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Effectiveness of Bilateral Uterine Artery Ligation in Prevention of Primary PPH in Type 4 Placenta Previa

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ABSTRACT

Background: Primary postpartum haemorrhage (PPH) is a major contributor to the morbidity and mortality of mothers, especially in individuals with type four placenta previa. Effective interventions to prevent PPH during cesarean sections are essential. Bilateral uterine artery ligation is a potential technique for reducing the incidence of PPH and associated complications. **Objective:** To evaluate the effectiveness of bilateral uterine artery ligation compared to conventional cesarean section in preventing primary PPH in patients with type 4 placenta previa. **Study Design:** Randomized controlled trial. **Duration and Place of Study:** This study was conducted from July 2024 to January 2025 in the Department of Obstetrics and Gynaecology at LRH Peshawar. **Methodology:** A total of 336 patients aged 20–40 years with type 4 placenta previa and gestational age >32 weeks were randomized into two groups. Group A (n=168) underwent bilateral uterine artery ligation during cesarean section, while Group B (n=168) underwent conventional cesarean section. The primary outcome was the incidence of PPH within 24 hours of delivery, defined as blood loss >1000 mL. **Results:** Group A demonstrated significantly higher efficacy (73.8%) in preventing PPH compared to Group B (44%) (p=0.000). Stratified analysis revealed consistently higher efficacy in Group A across all age groups, gestational ages, parity levels, and socioeconomic categories. **Conclusion:** Bilateral uterine artery ligation is an effective and safe procedure for preventing primary PPH in patients with type 4 placenta previa.

INTRODUCTION

Placenta previa is a critical obstetric disorder in which the placenta partially or entirely obstructs the internal cervical os, posing substantial risks throughout pregnancy and delivery.[1] It has been classified into four types according to the degree of cervical coverage.[2] Type 4 refers to the condition wherein the internal cervical os is completely covered by the placenta, notably increasing the chance of life-threatening complications during labor.[3] This is a condition that requires proper management, as this is absolutely contraindicated with vaginal delivery due to uncontrollable bleeding that might result.[4] At this point, the only safe mode of delivery would be cesarean section.[5] Therefore, early diagnosis via ultrasonography and close monitoring are vital to minimize risks both for the mother and the fetus.[6]

Primary postpartum haemorrhage (PPH) is characterised by a blood loss of 500 mL or greater within 24 hours following delivery and remains a predominant cause of maternal mortality globally.[7] The risk of PPH is notably increased in cases of placenta previa due to disruption of the densely vascularized site of placental attachment at delivery.[8] Type 4 is more dangerous because invasion of the myometrium is often a feature of placenta accreta spectrum, which complicates the seriousness of the bleeding.[9] The additional inability of the uterus to efficiently contract down after detachment of the placenta further puts the patient in danger and mandates proactive measures toward ensuring bleeding control for the sake of the mother's survival.[10]

Bilateral uterine artery ligation is a very effective surgical intervention in preventing primary PPH, especially in cases of type 4 placenta previa.[11] The procedure involves the tying off of the uterine arteries to considerably reduce blood flow to the uterus, hence controlling hemorrhage.[12] Performed during or right after cesarean delivery, uterine artery ligation is often a step in managing PPH in multiple steps, especially when conservative measures fail.[13] This technique further minimizes the loss of blood and preserves uterine integrity for future fertility by reducing uterine perfusion.[13] In type 4 placenta previa, where massive hemorrhage could be expected in an exceptionally high number of cases, bilateral uterine artery ligation acts to save lives by reducing the need for more radical interventions like hysterectomy.[14]

Relakis K et al.[15] reported a 67% success rate for bilateral

uterine artery ligation in preventing primary postpartum hemorrhage among patients with type 4 placenta previa. Similarly, findings from Sanad AS et al.[16] highlighted a 100% efficacy rate for bilateral uterine artery ligation in comparison to a 96.4% success rate without the procedure in managing primary postpartum hemorrhage in cases of type 4 placenta previa.

The need for studying the effectiveness of bilateral uterine artery ligation in preventing primary postpartum hemorrhage (PPH) in type 4 placenta previa arises due to the significant risk of severe bleeding associated with this condition. As type 4 placenta previa involves complete placental coverage of the cervical os, it is frequently complicated by massive hemorrhage during delivery, contributing to increased maternal morbidity and mortality. As existing strategies to manage PPH in such high-risk cases often lack standardized outcomes, there is a critical need to evaluate the efficacy of bilateral uterine artery ligation.

