

Clinical Outcomes of Carbetocin and Oxytocin in Preventing Postpartum Hemorrhage: An Observational Study

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ABSTRACT

Background: Postpartum hemorrhage (PPH) is one of the leading causes of maternal morbidity and mortality worldwide. Effective uterotonic agents play a crucial role in reducing blood loss during the third stage of labor. Carbetocin, a long-acting synthetic analogue of oxytocin, has been proposed as an alternative to conventional oxytocin for the prevention of PPH.

Objective: To compare the clinical outcomes of carbetocin and oxytocin in the prevention of postpartum hemorrhage among women undergoing vaginal delivery.

Methods: A prospective comparative observational study was conducted among 94 pregnant women undergoing vaginal delivery. Participants were divided equally into carbetocin (n=47) and oxytocin (n=47) groups. Estimated blood loss was measured using the gravimetric method. Hemoglobin (Hb) and hematocrit (Hct) levels before and after delivery, requirement for additional uterotonics, and adverse drug reactions (ADRs) were assessed.

Results: The mean estimated blood loss was significantly lower in the carbetocin group (360.87 ± 82.83 mL) compared with the oxytocin group (416.19 ± 72.90 mL). The mean reduction in Hb and Hct levels was lower among women receiving carbetocin. Additional uterotonic therapy was required in 17% of women in the carbetocin group compared with 40.4% in the oxytocin group. ADR incidence was comparable between groups. Conclusion: Carbetocin demonstrated superior efficacy in reducing postpartum blood loss and the need for additional uterotonic therapy while maintaining a comparable safety profile to oxytocin.

Keywords: Postpartum hemorrhage, Carbetocin, Oxytocin, Uterotonics, Vaginal delivery.

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INTRODUCTION

Postpartum hemorrhage (PPH) remains a major public health concern and is one of the leading causes of maternal morbidity and mortality worldwide. The World Health Organization defines PPH as blood loss of 500 mL or more within the first 24 hours after vaginal delivery. Despite advances in obstetric care, PPH continues to account for a substantial proportion of maternal deaths, particularly in developing countries where access to emergency obstetric services may be limited.

Uterine atony is recognized as the most common cause of PPH and is responsible for nearly 70–80% of cases. Active management of the third stage of labor has been

widely recommended to minimize blood loss and reduce the incidence of PPH. Administration of uterotonic agents immediately following delivery is a key component of this strategy.

Oxytocin has long been considered the first-line uterotonic agent for the prevention of postpartum hemorrhage due to its effectiveness, rapid onset of action, and favorable safety profile. However, its short plasma half-life necessitates repeated administration or continuous infusion to maintain adequate uterine tone.

Carbetocin is a long-acting synthetic analogue of oxytocin that possesses prolonged uterotonic activity. Due to its extended duration of action, carbetocin has gained increasing attention as a potential alternative to

oxytocin in the prevention of PPH. Several clinical studies have demonstrated that carbetocin may reduce blood loss and decrease the need for additional uterotonic agents.

Although evidence supporting the use of carbetocin is increasing, data regarding its effectiveness in routine clinical practice among women undergoing vaginal delivery remain limited. Therefore, the present study was undertaken to compare the clinical outcomes of carbetocin and oxytocin for the prevention of postpartum hemorrhage.

MATERIALS AND METHODS

Study Design

A prospective comparative observational study was conducted to evaluate and compare the effectiveness and safety of carbetocin and oxytocin in preventing postpartum hemorrhage among women undergoing vaginal delivery.

Study Setting

The study was carried out in the Department of Obstetrics and Gynecology at a Super Specialty Hospital, Perinthalmanna, Kerala.

Study Population

Pregnant women admitted for vaginal delivery and receiving either carbetocin or oxytocin as part of routine obstetric management were enrolled in the study.

Sample Size

A total of 94 participants were included. Forty-seven women received carbetocin, while forty-seven received oxytocin.

Inclusion Criteria

1. Primigravida women.
2. Second gravida women.
3. Women undergoing vaginal delivery.
4. Women willing to participate in the study.

Exclusion Criteria

1. Third gravida and above.
2. Caesarean section deliveries.
3. Women with significant obstetric complications affecting study outcomes.

Data Collection

Patient demographic details, obstetric history, medication details, laboratory investigations, and delivery outcomes were collected from patient records. Estimated blood loss was assessed using the gravimetric method. Pre-delivery and post-delivery Hb and Hct levels were documented. The need for

additional uterotonics and occurrence of ADRs were recorded.

Outcome Measures

Primary Outcome:

1. Estimated blood loss following delivery.

Secondary Outcomes:

2. Change in hemoglobin levels.
3. Change in hematocrit levels.
4. Requirement for additional uterotonics.
5. Incidence of adverse drug reactions.

STATISTICAL ANALYSIS

Data were analyzed using appropriate statistical software. Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were expressed as percentages. Statistical significance was considered at $p < 0.05$.

RESULTS

Baseline Characteristics

A total of 94 pregnant women undergoing vaginal delivery were included in the study. Participants were divided equally into the carbetocin group ($n=47$) and the oxytocin group ($n=47$). The demographic and obstetric characteristics of both groups were comparable, indicating homogeneity between the study populations.

Estimated Blood Loss

The mean estimated blood loss in the carbetocin group was 360.87 ± 82.83 mL, whereas the oxytocin group exhibited a mean blood loss of 416.19 ± 72.90 mL. Statistical analysis demonstrated a significant reduction in blood loss among women receiving carbetocin ($p < 0.05$).

Hemoglobin and Hematocrit Changes

Assessment of hematological parameters revealed a lower decline in hemoglobin and hematocrit levels among women treated with carbetocin. The mean hemoglobin reduction was 0.99 g/dL in the carbetocin group compared with 1.15 g/dL in the oxytocin group. Similarly, the mean hematocrit reduction was 2.0% and 3.06%, respectively.

Requirement of Additional Uterotonics

Additional uterotonic agents were required less frequently in the carbetocin group. Eight women (17%) receiving carbetocin required supplementary uterotonic therapy compared with nineteen women (40.4%) receiving oxytocin.

Adverse Drug Reactions

Adverse drug reactions were observed in both groups. The incidence of ADRs was 14.9% in the carbetocin group and 17% in the oxytocin group. The most commonly reported reactions included nausea, vomiting, headache, and transient hypotension. No serious adverse events were reported during the study period.

DISCUSSION

Postpartum hemorrhage continues to be one of the most significant contributors to maternal morbidity and mortality worldwide. Effective prevention strategies are therefore essential to improve maternal outcomes and reduce the burden of obstetric complications. The present study compared the clinical outcomes of carbetocin and oxytocin in the prevention of postpartum hemorrhage among women undergoing vaginal delivery.

The findings demonstrated that women receiving carbetocin experienced significantly lower blood loss compared with those receiving oxytocin. This observation may be attributed to the prolonged uterotonic action of carbetocin, which promotes sustained uterine contraction during the immediate postpartum period. Effective uterine contraction facilitates compression of uterine blood vessels and minimizes postpartum bleeding.

