced and we can be one step forward to ensure safe motherhood. Keeping the above context in mind the aims of the present study was to compare the hemodynamic effects, adverse effects of carbetocin and oxytocin and the additional uterotonic needed in caesarean section for the control of postpartum haemorrhage.

## Methodology

**Study Settings and Population:** This randomized controlled trial was conducted in the Department of Obstetrics and Gynaecology at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh from July 2015 to December 2015 for a period of six months. Pregnant women diagnosed on the standard criteria admitted in BSMMU, Dhaka, Bangladesh were selected as study population by consecutive type of sampling. Patient with risk factors for primary post-partum haemorrhage such as multiple pregnancy, one or more previous caesarean section, presence of uterine fibroids, previous myomectomy, presence of placenta previa, past history of post-partum hemorrhage, fetal macrosomia and fetal malformations associated with polyhydramnios were included in this study. Presence of hypertension, eclampsia, cardiac, renal or liver diseases, epilepsy, general anaesthesia, as well as women with history of hypersensitivity to Carbetocin according to the British National Formulary or patients unwilling to give consent for this study were excluded from this study.

**Randomization and Blinding:** Randomization was performed according to computer generated simple random sampling method. Single binding was performed without knowing the drugs to the participants.

**Study Procedure:** Postpartum haemorrhage was defined as any amount of bleeding from or into the genital tract following birth of the baby up to the end of puerperium, which adversely affects the general condition of the patient evidenced by rise in pulse rate and falling blood pressure, is called postpartum haemorrhage. An Uterotonic was an agent used to induce contraction or greater tonicity of the uterus. Detail history was taken by structured questionnaire. At first the pregnant women were selected according to inclusion and exclusion criteria. Then detailed informed written consent was taken from each patient. The drug that was introduced during caesarean section was allocated by coin tossing.

**Follow up and Outcomes Measures:** Then the patients were monitored per operatively and post operatively. All the information was recorded in data collection sheet. Main outcome variables were Estimated blood loss (Visual estimation, number of used mops, amount of aspirated blood), difference between preoperative and post-operative haemoglobin level, vital sign during and after operation, Uterine tone, Incidence of blood transfusion and Adverse effects like nausea, vomiting, headache and so on.

**Statistical Analysis:** Statistical analyses were carried out by using the Statistical Package for Social Sciences version 20.0 for Windows (SPSS Inc., Chicago, Illinois, USA). The mean values were calculated for continuous variables. The quantitative observations were indicated by frequencies and percentages. Chi-Square test with Yates correction was used to analyze the categorical variables, shown with cross tabulation. Student t-test was used for continuous variables. P values $<0.05$ was considered as statistically significant.

**Ethical implications:** Ethical clearance was obtained from Institutional Review Board of BSMMU. Written informed consent was obtained from the patient or from her legal guardian. Patient confidentiality was strictly maintained. No name, address or contact details of the patient was divulged.

**Results**

A total number of 96 pregnant women were recruited for this study of which 48 cases were enrolled in group I and the rest of 48 case were enrolled in group II. The mean age with SD of the group I and group II were 24.4±4.7 years and 24.7±3.7 years. The difference between the mean age of group I and group II were not statistically significant (Table 1).

Table 1: Distribution of the study patients by demographic variable (n=96)

| Age Group | Group I | Group II | P value |
|---|---|---|---|
| ≤20 Years | 13(27.1%) | 9(18.8%) | |
| 21 to 30 Years | 31(64.6%) | 35(72.9%) | |
| More than 30 Years | 4(8.3%) | 4(8.3%) | |
| **Total** | **48(100.0%)** | **48(100.0%)** | |
| Mean±SD | 24.4±4.7 | 24.7±3.7 | 0.729 |
| Range (min, max) | 19, 39 | 19, 33 | |

Before administration of drug, mean systolic blood pressure was found 115.6±5.8 mmHg in group I and 114.8±7.8 mmHg in group II. At 1 minute after caesarean section, mean systolic blood pressure was found 102.5±6.7 mmHg in group I and 101.7±7.1 mmHg in group II. At 30 minutes after caesarean section, mean systolic blood pressure was found 105.9±7.4 mmHg in group I and 107.8±9.9 mmHg in group II. At 12 hours after caesarean section, mean systolic blood pressure was found 116.2±5.9 mmHg in group I and 114.4±8.2 mmHg in group II. At 24 hours after caesarean section, mean systolic blood pressure was found 116.9±5.8 mmHg in group I and 113.9±8.8 mmHg in group II. The mean difference were not statistically significant (p>0.05) between two groups (Table 2).