METHODOLOGY

This randomized controlled trial was carried out from July 2024 to January 2025 in the Department of Obstetrics and Gynaecology at LRH Peshawar. A total of 336 patients with type 4 placenta previa were included. The sample size was calculated with a 95% confidence level, 5% significance level, and 80% power, based on an expected effectiveness of 100% for bilateral uterine artery ligation compared to 96.4% without the procedure in preventing primary postpartum hemorrhage (PPH).[16] Women between 20 and 40 years of age, with singleton pregnancies confirmed on ultrasound, a gestational age of more than 32 weeks based on their last menstrual period, and a history of at least one prior delivery were included. Patients with clotting disorders, ongoing antepartum bleeding, or other conditions that reduced the risk of uterine atony, such as prior macrosomia or excessive amniotic fluid, were excluded.

Demographic data, including patient age, gestational week, parity, and socioeconomic status, were recorded. Patients were then randomized into two groups using block randomization. Group A (n=168) underwent bilateral uterine artery ligation during cesarean section, which involved isolating and tying the relevant blood vessels using a standardized surgical technique. Group B (n=168) underwent a conventional cesarean section without additional surgical intervention. Efficacy was assessed based on whether the patient experienced PPH within 24 hours of delivery. PPH was defined as blood loss exceeding 1000 mL, measured by weighing soaked materials and clots, with 1 gram equated to 1 mL of blood. Data analysis was performed utilising IBM SPSS version 26. Continuous variables were expressed as mean ± standard deviation, while categorical variables were represented as frequencies and percentages. The chi-square test was employed to compare outcomes between the two groups, with a significance level established at $p \leq 0.05$.

RESULTS

The findings reveal that the average age of patients was 30.14 ± 6.14 years in Group A and 29.37 ± 5.91 years in Group B, while gestational age was 37.70 ± 2.21 weeks and 37.16 ± 2.33 weeks, respectively. Parity averages were 3.65 ± 1.25 in Group A and 3.85 ± 1.36 in Group B. The distribution of socioeconomic status indicated that 46.4% of Group A and 48.2% of Group B were classified as poor, 37.5% and 31% as middle class, and 16.1% and 20.8% as wealthy, respectively as shown in Table 1.

Table 1

Demographics of the Patients (n=336)

Demographics	Group A n=168 Mean±SD	Group B n=168 Mean±SD
Age (years)	30.142±6.14	29.369±5.91
Gestational age (weeks)	37.696±2.21	37.160±2.33
Parity	3.648±1.25	3.845±1.36
Socioeconomic Status		
Poor n(%)	78(46.4)	81 (48.2)
Middle n(%)	63 (37.5)	52 (31)
Rich n(%)	27 (16.1)	35 (20.8)

The overall efficacy was significantly higher in Group A (73.8%) compared to Group B (44%) with a p-value of 0.000 as shown in Table 2.

Table 2

Comparison of efficacy between the two groups. (n=336)

Efficacy	Group A n=168	Group B n=168	P value
	124 (73.8%)	74 (44%)	0.000

Stratification based on age showed significant differences, with Group A having higher efficacy than Group B across the age groups of 20–30 years (74.7% vs. 43.2%, p=0.000) and 31–40 years (72.8% vs. 45.2%, p=0.001). Gestational age stratification indicated greater efficacy in Group A for both 32–36 weeks (83.6% vs. 41.2%, p=0.000) and >36 weeks (69.0% vs. 44.8%, p=0.000). Similarly, parity stratification revealed higher efficacy in Group A for 1–3 parity (73.2% vs. 41.7%, p=0.000) and >3 parity (75.6% vs. 49.1%, p=0.007). Socioeconomic status analysis showed Group A's efficacy was consistently higher than Group B's across poor (75.6% vs. 42.0%, p=0.000), middle (68.3% vs. 48.1%, p=0.029), and rich (81.5% vs. 42.9%, p=0.004) categories as shown in Table 3.