The reduction in hemoglobin and hematocrit levels following delivery was lower among women treated with carbetocin. These findings further support the effectiveness of carbetocin in controlling postpartum blood loss. Maintenance of hematological parameters is clinically important because excessive declines in hemoglobin and hematocrit can contribute to postpartum anemia, delayed recovery, and increased healthcare utilization.

An important finding of the present study was the reduced requirement for additional uterotonic therapy in the carbetocin group. Only 17% of women receiving carbetocin required supplementary uterotonics compared with 40.4% of women receiving oxytocin. This finding suggests that the prolonged duration of action of carbetocin may provide more effective and sustained uterine tone, thereby reducing the need for additional interventions.

The incidence of adverse drug reactions was comparable between the two groups. The absence of serious adverse reactions indicates that both medications possess acceptable safety profiles when used for postpartum hemorrhage prevention. Similar findings have been reported in previous studies evaluating carbetocin and oxytocin in obstetric practice.

The results of the present study are consistent with previous investigations that demonstrated reduced blood loss and lower requirements for additional uterotonics among women receiving carbetocin. Several randomized trials and observational studies have reported superior efficacy of carbetocin owing to its longer half-life and prolonged uterine activity.

One of the strengths of this study was the prospective observational design, which allowed assessment of outcomes under routine clinical conditions. Furthermore, blood loss estimation was performed using the gravimetric method, which provides a more objective assessment compared with visual estimation alone.

However, certain limitations should be acknowledged. The study was conducted at a single center and included a relatively small sample size. Caesarean deliveries and higher-order gravida women were excluded, which may limit the generalizability of the findings. Future multicenter studies involving larger populations are warranted to further validate these observations.

Despite these limitations, the findings indicate that carbetocin offers several clinical advantages over oxytocin in the prevention of postpartum hemorrhage following vaginal delivery.

CONCLUSION

Carbetocin demonstrated superior efficacy compared with oxytocin in reducing postpartum blood loss, minimizing reductions in hemoglobin and hematocrit levels, and decreasing the requirement for additional uterotonic agents. Both medications exhibited comparable safety profiles. These findings suggest that carbetocin may serve as an effective alternative to oxytocin for the prevention of postpartum hemorrhage among women undergoing vaginal delivery.

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CONFLICT OF INTEREST

The authors declare no conflict of interest obtained from all participants before enrollment in the study.

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FIGURES

MODE OF DELIVERY

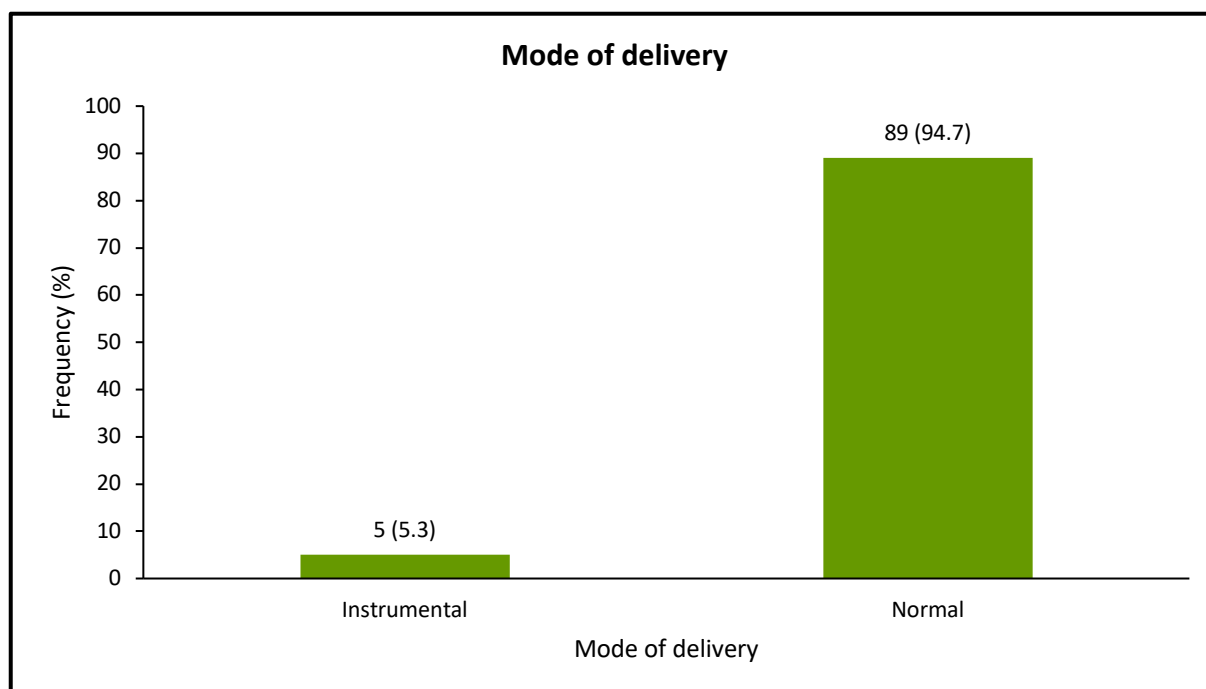


FIG.1. Mode of delivery among all participants.

