Journal of Current and Advance Medical Research
July 2023, Vol. 10, No. 2, pp. 53-59
http://www.banglajol.info/index.php/JCAMR
ISSN (Print) 2313-447X
ISSN (Online) 2413-323X
NLM Catalog ID 101673828
DOI: https://doi.org/10.3329/jcamr.v10i2.71714

ORIGINAL ARTICLE

Compare the Need of Additional Uterotonic Drugs for the Control of Post-Partum Hemorrhage after Caesarean Section

Farhana Haque Choudhury[1], Shahnaz Ahmed[2], Sufia Khatun Sumi[3], Silvia Rahman[4]

[1]Assistant Professor, Department of Obstetrics & Gynaecology, Monno Medical College, Manikganj, Bangladesh; [2]Assistant Professor Department of Gynaecology and Obstetrics, Sir Salimullah Medical College, Mitford, Dhaka, Bangladesh; [3]Junior consultant (Pediatrics), Department of Paediatric Neurology, National Institute of Neurosciences & Hospital, Dhaka, Bangladesh; [4]Assistant Professor, Department of Obstetrics & Gynaecology, Monno Medical College and Hospital, Manikganj, Bangladesh

Abstract

Background: Management of Post-Partum hemorrhage is very crucial among women after Caesarean Section. **Objective:** The purpose of the present study was to compare the need of additional uterotonic drugs for the control of post-partum hemorrhage among women 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 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. Before administration of drug, 44(91.7%) patients had well contracted uterus in group I and 41(85.4%) in group II. At 30 minutes after caesarean section, 48(100.0%) patients had well contracted uterine tone in group I and 47(97.9%) in group II. At 12 and 24 hours after caesarean section, 48(100.0%) patients had well contracted uterine tone in group I and group II respectively. The difference was not statistically significant ($p>0.05$) between two groups. Four (8.3%) patients need additional utero tonic in group I and 7(14.6%) in group II. The difference was not statistically significant ($p>0.05$) between two groups. In primary PPH of the study patients, it was observed that 2(4.2%) patients had primary PPH in group I and 6(12.5%) in group II. The difference was not statistically significant ($p>0.05$) between two groups. **Conclusion:** In conclusion, additional uterotonic drugs are needed for the control of post-partum hemorrhage among women after Caesarean Section. [*Journal of Current and Advance Medical Research, July 2023;10(2):53-59*]

Keywords: Additional drug; uterotonic drugs; post-partum hemorrhage; caesarean section

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

Introduction

Oxytocin is relatively safe when used at recommended doses, and side effects are uncommon[1]. 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[2-3]. It is an effective drug for the control of PPH, but the disadvantage is its short half-life of 4 to 10 min, regularly requiring a continuous intravenous infusion or repeated intramuscular injections[4].

Carbetocin is stable for 2 years from date of manufacture when stored at 2 to 8^0 C. Depending upon the manufacturer and regulatory agency specification, oxytocin products should be stored at either controlled room temperature (25^0 C or less) or refrigerated storage (2^0 to 8^0 C) in order to ensure quality and comply with the labeled storage conditions. A single dose of carbetocin has been hypothesized to act as a 16 hours' intravenous oxytocin infusion regarding the increase in uterine tone and the reduction of the risk of PPH in elective caesarean section[5].

Several data of literature[6-8] suggest that prophylactic administration of carbetocin may be a good alternative to oxytocin to prevent post-partum haemorrhage, but which uterotonic agent is ideal for prophylactic use is being debated. Nonetheless, primary prevention of a post-partum haemorrhage begins with the assessment of identifiable risk factors.

The purpose of the present study was to compare the need of additional uterotonic drugs for the control of post-partum hemorrhage among women after Caesarean Section.

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 PPH, 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 Br 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.