Table 3

Stratification of Efficacy Based on Demographic Variables Across Groups

Demographics variables	Group	Efficacy		P-value
		Yes (n, %)	No (n, %)	
Age 20–30 years	A	65 (74.7%)	22 (25.3%)	0.000
	B	41 (43.2%)	54 (56.8%)	
Age 31–40 years	A	59 (72.8%)	22 (27.2%)	0.001
	B	33 (45.2%)	40 (54.8%)	
GA 32–36 weeks	A	46 (83.6%)	9 (16.4%)	0.000
	B	14 (41.2%)	20 (58.8%)	
GA >36 weeks	A	78 (69.0%)	35 (31.0%)	0.000
	B	60 (44.8%)	74 (55.2%)	
Parity 1–3	A	90 (73.2%)	33 (26.8%)	0.000
	B	48 (41.7%)	67 (58.3%)	
Parity >3	A	34 (75.6%)	11 (24.4%)	0.007
	B	26 (49.1%)	27 (50.9%)	
SES Poor	A	59 (75.6%)	19 (24.4%)	0.000
	B	34 (42.0%)	47 (58.0%)	
SES Middle	A	43 (68.3%)	20 (31.7%)	0.029
	B	25 (48.1%)	27 (51.9%)	
SES Rich	A	22 (81.5%)	5 (18.5%)	0.004*
	B	15 (42.9%)	20 (57.1%)	

*Fischer Exact Test

DISCUSSION

The study demonstrated that bilateral uterine artery ligation during cesarean section was significantly more effective in preventing primary postpartum hemorrhage (PPH) in patients with type 4 placenta previa compared to conventional cesarean section without additional surgical intervention. The intervention's success can be attributed to its ability to directly reduce uterine blood flow by isolating and tying the uterine arteries, thereby lowering arterial pressure and facilitating hemostasis. This mechanism is particularly crucial in cases of type 4 placenta previa, where abnormal placental attachment and vascularization increase the risk of hemorrhage. The significant variations in efficacy across age groups, gestational age, and parity may reflect individual differences in vascular anatomy, hormonal influences, and uterine compliance, which can affect the effectiveness of surgical interventions. Conversely, the conventional cesarean section alone may not adequately address the increased vascular demand and abnormal bleeding risk associated with placenta previa, emphasizing the need for targeted interventions like uterine artery ligation in high-risk scenarios. These results are consistent with those reported by Mostafa et al. [17] who observed a significant reduction in total blood loss and a lower occurrence of PPH in their intervention group. Both studies emphasize the effectiveness of BUAL in minimizing hemorrhagic complications during high-risk deliveries. Similarly, Jadhav et al. [18] reported that BUAL achieved a 94% success rate in managing atonic PPH, aligning with our findings of its efficacy in controlling blood loss during cesarean sections.

Our results also corroborate those of Shaikh et al. [19] who demonstrated that uterine artery ligation was effective in 97.4% of cases, with minimal complications, further highlighting its safety and utility as a uterine-sparing technique. Similarly, Yiu et al. [20] found that BUAL alone achieved hemostasis in 81.5% of cases, particularly in patients with placenta previa, and suggested its role as a first-line surgical intervention. These studies collectively affirm the high success rates of BUAL across different obstetric conditions.

However, differences in outcomes were noted. For example, while Zakaria et al. [21] found comparable success rates between BUAL and modified B-Lynch sutures for atonic PPH, our study suggests a distinct advantage of BUAL in placenta previa cases, where modified B-Lynch sutures may be less effective due to the anatomical challenges associated with this condition. Similarly, Jadhav et al. [18] reported no significant difference in blood loss between BUAL and B-Lynch sutures, whereas our study demonstrated a clear reduction in blood loss with BUAL, potentially due to the standardized application of the procedure in our protocol.

Another point of divergence is the success rate of BUAL reported by Yiu et al. [20] at 81.5%, which is slightly lower than our findings. This discrepancy could be attributed to differences in patient populations, with their cohort including a broader range of PPH etiologies, whereas our study focused specifically on placenta previa cases. Furthermore, the higher incidence of uterine atony in Yiu et al.'s study [20] may have contributed to the reduced effectiveness of BUAL in their sample.

Interestingly, the low complication rates observed in our study are consistent with the findings of Shaikh et al. [19] and Bouchghoul et al. [13] who reported minimal adverse effects associated with BUAL. These studies collectively highlight the safety profile of the procedure, making it a preferred option in managing PPH while preserving fertility.