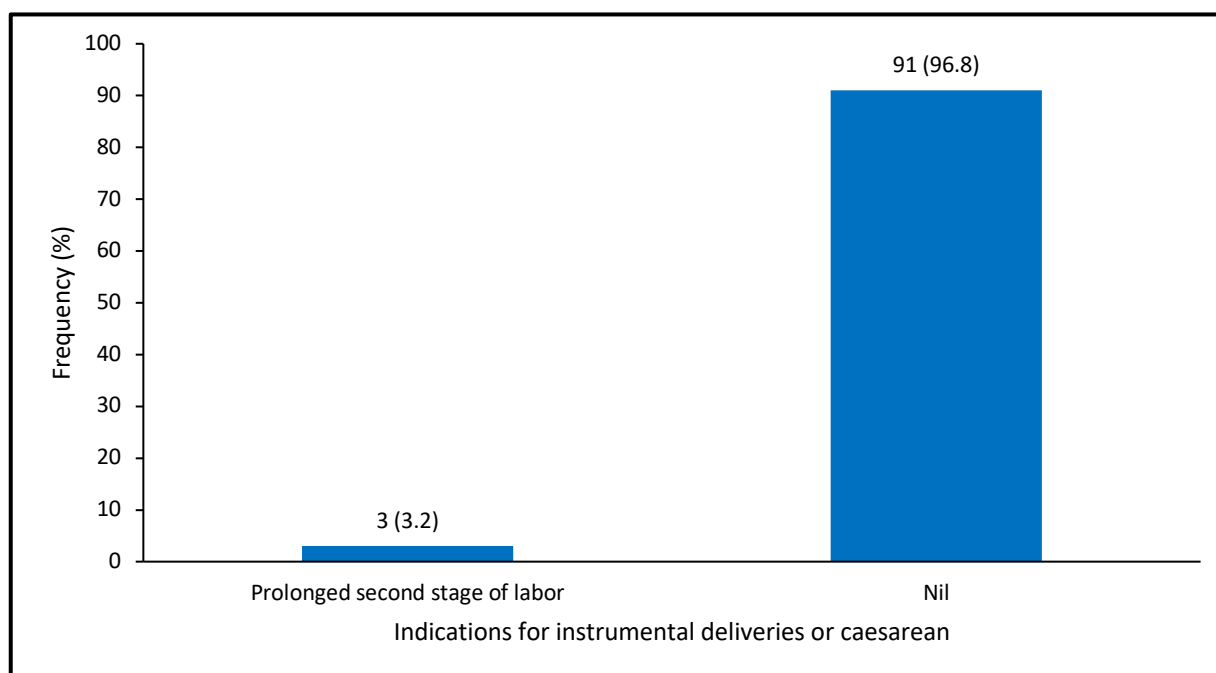


FIG.2. Indications for instrumental delivery or caesarean section.

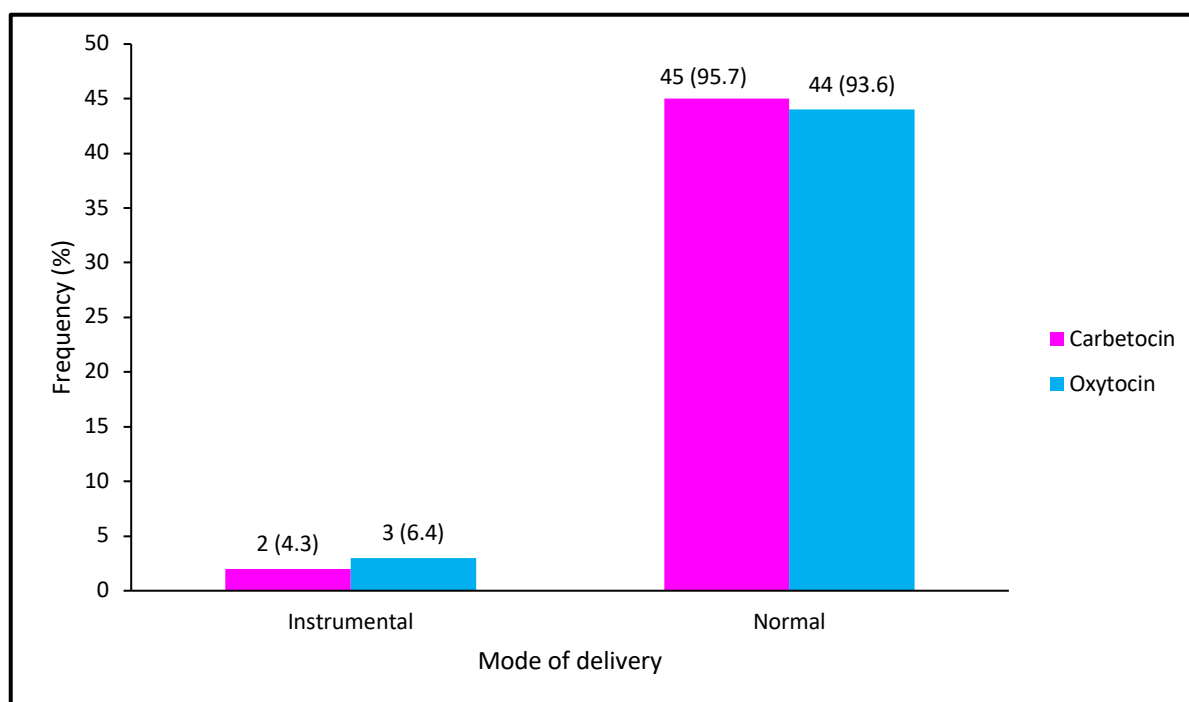


Fig.3. Mode of delivery according to uterotonic used.

