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Efficacy of B Lynch Suture and Intrauterine Balloon Tamponade Among Women with Severe Postpartum Hemorrhage Presenting to MMC Mardan

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ABSTRACT

Background: Severe postpartum hemorrhage (PPH) is a common cause of maternal morbidity and mortality and requires effective, timely interventions. Two well-known methods in the control of PPH include the B Lynch suture and the intrauterine balloon tamponade, although the comparative effectiveness between the two is yet to be determined. **Objective:** To compare the efficacy b lynch suture and intrauterine balloon tamponade among women with severe postpartum hemorrhage presenting to MMC Mardan. **Study Design:** A randomized controlled trial. **Duration and Place of Study:** The study was conducted from September 2024 to March 2025 at the Department of Obstetrics and Gynecology, Mardan Medical Complex, Mardan. **Methodology:** A total of 152 women with severe postpartum hemorrhage were enrolled and randomly assigned to either the B Lynch suture group (Group A) or the intrauterine balloon tamponade group (Group B). Demographic and clinical data were collected, and the effectiveness of each technique was evaluated based on the cessation of bleeding within 15 minutes. The primary outcomes measured included the success rate of each intervention. **Results:** The primary efficacy analysis revealed that the B Lynch suture was successful in 68 patients (89.5%), while intrauterine balloon tamponade succeeded in 60 patients (78.9%). However, this difference did not achieve statistical significance (p=0.075). **Conclusion:** While B Lynch suture demonstrated a numerically higher success rate in controlling severe postpartum hemorrhage compared to intrauterine balloon tamponade, the difference did not reach statistical significance.

INTRODUCTION

Postpartum hemorrhage (PPH) is a leading cause of maternal mortality and morbidity globally, especially in the developing world.[1] PPH is characterized as excessive postpartum bleeding, commonly in excess of 500 mL after vaginal delivery or 1000 mL after cesarean section.[2] The etiologies for PPH fall primarily under uterine atony, retained placenta, genital tract laceration, and coagulopathies.[3] Uterine atony is the leading cause for PPH, which results from failure of the uterus to contract following delivery, with subsequent bleeding from the site of the placenta.[4] Early detection and proper management can help decrease the risk for life-threatening sequelae, such as shock from hypovolemia and failure of organs.[5] Against this backdrop, treatments need to be tailored, aiming to control hemorrhage, stabilize the patient, and protect against long-term sequelae.

Management of severe postpartum hemorrhage is a stepwise approach, with a starting point in the majority of cases involving the use of simple methods like uterine massage and uterotonic drugs like oxytocin.[6] In cases where the above fails, interventions like surgery and invasive methods may be required.[7] The aim in the plan is to control bleeding, achieve hemodynamic stabilization, and conserve fertility wherever possible. In cases where hemorrhage is not managed with medical treatment, intervention with procedures like uterine artery ligation or advanced methods like the B-Lynch suture or intrauterine balloon tamponade is done.[8] Application of these methods has improved maternal outcomes through provision of efficient methods for control of bleeding with preservation of the uterus in a majority of cases.

The B-Lynch suture, created in the year 1997, is a surgical intervention for the control of severe postpartum hemorrhage from uterine atony.[9] It is the placement of a compressive suture that is meant to diminish bleeding by putting pressure on the uterine walls as well as narrowing blood vessels.[11] The B-Lynch suture is a critical intervention in the management of PPH, especially when the use of traditional methods, like uterotonics, is ineffective in arresting bleeding.[11] The fact that it saves the uterus and hence the fertility of the woman is one of the best things about the B-Lynch suture and therefore it is one of the most abundant factors in women in the reproductive age.[11] When conducted by experienced surgeons, it is safe and efficient intervention with a low

rate of complications.

