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Evaluation of Hand Glove Tamponade Versus Foley's Catheter (24 Fr) in the Management of Atonic Uterus in Postpartum Hemorrhage

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Abstract

Background: Postpartum haemorrhage (PPH) is a major contributor to maternal morbidity and mortality worldwide, especially in low-resource settings. Uterine atony is the most frequent cause of PPH. Balloon tamponade methods, such as Foley's catheter, are commonly employed, but alternative low-cost methods like glove tamponade are gaining attention. **Objectives:** To compare the efficacy of hand glove balloon versus Foley's catheter (24 Fr) in controlling bleeding from an atonic uterus following postpartum hemorrhage. **Study Design & Setting:** This was a randomized controlled trial conducted in the Department of Obstetrics and Gynecology, DHQ Hospital, Rawalpindi, over a period of six months. **Methodology:** A total of 66 women aged 18–40 years with PPH due to uterine atony following normal vaginal delivery were enrolled through consecutive non-probability sampling. They were randomly assigned into two equal groups: Group A received glove tamponade, and Group B received Foley's catheter tamponade. Outcomes measured included efficacy of bleeding control, estimated blood loss, insertion time, hemoglobin levels, ICU admissions, and need for re-exploration. **Results:** Glove tamponade showed higher efficacy (93.9%) compared to Foley's catheter (72.7%) with a statistically significant p-value (0.012). Mean blood loss was significantly lower in Group A (280.6 ± 75.3 mL) versus Group B (362.8 ± 96.4 mL). Fewer ICU admissions and re-explorations were also noted in the glove group. Conclusion: Glove tamponade is a simple, effective, and low-cost alternative to Foley's catheter for managing atonic PPH, particularly in resource-constrained environments.

Keywords: Atonic Uterus, Balloon Tamponade, Foley's Catheter, Glove Tamponade, Postpartum Hemorrhage, Uterine Bleeding

INTRODUCTION

Postpartum haemorrhage (PPH) remains the leading cause of maternal mortality in low- and middleincome countries, accounting for more than 20% of maternal deaths worldwide.[1] According to the WHO, PPH is defined as a blood loss of >500 mL within 24 hours after vaginal delivery, >1,000 mL after cesarean delivery, or the requirement for blood transfusion within 24 hours.[2] Uterine atony—failure of the uterus to contract effectively after delivery—is the most common cause, resulting in continued bleeding from the placental bed.[3]

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When uterine muscle fibres do not contract adequately, the myometrial compression of spiral arteries is lost, allowing unrestrained blood flow.[4] First-line management involves uterotonics to stimulate myometrial contraction. In cases where pharmacologic therapy fails, mechanical methods aim to achieve hemostasis by applying direct intrauterine pressure, thereby compressing bleeding vessels against the uterine wall and promoting clot formation.[5]

Uterine balloon tamponade (UBT) works on this principle. By occupying the uterine cavity and exerting uniform pressure, it reduces perfusion, facilitates platelet plug formation, and buys time for uterine muscle recovery.[6] Commercial balloon systems are effective but costly and often unavailable in resource-limited settings. Adapted low-cost devices—such as Foley catheters and condom balloon tamponades—have been used successfully, but may have drawbacks including limited capacity or leakage.[7] Glove balloon tamponade is an innovative, costeffective alternative in which a sterile surgical glove is securely tied to a catheter (often a Foley) and inflated within the uterine cavity. The glove's multifinger structure expands uniformly, providing broader surface contact with the endometrium compared to a single-lumen balloon. The increased surface area and compliance enhance vessel compression, reduce intrauterine dead space, and promote more effective hemostasis.[8] This method is easy to assemble from readily available surgical supplies, making it particularly valuable in emergency settings and rural facilities.

Current literature primarily focuses on condom catheter tamponade, leaving a gap in evidence regarding glove balloon tamponade. Till now, no direct comparison between glove balloon tamponade and Foley's catheter tamponade has been published internationally or locally in Pakistan. In this study, we combine the efficacy data of these two techniques from available literature and conduct a direct comparison to address this gap. As glove tamponade is costeffective and suitable for resource-limited settings, this research aims to establish its utility and effectiveness in managing postpartum hemorrhage in Pakistan. The findings will help establish standardized protocols for resourcelimited settings.

