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Original Research Article

Comparative Study of Tranexamic Acid vs. Carbetocin in Managing Atonic Postpartum Hemorrhage

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Abstract:

Background: Postpartum hemorrhage (PPH) remains a leading cause of maternal morbidity and mortality worldwide, with uterine atony accounting for the majority of cases. Pharmacological interventions play a crucial role in the management of atonic PPH. Tranexamic acid and carbetocin are commonly used agents, but comparative data regarding their effectiveness remain limited.

Objective: To compare the efficacy and safety of tranexamic acid versus carbetocin in the management of atonic postpartum hemorrhage.

Methods: A prospective cross-sectional study was conducted at Indira Gandhi Institute of Medical Sciences (IGIMS), Patna, over a period of two years. A total of 200 women with atonic PPH were enrolled and divided into two groups: Group A (tranexamic acid) and Group B (carbetocin), with 100 patients in each group. Primary outcomes included amount of blood loss, need for additional uterotonics, and requirement for blood transfusion.

Results: Both drugs were effective in controlling hemorrhage. However, the carbetocin group demonstrated significantly reduced blood loss, fewer additional interventions, and lower transfusion requirements compared to the tranexamic acid group ($p < 0.05$).

Conclusion: Carbetocin appears to be more effective than tranexamic acid in managing atonic PPH, though tranexamic acid remains a valuable adjunct therapy. Judicious use based on clinical scenario is recommended.

Keywords: Postpartum Hemorrhage, Atonic PPH, Tranexamic Acid, Carbetocin, Uterotonics.

Introduction

Postpartum haemorrhage (PPH) is when a woman loses more than 500 ml of blood after giving birth vaginally or more than 1000 ml after having a caesarean section. It is still a major cause of maternal death, especially in low- and middle-income countries [1]. PPH causes almost a quarter of all maternal deaths around the world, which shows how important it is to have good ways to stop and treat it [2].

The most common cause of PPH is uterine atony, which accounts for about 70–80% of cases [3]. Bleeding from the placental bed continues because the uterus can't contract properly after delivery. Some things that can increase the risk are long labour, an overly full uterus, having more than one child, and starting labour [4].

The best way to prevent and treat PPH is still to actively manage the third stage of labour and give uterotonic agents on time [5]. Oxytocin is a common first-line treatment, but because it has a short half-life, it needs to be given again and again or continuously [6]. Carbetocin is a synthetic version of oxytocin that lasts for a long time. It causes the uterus to contract for a long time with just one dose. In recent years, it has gotten more and more attention [7].

Tranexamic acid is an antifibrinolytic agent that stops the conversion of plasminogen to plasmin, which slows down the breakdown of blood clots [8]. Large studies, like the WOMAN trial, have shown that giving it early in PPH can lower the risk of death from bleeding [9]. Tranexamic acid, on the other hand, does not directly treat uterine atony and is often used as an add-on rather than a main uterotonic agent [10].

Even though both drugs are widely used, there aren't many studies that directly compare tranexamic acid and carbetocin in atonic PPH, especially in India

[11–13]. Therefore, this study was undertaken to compare their efficacy and safety in managing atonic PPH.

Materials and Methods

Study Design and Setting: This prospective cross-sectional study was conducted in the Department of Obstetrics and Gynecology at IGIMS, Patna.

Study Duration: Two years.

Sample Size: A total of 200 patients diagnosed with atonic PPH.

Inclusion Criteria

- Women aged 18–40 years
- Diagnosed with atonic PPH following vaginal or cesarean delivery
- Hemodynamically stable at presentation

Exclusion Criteria

- PPH due to causes other than uterine atony
- Known coagulation disorders
- Severe anemia (<7 g/dL) prior to delivery

Group Allocation

- **Group A (n = 100):** Received intravenous tranexamic acid 1 g
- **Group B (n = 100):** Received intravenous carbetocin 100 µg

Outcome Measures

- Amount of blood loss (measured in ml)
- Need for additional uterotonics
- Requirement of blood transfusion
- Need for surgical intervention

Statistical Analysis: Data were analyzed using SPSS version 26. Continuous variables were expressed as mean ± SD. Chi-square test and unpaired t-test were applied. A p-value < 0.05 was considered statistically significant.

Results

A total of 200 women diagnosed with atonic postpartum hemorrhage were included in the present prospective cross-sectional study. The study population was equally divided into two groups: Group A (Tranexamic Acid group, n = 100) and Group B (Carbetocin group, n = 100). All participants completed follow-up until successful control of hemorrhage, and complete data were available for analysis.

Baseline Demographic and Obstetric Characteristics: Baseline demographic and obstetric variables were comparable between the two study groups, with no statistically significant differences observed. The mean age of patients in Group A was 26.8 ± 4.2 years, while in Group B it was 27.1 ± 4.5 years (p = 0.62). The proportion of primiparous women and mode of delivery were also similar between groups (p > 0.05). These findings indicate adequate baseline homogeneity. Baseline characteristics are summarized in Table 1.

Table 1: Baseline Demographic and Obstetric Characteristics of Study Groups

Variable	Group A (TXA)	Group B (Carbetocin)	p-value
Mean age (years)	26.8 ± 4.2	27.1 ± 4.5	0.62
Primiparity (%)	48%	50%	0.78
Vaginal delivery (%)	66%	68%	0.75

Comparison of Blood Loss: The mean estimated blood loss was significantly higher in the tranexamic acid group compared to the carbetocin group. Group A recorded a mean blood loss of 812 ± 134 ml, whereas Group B had a significantly lower mean blood loss of 645 ± 118 ml. Statistical analysis using an unpaired t-test demonstrated a highly significant difference between the two groups (p < 0.001). The comparison of blood loss between groups is presented in Table 2.

