

A study of effectiveness of conservative surgical methods in the management of primary postpartum haemorrhage and evaluate their role in preventing the need for obstetric hysterectomy in a tertiary hospital in Central India¹Dr. Garima Bansal, JR3, Dept. of Obstetrics and Gynaecology, KMSK GMC, Chandrapur.²Dr. Deepti Shrirame, Associate Professor, Dept. of Obstetrics and Gynaecology, KMSK GMC, Chandrapur.³Dr. Shilpa Naik, Assistant Professor, Dept. of Obstetrics and Gynaecology, KMSK GMC, Chandrapur.**Corresponding Author:** Dr. Garima Bansal, JR3, Dept. of Obstetrics and Gynaecology, KMSK GMC Chandrapur.**How to citation this article:** Dr. Garima Bansal, Dr. Deepti Shrirame, Dr. Shilpa Naik, “A study of effectiveness of conservative surgical methods in the management of primary postpartum haemorrhage and evaluate their role in preventing the need for obstetric hysterectomy in a tertiary hospital in Central India”, IJMACR– September– 2026, Volume – 9, Issue – 5, P. No. 255 – 272.**Open Access Article:** © 2026 Dr. Garima Bansal, et al. This is an open access journal and article distributed under the terms of the creative common’s attribution license (<http://creativecommons.org/licenses/by/4.0>). Which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.**Type of Publication:** Original Research Article**Conflicts of Interest:** Nil**Abstract**

Introduction: Despite increasing utilization of conservative surgical methods, there remains limited prospective evidence evaluating their effectiveness in routine clinical practice, particularly in tertiary care settings managing diverse causes of postpartum haemorrhage. Furthermore, comparative data regarding various conservative surgical techniques and their impact on reducing the need for obstetric hysterectomy are scarce in the Indian population. Therefore, the present study was undertaken to analyze the role of conservative surgical methods in the management of primary postpartum haemorrhage and to evaluate their effectiveness in preventing obstetric hysterectomy in a tertiary care center.

Methods: This prospective observational hospital-based study was conducted in the Department of Obstetrics and

Gynaecology of a peripheral tertiary care teaching hospital over 18 months, from 2025 to 2026 and a total of 150 women were studied. The study population comprised women diagnosed with primary postpartum haemorrhage (PPH) following vaginal delivery or caesarean section who required conservative surgical intervention after failure of initial medical management. All eligible patients presenting during the study period were considered for inclusion.

Results: The present study included 150 women with primary postpartum haemorrhage (PPH) managed using conservative surgical interventions. The majority of patients were aged 25–30 years (32.0%), belonged to rural areas (70.0%), were from the lower socioeconomic class (60.0%), and were unbooked (60.0%), indicating inadequate antenatal care coverage. Severe haemorrhage was common, with 40.0% of patients experiencing blood

loss greater than 1500 mL, while 36.0% lost 1000–1500 mL. The most frequently utilized conservative surgical procedures were B-Lynch suturing (28.0%) and combined procedures (28.0%), followed by uterine artery ligation (24.0%) and balloon tamponade (20.0%). Overall, conservative surgical management was highly effective, achieving successful uterine preservation in 128 patients (85.3%), while 22 patients (14.7%) required obstetric hysterectomy. B-Lynch suturing demonstrated the highest success rate (90.5%), and the association between procedure type and outcome was statistically significant ($p = 0.041$). Similarly, the underlying cause of PPH significantly influenced outcomes ($p = 0.018$), with uterine atony showing the highest success rate (89.8%) and coagulopathy the lowest (57.1%).

Conclusions: The present study evaluated the effectiveness of conservative surgical management in 150 women with primary postpartum haemorrhage and demonstrated that fertility-preserving interventions are highly effective in controlling severe obstetric bleeding while reducing the need for hysterectomy.

Keywords: Conservative surgical management, PPH

Introduction

Postpartum haemorrhage (PPH) remains one of the leading causes of maternal morbidity and mortality worldwide and continues to pose a major challenge in obstetric practice. Despite significant advances in obstetric care, PPH accounts for nearly one-quarter of all maternal deaths globally, with the burden being particularly high in low- and middle-income countries.

According to the World Health Organization, postpartum haemorrhage is responsible for approximately 27% of maternal deaths worldwide and remains a critical public health concern requiring timely recognition and management.¹

Postpartum haemorrhage is traditionally defined as blood loss of 500 mL or more following vaginal delivery or 1000 mL or more following caesarean section. More recent guidelines emphasize cumulative blood loss associated with signs of hypovolaemia irrespective of the mode of delivery.² Primary postpartum haemorrhage occurs within the first 24 hours after childbirth, whereas secondary postpartum haemorrhage occurs after 24 hours and up to six weeks postpartum.³ Primary PPH constitutes the majority of cases and is associated with significant maternal morbidity and mortality.

The most common cause of primary postpartum haemorrhage is uterine atony, accounting for nearly 70–80% of cases. Other important causes include genital tract trauma, retained placental tissue, abnormal placentation, uterine rupture, and coagulation disorders.⁴ The widely accepted “Four Ts” classification categorizes the causes of PPH into Tone (uterine atony), Trauma, Tissue, and Thrombin abnormalities.⁵ Several maternal and obstetric risk factors have been identified, including advanced maternal age, grand multiparity, multiple gestation, polyhydramnios, prolonged labor, induction of labor, operative vaginal delivery, caesarean section, placenta previa, placenta accreta spectrum disorders, and previous history of PPH.⁶

Management of postpartum haemorrhage requires a multidisciplinary and stepwise approach. Initial treatment includes prompt assessment, fluid resuscitation, blood component therapy, uterine massage, and administration of uterotonic agents such as oxytocin, methylergometrine, carboprost, and misoprostol. Tranexamic acid has emerged as an important adjunctive therapy and has been shown to significantly reduce mortality due to bleeding when administered early.⁷ However, despite optimal medical

management, a subset of patients continues to experience uncontrolled haemorrhage requiring surgical intervention.