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	13(27.1%)	9(18.8%)	
21-30	31(64.6%)	35(72.9%)	
>30	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	19, 39	19, 33	

Majority (85.4%) patients gestational age was between 38 to 40 weeks in group I and 43(89.6%) in group II. The mean gestational age was found 40.0±1.7 weeks in group I and 40.1±1.6 weeks in group II. The mean gestational age was not statistically significant (p>0.05) between two groups (Table 2).

Table 2: Distribution of the Study Patients by Gestational Age (n=96)

Gestational Age	Group I	Group II	P value
Term	41(85.4%)	43(89.6%)	
Post term	7(14.6%)	5(10.4%)	
Total	**48(100.0%)**	**48(100.0%)**	
Mean±SD	40.0±1.7	40.1±1.6	0.767
Range	38-42	38-42	

ns= not significant; P value reached from unpaired t-test;
Term= 38 to 42 Weeks; Post term= More than 42 Weeks

Before administration of drug, 44(91.7%) patients had well contracted uterus in group I and 41(85.4%) in group II. At 30 minutes after caesarean section, 48(100.0%) patients had well contracted uterine tone in group I and 47(97.9%) in group II. At 12 and 24 hours after caesarean section, 48(100.0%) patients had well contracted uterine tone in group I and group II respectively. The difference was not statistically significant (p>0.05) between two groups (Table 3).

Table 3: Uterine Tone in Different Follow Up (n=96)

Uterine Tone	Group I	Group II	P value
Before administration of drug			
Well contracted	44(91.7%)	41(85.4%)	0.336
Flabby	4(8.3%)	7(14.6%)	
At 30 minutes after caesarean section			
Well contracted	48(100.0%)	47(97.9%)	0.500
Flabby	0(0.0%)	1(2.1%)	
At 12 hours after caesarean section			
Well contracted	48(100.0%)	48(100.0%)	-
Flabby	0(0.0%)	0(0.0%)	
At 24 hours after caesarean section			
Well contracted	48(100.0%)	48(100.0%)	-
Flabby	0(0.0%)	0(0.0%)	

ns= not significant; P value reached from chi square test

Four (8.3%) patients need additional utero tonic in group I and 7(14.6%) in group II. The difference was not statistically significant (p>0.05) between two groups (Table 4).

Table 4: Distribution of the Study Patients by need for Additional Utero Tonic (n=96)

Additional Utero Tonic	Group I	Group II	P value
Needed	4(8.3%)	7(14.6%)	0.336
Not Needed	44(91.7%)	41(85.4%)	
Total	**48(100.0%)**	**48(100.0%)**	
If yes			
Inj ergometrine	4(8.3%)	7(14.6%)	
Tab misoprostol	2(4.2%)	4(8.3%)	
Balloon catheterization	0(0.0%)	1(2.1%)	

P value reached from chi square test

In primary PPH of the study patients, it was observed that 2(4.2%) patients had primary PPH in group I and 6(12.5%) in group II. The difference was not statistically significant (p>0.05) between two groups (Table 5).

Table 5: Distribution of the Study Patients by Primary PPH (n=96)

Primary PPH	Group-I	Group-II	P value
Yes	2(4.2%)	6(12.5%)	0.134
No	46(95.8%)	42(87.5%)	
Total	**48(100.0%)**	**48(100.0%)**	

P value reached from chi square test

Discussion

A total of 96 patients admitted in Gynaecology and Obstetrics department of Bangabandhu Sheikh Mujib Medical University, Dhaka, for delivery between July 2015 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 PPH, 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 British 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[7] 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, Holleboom et al[8] had observed the mean age was 33.0±4.6 years in carbetocin group and 33.3±4.6 years in oxytocin group.

Similarly, Uy et al[9] 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[10].

In this current study it was observed that majority (85.4%) patients were gestational age between 38 to 40 weeks in group I and 43(89.6%) cases in group II. The mean gestational age was found 40.0±1.7 weeks in group I and 40.1±1.6 weeks in group II. The mean gestational age was not statistically significant (p>0.05) between two groups, which is consistent with Uy et al[9] study, where the investigators found there was no significant difference between carbetocin and oxytocin in terms of mean gestational weeks (P>0.05). Holleboom et al[8] found that the mean gestational age was found 38.9±1.0 weeks in Carbetocin group and 38.8±1.0 weeks in group Oxytocin group. The difference was not statistically significant (p>0.05) between two groups, which is consistent with the present study. Similarly, Larciprete et al[11] and Reyes et al[7] had observed the identical mean gestational age of their studied patients, thus support the present study.