Table 2: Comparison of Mean Blood Loss Between Groups

Group	Mean Blood Loss (ml)	p-value
Tranexamic Acid	812 ± 134	<0.001*
Carbetocin	645 ± 118	<0.001*

*Statistically significant (p < 0.05)

Requirement of Additional Uterotonics and Blood Transfusion: The requirement for additional uterotonic agents was significantly higher in the tranexamic acid group. Forty-two percent of patients in Group A required additional uterotonics compared to only 18% in Group B (p < 0.001). Similarly, blood transfusion was required in 36% of patients receiving tranexamic acid, whereas only 14% of patients in the carbetocin group required transfusion, which was statistically significant (p = 0.002).

Although the need for surgical intervention was higher in the tranexamic acid group (6%) compared to the carbetocin group (2%), this difference did not reach statistical significance (p = 0.15). These findings are detailed in Table 3.

Table 3: Comparison of Additional Interventions Required

Outcome	TXA (%)	Carbetocin (%)	p-value
Additional uterotonics	42	18	<0.001*
Blood transfusion	36	14	0.002*
Surgical intervention	6	2	0.15

*Statistically significant ($p < 0.05$)

Graphical Representation of Outcomes: A graphical comparison of blood transfusion requirements between the two groups is shown in Figure 1. The bar diagram demonstrates a markedly higher proportion of patients requiring blood transfusion in the tranexamic acid group compared to the carbetocin group, reinforcing the superior efficacy of carbetocin in reducing hemorrhage severity.

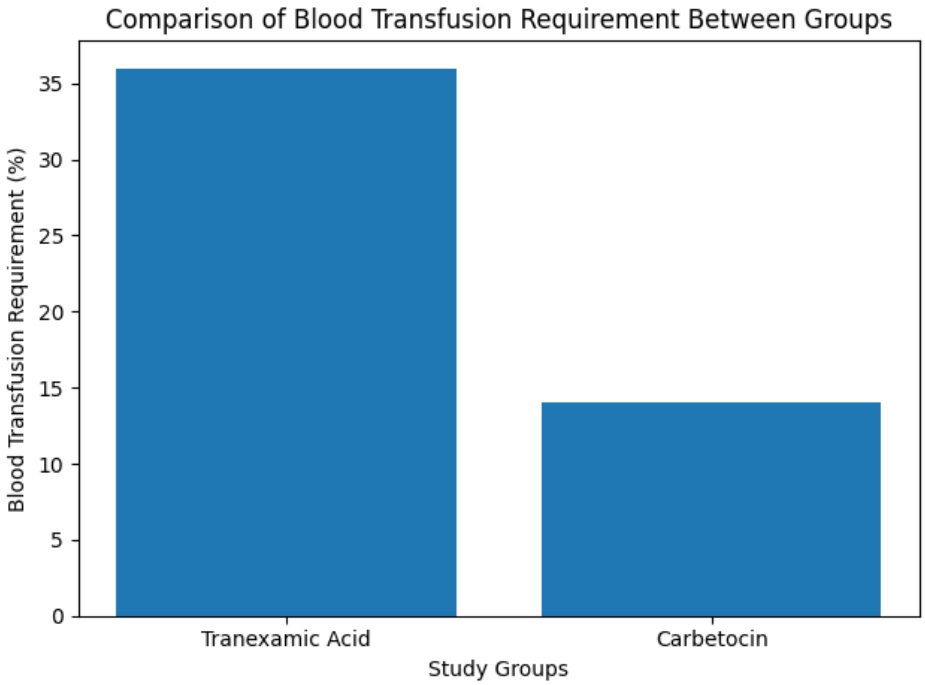

Figure 1: Bar chart showing comparison of blood transfusion requirement between tranexamic acid and carbetocin groups.

Summary of Key Results

- Baseline characteristics were comparable between both groups (Table 1).
- Mean blood loss was significantly lower in the carbetocin group (Table 2).
- Requirement for additional uterotonics and blood transfusion was significantly reduced in the carbetocin group (Table 3).
- Graphical analysis confirmed reduced transfusion needs with carbetocin (Figure 1).

Discussion

The current study shows that both tranexamic acid and carbetocin are good at treating atonic PPH. However, carbetocin works better because it reduces blood loss and the need for more interventions. These results align with prior research emphasising the extended uterotonic effect of carbetocin [14–16].

Tranexamic acid has received extensive endorsement as a life-saving intervention in postpartum haemorrhage (PPH) when administered promptly, especially in resource-constrained environments [17]. However, its mechanism of action focusses on fibrinolysis instead of uterine contractility, which might account for its relatively lower efficacy when administered alone in atonic PPH [18].

Numerous randomised trials and meta-analyses have shown that carbetocin is at least as effective as oxytocin, with the additional benefit of prolonged uterine contraction after a single dose [19–21]. Our results provide additional evidence for its efficacy as a primary treatment for atonic PPH.

It is clinically important that the carbetocin group needed fewer blood transfusions, especially in places where blood products are hard to come by [22]. Tranexamic acid is still a useful addition, but it seems to be more of a support than a cure for atonic PPH [23].

This study's limitations encompass its single-center design and the absence of long-term follow-up. Nonetheless, the prospective design and sufficient sample size enhance the validity of the results. To further establish optimal management protocols, larger multicentric trials are recommended [24,25].

Conclusion

Both tranexamic acid and carbetocin are effective in the management of atonic postpartum hemorrhage. However, carbetocin demonstrates superior efficacy in reducing blood loss and minimizing the need for additional interventions. Tranexamic acid remains an important adjunct therapy. Individualized treatment based on patient profile and resource availability is recommended.

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