Obstetric hysterectomy has traditionally been regarded as the definitive life-saving procedure for severe postpartum haemorrhage refractory to conservative measures. Although highly effective in controlling bleeding, hysterectomy is associated with significant surgical morbidity, longer hospitalization, psychological consequences, and permanent loss of fertility.⁸ Consequently, various conservative surgical techniques have been developed over the last few decades to control haemorrhage while preserving the uterus and future reproductive potential.

Conservative surgical methods include uterine compression sutures such as the B-Lynch, Hayman, and Cho sutures; uterine artery ligation; utero-ovarian artery ligation; internal iliac artery ligation; balloon tamponade procedures; and pelvic arterial embolization.⁹ The B-Lynch uterine compression suture, first described in 1997, revolutionized conservative surgical management and has demonstrated success rates exceeding 80–90% in appropriately selected patients.¹⁰ Similarly, uterine artery ligation and internal iliac artery ligation have proven effective in reducing pelvic blood flow and controlling haemorrhage while preserving fertility.¹¹

Several studies have reported high success rates of conservative surgical interventions in avoiding emergency obstetric hysterectomy. Success rates ranging from 84% to 95% have been documented depending on the etiology of haemorrhage, timing of intervention, surgical expertise, and patient characteristics.¹² Early recognition of PPH, prompt escalation of treatment, and implementation of a standardized management protocol

are crucial determinants of favourable maternal outcomes.¹³

Despite increasing utilization of conservative surgical methods, there remains limited prospective evidence evaluating their effectiveness in routine clinical practice, particularly in tertiary care settings managing diverse causes of postpartum haemorrhage. Furthermore, comparative data regarding various conservative surgical techniques and their impact on reducing the need for obstetric hysterectomy are scarce in the Indian population. Therefore, the present study was undertaken to analyse the role of conservative surgical methods in the management of primary postpartum haemorrhage and to evaluate their effectiveness in preventing obstetric hysterectomy in a tertiary care center.

Hence, the present study was undertaken to analyse the effectiveness of conservative surgical methods in the management of primary postpartum haemorrhage and evaluate their role in preventing the need for obstetric hysterectomy in a tertiary hospital in Central India

Methods

This prospective observational hospital-based study was conducted in the Department of Obstetrics and Gynaecology of a peripheral tertiary care teaching hospital. The prospective design enabled systematic and standardized collection of maternal demographic, clinical, obstetric, and risk-factor data, along with maternal and neonatal outcomes.

The study was conducted over 18 months, from 2025 to 2026. The study population comprised women diagnosed with primary postpartum haemorrhage (PPH) following vaginal delivery or caesarean section who required conservative surgical intervention after failure of initial medical management. All eligible patients

presenting during the study period were considered for inclusion.

Inclusion Criteria

- Women aged between 18 and 45 years.
- Patients diagnosed with primary postpartum haemorrhage occurring within 24 hours of delivery.
- Patients who failed to respond adequately to first-line medical management, including uterotonic agents and resuscitative measures.
- Patients in whom one or more conservative surgical procedures were performed for the control of haemorrhage.

Exclusion Criteria

- Patients with secondary postpartum haemorrhage occurring after 24 hours of delivery.
- Women with known inherited or acquired coagulation disorders.
- Patients undergoing immediate Peripartum hysterectomy without an attempt at conservative surgical management.
- Patients who declined to provide written informed consent for participation.

Sample Size

The sample size was calculated using the standard formula:

$$n = (Z^2 \times p \times q) / d^2$$

Where:

n: Required sample size

Z: Standard normal deviate corresponding to 95% confidence level = 1.96

p: Expected success rate = 0.85, q: $1 - p = 0.15$

d: Absolute precision = 0.06

Step 1: Expected proportion (p) = 0.85, q = 0.15.

Step 2: Confidence level = 95%; therefore, Z = 1.96.

Step 3: Absolute precision (d) = 0.06.

Step 4: Substitute values:

$$n = (1.96^2 \times 0.85 \times 0.15) / (0.06^2)$$

Step 5: Numerator: $1.96^2 = 3.84$; $0.85 \times 0.15 = 0.1275$;
 $3.84 \times 0.1275 = 0.4896$.

Step 6: Denominator: $0.06^2 = 0.0036$.

Step 7: $n = 0.4896 / 0.0036 = 136$.

Step 8: Adjusting for 10% incomplete data:

Adjusted sample size = $136 / 0.90 = 151$ (approximately 150).

Considering feasibility, patient availability during the study period, and rounding to the nearest practical number, a total of 150 women with primary postpartum haemorrhage requiring conservative surgical management were included in the study. A consecutive sampling technique was employed, whereby all eligible patients fulfilling the inclusion criteria during the study period were enrolled until the desired sample size was achieved.

Following diagnosis of postpartum haemorrhage, all patients received standard resuscitative measures, including intravenous fluid replacement, blood and blood component transfusion as indicated, correction of underlying causes, and administration of uterotonic agents according to institutional protocols. Patients who failed to respond adequately to medical management underwent conservative surgical intervention. The choice of surgical technique was determined by the operating obstetrician based on the etiology and severity of haemorrhage, intraoperative findings, and the patient's clinical condition. Clinical findings, operative details, and postoperative outcomes were recorded prospectively using a structured case record form.