The uterine tone like standardized as very good, good, sufficient, atony, uterine position with respect to the umbilical point, UP were monitored 2 hours, 12 hours and 24 hours after delivery by the same midwife. In this series it was observed that before administration of drug, 44(91.7%) patients had well contracted uterine tone in group I and 41(85.4%) in group II. At 30 minutes after caesarean section, 48(100.0%) patients had well contracted uterine tone in group I and 47(97.9%) in group II. At 12 and 24 hours after caesarean section, 48(100.0%) patients had well contracted uterine tone in group I and group II respectively. The difference was not statistically significant (p>0.05) between two groups. Holleboom et al[8] mentioned in their report that the uterine tone remained well contracted in both the groups even after 24 hours after caesarean section. After carbetocin, the need for uterine massage was 3.4%. The fundus uterus was at or below the umbilicus in 92.9% of the patients and uterine tone was firm in 97.1% cases. Physician's subjective experience with carbetocin was rated as good in 92.0% of the cases[8]. In another study, Larciprete et al[11] observed there was a significant difference in the uterine tone. The uterine contractility was better in the carbetocin group at 2, 12 and 24 hours after caesarean section, and the difference was statistically significant at 24 hours (p<0.05). Uy et al[9] observed a statistically significant higher proportion of uteri in the carbetocin group were well contracted after the delivery of the neonate (23.0% versus 0.0%,

P<0.05); immediately after the intervention was given (77.0% versus 8.0%, P<0.05); immediate postoperative (60.0% versus 26.0%, P<0.05) and 24 hours after post-operative (77.0% versus 8.0%, P<0.05). A statistically significant higher proportion of uteri in the carbetocin group were below the umbilicus immediately after the intervention (66.0% versus 29.0%, P<0.05); and immediate post-operative (97.0% versus 57.0%, P<0.05). No significant difference immediately after the neonate was delivered (P>0.05) and at 24 hours post-operative (P>0.05).

In this study it was observed that 4 (8.3%) patients need for additional uterotonic in group I and 7(14.6%) in group II. The difference was not statistically significant (p>0.05) between two groups. Uy et al[9] found a statistically lower proportion of women in the carbetocin group required additional uterotonic agents post-operatively, that was 5.7% and 34.3% respectively, which is comparable with the current study. In another study Reyes et al[7] found need for additional uterotonic was 3.4% in oxytocin group, which differ with the current study. In this present study it was observed that before administration of drug, mean urine output was found 59.6±34.1 ml in group I and 51.1±34.8 ml in group II. At 30 minutes after caesarean section, mean urine output was found 260.3±75.6 ml in group I and 254.1±70.8 ml in group II. At 2 hours after caesarean section, mean urine output was found 630.1±124.9 ml in group I and 598.6±90.1 ml in group II. At 12 hours after caesarean section, mean urine output was found 1445.9±256.2 ml in group I and 1380.2±240.1 ml in group II. The mean difference was not statistically significant (p>0.05) between two groups.