MATERIALS AND METHODS

This study was designed as a randomized controlled trial and was conducted at the Department of Obstetrics and Gynecology, DHQ Hospital, Rawalpindi. A sample size of 66 patients, with 33 patients allocated to each group, was calculated using a power of 80% and a 95% confidence interval. The calculation was based on an expected efficacy rate of 95% for glove tamponade and 68.1% for Foley's catheter in patients with atonic uterus following postpartum hemorrhage, as reported in previous studies.[8,9] The sampling technique employed was probability sampling — simple random sampling (via lottery method).

Inclusion criteria comprised women aged 18 to 40 years who developed postpartum hemorrhage, as per the operational definition, following a normal vaginal delivery. Women who experienced postpartum hemorrhage within 6 hours of delivery were included. Only those with an antenatal hemoglobin level greater than 10 mg/dL and who provided written informed consent to participate in the study were enrolled. Exclusion criteria for the study included a patient's history of postpartum haemorrhage, a woman's use of intrauterine devices, or a history of postpartum haemorrhage caused by anything other than uterine atony. Participants were not allowed to take part in the study if they were pregnant, had a history of bleeding disorders, genital tract injuries, were on anticoagulant medication, had a burst uterus, retained pregnancy products, or were otherwise ineligible. In the lottery method, each participant is assigned a unique number, and numbers are randomly drawn from a container to allocate participants into study groups. This can be

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done with blinding, where the allocator is unaware of the group codes, or without blinding if group assignments are visible.

Patients were randomly divided into two treatment groups using the lottery method: Group A (Glove Tamponade, n = 33) and Group B (Foley's Catheter, n = 33). Patients in Group A underwent glove tamponade, in which a sterile latex glove (size 6.5 or 7) was prepared by securely tying the sleeve end. A 6 Fr Foley's catheter was inserted into the glove to allow controlled fluid filling. The practitioner proceeded to put the glove into the uterine cavity using forceps that held a sponge, ensuring correct orientation. Sterile fluid was infused through a drip set placed at a height of around 4.5 feet. Once backflow was observed, the fluid flow was stopped, the Foley's catheter was clamped, and a vaginal pack was applied if necessary to prevent displacement. Patients in Group B underwent tamponade using a 24 Fr Foley's catheter. With the use of forceps that held a sponge, the catheter was introduced into the uterine cavity via the cervix. The balloon was then inflated with sterile fluid (either normal saline or water) to achieve tamponade, Furthermore documented was the amount of blood that was drawn out of the drainage bag. Both procedures were performed under strict aseptic conditions. A balloon was progressively inflated at a rate of 50 mL/hour until it reached half of its volume over two hours if, after six hours, there had been no bleeding occurring per vaginam and the fundus of the uterus felt constricted. Under the guidance of a senior staff member, the balloon was removed entirely if no further bleeding happened within the following 30 minutes. The patient was sent for surgical intervention in instances where the uterine fundus elevated or bleeding persisted after tamponade failure was established. As per hospital procedure, an oxytocin drip was started after 24 hours. The drip consisted of 500 mL of sterile water with 40 units of oxytocin.

The primary outcome of the study was the effectiveness of glove tamponade versus Foley's catheter in controlling primary postpartum hemorrhage (PPH), as defined in the operational criteria. All procedures, including the insertion of the Foley's catheter into the uterine cavity, were performed by a single trained doctor with three years of experience in obstetrics, to ensure procedural consistency and minimize bias. Confounding variables were controlled by applying strict exclusion criteria. Patient demographic data, antenatal hemoglobin levels, and efficacy outcomes were documented in a structured proforma by the principal investigator.

We used SPSS version 26 to input and analyse all of the data that we gathered. The mean ± standard deviation (SD) was used to display numerical variables including parity, gestational age, and maternal age. We used percentages and frequencies to summarise categorical information such treatment efficacy, blood loss (mL), and haemoglobin (Hb) level. A p-value of less than or equal to 0.05 was deemed statistically significant when comparing the frequency of efficacy between the two treatment groups using the Chi-square test. Maternal age, gestational age, parity, haemoglobin level, and blood loss were some of the potential effect modifiers that were further taken into account when data were stratified. To determine if there were any significant differences in efficacy between the groups, the Chi-square test was used again after stratification, with a p-value of ≤ 0.05 being considered statistically significant once again.