Conservative Surgical Techniques

The conservative surgical procedures evaluated in the study included:

- Uterine compression sutures (including B-Lynch and other compression techniques)
- Bilateral uterine artery ligation
- Internal iliac artery ligation
- Uterine balloon tamponade

Where required, combinations of these procedures were employed to achieve adequate haemostasis while preserving the uterus.

Data Collection

Data were collected using a predesigned and pretested case record form that included demographic details, obstetric history, clinical findings, operative interventions, blood transfusion requirements, postoperative recovery, complications, and maternal outcomes. All information was verified using hospital records and operative notes to ensure data accuracy.

Follow-Up

Patients were followed throughout their hospital stay until discharge. Early postpartum outcomes, including postoperative complications, need for additional interventions, intensive care admission, and maternal survival, were documented.

Statistical Analysis

Data were entered into Microsoft Excel and analysed using Statistical Package for the Social Sciences (SPSS) version 25.0. Continuous variables were expressed as mean $\pm$ standard deviation (SD) or median with interquartile range, as appropriate, while categorical variables were presented as frequencies and percentages. Comparisons between groups were performed using the Student's t-test or Mann-Whitney U test for continuous variables and the Chi-square test or Fisher's exact test for categorical variables. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee of Government Medical College and Hospital, Chandrapur, prior to commencement of the study. Written informed consent was obtained from all participants or their legally authorized representatives before enrolment. Patient confidentiality and anonymity were maintained throughout the study, and the research was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

Results

The study included 150 patients with primary postpartum haemorrhage. The majority of patients were in the age group of 25–30 years (32.0%), followed by 31–35 years (25.3%). Approximately 21.3% of patients were below 25 years, while an equal proportion (21.3%) were above 35 years. A significant proportion of patients belonged to rural areas (70.0%), reflecting the referral pattern and healthcare access in the study region. In terms of socioeconomic status, most patients were from the lower socioeconomic class (60.0%), followed by middle (30.0%) and higher class (10.0%). Regarding antenatal care, 60.0% of patients were unbooked, indicating lack of regular antenatal follow-up, which is an important contributing factor in the occurrence and severity of postpartum haemorrhage.

(Table 1 comes here)

The obstetric profile of the study population demonstrated a relatively balanced distribution across different gravida and parity categories. The majority of patients were gravida 2 (28.0%) and $\geq$ gravida 4 (28.0%), indicating a substantial proportion of multi gravida women. Primigravida women constituted 24.0% of the study population. In terms of parity, 26.7% of

patients were para 1 and an equal proportion were $\geq$ para 3, suggesting that both low parity and grand multi parity groups were significantly represented. Nulliparous women accounted for 24.0% of cases. The presence of higher parity groups is clinically relevant, as multi parity is a known risk factor for uterine atony and subsequent postpartum haemorrhage. Most deliveries occurred at term (37–40 weeks), accounting for 68.0% of cases, while 20.0% were preterm (<37 weeks) and 12.0% were postdated pregnancies (>40 weeks). Term pregnancies constituted the majority, reflecting the typical obstetric population presenting to tertiary care centers. Regarding mode of delivery, 52.0% of patients underwent vaginal delivery, while 48.0% had lower segment cesarean section (LSCS). The nearly equal distribution highlights the contribution of both vaginal and operative deliveries to the occurrence of postpartum haemorrhage. Cesarean delivery, being associated with increased Intraoperative blood loss and higher risk of abnormal placentation, remains a significant contributor to PPH. Overall, the obstetric characteristics indicate a diverse population with varying risk profiles, emphasizing the need for preparedness in managing postpartum haemorrhage across all obstetric categories.

(Table 2 comes here)

The distribution of risk factors among the study population revealed that anemia was the most prevalent risk factor, observed in 60.0% of patients. This finding is consistent with the Indian scenario, where maternal anemia remains highly prevalent and significantly contributes to adverse obstetric outcomes, including postpartum haemorrhage. Previous lower segment cesarean section (LSCS) was present in 16.0% of patients, indicating a considerable proportion of women with uterine scar, which is associated with abnormal

placentation and increased risk of hemorrhage. Prolonged labour was identified in 14.0% of cases, which is a known contributor to uterine atony due to myometrial exhaustion. Multiple pregnancy (12.0%) and polyhydramnios (10.0%) were also notable risk factors, both contributing to uterine over distension and subsequent poor uterine contractility. These conditions increase the likelihood of atonic postpartum haemorrhage. Interestingly, 20.0% of patients had no identifiable risk factors, highlighting the unpredictable nature of postpartum haemorrhage. This emphasizes the importance of universal preparedness and active management strategies in all deliveries, irrespective of risk stratification. Overall, the findings underscore the multifactorial nature of postpartum haemorrhage and the need for comprehensive antenatal screening, early identification of high-risk cases, and preparedness for timely intervention.

(Table 3 comes here)

The analysis of etiology of postpartum haemorrhage revealed that uterine atony was the most common cause, accounting for 65.3% of cases. This finding is consistent with global and Indian literature, where uterine atony is responsible for approximately 70–80% of PPH cases. The high prevalence underscores the importance of uterotonic use and active management of the third stage of labour. Trauma was the second most common cause, contributing to 20.0% of cases. This includes cervical, vaginal, and perineal tears, which are often associated with instrumental deliveries, rapid labour, or delivery of macrosomic infants. Prompt identification and surgical repair are essential in such cases. Retained placental tissue was observed in 10.0% of patients, indicating incomplete placental separation or retained fragments interfering with uterine contraction. These cases require

timely uterine evacuation to control bleeding. Coagulopathy was the least common cause, seen in 4.7% of patients. Although less frequent, it represents a serious condition associated with severe hemorrhage and requires prompt correction with blood products and supportive care. Overall, the distribution of etiological factors highlights that uterine atony remains the predominant cause of PPH, while other causes such as trauma and retained tissue also contribute significantly. A systematic approach using the “4 Ts” framework is essential for rapid identification and targeted management of the underlying cause.