OBSTETRIC PROFILE

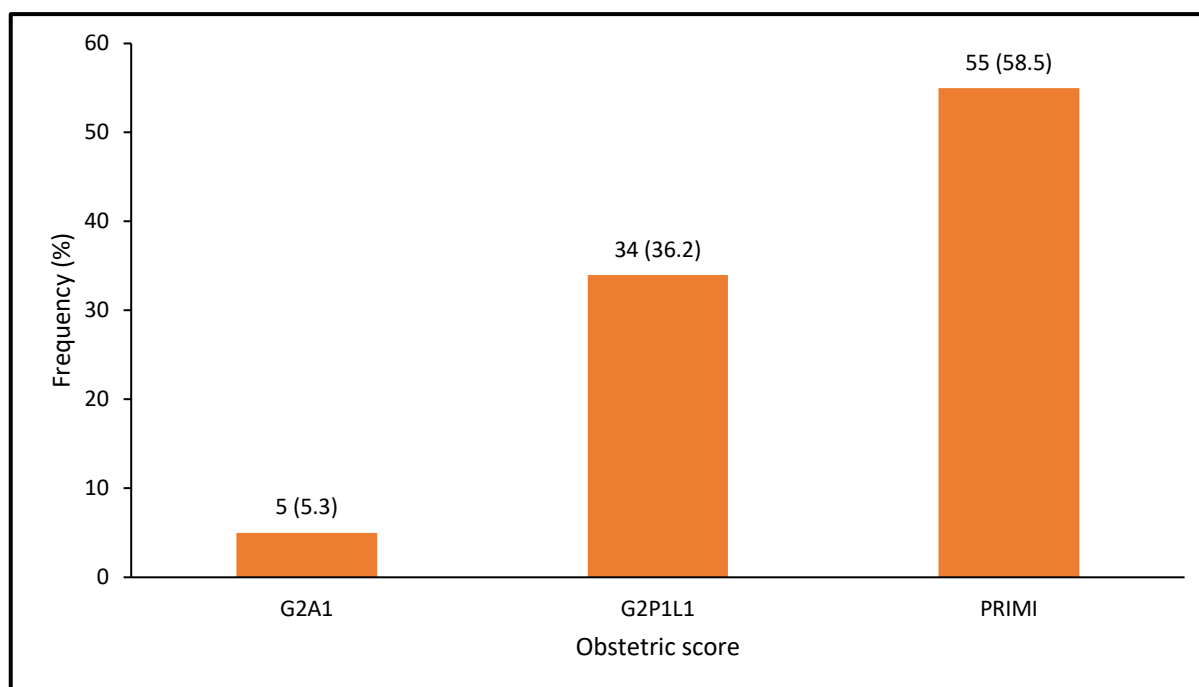


FIG.4. Overall distribution of obstetric scores among participants

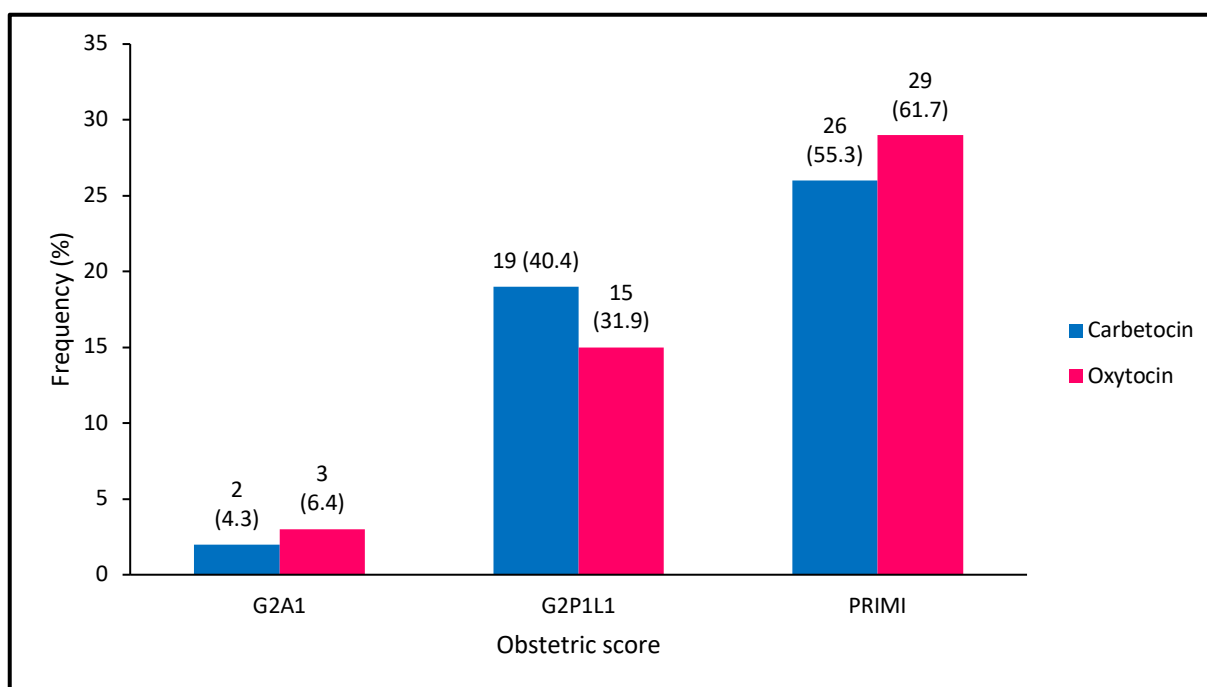


FIG.5. Obstetric score distribution according to uterotonic used.

ADVERSE DRUG REACTIONS (ADRs)