RESULTS

As shown in Table 1, the efficacy of glove tamponade in controlling bleeding in patients with an atonic uterus after postpartum hemorrhage was significantly higher than that of Foley's catheter. In Group A (glove tamponade), 93.9% of patients achieved effective control of bleeding, compared to 72.7% in Group B (Foley's catheter), with the difference being statistically significant ($p = 0.012$). Table 2 compares the

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estimated blood loss between the two groups. The mean blood loss in the glove tamponade group was 280.6 ± 75.3 mL, which was significantly lower than that in the Foley's catheter group, where the mean blood loss was 362.8 ± 96.4 mL (p = 0.004). This indicates that glove tamponade was more effective in minimizing blood loss.

As shown in Table 3, the average time required for insertion and assembly of the tamponade devices was significantly shorter in the glove tamponade group (5.9 ± 1.8 minutes) compared to the Foley's catheter group (7.4 ± 2.1 minutes), with a p-value of 0.021. This suggests that glove tamponade was quicker to assemble and insert. According to Table 4, there was no significant difference in pre-procedural hemoglobin levels between the two groups (10.8 ± 0.6 g/dL in Group A vs. 10.7 ± 0.5 g/dL in Group B; p = 0.432). However, post-procedural hemoglobin levels after 24 hours were significantly higher in the glove tamponade group (10.1 ± 0.7 g/dL) compared to the Foley's catheter group (9.4 ± 0.8 g/dL), with a p-value of 0.003. This finding supports better blood conservation with glove tamponade.

Table 5 demonstrates the need for ICU admission in both groups. Only 6.1% of patients in the glove tamponade group required ICU admission **tamponade and foley's catheter**

compared to 24.2% in the Foley's catheter group.

This difference was statistically significant (p = 0.041), suggesting a better hemodynamic outcome with glove tamponade. As indicated in Table 6, re-exploration was needed in just 3.0% of patients in the glove tamponade group, while 18.2% of patients in the Foley's catheter group required additional surgical intervention. This difference was statistically significant (p = 0.047), further supporting the superior efficacy of glove tamponade in managing refractory postpartum hemorrhage due to uterine atony.

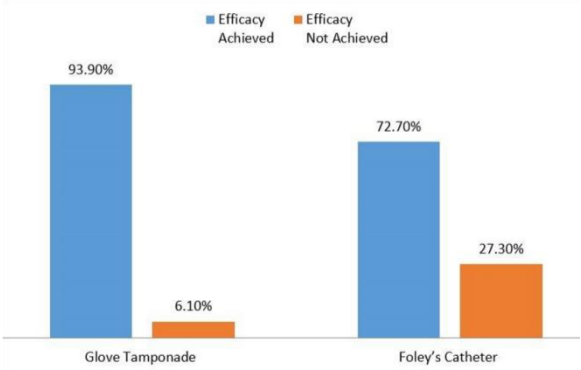

Figure 1: Comparison of efficacy between glove

Table 1: Comparison of efficacy between glove tamponade and foley's catheter (n = 66)

Treatment Group	Efficacy Achieved	Efficacy Not Achieved	Total	p-value
Glove Tamponade (Group A)	31 (93.9%)	2 (6.1%)	33	0.012
Foley's Catheter (Group B)	24 (72.7%)	9 (27.3%)	33	

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Table 2: Comparison of estimated blood loss (ml) between groups

Treatment Group	Mean ± SD Blood Loss (mL)	p-value
Glove Tamponade (Group A)	280.6 ± 75.3	0.004
Foley's Catheter (Group B)	362.8 ± 96.4	

Table 3: Comparison of time taken for insertion and assembly (minutes)

Treatment Group	Mean ± SD Time (min)	p-value
Glove Tamponade (Group A)	5.9 ± 1.8	0.021
Foley's Catheter (Group B)	7.4 ± 2.1	

Table 4: Comparison of hemoglobin levels (g/dl)

Hemoglobin Level	Glove Tamponade (Mean ± SD)	Foley's Catheter (Mean ± SD)	p-value
Pre-Procedural Hb	10.8 ± 0.6	10.7 ± 0.5	0.432
Post-Procedural Hb (24h)	10.1 ± 0.7	9.4 ± 0.8	0.003

Table 5: ICU admission requirement in both groups

Treatment Group	ICU Admission Required	ICU Not Required	Total	p-value
Glove Tamponade (Group A)	2 (6.1%)	31 (93.9%)	33	0.041
Foley's Catheter (Group B)	8 (24.2%)	25 (75.8%)	33	