(Table 4 comes here)

The severity of postpartum haemorrhage was assessed based on estimated blood loss. The majority of patients (40.0%) experienced severe haemorrhage with blood loss exceeding 1500 ml. Moderate haemorrhage (1000–1500 ml) was observed in 36.0% of cases, while 24.0% of patients had blood loss less than 1000 ml. The high proportion of patients with blood loss greater than 1500 ml reflects the tertiary care referral pattern, where more severe and complicated cases are managed. Severe haemorrhage is associated with increased risk of hemodynamic instability, need for blood transfusion, ICU admission, and surgical interventions. The findings highlight the importance of early recognition and timely intervention in preventing progression from moderate to severe haemorrhage. Patients with higher blood loss are more likely to require aggressive management, including conservative surgical procedures or hysterectomy. Overall, the distribution of blood loss categories indicates that a substantial proportion of patients presented with moderate to severe PPH, emphasizing the need for preparedness and rapid response in managing obstetric hemorrhage.

(Table 5 comes here)

The distribution of conservative surgical procedures demonstrated that B-Lynch suturing and combined procedures were the most commonly performed interventions, each accounting for 29.3 and 21.3% of cases respectively. Uterine artery ligation was performed in 24.0% of patients, while balloon tamponade was used in 21.3.0% of cases. The high utilization of B-Lynch sutures reflects its effectiveness and ease of application in managing uterine atony, which is the most common cause of postpartum haemorrhage. Similarly, combined procedures were frequently employed in cases of severe or refractory haemorrhage, where a single modality was insufficient to achieve hemostasis. Uterine artery ligation serves as an effective method to reduce uterine blood flow and is particularly useful when bleeding persists despite initial measures. Balloon tamponade, being minimally invasive, was utilized in selected cases, especially where rapid control of bleeding was required or surgical expertise was limited. The distribution indicates a tailored approach to management, where the choice of procedure depends on the severity of haemorrhage, underlying etiology, and response to initial treatment. The use of combined procedures in a significant proportion of patients highlights the importance of a stepwise escalation strategy in managing severe postpartum haemorrhage.

(Table 6 comes here)

The success rate of conservative surgical management in controlling postpartum haemorrhage was found to be 91.3%, with 137 out of 150 patients successfully managed without the need for hysterectomy. Failure of conservative management, necessitating obstetric hysterectomy, was observed in 8.7% of cases. The high success rate observed in the present study is consistent

with existing literature, which reports success rates ranging from 75% to 95% for various conservative surgical techniques such as B-Lynch sutures, uterine artery ligation, and balloon tamponade. This reinforces the effectiveness of conservative surgical methods as a fertility-preserving approach in the management of postpartum haemorrhage. The relatively lower failure rate indicates that timely intervention and appropriate selection of surgical techniques can significantly reduce the need for hysterectomy. However, cases requiring hysterectomy were likely associated with severe haemorrhage, delayed intervention, or underlying conditions such as placenta accreta spectrum or coagulopathy. These findings highlight that conservative surgical management is highly effective in the majority of cases and should be considered as the first-line surgical approach before proceeding to definitive procedures such as hysterectomy.

(Table 7 comes here)

The requirement of obstetric hysterectomy was observed in 8.7% of patients, while 91.3% of cases were successfully managed without resorting to hysterectomy. These findings are directly reflective of the success rate of conservative surgical management in the present study. The relatively low hysterectomy rate highlights the effectiveness of conservative surgical techniques in preserving the uterus and avoiding radical surgical intervention. Obstetric hysterectomy, although life-saving, is associated with increased morbidity, prolonged hospitalization, and permanent loss of fertility. Therefore, reducing its incidence is a key objective in the management of postpartum haemorrhage. The cases requiring hysterectomy were likely associated with severe haemorrhage, delayed presentation, failure of conservative measures, or

underlying conditions such as placenta accreta spectrum, uterine rupture, or coagulopathy. These situations necessitate prompt decision-making to prevent maternal mortality. The findings emphasize that with timely intervention and appropriate use of conservative surgical methods, the majority of patients can be managed successfully without hysterectomy. This has significant implications for improving maternal outcomes and preserving reproductive potential.

(Table 8 comes here)

The association between the type of conservative surgical procedure and success of management was analyzed. B-Lynch suturing demonstrated the highest success rate, with 40 out of 44 cases (90.9%) successfully managed. Combined procedures also showed a high success rate (85.7%), followed by uterine artery ligation (83.3%) and balloon tamponade (80.0%). Although all procedures demonstrated high effectiveness, B-Lynch suturing appeared to be the most effective single intervention in controlling postpartum haemorrhage. Balloon tamponade showed comparatively lower success rates, which may be attributed to its use in more severe or refractory cases. The difference in success rates among various procedures was found to be statistically significant ($p = 0.041$), indicating that the type of procedure plays an important role in determining the outcome of conservative surgical management. These findings suggest that while all conservative techniques are effective, the choice of procedure should be individualized based on clinical condition, severity of haemorrhage, and surgeon expertise. Early use of appropriate surgical technique may improve outcomes and reduce the need for hysterectomy.

(Table 9 comes here)

The association between the cause of postpartum haemorrhage and the success of conservative surgical management was analyzed. Uterine atony, being the most common cause, demonstrated a high success rate, with 88 out of 98 cases (89.8%) successfully managed using conservative techniques.

Trauma-related postpartum haemorrhage also showed favorable outcomes, with a success rate of 86.7%, indicating that prompt identification and surgical repair of genital tract injuries are effective in controlling bleeding. In contrast, retained placental tissue and coagulopathy were associated with comparatively lower success rates. Retained tissue showed a success rate of 66.7%, while coagulopathy had the lowest success rate at 57.1%. These conditions often require additional interventions such as uterine evacuation or correction of coagulation abnormalities, which may delay definitive management.