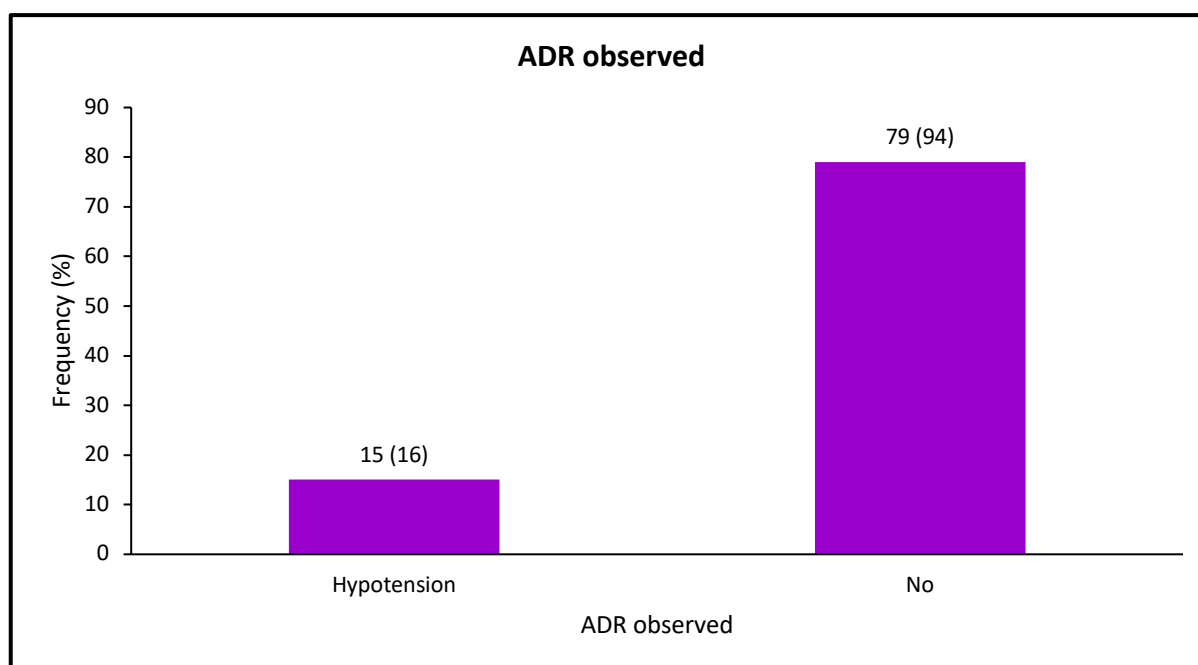


FIG.6. Overall incidence of Adverse Drug Reactions among study participants

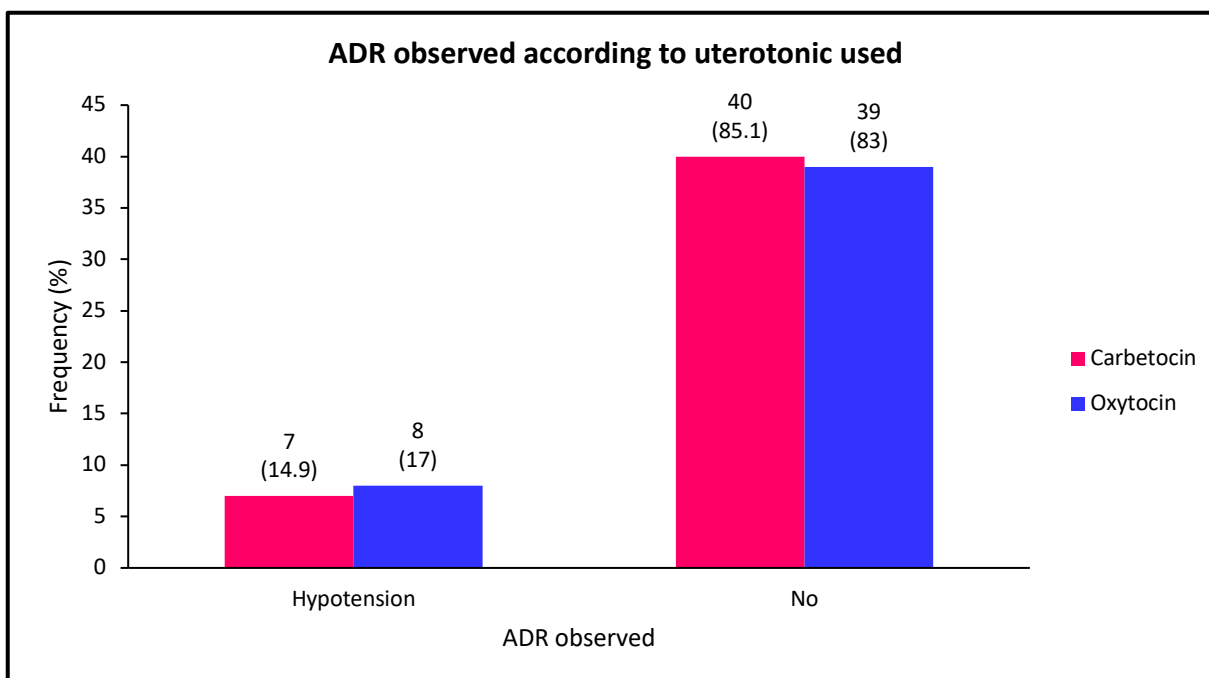


FIG.7. ADRs according to uterotonic used.

ADDITIONAL UTEROTONIC USE

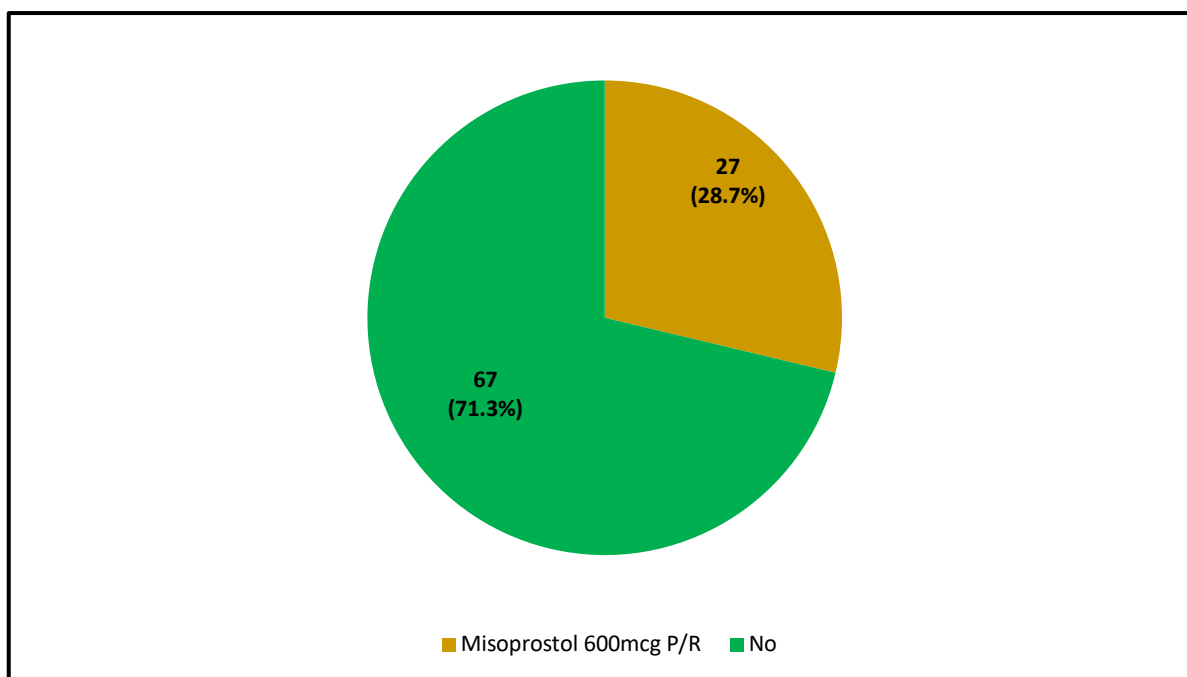


FIG.8. Overall distribution of additional uterotonic used. (Misoprostol 600 mcg P/R)

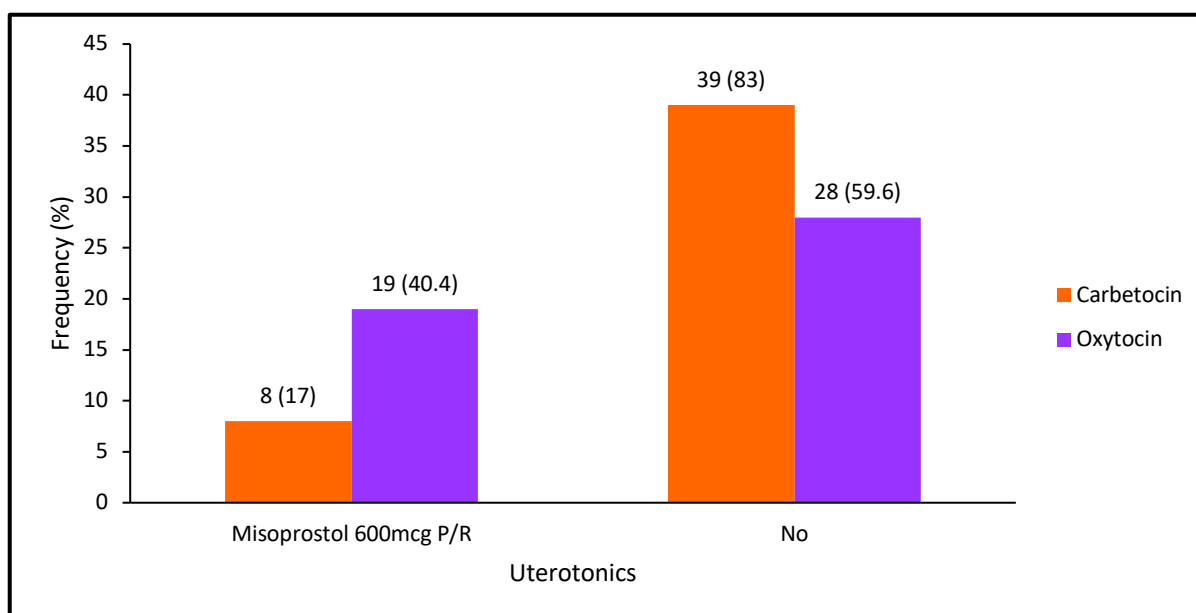


FIG.9. Comparison of additional uterotonic use between Carbetocin and Oxytocin groups.