Table 6: Re-exploration needed in both groups

Treatment Group	Re-exploration Needed	Not Needed	Total	p-value
Glove Tamponade (Group A)	1 (3.0%)	32 (97.0%)	33	0.047
Foley's Catheter (Group B)	6 (18.2%)	27 (81.8%)	33	

DISCUSSION

Postpartum hemorrhage (PPH) remains a leading cause of maternal morbidity and mortality, particularly in low-resource settings. Uterine atony is the most common cause of PPH and requires timely and effective intervention.[10] Balloon tamponade techniques are widely used for controlling atonic PPH when medical management fails. Foley's catheter is a commonly used method; however, limitations in availability and cost exist. The hand glove balloon tamponade is a cost-effective, easily assembled alternative using readily available materials.[11] This study aims to compare the efficacy of glove tamponade versus Foley's catheter in managing atonic PPH.

The findings of our study revealed that glove tamponade achieved a significantly higher efficacy (93.9%) compared to Foley's catheter (72.7%) in controlling atonic postpartum hemorrhage (PPH), which is closely in line with Nalini et al. (2023), who reported a success rate

of 92% for JH balloon and 88% for Foley catheter ($p = 0.74$).[13] Although their statistical difference was insignificant, the trend supports our conclusion that glove-based alternatives may offer superior efficacy. Additionally, the significantly lower rate of balloon slippage in the glove group in our study is consistent with Nalini's findings, where slippage was noted in 10 patients in the Foley group compared to only one in the glove group ($p = 0.008$).[13] Our results also closely relate to Akhtar et al. (2022), who reported a 93.98% success rate with Foley's balloon tamponade, nearly identical to our glove group outcomes.[19] Likewise,

Dawood et al. (2022) reported an overall efficacy of 91.5% with intrauterine balloon tamponade, supporting the effectiveness of tamponade techniques in atonic PPH. However, our reported mean blood loss (280.6 ± 75.3 mL in glove group vs. 362.8 ± 96.4 mL in Foley group) was substantially lower than that reported by Dawood (1208.5 ± 227.9 mL), suggesting that earlier intervention or more controlled procedures in our setup may have contributed to improved outcomes.[17]

In line with Nipanal et al. (2022), who demonstrated a 95.75% success rate using 24 Fr Foley catheters in 800 patients, our findings reinforce the overall effectiveness of balloon tamponade.[15] However, our results also contrast slightly with Bukhari et al. (2023), who reported an even higher success rate of 98% using a 16 Fr Foley catheter.[14] This discrepancy may be attributed to differences in catheter size, infusion volume (240 mL in Bukhari's study), or patient selection criteria.[14] Khan et al. (2025) reported an

89.2% success rate with Foley balloon tamponade, slightly lower than our glove group but higher than our Foley group. Their observation that failure was associated with coagulopathy and anemia supports our strategy of excluding such cases to eliminate confounders.[18] The higher re-exploration rate in our Foley group (18.2%) compared to the glove group (3.0%) also mirrors the trends observed by Gaikwad et al. (2021), who documented bleeding persistence in 4.8% of condom balloon tamponade cases, requiring surgical intervention in some.[20]

In contrast, the meta-analysis by Pingray et al. (2022) highlighted inconsistent outcomes and lowcertainty evidence regarding balloon tamponade effectiveness. Their findings emphasize the need for standardized protocols and better-quality trials. Despite this, our results provide further evidence that glove tamponade is a viable, cost-effective alternative that may outperform Foley's catheter in certain clinical scenarios.[16] Taken together, the literature supports and aligns with our study, confirming that uterine balloon tamponade, particularly glove-based methods, is an effective strategy for controlling atonic PPH and reducing the need for surgical intervention.

STUDY LIMITATIONS

However, the sample size was relatively small, which may affect the generalizability of findings. The study was conducted at a single center,

limiting external validity. Short-term outcomes were assessed without long-term follow-up on complications or recurrence.

CONCLUSION

Glove tamponade was found to be more effective than Foley's catheter in controlling bleeding in atonic uterus following postpartum hemorrhage. It resulted in lower blood loss, reduced ICU admissions, and fewer re-explorations. This technique offers a simple, lowcost, and efficient alternative in emergency obstetric care.

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