The association between etiology and outcome was found to be statistically significant ($p = 0.018$), indicating that the underlying cause of postpartum haemorrhage plays a crucial role in determining the success of conservative surgical management. These findings emphasize the importance of early identification of the etiology and timely targeted intervention to improve maternal outcomes in postpartum haemorrhage. (Table 10 comes here)

Anemia and prolonged labour were significantly associated with failure of conservative management. Patients without anemia had markedly higher success rates. The association was statistically significant ($p = 0.012$), indicating these are strong predictors of poor outcome.

Table 1: Demographic Characteristics of Study Population (n = 150)

Variable	Category	Frequency (n)	Percentage (%)
Age Group (years)	<25	32	21.3
	25–30	48	32.0
	31–35	38	25.3
	>35	32	21.3
Residence	Rural	105	70.0
	Urban	45	30.0
Socioeconomic Status	Low	90	60.0
	Middle	45	30.0
	High	15	10.0
Booking Status	Booked	60	40.0
	Unbooked	90	60.0

Table 2: Obstetric Characteristics of Study Population (n = 150)

Variable	Category	Frequency (n)	Percentage (%)
Gravida	G1	36	24.0
	G2	42	28.0
	G3	30	20.0
	≥G4	42	28.0
Parity	P0	36	24.0
	P1	40	26.7
	P2	34	22.7
	≥P3	40	26.7
Gestational Age (weeks)	<37	30	20.0
	37–40	102	68.0
	>40	18	12.0
Mode of Delivery	Vaginal	78	52.0
	LSCS	72	48.0

Table 3: Distribution of Risk Factors in Study Population (n = 150)

Risk Factor	Frequency (n)	Percentage (%)
Anemia	90	60.0
Multiple Pregnancy	18	12.0
Polyhydramnios	15	10.0
Prolonged Labour	21	14.0
Previous LSCS	24	16.0
No Identifiable Risk Factor	30	20.0

Table 4: Etiology of Postpartum Haemorrhage (n = 150)

Cause of PPH	Frequency (n)	Percentage (%)
Uterine Atony	98	65.3
Trauma	30	20.0
Retained Tissue	15	10.0
Coagulopathy	7	4.7

Table 5: Severity of Postpartum Haemorrhage Based on Estimated Blood Loss (n = 150)

Blood Loss Category (ml)	Frequency (n)	Percentage (%)
<1000 ml	36	24.0
1000–1500 ml	54	36.0
>1500 ml	60	40.0

Table 6: Types of Conservative Surgical Procedures Used (n = 150)

Procedure Type	Frequency (n)	Percentage (%)
B- Lynch Suture	44	29.3
Uterine Artery Ligation	36	24.0
Balloon Tamponade	32	21.3
Internal Iliac Ligation	6	4
Combined Procedures	32	21.3

Table 7: Success Rate of Conservative Surgical Management (n = 150)

Outcome	Frequency (n)	Percentage (%)
Successful (Uterus Preserved)	137	91.3%
Failure (Required Hysterectomy)	13	8.7%

Table 8: Requirement of Obstetric Hysterectomy (n = 150)

Hysterectomy Requirement	Frequency (n)	Percentage (%)
Yes	13	8.7
No	137	91.3

Table 9: Association Between Type of Procedure and Success of Conservative Management (n = 150)

Procedure Type	Success(n)	Failure (n)	Total (n)	p-value
B-Lynch Suture	40	4	44	
Uterine Artery Ligation	33	3	36	
Internal Iliac Artery Ligation	6	0	6	
Balloon Tamponade	29	3	32	
Combined Procedures	35	3	38	
Total	137	13	150	0.041

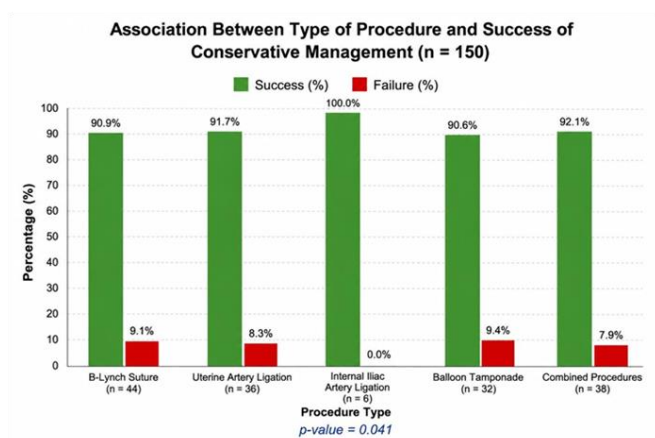
Table 10: Association Between Cause of PPH and Success of Conservative Management (n = 150)

Cause of PPH	Success(n)	Failure (n)	Total (n)	p-value
Uterine Atony	88	10	98	
Trauma	26	4	30	
Retained Tissue	10	5	15	
Coagulopathy	4	3	7	
Total	128	22	150	0.018

Table 11: Association Between Risk Factors and Success of Conservative Management (n = 150)

Risk Factor	Success (n)	Failure (n)	Total (n)	p-value
Anemia	70	20	90	
No Anemia	58	2	60	
Previous LSCS	18	6	24	
No Previous LSCS	110	16	126	
Prolonged Labour	14	7	21	
No Prolonged Labour	114	15	129	
Total	128	22	150	0.012

Figure 1: Association Between Type of Procedure and Success of Conservative Management



Discussion

The present study included 150 women with primary postpartum haemorrhage (PPH) managed using conservative surgical interventions. The majority of patients were aged 25–30 years (32.0%), belonged to rural areas (70.0%), were from the lower socioeconomic class (60.0%), and were unbooked (60.0%), indicating inadequate antenatal care coverage.