GRAVIMETRIC ESTIMATION OF BLOOD LOSS

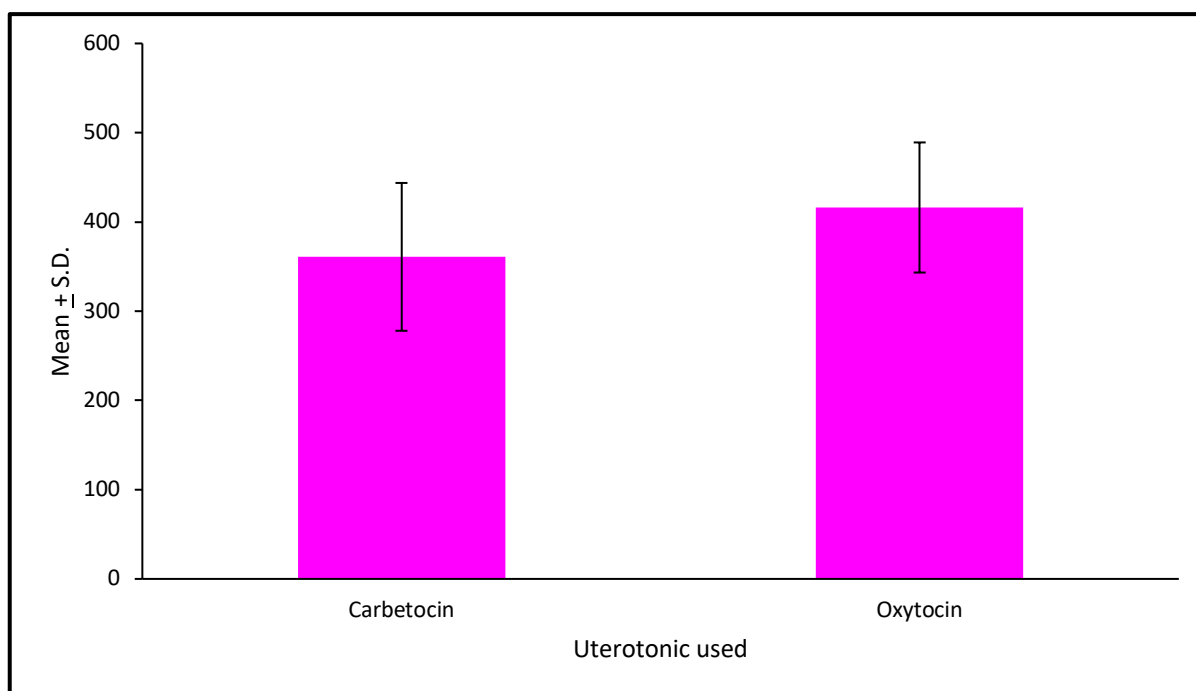


FIG.10. Estimated blood loss during delivery using gravimetric method (ml) (Carbetocin vs. Oxytocin)

HEMOGLOBIN DROP

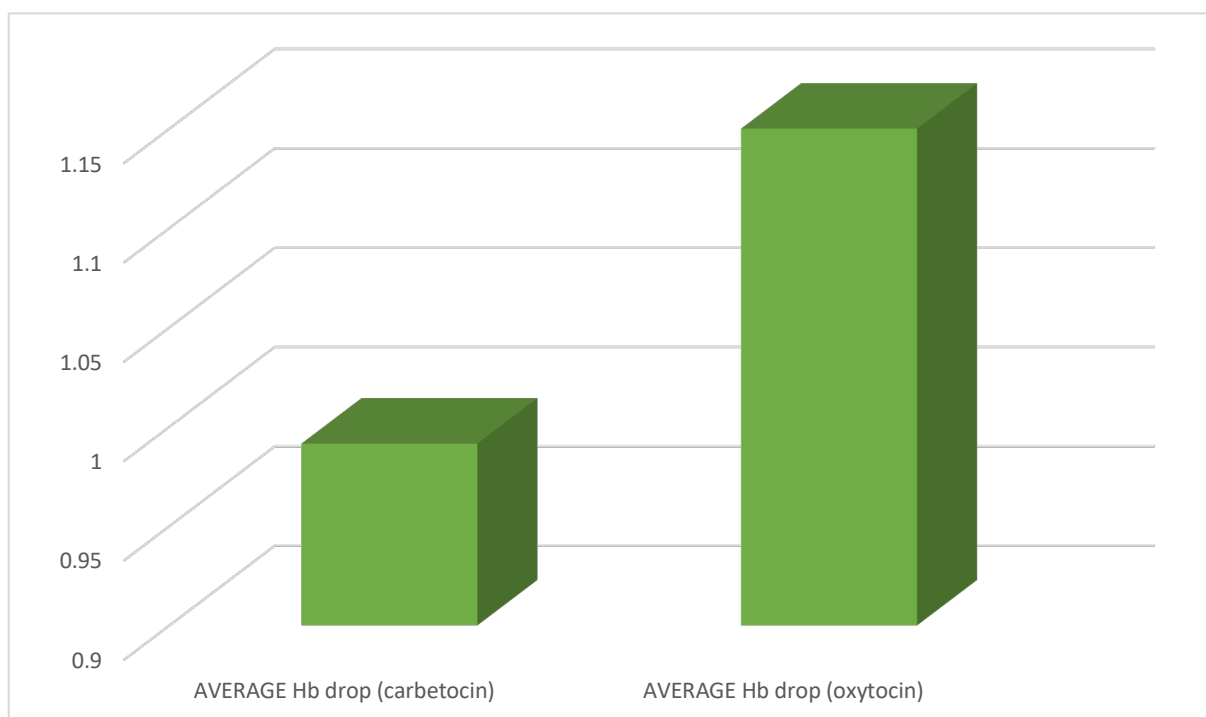


FIG.11. Comparison of Mean Hemoglobin drop (g/dl) between Carbetocin and Oxytocin Groups.