Intrauterine balloon tamponade is also another essential technique of controlling postpartum hemorrhage, especially in situations where a woman bleeds persistently even after medical management.[12] It has been accomplished by placing balloon catheter into the uterus which is inflated to apply pressure on the walls of the uterus, and to tamponade the bleeding.[13] Cases of uterine atony, where the uterus fails to contract following delivery, are best. It is less invasive and can be frequently done at the bedside, providing an attractive alternative in the control of hemorrhage and uterus preservation, which is important in future fertility.[14]

A study demonstrated an 89.47% success rate for the cessation of severe postpartum hemorrhage in women treated with the B-Lynch suture, and a 71.43% success rate in those managed with intrauterine balloon tamponade.[15]

Comparative effectiveness study between B-Lynch suture and intrauterine balloon tamponade in women with severe postpartum hemorrhage is essential, particularly in areas like Mardan. In spite of the presence of both interventions, the comparison between the two interventions as far as effectiveness is concerned in treating severe postpartum hemorrhage in local practice is not well documented. This study might be able to offer essential information on which intervention is best in the aspect of success rates, complication control, and recovery in maternal well-being. By targeting Mardan, where maternal services may be inadequate, this study would offer essential data to maximize clinical practice and prevent maternal mortality in the area.

METHODOLOGY

This randomized controlled trial was conducted from September 2024 to March 2025 at the Department of Obstetrics and Gynecology, Mardan Medical Complex, Mardan. The study was ethically approved with certificate number 384/BKMC dated 13-09-2023. A sample size of 152 was calculated using the WHO sample size calculator, with a power of 80% and a 95% confidence interval. Based on the reported efficacy of B Lynch suture (89.47%) and intrauterine balloon tamponade (71.43%) in treating severe postpartum hemorrhage,[15] the sample was divided equally, with 76 patients in each group.

Inclusion criteria consisted of women aged 18 to 40 years who presented with severe postpartum hemorrhage, defined as blood loss greater than 1000 mL after vaginal delivery or more than 1500 mL following a cesarean section. This assessment was based on the volume of blood collected in kidney trays or saturated pads. Additionally, a decline in hemoglobin by 4 g/dL, requiring the transfusion of at least 3 blood pints, was considered an indicator of severe hemorrhage. Women with genital tract trauma, ruptured uterus, retained products of conception, or bleeding disorders were excluded from the study. Written informed consent was obtained from all participants, and demographic details such as age, education, occupation, living area, and socio-economic status were documented. Medical history, including comorbidities like diabetes and hypertension, was also recorded, followed by a physical examination. Women diagnosed with severe postpartum hemorrhage were randomly assigned to one of two groups using block randomization. Group A received the B Lynch suture, while Group B was treated with intrauterine balloon tamponade. In Group A, the B Lynch suture was performed in the lithotomy position, with access to the vagina. The abdomen was opened using a Pfannenstiel incision, or in cases of cesarean section followed by bleeding, the same incision was re-opened. Bimanual compression was applied, and vaginal swabbing ensured sufficient control of bleeding. The suture, positioned about 4 cm from the cornua, was tightened to achieve compression and minimize trauma. In Group B, intrauterine balloon tamponade was performed by inserting a 24 Fr Foley catheter into the uterine cavity. The balloon was inflated with warm saline to a total volume of 320–400 mL. The effectiveness of each procedure was evaluated based on the cessation of postpartum hemorrhage within 15 minutes.

Data analysis was performed using IBM SPSS v.24. Categorical data, such as efficacy, comorbid conditions, and socio-demographic variables, were presented as frequencies and percentages. Numerical data, including age, height, weight, BMI, and blood loss, were expressed as mean ± standard deviation. The efficacy between the two groups was compared using the chi-square test, with a p-value < 0.05 considered statistically significant. Effect modifiers, including age, BMI, diabetes, hypertension, and socio-economic factors, were controlled through stratification.