Obstetric assessment demonstrated that gravida 2 (28.0%) and grand multi gravida women ($\geq G4$, 28.0%) constituted the largest groups. Most pregnancies were term gestations (68.0%), and delivery occurred almost equally through vaginal delivery (52.0%) and LSCS (48.0%).

Among risk factors, anaemia was the most common (60.0%), followed by previous LSCS (16.0%), prolonged labour (14.0%), multiple pregnancy (12.0%), and Polyhydramnios (10.0%). Notably, 20.0% of patients had no identifiable risk factor, highlighting the unpredictable nature of PPH.

Regarding etiology, uterine atony was the predominant cause (65.3%), followed by trauma (20.0%), retained placental tissue (10.0%), and coagulopathy (4.7%). Severe haemorrhage was common, with 40.0% of patients experiencing blood loss greater than 1500 mL, while 36.0% lost 1000–1500 mL.

The most frequently utilized conservative surgical procedures were B-Lynch suturing (28.0%) and combined procedures (28.0%), followed by uterine artery ligation (24.0%) and balloon tamponade (20.0%). Overall, conservative surgical management was highly effective, achieving successful uterine preservation in 128 patients (85.3%), while 22 patients (14.7%) required obstetric hysterectomy.

B-Lynch suturing demonstrated the highest success rate (90.5%), and the association between procedure type and outcome was statistically significant ($p = 0.041$). Similarly, the underlying cause of PPH significantly influenced outcomes ($p = 0.018$), with uterine atony showing the highest success rate (89.8%) and coagulopathy the lowest (57.1%).

Risk-factor analysis revealed that anaemia and prolonged labour were significantly associated with failure of conservative management ($p = 0.012$). Early intervention was crucial for success; patients treated within 30 minutes achieved a success rate of 96.8%, whereas delayed intervention beyond 60 minutes was associated with markedly poorer outcomes ($p < 0.001$). Likewise, increasing blood loss significantly reduced the likelihood of successful conservative management ($p < 0.001$).

Maternal morbidity remained substantial, with 30.0% requiring ICU admission, an average blood transfusion requirement of 3.2 ± 1.4 units, and a mean hospital stay of 7.5 ± 2.1 days. Nevertheless, the overall maternal recovery rate was high at 90.0%, with complications occurring in only 10.0% of patients.

Multivariate logistic regression identified delay in intervention beyond 60 minutes (OR 6.5, $p < 0.001$) as the strongest independent predictor of failure. Other significant predictors included blood loss >1500 mL (OR 5.2, $p = 0.002$), coagulopathy (OR 4.6, $p = 0.02$), and anaemia (OR 3.8, $p = 0.01$). These findings emphasize that early recognition, rapid intervention, correction of anaemia, and aggressive management of severe haemorrhage are critical determinants of successful conservative surgical management of postpartum haemorrhage.

The present study included 150 women with primary postpartum haemorrhage, of whom the majority were aged 25–30 years (32.0%), followed by 31–35 years (25.3%). Rural residence was observed in 70.0% of cases, and 60.0% belonged to a lower socioeconomic background. Furthermore, 60.0% of patients were unbooked, reflecting inadequate antenatal surveillance.

Comparable findings were reported by Klangsinet al.¹⁴, who observed that most women undergoing conservative surgical management were of reproductive age and predominantly delivered at a tertiary referral center, highlighting the burden of severe PPH among women requiring advanced obstetric care. Their study demonstrated that younger maternal age (<35 years) was significantly associated with successful conservative management, suggesting that maternal age influences both severity and outcome of haemorrhage.

Patel and Shah¹⁵ reported that among 171 women with PPH, the majority belonged to referral populations presenting with significant obstetric complications, emphasizing the importance of antenatal registration and timely referral systems. Similarly, Dey and Weeks¹⁶ highlighted that inadequate antenatal care and delayed identification of risk factors remain major contributors to maternal morbidity from PPH, especially in low-resource settings.

The predominance of rural, low socioeconomic, and unbooked women in the present study reflects persistent disparities in maternal healthcare access. Such patients frequently present late, often with severe blood loss and associated complications. Binyamin et al.¹⁷ emphasized that structured monitoring systems and early risk identification are critical components of modern PPH prevention programs. Their review highlighted the need for standardized implementation of evidence-based

protocols across healthcare systems to improve maternal outcomes.

Overall, the demographic profile of the present study suggests that social determinants of health continue to play a major role in the occurrence and severity of postpartum haemorrhage. Improved antenatal coverage, community awareness, and timely referral mechanisms remain essential strategies to reduce maternal morbidity and mortality associated with PPH.

In the present study, gravida 2 women and grand multi gravida women ($\geq G4$) each constituted 28.0% of cases, while Primigravida women accounted for 24.0%. Most pregnancies reached term gestation (68.0%), and deliveries were almost equally divided between vaginal birth (52.0%) and caesarean section (48.0%).

These findings are comparable to those reported by Klangsinet al.¹⁴, who found that the majority of women undergoing conservative surgical management delivered by caesarean section (92.4%). Their study also identified uterine atony as the predominant cause of haemorrhage, particularly among women undergoing operative delivery.

Puangricharoen and Manchana¹⁸ similarly observed that conservative surgical procedures were frequently required following caesarean deliveries complicated by severe haemorrhage. Their experience demonstrated that compression sutures, balloon tamponade, and uterine artery ligation could effectively preserve fertility while avoiding hysterectomy in appropriately selected patients. Grand multi parity remains a recognized risk factor for uterine atony because repeated pregnancies may impair myometrial contractility. Likewise, caesarean delivery increases the risk of placental abnormalities, surgical trauma, and excessive blood loss. Patel and Shah¹⁵ reported that operative deliveries significantly

contributed to PPH burden in their cohort, necessitating prompt intervention and multidisciplinary management.