HEMATOCRIT LEVEL

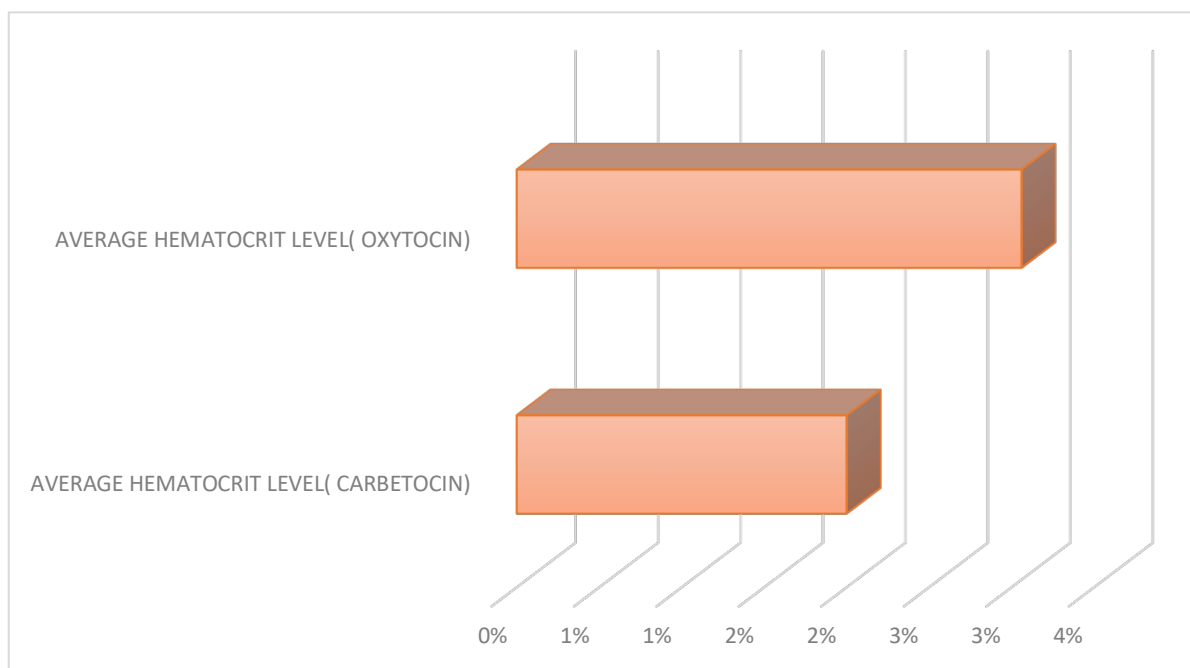


FIG.12. Comparison of Mean hematocrit drop (%) between the Carbetocin and Oxytocin Group

COMPARISON OF VITAL PARAMETERS BEFORE AND AFTER DELIVERY

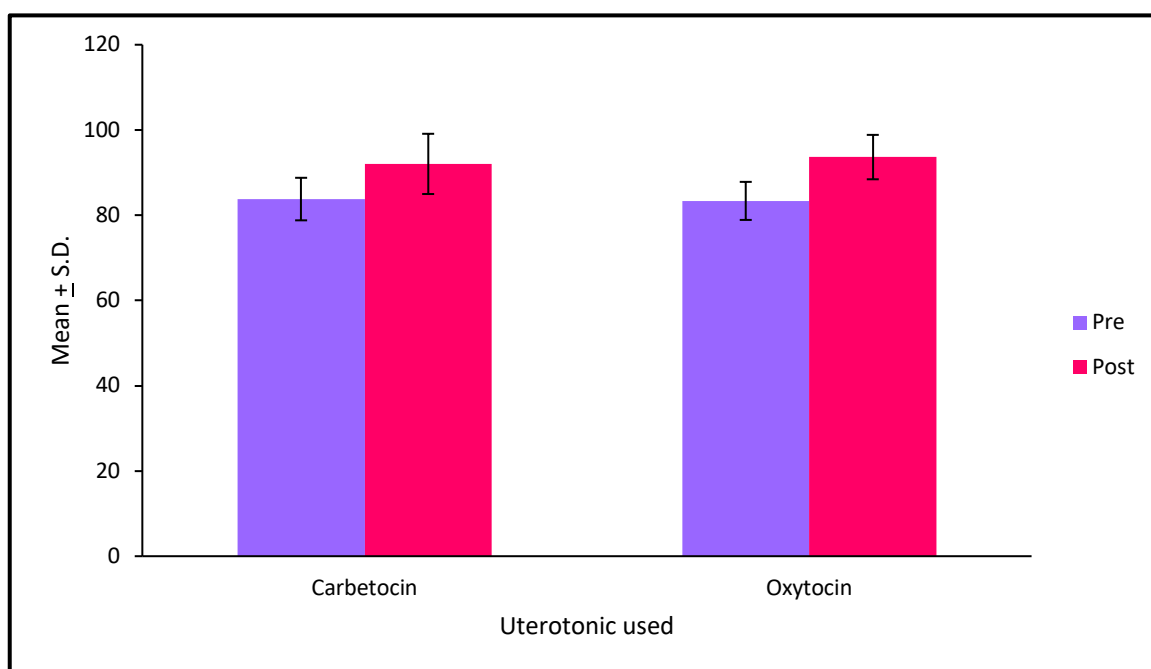


FIG. 13: Comparison of mean pulse rate before and after delivery according to the uterotonic used

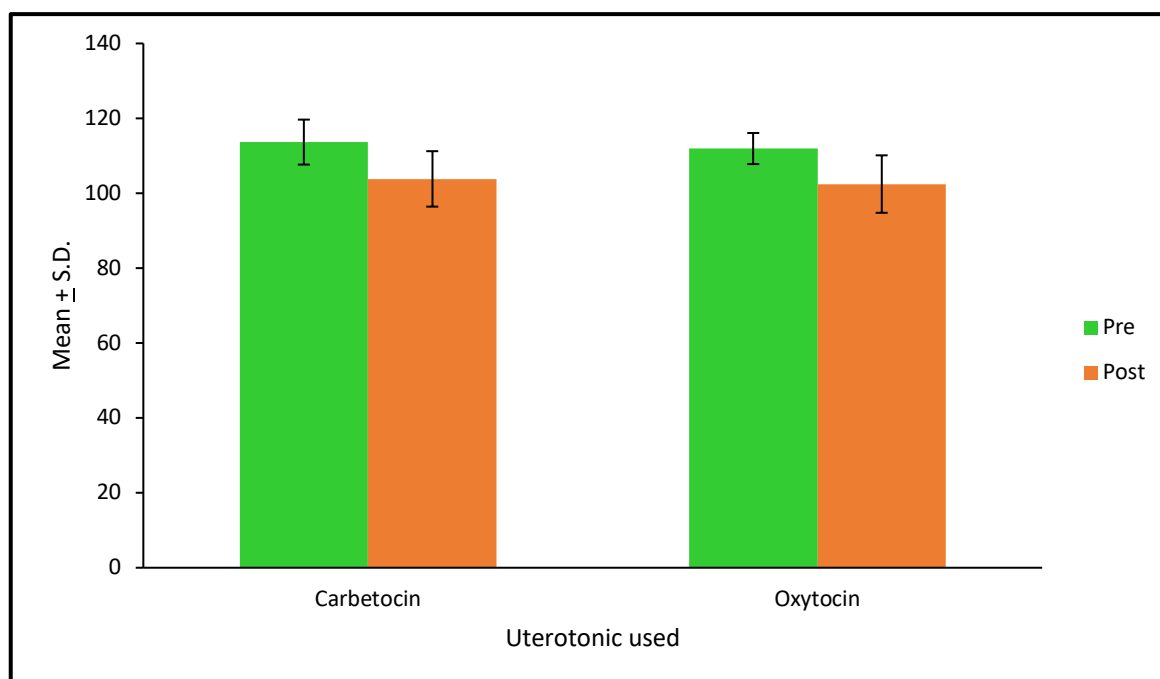


FIG. 14: Comparison of mean systolic BP before and after delivery according to the uterotonic used