In Larciprete et al[11] study, all patients had the Foley catheter and urobag in situ for 24 hours after caesarean section and the amount of urine was monitored 2 hours and 12 hours after delivery by the midwife. Their study had no external funding source. No author had any potential relationships that may pose conflict of interest. In this current study it was observed that 2(4.2%) patients need blood transfusion in group I and 5(10.4%) in group II. The difference was not statistically significant (p>0.05) between two groups, which is similar with Reyes et al[7] study, where they found 10.3% need for blood transfusions in oxytocin group. Similarly, Uy et al[9] found that the two groups did not significantly differ in terms of blood transfusion requirements (P>0.05). In another study Holleboom et al[8] administrated blood transfusions in 2.2% of the cases in the carbetocin group and 2.7% in the oxytocin group (p>0.05). Reyes et al[7] found that 3(10.3%) patients needed blood transfusion in Oxytocin group but not needed in Carbetocin group. The difference was not statistically significant (p>0.05) between two groups. In another study Attilakos et al[12] observed that blood transfusion was needed 4(2.1%) in carbetocin group and 39 5(2.6%) in oxytocin group. The difference was not statistically significant (p>0.05) between two groups, which are comparable with the current study.

In this study it was observed that 1(2.1%) patients had nausea in group I and 4(8.3%) in group II. Two (4.2%) patients had vomiting in group I and 5(10.4%) in group II. One (2.1%) patients had headache in group I and 4(8.3%) in group II. Four (8.3%) patients had risen of temperature in group I and 5(10.4%) in group II. Side effects were comparatively less in group I but the difference were not statistically significant (p>0.05) between two groups. Holleboom et al[8] found 2 subjects experienced at least one AE with a moderate degree of severity and four subjects experienced a mild AE after carbetocin like nausea, headache, abdominal pain. In those six cases, the relationship with carbetocin was rated as unlikely or none. In the oxytocin group a total of six AEs were experienced by six subjects. Two subjects experienced moderate AEs (fluxus, atony) unrelated to oxytocin. Four subjects experienced mild AEs like hypotension or fluxus, rated as having no, unlike or possible relationship with oxytocin. In another study Reyes et al[7] obtained that nausea and vomiting was found 3.6% in carbetocin group and but not found in Oxytocin group. Fever was found 3.4% in Oxytocin group but not found in carbetocin group. The difference was not statistically significant (p>0.05) between two groups. There weren't any recorded important adverse effects in both study groups, instead nausea and vomiting was observed with similar frequency in both study groups also observed by Larciprete et al[11] and Attilakos et al[12] The above findings are consistent with the current study.

In this present study it was observed that 2(4.2%) patients had primary PPH in group I and 6(12.5%) in group II. PPH was comparatively higher in group II, but the difference was not statistically significant (p>0.05) between two groups. Holleboom et al[8] 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 Larciprete et al[11] 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 40 caesarean section and in the drop of hemoglobin level within 2 hours and 24 hours, but we showed in the oxytocin group a significant need (23.5%) of additional uterotonic agents. Previous studies have shown that carbetocin could induce maternal tachycardia and facial flushing[13-14] but none in our carbetocin subgroup had these adverse events.

Conclusion

In conclusion, primary PPH was less in patients treated with carbetocin than patients treated with oxytocin group. Uterine tone was almost similar between two groups. Maternal blood loss, need for additional utero tonic and blood transfusion were less in carbetocin group. On the other hand, side effects and primary PPH were lesser observed in carbetocin group. On the other hand, carbetocin has single dose administration with longer half-life, long duration of action and lesser water retention property. Therefore, it can be concluded that a single injection of carbetocin is more convenient to use than a continuous infusion of oxytocin to maintain adequate uterine tone, with a similar safety profile for the prevention of postpartum haemorrhage.

Acknowledgements
None

Conflict of Interest
The authors have no conflicts of interest to disclose

Financial Disclosure and Funding Sources
This study has been performed without any funding from outside else.

Contributions to authors: Choudhury FH, Ahmed S prepared the manuscript from protocol preparation upto report writing. Sumi SK, Rahman S have revised the manuscript. All authors involved from protocol preparation up to manuscript writing & revision.

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.