Table 2: Systolic Blood Pressure in Different Follow Up (Mean ±SD)

| Systolic Blood Pressure (mmHg) | Group I | Group II | P value |
|---|---|---|---|
| Before admission of drug | 115.6±5.8 | 114.8±7.8 | 0.570 |
| Range (min, max) | 100, 130 | 100, 128 | |
| At 1 minute after caesarean section | 102.5±6.7 | 101.7±7.1 | 0.572 |
| Range (min, max) | 85, 115 | 90, 112 | |
| At 30 minutes after caesarean section | 105.9±7.4 | 107.8±9.9 | 0.289 |
| Range (min, max) | 90, 115 | 90, 120 | |
| At 12 hrs after caesarean section | 116.2±5.9 | 114.4±9.2 | 0.257 |
| Range (min, max) | 95, 120 | 90, 120 | |
| At 24 hrs after caesarean section | 116.9±5.8 | 113.9±8.8 | 0.052 |
| Range (min, max) | 100, 130 | 90, 130 | |

ns= not significant; P value reached from unpaired t-test

Before administration of drug, mean diastolic blood pressure was found 75.8±7.9 mmHg in group I and 76.9±9.9 mmHg in group II. At 1 minute after caesarean section, mean diastolic blood pressure was found 67.1±7.6 mmHg in group I and 67.9±7.9 mmHg in group II. At 30 minutes after caesarean section, mean diastolic blood pressure was found 75.4±9.1 mmHg in group I and 73.1±9.9 mmHg in group II. At 12 hrs after caesarean section, mean diastolic blood pressure was found 74.1±8.0 mmHg in group I and 72.7±8.2 mmHg in group II. At 24 hours after caesarean section, mean diastolic blood pressure was found 76.7±6.6 mmHg in group I and 76.1±7.2 mmHg in group II. The mean difference was not statistically significant (p>0.05) between two groups (Table 3).

Table 3: Diastolic Blood Pressure in Different Follow-Up (Mean±SD)

| Diastolic Blood Pressure (mmHg) | Group I | Group II | P value |
|---|---|---|---|
| Before admission of drug | 75.8±7.9 | 76.9±9.9 | 0.549 |
| Range (min, max) | 60, 85 | 60, 90 | |
| At 1 minute after caesarean section | 67.1±7.6 | 67.9±7.9 | 0.614 |
| Range (min, max) | 55, 85 | 60, 90 | |
| At 30 minutes after caesarean section | 75.4±9.1 | 73.1±9.9 | 0.239 |
| Range (min, max) | 60, 85 | 60, 90 | |
| At 12 hrs after caesarean section | 74.1±8.0 | 72.7±8.2 | 0.399 |
| Range (min, max) | 60, 85 | 60, 90 | |
| At 24 hrs after caesarean section | 76.7±6.6 | 76.1±7.2 | 0.259 |
| Range (min, max) | 60, 90 | 60, 90 | |

ns= not significant; P value reached from unpaired t-test

Before administration of drug, mean maternal blood loss was found 376.4±110.4 ml in group I and 439.4±199.9 ml in group II. At 30 minutes after caesarean section, mean maternal blood loss was found