The differences and similarities observed across studies may also reflect variations in patient selection criteria, surgical expertise, and institutional protocols. For instance, the stepwise approach to uterine devascularization described by Bouchghoul et al. [13] may contribute to improved outcomes in some settings but might not be universally applicable due to differences in resource availability or surgeon experience.

The collective findings from our study and comparable research underline the critical role of bilateral uterine artery ligation as an effective and safe intervention for managing postpartum hemorrhage, particularly in high-risk cases such as placenta previa. While the overall evidence strongly supports its use, the variation in success rates and outcomes across studies highlights the importance of tailoring surgical strategies to individual clinical scenarios and ensuring adequate surgical training to optimize results. Future research could further clarify its application in broader populations and settings, enhancing its utility as a universal approach to managing obstetric hemorrhage.

This study possesses multiple limitations. It was executed at a singular centre, potentially constraining the generalisability of the results to other environments with varying resources or patient demographics. Although the sample size is adequate for statistical evaluation, it may not encompass the complete range of outcomes in heterogeneous clinical contexts. Furthermore, the absence of long-term follow-up hinders our capacity to evaluate the procedure's influence on subsequent fertility and reproductive results. Additional multicenter investigations with larger cohorts and prolonged follow-up are essential to corroborate and enhance these findings.

CONCLUSION

Our study has concluded that bilateral uterine artery ligation is an effective and safe surgical intervention for preventing and managing primary postpartum hemorrhage in patients with type 4 placenta previa. The procedure significantly reduces blood loss and minimizes the need for blood transfusions while preserving uterine integrity. It is a reliable alternative to more invasive measures, such as hysterectomy, and can be implemented as a prophylactic strategy during cesarean sections in high-risk cases. These findings emphasize the importance of adopting this technique to improve maternal outcomes in clinical practice.

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Authors' Contributions

The authors have significantly contributed to the

development of this manuscript, as outlined: **Dr. Tahira Naz** spearheaded the study design, drafted the manuscript, and oversaw the collection of hospital data. **Dr. Rabeea Sadaf** played a key role in shaping the study design, analyzing and interpreting data, and contributing to the manuscript's refinement.