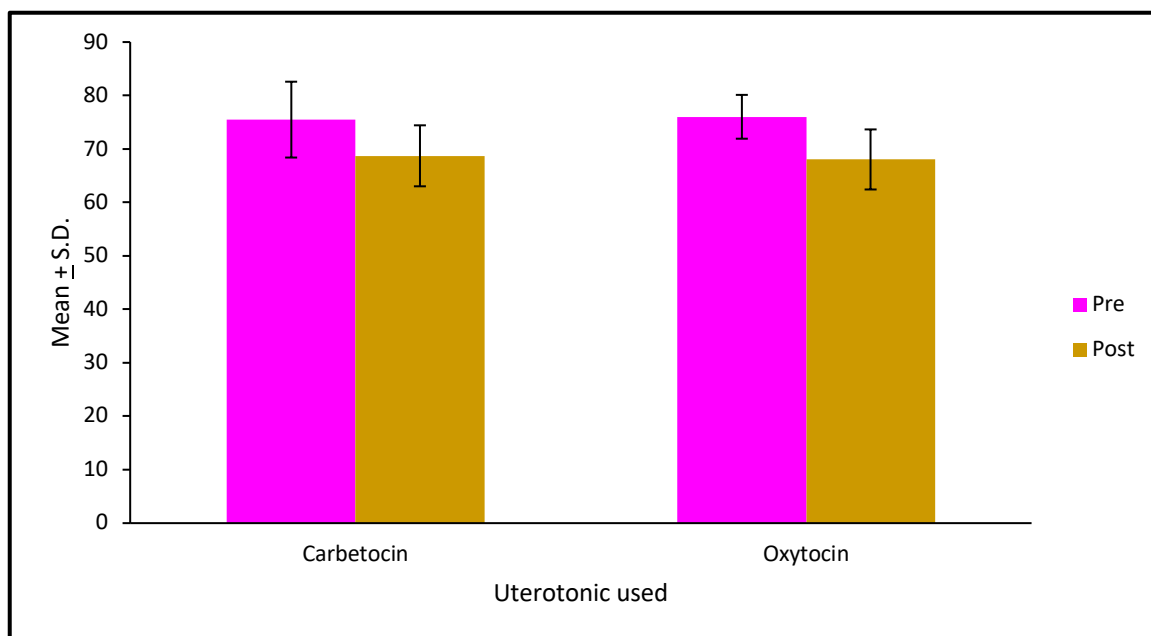


FIG. 15: Comparison of mean Diastolic BP before and after delivery according to the uterotonic used

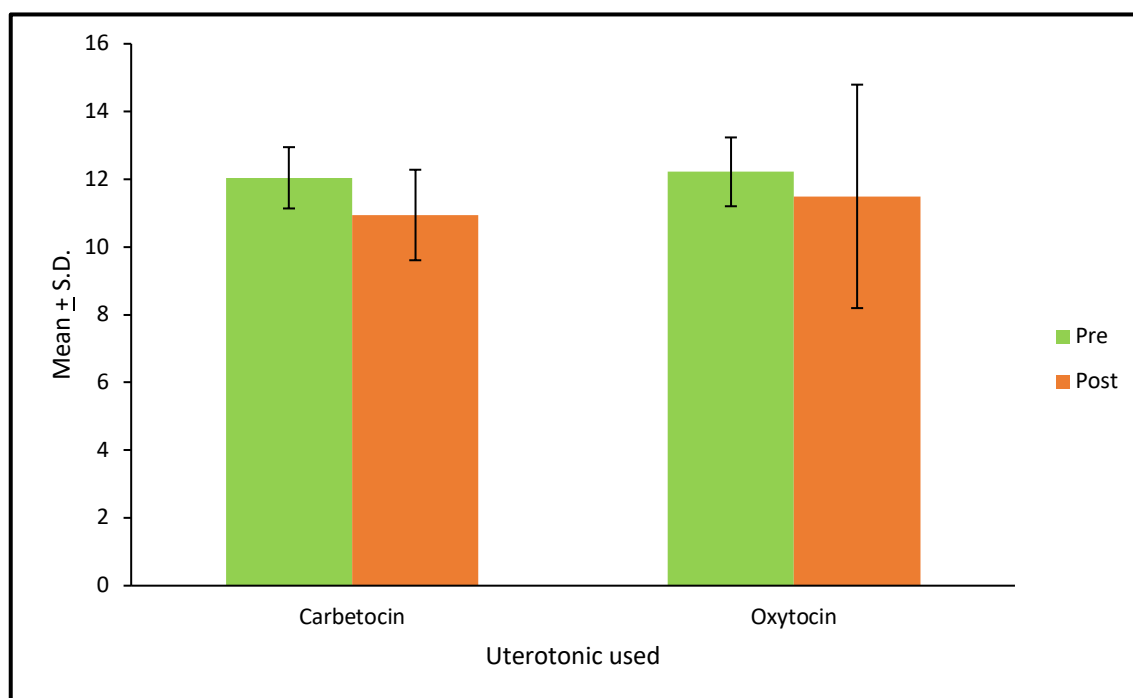


FIG. 16: Comparison of mean SpO2 before and after delivery according to the uterotonic used

TABLES

DEMOGRAPHIC PROFILE

Table 1: Descriptive Statistics For Age, Gestational Age, And Duration Of Labour

(n = 94)	Range	Mean	S.D.
Age (Years)	20 to 35	25.76	3.38
Gestational age (Weeks)	37.1 to 40.2	38.86	0.61
Duration of labor (Hours)	2.5 to 8.5	5.47	1.32

OBSTETRIC AND CLINICAL CHARACTERISTICS**Table 2. Descriptive Summary Of Obstetric And Clinical Characteristics Of The Study Population.**

	Frequency	%
Uterotonic used	Carbetocin	47
	Oxytocin	47
Obstetric score	G2A1	5
	G2P1L1	34
	PRIMI	55
Previous pregnancies	Nil	55
	No previous full-term delivery	5
	One previous full term normal vaginal delivery	34
Complication in previous pregnancies	Nil	94
Mode of delivery	Instrumental	5
	Normal	89
Indications for instrumental deliveries or caesarean	Prolonged second stage of labor	3
	Nil	91
Blood transfusion needed	No	94
ADR observed	Hypotension	15
	No	79
Uterotonics	Misoprostol 600mcg P/R	27
	No	67

GRAVIMETRIC ESTIMATION OF BLOOD LOSS**Table.3. Comparison Of Total Amount Of Blood Soaked Under Pad (G), Under Mop (G), Under Mat (G), And Estimated Blood Loss During Delivery Using Gravimetric Method (Ml) According To Uterotonic Used.**

	Mean	S.D.	"t"	p value
Total amount of blood soaked under pad (g)	Carbetocin	76.23	31.83	-3.89
	Oxytocin	100.91	29.58	
Under MOP (g)	Carbetocin	57.13	32.65	-1.87
	Oxytocin	67.64	20.45	
Under MAT (g)	Carbetocin	225.17	51.05	-1.54
	Oxytocin	242.38	57.39	
Estimated blood loss during delivery using gravimetric method (ml)	Carbetocin	360.87	82.83	-3.44
	Oxytocin	416.19	72.90	

("t" = Independent sample "t" test; * Significant)