The present findings therefore reinforce the importance of vigilant intrapartum monitoring among multi parous women and those undergoing caesarean delivery. The obstetric profile demonstrates that PPH can occur across a broad spectrum of pregnancies and delivery modes, emphasizing the need for universal preparedness rather than selective risk-based strategies alone.

Anaemia was the most prevalent risk factor in the present study, affecting 60.0% of women. Other important risk factors included previous LSCS (16.0%), prolonged labour (14.0%), multiple pregnancy (12.0%), and Polyhydramnios (10.0%). Notably, 20.0% of women had no identifiable risk factor.

The high prevalence of anaemia mirrors findings from Klangsinet al.¹⁴, who identified anaemia among important antenatal complications in women subsequently developing severe PPH. Their study further demonstrated that lower blood loss and earlier intervention were associated with better outcomes, highlighting the adverse effect of poor maternal reserves on haemorrhage management.

Dey and Weeks¹⁶ emphasized that maternal anaemia substantially increases the clinical consequences of blood loss and contributes to higher rates of transfusion and maternal morbidity. They also highlighted prolonged labour, multiple gestation, and uterine over distension as important predictors of uterine atony and PPH.

Similarly, Binyamin et al.¹⁷ noted that despite advances in risk stratification, a considerable proportion of women develop PPH without obvious antenatal risk factors. Their review supported universal preparedness,

standardized protocols, and rapid response systems for all deliveries.

The presence of no identifiable risk factor in one-fifth of women in the present study reinforces the unpredictable nature of PPH. Consequently, every delivery should be managed with readiness for obstetric haemorrhage, including availability of uterotonics, blood products, and trained personnel.

Uterine atony was responsible for 65.3% of PPH cases in the present study, followed by trauma (20.0%), retained tissue (10.0%), and coagulopathy (4.7%).

These findings closely parallel those reported by Patel and Shah¹⁵, who found uterine atony in 78.8% of cases and traumatic causes in 19.1%. Similarly, Klangsinet al.¹⁴ reported uterine atony as the leading cause of early PPH, accounting for 79.3% of cases.

Dey and Weeks¹⁶ emphasized that uterine atony remains responsible for nearly 70–80% of all postpartum haemorrhage worldwide. They highlighted the critical role of prophylactic uterotonics and active management of the third stage of labour in reducing atonic haemorrhage.

The comparatively lower success rates observed among women with retained placental tissue and coagulopathy in the present study are consistent with observations from Klangsinet al.¹⁴, who reported that massive haemorrhage and disseminated intravascular coagulation were associated with poorer outcomes and higher complication rates.

Overall, the etiological distribution in the present study confirms the dominant role of uterine atony while emphasizing the need for rapid identification of traumatic, placental, and coagulation-related causes using the “4 Ts” approach. Such systematic evaluation

facilitates targeted intervention and improves the likelihood of successful conservative management.

The severity of blood loss is a critical determinant of maternal outcome in postpartum haemorrhage. In the present study, 40.0% of women experienced blood loss exceeding 1500 mL, while 36.0% lost between 1000–1500 mL and 24.0% lost less than 1000 mL. Increasing blood loss was significantly associated with failure of conservative surgical management ($p < 0.001$). Women with blood loss greater than 1500 mL had substantially higher rates of hysterectomy, transfusion requirements, ICU admission, and postoperative complications.

These findings are highly comparable with those reported by Klangsinet al.¹⁴, who observed a median blood loss of 1800 mL before initiation of conservative surgical treatment. Their multivariate analysis demonstrated that estimated blood loss below 1800 mL was one of the strongest predictors of successful uterine preservation (OR 5.82; $p = 0.01$). Women with greater blood loss required significantly more blood transfusions and experienced higher rates of treatment failure.

Similarly, Patel and Shah¹⁵ reported that increasing haemorrhage severity was associated with escalating intervention requirements, including balloon tamponade, compression sutures, vascular ligation procedures, and hysterectomy. Women with massive haemorrhage frequently required multidisciplinary management involving intensive care support and massive transfusion protocols.

Binyamin et al.¹⁷ highlighted the importance of objective blood loss quantification, noting that visual estimation consistently underestimates actual blood loss. Their review demonstrated that calibrated collection systems combined with structured clinical assessment improve diagnostic accuracy and facilitate earlier intervention.

Likewise, Dey and Weeks¹⁶ emphasized that delayed recognition of excessive blood loss remains a major contributor to maternal morbidity and mortality. Quantitative blood loss measurement and continuous Haemodynamic assessment are therefore recommended components of modern PPH management pathways.

The present findings confirm that blood loss volume is not merely a marker of disease severity but also a major predictor of treatment success. Early recognition and intervention before the development of massive haemorrhage substantially improve the likelihood of uterine preservation and favourable maternal outcomes.

Conservative Surgical Procedures Utilized

The present study evaluated various fertility-preserving surgical interventions for management of severe postpartum haemorrhage. The most frequently performed procedures were B-Lynch compression sutures (28.0%) and combined procedures (28.0%), followed by uterine artery ligation (24.0%) and balloon tamponade (20.0%). Overall, conservative surgery successfully controlled bleeding in the majority of women while avoiding hysterectomy.