Table 4: Maternal Blood Loss in Different Follow Up (Mean ±SD)

| Maternal Blood Loss (ml) | Group I | Group II | P value |
|---|---|---|---|
| Before administration of drug | 376.4±110.4 | 439.4±199.9 | 0.059 |
| Range (min, max) | 260, 660 | 310, 890 | |
| At 30 minutes after caesarean section | 397.2±114.3 | 470.1±240.1 | 0.060 |
| Range (min, max) | 280, 710 | 340, 1020 | |
| At 12 hours after caesarean section | 432.2±125.1 | 510.1±254.1 | 0.060 |
| Range (min, max) | 300, 790 | 350, 1190 | |
| At 24 hours after caesarean section | 468.2±121.9 | 532.6±243.0 | 0.104 |
| Range (min, max) | 290, 810 | 380, 1200 | |

ns= not significant; P value reached from unpaired t-test

397.2±114.3 ml in group I and 470.1±240.1 ml in group II. At 12 hours after caesarean section, mean maternal blood loss was found 432.2±125.1 ml in group I and 510.1±254.1 ml in group II. At 24 hours after caesarean section, mean maternal blood loss was found 468.2±121.9 ml in group I and 532.6±243.0 ml in group II. The mean difference was not statistically significant between two groups (p>0.05) (Table 4).

**Discussion**

This randomized controlled trial study was carried out with an aim to compare the haemodynamic effects of carbetocin and oxytocin and to compare the adverse effects like nausea, vomiting, headache of these two drugs as well as to compare the need of additional uterotonic drugs for the control of post-partum hemorrhage. A total of 96 patients admitted in Gynaecology and Obstetrics department of Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh for delivery between July to December 2015 were included in this study. Among them 48 cases treated with Carbetocin was considered as group I and rest 48 treated with Oxytocin was considered as group II. Patient with risk factors for primary post-partum haemorrhage such as: multiple pregnancy, one or more previous caesarean section, presence of uterine fibroids, previous myomectomy, presence of placenta previa, past history of post-partum hemorrhage, fetal macrosomia and fetal malformations associated with polyhydramnios were enrolled in this study. Presence of hypertension, eclampsia, cardiac, renal or liver diseases, epilepsy, general anaesthesia, as well as women with history of hypersensitivity to Carbetocin according to the Br National Formulary and patients unwilling to give consent were excluded from the study. The present study findings were discussed and compared with previously published relevant studies.

In this present study it was observed mean age was found 24.4±4.7 years in group I and 24.7±3.7 years in group II. The mean marital age was found 4.4±4.0 years in group I and 4.1±3.9 years in group II. The difference was not statistically significant (p>0.05) between two groups. Reyes et al.[20] found the mean age was 26.52±9.12 years in Carbetocin group and 26.78±8.39 years in Oxytocin group. The difference was not statistically significant (p>0.05) between two groups, which is closely resembled with the present study. On the other hand, Al Anwar et al[11] had observed the mean age was 33.0±4.6 years in carbetocin group and 33.3±4.6 years in oxytocin group. Similarly, Magann et al[12] observed at baseline, there was no significant difference between carbetocin and oxytocin in terms of mean age, where mean was 30 years and 31 years respectively. The higher mean age may be due to geographical variations, racial, ethnic differences, genetic causes, different lifestyle and increased life expectancy may have significant influence in their study patients[9].

In this study it was observed that before administration of drug, mean systolic blood pressure was found 115.6±5.8 mmHg in group I and 114.8±7.8 mmHg in group II. At 1 minute after caesarean section, mean systolic blood pressure was found 102.5±6.7 mmHg in group I and 101.7±7.1 mmHg in group II. At 30 minutes after caesarean section, mean systolic blood pressure was found 105.9±7.4 mmHg in group I and 107.8±9.9 mmHg in group II. At 12 hours after caesarean section, mean systolic blood pressure was found 116.2±5.9 mmHg in group I and 114.4±8.2 mmHg in group II. At 24 hours after caesarean section, mean systolic blood pressure was found 116.9±5.8 mmHg in group I and 113.9±8.8 mmHg in group II. The mean difference was not statistically significant between two groups (p>0.05).