RESULTS

Demographic characteristics were well-matched between groups, with mean ages of 28.12±3.53 years for B Lynch suture and 28.68±3.90 years for intrauterine balloon tamponade patients. Both groups had similar anthropometric measurements including height (1.61±0.02m vs 1.60±0.02m), weight (65.42±4.91kg vs 66.01±5.48kg), and BMI (25.34±2.01kg/m^2 vs 25.74±2.36kg/m^2), with comparable blood loss volumes of 1453.95±284.94ml and 1474.21±287.93ml respectively. The B Lynch suture group had a higher proportion of urban patients (73.7% vs 52.6%), while the balloon tamponade group had more rural patients (47.4% vs 26.3%). Socioeconomic distribution was similar between groups, with middle-class patients predominating (61.8% vs 60.5%). Diabetes prevalence was 30.3% in the B Lynch group versus 22.4% in the balloon tamponade group, while hypertension was more common in the balloon tamponade group (32.9% vs 22.4%) (as shown in Table 1).

The primary efficacy analysis revealed that B Lynch suture achieved success in 68 patients (89.5%) compared to 60 patients (78.9%) with intrauterine balloon tamponade, though this difference was not statistically significant (p=0.075) (as shown in Table 2).

Stratified analysis by demographic variables showed no significant associations between treatment efficacy and patient characteristics. Age stratification (≤30 vs >30 years) showed similar efficacy rates for B Lynch suture (89.5% in both age groups) and varying rates for balloon tamponade (80.0% vs 76.9%), with p-values of 1.000 and 0.692 respectively. BMI stratification (≤25 vs >25 kg/m^2) demonstrated efficacy rates of 93.3% vs 87.0% for B Lynch

suture and 81.8% vs 76.7% for balloon tamponade (p=0.348 and p=0.210). Residential status showed higher efficacy for B Lynch suture in urban patients (92.9% vs 80.0%, p=0.089) compared to rural patients (80.0% vs 77.8%, p=0.800). Socioeconomic status, diabetes, and hypertension subgroup analyses all demonstrated consistently higher efficacy rates for B Lynch suture across all categories, though none reached statistical significance with p-values ranging from 0.105 to 0.696 (as shown in Table 3).

Table 1

Demographics of the Patients (n=152)

Demographics		Group A (n=76) Mean±SD	Group B (n=76) Mean±SD
Age (years)		28.12±3.53	28.68±3.90
Height (m)		1.61±0.02	1.60±0.02
Weight (kg)		65.42±4.91	66.01±5.48
BMI (kg/m^2)		25.34±2.01	25.74±2.36
Blood Loss (ml)		1453.95±284.94	1474.21±287.93
Residential Status	Rural n(%)	20 (26.3%)	36 (47.4%)
	Urban n(%)	56 (73.7%)	40 (52.6%)
Socioeconomic Status	Low n(%)	19 (25.0%)	19 (25.0%)
	Middle n(%)	47 (61.8%)	46 (60.5%)
	High n(%)	10 (13.2%)	11 (14.5%)
Diabetes	Yes n(%)	23 (30.3%)	17 (22.4%)
	No n(%)	53 (69.7%)	59 (77.6%)
Hypertension	Yes n(%)	17 (22.4%)	25 (32.9%)
	No n(%)	59 (77.6%)	51 (67.1%)

Table 2

Comparison of Efficacy between the Two Groups (n=152)

Efficacy	Group A (n=76) n (%)	Group B (n=76) n (%)	P value
Yes	68 (89.5%)	60 (78.9%)	
No	8 (10.5%)	16 (21.1%)	0.075
Total	76 (100%)	76 (100%)	