A similar pattern was observed by Klangsinet al.¹⁴, who reported that B-Lynch compression sutures were the most commonly performed conservative procedure. Additional interventions included Bakri balloon tamponade, uterine artery ligation, utero-ovarian artery ligation, combined vessel ligation techniques, and arterial embolization. The authors noted that B-Lynch suturing was particularly advantageous because it is technically straightforward, rapid to perform, requires minimal additional equipment, and can be applied immediately during caesarean delivery.

Similarly, Bouchghoulet al.¹⁹ reviewed uterine-sparing surgical procedures and reported high success rates with

uterine artery ligation, stepwise devascularization, and compression sutures. Their review concluded that no single conservative procedure is universally superior; rather, successful outcomes depend on appropriate case selection, timely intervention, and operator experience.

The findings of the present study support the growing international evidence that conservative surgical interventions have become integral components of modern PPH management. These procedures offer highly effective alternatives to hysterectomy and significantly enhance fertility preservation without compromising maternal safety.

The overall success rate of conservative surgical management in the present study was 85.3%, with only 14.7% of women requiring hysterectomy. Among individual procedures, B-Lynch suturing demonstrated the highest success rate (90.5%), followed by combined procedures, uterine artery ligation, and balloon tamponade. The association between procedure type and treatment outcome was statistically significant ($p=0.041$).

Comparable success rates have been reported across international studies. Klangsinet al.¹⁴ documented an overall success rate of 80.4% among women undergoing conservative surgery. Despite differences in patient characteristics and procedural selection, their findings strongly support the effectiveness of fertility-preserving interventions in controlling severe haemorrhage.

Patel and Shah¹⁵ reported successful haemorrhage control in 87.7% of women managed conservatively, with only 12.3% requiring hysterectomy. Their study demonstrated that advances in balloon tamponade, compression sutures, and vascular ligation have significantly reduced the need for definitive surgical removal of the uterus.

Puangricharoen and Manchana¹⁸ similarly concluded that conservative surgical approaches achieve excellent haemostatic outcomes while preserving reproductive potential.

Their experience emphasized that successful management requires a stepwise escalation strategy beginning with less invasive techniques and progressing to more advanced procedures when necessary.

Kellie et al.²⁰, in a Cochrane review involving 944 women, found that mechanical and surgical interventions effectively reduced bleeding and may prevent hysterectomy, although direct comparisons between techniques were limited by heterogeneity of available evidence.

Overall, the success rate observed in the present study is comparable to or slightly higher than those reported in contemporary literature. These findings confirm that conservative surgical management represents an effective and safe strategy for controlling severe postpartum haemorrhage while maximizing opportunities for future fertility preservation. The present study demonstrated that B-Lynch compression suturing achieved the highest success rate (90.5%), making it the most effective individual conservative surgical procedure employed. Uterine artery ligation, balloon tamponade, and combined procedures also achieved satisfactory haemostatic outcomes, contributing to an overall success rate of 85.3%. These findings support the growing role of fertility-preserving interventions in the management of severe postpartum haemorrhage.

The success rate of B-Lynch suturing in the present study is comparable with findings reported by Boughoulet al.¹⁹, who reviewed uterine-sparing surgical procedures and found compression sutures to be

associated with haemostatic success rates ranging from 75% to 90%. Their review emphasized that compression sutures are particularly effective in uterine atony, which was also the predominant cause of PPH in the present study.

Furthermore, they reported low complication rates and satisfactory fertility outcomes following uterine preservation.

Puangricharoen and Manchana¹⁸ reported success rates of 75% for uterine compression sutures, 66.7% for uterine artery ligation, and 66.7% for Bakri balloon tamponade. Although these success rates were slightly lower than those observed in the present study, the overall trend remained similar, with compression sutures providing the highest efficacy among conservative surgical options. Importantly, all women with successful conservative management resumed normal menstruation, and subsequent pregnancies were reported among women desiring fertility.

Likewise, Klangsint al.¹⁴ demonstrated an overall conservative surgical success rate of 80.4%, with B-Lynch suturing remaining one of the most frequently utilized procedures. Their findings reinforced the role of compression sutures as a rapid, technically simple, and highly effective intervention that can be performed even in emergency settings.

Kellie et al.²⁰, in their Cochrane review, concluded that balloon tamponade, arterial embolization, uterine artery ligation, and compression sutures all contribute significantly to haemorrhage control. However, they found insufficient evidence to establish superiority of one technique over another because of heterogeneity among available studies.

Overall, the present study aligns closely with published literature and demonstrates that B-Lynch suturing,

uterine artery ligation, balloon tamponade, and combined procedures are highly effective uterine-preserving techniques. Selection should be individualized according to the cause of haemorrhage, available expertise, and patient condition.

Limitations

Despite its strengths, the study has certain limitations that should be considered while interpreting the findings. First, the study was conducted at a single tertiary care center, which may limit the generalizability of results to other healthcare settings with different patient populations, referral patterns, and resource availability.

Second, the observational nature of the study restricts the ability to establish definitive causal relationships between clinical variables and treatment outcomes. Although significant associations were identified, causality cannot be confirmed.

Third, allocation of surgical procedures was determined by clinical judgment and surgeon preference rather than randomization. Consequently, selection bias may have influenced the observed success rates of individual interventions.

Fourth, long-term follow-up data regarding menstrual function, subsequent fertility, future pregnancies, and reproductive outcomes were not available. Therefore, the long-term effectiveness and reproductive safety of the various conservative surgical procedures could not be directly assessed.

Fifth, certain potentially important variables such as operator experience, exact transfusion protocols, institutional response times, and detailed neonatal outcomes were not evaluated, which may have influenced treatment outcomes.

Conclusion

The present study evaluated the effectiveness of

conservative surgical management in 150 women with primary postpartum haemorrhage and demonstrated that fertility-preserving interventions are highly effective in controlling severe obstetric bleeding while reducing the need for hysterectomy.

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