In this present study it was observed that before administration of drug, mean diastolic blood pressure was found 75.8±7.9 mmHg in group I and 76.9±9.9 mmHg in group II. At 1 minute after caesarean section, mean diastolic blood pressure was 36 found 67.1±7.6 mmHg in group I and 67.9±7.9 mmHg in group II. At 30 minutes after caesarean section, mean diastolic blood pressure was found 75.4±9.1 mmHg in group I and 73.1±9.9 mmHg in group II. At 12 hours after caesarean section, mean diastolic blood pressure was found 74.1±8.0 mmHg in group I and 72.7±8.2 mmHg in group II. At 24 hours after caesarean section, mean diastolic blood pressure was found 76.7±6.6 mmHg in group I and 76.1±7.2 mmHg in group II. The mean difference was not statistically significant (p>0.05) between two groups. Magann et al[12] found systolic and diastolic BP were not significantly different immediate post intervention between the two groups, immediate post-operative and while recovering between group were also not significant. Butwick et al[13] obtained that systolic blood pressure was lower in the oxytocin group at the 5th minute after administration, at uterine closure time, at 12 hours postoperatively. Al Anwar et al[11] showed there were significant changes with time for each of systolic blood pressure and diastolic blood

pressure respectively but no significant main effect of group, which are similar with the current study.

In this current study it was observed that before administration of drug; mean maternal blood loss was found 376.4±110.4 mL in group I and 439.4±199.9 mL in group II. At 30 minutes after caesarean section, mean maternal blood loss was found 397.2±114.3 mL in group I and 470.1±240.1 mL in group II. At 12 hours after caesarean section, mean maternal blood loss was found 432.2±125.1 mL in group I and 510.1±254.1 ml in group II. At 24 hours after caesarean section, mean maternal blood loss was found 468.2±121.9 ml in group I and 532.6±243.0 ml in group II. Maternal blood loss was lower in group I but the mean difference was not statistically significant ($p>0.05$) between two groups. Patel and Radeos[14] showed the proportion of subjects with blood loss [500 ml (carbetocin 28.8%, oxytocin 26.9%) and [1,000 ml (carbetocin 7.8%, oxytocin 8.4%) was also comparable for both groups. In another study Butwick et al[13] reported that there was no significant difference in the amount of estimated blood loss and in the incidence of primary post-partum haemorrhage (>1000 mL) in both groups. In fact, the investigators did not demonstrate any difference in the amount of blood loss after caesarean section and in the drop of haemoglobin level within 2 hours and 24 hours, but we showed in the oxytocin group a significant need (23.5%) of additional uterotonic agents. Patel and Radeos[14] study showed that carbetocin could induce maternal tachycardia and facial flushing, but none in our carbetocin subgroup had these adverse events.

## Conclusion

In conclusion before administration of drug, at 1 minute after caesarean section, at 30 minutes after caesarean section, at 12 hours after caesarean section and at 24 hours after caesarean section the mean difference of systolic blood pressure in group I and in group II is varied. This mean difference is not statistically significant between two groups. Again, at 1 minute, at 30 minutes, at 12 hours and at 24 hours, the mean difference of diastolic blood pressure in group I and in group II is varied. This mean difference is not statistically significant between two groups. Further large scale study should be carried out.

**Acknowledgements**
None

**Conflict of interest:** Other than technical and logistic support from the scientific partner the investigators did not have any conflict of interest in any means.

**Funding agency:** This research project was not funded by any organization.

**Contribution to authors:** Choudhury FH, Ahmed S, Tanzin ST conceived and designed the study, analyzed the data, interpreted the results, and wrote up the draft manuscript. Rahman S, Fatema N, Khatun K involved in the manuscript review and editing. All authors read and approved the final manuscript.

**Data Availability**
Any inquiries regarding supporting data availability of this study should be directed to the corresponding author and are available from the corresponding author on reasonable request.

**Ethics Approval and Consent to Participate**
Ethical approval for the study was obtained from the Institutional Review Board. As this was a prospective study the written informed consent was obtained from all study participants. All methods were performed in accordance with the relevant guidelines and regulations.