Table 3

Association of Efficacy with Demographic Variables

Demographics variables		Group	Efficacy Yes (n, %)	Efficacy No (n, %)	P-value
Age (years)	≤30	A	51 (89.5%)	6 (10.5%)	1.000
		B	40 (80.0%)	10 (20.0%)	
	>30	A	17 (89.5%)	2 (10.5%)	0.692*
		B	20 (76.9%)	6 (23.1%)	
BMI (kg/m^2)	≤25	A	28 (93.3%)	2 (6.7%)	0.348*
		B	27 (81.8%)	6 (18.2%)	
	>25	A	40 (87.0%)	6 (13.0%)	0.210
		B	33 (76.7%)	10 (23.3%)	
Residential Status	Rural	A	16 (80.0%)	4 (20.0%)	0.800*
		B	28 (77.8%)	8 (22.2%)	
	Urban	A	52 (92.9%)	4 (7.1%)	0.089*
		B	32 (80.0%)	8 (20.0%)	
Socioeconomic Status	Low	A	17 (89.5%)	2 (10.5%)	0.325*
		B	15 (78.9%)	4 (21.1%)	
	Middle	A	42 (89.4%)	5 (10.6%)	0.224*
		B	36 (78.3%)	10 (21.7%)	
	High	A	9 (90.0%)	1 (10.0%)	0.643*
		B	9 (81.8%)	2 (18.2%)	
Diabetes	Yes	A	21 (91.3%)	2 (8.7%)	0.391*
		B	14 (82.4%)	3 (17.6%)	
	No	A	47 (88.7%)	6 (11.3%)	0.272
		B	46 (78.0%)	13 (22.0%)	
Hypertension	Yes	A	14 (82.4%)	3 (17.6%)	0.696*
		B	19 (76.0%)	6 (24.0%)	
	No	A	54 (91.5%)	5 (8.5%)	0.105*
		B	41 (80.4%)	10 (19.6%)	

*Fischer Exact Test

DISCUSSION

The present study demonstrates that B Lynch suture achieved a numerically higher success rate (89.5%) compared to intrauterine balloon tamponade (78.9%) in managing severe postpartum hemorrhage, though this difference did not reach statistical significance (p=0.075). The superior efficacy of B Lynch suture can be attributed to its mechanism of direct mechanical compression of the uterine arteries and myometrial vessels through the brace-like suture configuration, which creates immediate and sustained hemostasis by compressing the bleeding vessels against the uterine wall. This technique provides continuous compression that is independent of uterine contractility, making it particularly effective in cases of severe uterine atony where the myometrium has lost its natural ability to contract and compress bleeding vessels. The intrauterine balloon tamponade mechanism relies on creating tamponade pressure against the uterine walls to compress bleeding vessels, but this method may be less effective in cases of severe uterine atony where the myometrium lacks sufficient contractile tone to maintain adequate pressure against the balloon. Additionally, the balloon's effectiveness depends on proper filling volume and positioning, and its pressure may decrease over time due to balloon deflation or displacement. The B Lynch suture's permanent nature ensures consistent compression throughout the critical hemostatic period, whereas balloon tamponade requires continuous monitoring and potential adjustments.

Our study results were consistent with several published comparative studies that demonstrated superior efficacy of B Lynch suture over intrauterine balloon tamponade. Fatima et al.[16] reported remarkably similar findings with success rates of 88.46% for B-Lynch suture versus 67.31% for intrauterine balloon tamponade among 104 patients, achieving statistical significance in their study. This finding was corroborated by Syed et al.[17] who demonstrated even higher success rates of 90% for B-Lynch suture compared to 65% for intrauterine balloon tamponade in 120 patients, with statistically significant differences. Similarly, Malik et al. [18] reported identical results to Fatima et al. [16] with success rates of 88.46% for B-Lynch suture versus 67.31% for balloon tamponade, further supporting the superior efficacy of surgical compression techniques.

The consistently higher efficacy rates of B Lynch suture across multiple studies can be explained by its permanent mechanical compression mechanism that maintains continuous pressure on bleeding vessels regardless of uterine tone. The intrauterine balloon tamponade mechanism relies on creating tamponade pressure against the uterine walls to compress bleeding vessels, but this method may be less effective in cases of severe uterine atony where the myometrium lacks sufficient contractile tone to maintain adequate pressure against the balloon. Additionally, the balloon's effectiveness depends on proper filling volume and positioning, and its pressure may decrease over time due to balloon deflation or displacement.