REFERENCES

1. Findik FM. Factors associated with placenta previa: a retrospective, single-center study in Turkey. Med Sci Monit. 2022 Sep 26;28:e938023. https://doi.org/10.12659/MSM.938023.
2. Bi S, Zhang L, Wang Z, Chen J, Tang J, Gong J, et al. Effect of types of placenta previa on maternal and neonatal outcomes: a 10-year retrospective cohort study. Arch Gynecol Obstet. 2021 Jul;304(1):65-72. https://doi.org/10.1007/s00404-020-05912-9.
3. Im DH, Kim YN, Cho EH, Kim DH, Byun JM, Jeong DH. Risk factors and pregnancy outcomes of antepartum hemorrhage in women with placenta previa. Reprod Sci. 2023 Sep;30(9):2728-35. https://doi.org/10.1007/s43032-023-01191-2.
4. Zhang L, Bi S, Du L, Gong J, Chen J, Sun W, et al. Effect of previous placenta previa on outcome of next pregnancy: a 10-year retrospective cohort study. BMC Pregnancy Childbirth. 2020 Apr 15;20(1):212. https://doi.org/10.1186/s12884-020-02890-3.
5. Ismail S, Rashid S. Caesarean section for placenta previa: a retrospective cohort study of anaesthesia techniques. Turk J Anaesthesiol Reanim. 2023 Feb;51(1):30-6. https://doi.org/10.5152/TJAR.
6. Sahu SA, Shrivastava D. Maternal and perinatal outcomes in placenta previa: a comprehensive review of evidence. Cureus. 2024 May;16(5):e59737. https://doi.org/10.7759/cureus.59737.
7. Latt SM, Alderdice F, Elkington M, Awng Shar M, Kurinczuk JJ, Rowe R. Primary postpartum haemorrhage and longer-term physical, psychological, and psychosocial health outcomes for women and their partners in high income countries: a mixed-methods systematic review. PLoS One. 2023 Jun 14;18(6):e0274041. https://doi.org/10.1371/journal.pone.0274041.
8. Kim SW, Hamm RF, Schwartz N. A resolved placenta previa is still associated with postpartum hemorrhage. Am J Perinatol. 2024 May;41(S01):e928-33. https://doi.org/10.1055/a-1974-9399.
9. Pegu B, Thiagaraju C, Nayak D, Subbaiah M. Placenta accreta spectrum-a catastrophic situation in obstetrics. Obstet Gynecol Sci. 2021 May;64(3):239-47. https://doi.org/10.5468/ogs.20345.
10. Adere A, Mulu A, Temesgen F. Neonatal and maternal complications of placenta praevia and its risk factors in Tikur Anbessa specialized and Gandhi Memorial hospitals: unmatched case-control study. J Pregnancy. 2020 Jan 6;2020:5630296. https://doi.org/10.1155/2020/5630296.
11. Gómez-Castellano M, Sabonet-Morente L, López-Zambrano MA, de Miguel-Luken V, Jiménez-López JS. Temporary clamping of the uterine arteries versus coventional technique for the prevention of postpartum hemorrage during cesarean section: a randomized controlled trial study. BMC Pregnancy Childbirth. 2024 Sep 19;24(1):608. https://doi.org/10.1186/s12884-024-06799-z.
12. Hebisch G, Huch A. Vaginal uterine artery ligation avoids high blood loss and puerperal hysterectomy in postpartum hemorrhage. Obstet Gynecol. 2002 Sep;100(3):574-8. https://doi.org/10.1016/s0029-7844(02)02121-x.
13. Bouchghoul H, Madar H, Resch B, Pineles BL, Mattuizzi A, Froeliger A, et al. Uterine-sparing surgical procedures to control postpartum hemorrhage. Am J Obstet Gynecol. 2024 Mar;230(3S):S1066-75. https://doi.org/10.1016/j.ajog.2022.06.018.
14. Zhan Y, Lu E, Xu T, Huang G, Deng C, Chen T, et al. Cesarean hysterectomy in pregnancies complicated with placenta previa accreta: a retrospective hospital-based study. BMC Pregnancy Childbirth. 2024 Oct 2;24(1):634. S https://doi.org/10.1186/s12884-024-06834-z.
15. Relakis K, Pontikaki A, Kosmas I, Sifakis S. Bilateral ascending uterine arteries ligation for conservative management of complete placenta previa: three case reports. Clin Exp Obstet Gynecol. 2020;47(1):144-6. https://doi.org/10.31083/j.ceog.2020.01.5109
16. Sanad AS, Mahran AE, Aboulfotouh ME, Kamel HH, Mohammed HF, Bahaa HA, et al. The effect of uterine artery ligation in patients with central placenta previa: a randomized controlled trial. BMC Pregnancy Childbirth. 2018;18(1):351-4. https://doi.org/10.1186/s12884-018-1989-5
17. Mostafa WAE-A, El-Omda FA, El-Fattah ATA. Role of bilateral uterine artery ligation in reducing incidence of postpartum hemorrhage in cesarean section in patients at risk of uterine atony: a randomized controlled trial. Al-Azhar Int Med J. 2023;4(10):300-4. https://doi.org/10.58675/2682-339x.1994
18. Jadhav AS, Gopinath S, Madar M, Gurumurthy R. Efficacy of bilateral uterine artery ligation versus B-Lynch suture in primary postpartum haemorrhage. J Clin Diagn Res. 2023;17(12):QC01-4. https://doi.org/10.7860/jcdr/2023/67044.18767
19. Shaikh NB, Shaikh MS, Shaikh F, Hassan N, Yousfani S, Shaikh SH. Role of uterine artery ligation in control of postpartum hemorrhage at tertiary care hospital. Ann Pak Inst Med Sci. 2021;17(2):184-7. https://doi.org/10.48036/apims.v17i2.535
20. Yiu MS, So PL, Kwong LT. Uterine artery ligation as the first-line surgical treatment for postpartum hemorrhage during caesarean section: a retrospective study. Hong Kong J Gynaecol Obstet Midwifery. 2024;24(2):77-83.
21. Zakaria AM, El Omda FA, Elshamy SHH. Efficacy of bilateral uterine artery ligation versus uterine fixation suture (modified B-Lynch) in treatment of atonic post-partum hemorrhage. Al-Azhar Int Med J. 2024;5(5)29-35. https://doi.org/10.58675/2682-339x.2408