**How to cite this article:** Choudhury FH, Ahmed S, Tanzin ST, Rahman S, Fatema N, Khatun K. Effects of Carbetocin and Oxytocin on Haemodynamic among Women with Post-Partum Hemorrhage after Caesarean Section: A Single Blind Parallel Arm Randomized Controlled Trial. J Natl Inst Neurosci Bangladesh, 2023;9(2):141-146



**ORCID:**
Farhana Haque Choudhury- https://orcid.org/0009-0006-7282-7439
Shahnaz Ahmed- https://orcid.org/0000-0002-5197-4249
Syeda Tania Tanzin - https://orcid.org/0009-0001-2671-4728
Silvia Rahman- https://orcid.org/0009-0009-5927-2661
Naheed Fatema- https://orcid.org/0009-0004-3994-8410
Kashifa Khatun- https://orcid.org/0009-0003-8832-1713

**Article Info**
Received on: 7 April 2023
Accepted on: 24 May 2023
Published on: 1 July 2023

## References

1. Newsome J, Martin JG, Bercu Z, Shah J, Shekhani H, Peters G. Postpartum hemorrhage. Techniques in vascular and interventional radiology. 2017 Dec 1;20(4):266-73
2. Oyelese Y, Ananth CV. Postpartum hemorrhage: epidemiology, risk factors, and causes. Clinical obstetrics and gynecology. 2010 Mar 1;53(1):147-56
3. Ashwal E, Bergel Bson R, Aviram A, Hadar E, Yogev Y, Hiersch L. Risk factors for postpartum hemorrhage following cesarean delivery. The Journal of Maternal-Fetal & Neonatal Medicine. 2022 Sep 17;35(18):3626-30
4. Gong J, Chen Z, Zhang Y, Liu YY, Pu JC, Xiong CY, Gui SW, He XL, Wang HL, Zhong XG. Risk-factor model for postpartum hemorrhage after cesarean delivery: a retrospective study based on 3498 patients. Scientific Reports. 2022 Dec 21;12(1):22100.

5. Borruto F, Treisser A, Comparetto C. Utilization of carbetocin for prevention of postpartum hemorrhage after cesarean section: a randomized clinical trial. Archives of gynecology and obstetrics. 2009 Nov;280:707-12
6. Ortiz SR, Aguado RP, Hernandez RS, Castorena M. Carbetocin versus oxytocin for prevention of postpartum haemorrhage: a randomised controlled trial. The Lancet. 2014;383:51
7. Larciprete G, Montagnoli C, Frigo M, Panetta V, Todde C, Zuppani B, Centonze C, Bompiani A, Malandrenis I, Cirese A, Valensise H. Carbetocin versus oxytocin in caesarean section with high risk of post-partum haemorrhage. Journal of prenatal medicine. 2013 Jan;7(1):12.
8. Mannaerts D, Van der Veeken L, Coppejans H, Jacquemyn Y. Adverse effects of carbetocin versus oxytocin in the prevention of postpartum haemorrhage after caesarean section: a randomized controlled trial. Journal of pregnancy. 2018 Jan 2;2018
9. Maged AM, Hassan AM, Shehata NA. Carbetocin versus oxytocin in the management of atonic post-partum haemorrhage (PPH) after vaginal delivery: a randomized controlled trial. Archives of gynecology and obstetrics. 2016 May;293:993-9
10. Srinivas EJ. Carbetocin versus Oxytocin in the Prevention of Postpartum Haemorrhage after Caesarean Section.
11. 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 Oct 1;89(1):5063-8
12. Magann EF, Evans S, Hutchinson M, Collins R, Lanneau G, Morrison JC. Postpartum hemorrhage after cesarean delivery: an analysis of risk factors. Southern medical journal. 2005 Jul 1;98(7):681-6
13. Butwick AJ, Ramachandran B, Hegde P, Riley ET, El-Sayed YY, Nelson LM. Risk factors for severe postpartum hemorrhage after cesarean delivery: case-control studies. Anesthesia and analgesia. 2017 Aug;125(2):523.
14. Patel N, Radeos M. Severe delayed postpartum hemorrhage after cesarean section. The Journal of emergency medicine. 2018 Sep 1;55(3):408-10