Cite this article as: Choudhury FH, Ahmed S, Sumi SK, Rahman S. Compare the Need of Additional Uterotonic Drugs for the Control of Post-Partum Hemorrhage after Caesarean Section. J Curr Adv Med Res 2023;10(2):53-59

ORCID
Farhana Haque Choudhury: https://orcid.org/0009-0006-7282-7439
Shahnaz Ahmed: https://orcid.org/0000-0002-5197-4249
Sufia Khatun Sumi: https://orcid.org/0009-0004-5975-5878
Silvia Rahman: https://orcid.org/0009-0009-5927-2661

Article Info
Received: 7 March 2023
Accepted: 3 April 2023
Published: 1 July 2023

References

1. Pinder AJ, Dresner M, Calow C, Shorten GD, O'riordan J, Johnson R. Haemodynamic changes caused by oxytocin during caesarean section under spinal anaesthesia. International journal of obstetric anesthesia. 2002;11(3):156-9
2. Thomas JS, Koh SH, Cooper GM. Haemodynamic effects of oxytocin given as iv bolus or infusion on women undergoing Caesarean section. BJA: British Journal of Anaesthesia. 2007;98(1):116-9
3. Svanström MC, Biber B, Hanes M, Johansson G, Näslund U, Bålfors EM. Signs of myocardial ischaemia after injection of oxytocin: a randomized double-blind comparison of oxytocin and methylergometrine during Caesarean section. British journal of anaesthesia. 2008;100(5):683-9
4. Mousa HA, Walkinshaw S. Major postpartum haemorrhage. Current opinion in Obstetrics and Gynecology. 2001;13(6):595-603.
5. Boucher M, Horbay GL, Griffin P, Deschamps Y, Desjardins C, Schulz M, Wassenaar W. Double-blind, randomized comparison of the effect of carbetocin and oxytocin on intraoperative blood loss and uterine tone of patients undergoing cesarean section. Journal of perinatology: official journal of the California Perinatal Association. 1998;18(3):202-7.
6. 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;280:707-12.
7. Reyes OA, Gonzalez GM. Carbetocin versus oxytocin for prevention of postpartum hemorrhage in patients with severe preeclampsia: a double-blind randomized controlled trial. Journal of Obstetrics and Gynaecology Canada. 2011;33(11):1099-104
8. Holleboom CA, Van Eyck J, Koenen SV, Kreuwel IA, Bergwerff F, Creutzberg EC, et al. Carbetocin in comparison with oxytocin in several dosing regimens for the prevention of uterine atony after elective caesarean section in the Netherlands. Archives of gynecology and obstetrics. 2013;287:1111-7

9. Uy DL, Pangilian NC, Ricero-Cabingue C. Carbetocin versus oxytocin for the prevention of postpartum hemorrhage following elective cesarean section: Rizal Medical Center experience. Philipp J Obstet Gynecol. 2013;37:71-9.
10. Firouzbakht M, Kiapour A, Omidvar S. Prevention of post-partum hemorrhage by rectal Misoprostol: A randomized clinical trial. Journal of natural science, biology, and medicine. 2013;4(1):134.
11. Larciprete G, Montagnoli C, Frigo M, Panetta V, Todde C, Zuppani B, et al. Carbetocin versus oxytocin in caesarean section with high risk of post-partum haemorrhage. Journal of prenatal medicine. 2013;7(1):12
12. Attilakos G, Psaroudakis D, Ash J, Buchanan R, Winter C, Donald F, Hunt LP, Draycott T. Carbetocin versus oxytocin for the prevention of postpartum haemorrhage following caesarean section: the results of a double-blind randomised trial. BJOG: An International Journal of Obstetrics & Gynaecology. 2010;117(8):929-36.
13. Sweeney G, Holbrook AM, Levine M, Yip M, Alfredsson K, Cappi S, et al. Pharmacokinetics of carbetocin, a long-acting oxytocin analogue, in nonpregnant women. Current Therapeutic Research-Clinical and Experimental. 1990;47(3):528-40.
14. Van Dongen PW, Verbruggen MM, De Groot AN, Van Roosmalen J, Sporken JM, Schulz M. Ascending dose tolerance study of intramuscular carbetocin administered after normal vaginal birth. European Journal of Obstetrics & Gynecology and Reproductive Biology. 1998;77(2):181-7.