However, some studies have reported higher success rates for balloon tamponade when used in specific clinical scenarios. Ozgen and Aydin[19] achieved a 91.3% success

rate with Bakri balloon tamponade specifically in patients with placenta previa and placenta accreta spectrum, suggesting that balloon tamponade may be particularly effective in cases involving abnormal placentation where the bleeding source is more localized. Similarly, Akhtar et al.[20] reported an 88.8% success rate with balloon tamponade in primary postpartum hemorrhage after vaginal delivery, indicating that the mode of delivery and underlying pathophysiology may influence treatment effectiveness.

Our study's success rate for B Lynch suture (89.5%) aligns closely with Zaheen et al.[21] who reported an 88% effectiveness rate in high-risk patients, demonstrating the reproducibility of this technique across different populations and clinical settings. The demographic variables in our study showed no significant association with treatment efficacy, suggesting that both interventions are equally effective across different patient populations regardless of age, BMI, residential status, socioeconomic background, or comorbidities. This finding indicates that the choice between these interventions should be based primarily on clinical factors, surgeon expertise, and institutional protocols rather than patient demographic characteristics.

The slightly lower success rate of balloon tamponade in our study (78.9%) compared to some individual studies may be attributed to the severity of cases included, as our study specifically focused on severe postpartum hemorrhage with mean blood loss exceeding 1400ml in both groups. Leleu et al.[22] reported a 78.0% success rate for intrauterine balloon tamponade after vaginal delivery and identified that blood loss exceeding 200ml at 10 minutes post-balloon insertion was predictive of early failure, emphasizing the importance of prompt recognition of treatment failure to avoid delays in definitive management.

Both techniques serve as important fertility-preserving alternatives to more invasive procedures such as hysterectomy or uterine artery embolization, offering women the opportunity to maintain their reproductive potential while achieving effective hemostasis. The growing body of evidence supporting these conservative surgical approaches emphasizes their crucial role in the stepwise management of postpartum hemorrhage, particularly in resource-limited settings where advanced interventional procedures may not be readily available.

This study has several limitations that should be acknowledged when interpreting the results. As a single-center study conducted at one institution, the generalizability of our findings may be limited, and the results may not be representative of outcomes in different healthcare settings or populations with varying demographic characteristics. The sample size, while adequate for detecting large effect sizes, may have been insufficient to detect smaller but clinically meaningful differences between the two interventions, as evidenced by the borderline statistical significance (p=0.075). The study design did not account for potential confounding variables such as surgeon experience, time from delivery to intervention, specific underlying causes of hemorrhage, or institutional protocols that may influence treatment outcomes. Additionally, the lack of long-term follow-up data limits our understanding of potential complications, fertility outcomes, or patient satisfaction associated with each intervention.

CONCLUSION

Our study has concluded that B Lynch suture demonstrates superior efficacy compared to intrauterine balloon tamponade in the management of severe postpartum hemorrhage, though the difference did not reach statistical significance. These findings support the use of B Lynch suture as a preferred first-line surgical intervention for severe postpartum hemorrhage when medical management fails, while intrauterine balloon tamponade remains a valuable alternative, particularly in settings where surgical expertise may be limited.

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Author Contributions

Each author has made a vital contribution to the creation of this manuscript, as detailed below.

Dr. Tayyaba Akhtar led the conceptual framework of the study, contributed to the writing process, and supervised the gathering of hospital data.

Dr. Sadia Mahmood was instrumental in the development of the article, the planning of the study, and the analysis and interpretation of the collected data.

Dr. Sundas Jamal played a key role in designing the study, reviewed the manuscript, and offered valuable insights on the data interpretation.

Dr. Nuzhat Amin supported the data collection process, conducted statistical analysis, and assisted in refining the manuscript.

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