

Clinical Outcomes of Intrauterine Balloon Tamponade for Postpartum Hemorrhage in Placenta Previa and Placenta Accreta Spectrum

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Abstract:

Introduction: Postpartum hemorrhage associated with placenta previa and placenta accreta spectrum (PAS) is a major obstetric emergency. Intrauterine balloon tamponade (IUBT) provides a conservative mechanical approach to control bleeding and potentially avoid definitive surgery.

Materials and Methods: A prospective observational cohort study was conducted over one year at a tertiary-care teaching hospital in Western Gujarat, India. A total of 76 women with placenta previa and/or PAS complicated by PPH and managed with IUBT were evaluated for obstetric characteristics, balloon use, hemorrhage control, transfusion requirements, and maternal and neonatal outcomes.

Results: Previous cesarean or uterine surgery was present in 68.4% of women, while placenta previa and PAS constituted the major placental abnormalities. The Bakri balloon was used in 92.1% of cases, most commonly with an inflation volume of 200–300 mL and maintained for 12–24 hours. Obstetric hysterectomy was required in 7.9% of cases, with no maternal mortality; satisfactory maternal recovery was observed in all patients. 90.8% of neonates were alive at birth.

Conclusion: IUBT appears to be a useful conservative option for managing PPH associated with placenta previa and PAS. It may facilitate hemorrhage control and avoid definitive surgery in appropriately selected patients, although invasive PAS may require additional surgical management.

Keywords: Intrauterine balloon tamponade; postpartum hemorrhage; Placenta previa; Placenta accreta spectrum.

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Introduction

Placenta previa and placenta accreta spectrum (PAS) are important obstetric conditions associated with a high risk of severe postpartum hemorrhage (PPH) and maternal morbidity. [1] The increasing frequency of cesarean deliveries and previous uterine surgery has contributed to the growing clinical importance of these conditions. [2] Hemorrhage associated with placenta previa and PAS may require massive blood transfusion, surgical hemostatic procedures, and, in severe cases, obstetric hysterectomy with consequent loss of fertility. [3]

Intrauterine balloon tamponade (IUBT) has emerged as a relatively simple and minimally invasive method for controlling PPH when bleeding persists despite uterine massage and uterotonic therapy. [4]

By exerting intrauterine pressure and promoting mechanical tamponade, IUBT may achieve hemostasis and reduce the need for more invasive surgical interventions. [5] Bakri balloon tamponade is among the commonly used devices, with

previous studies reporting favorable success rates in the management of severe PPH, although effectiveness may vary according to the underlying cause of hemorrhage. [6] Placenta previa and PAS represent particularly challenging situations for IUBT because abnormal placentation can result in severe and persistent bleeding. [7] Previous studies have demonstrated encouraging outcomes with IUBT, but failure appears to be more frequent in PAS than in other causes of PPH. [8] In the present study, we therefore evaluated the efficacy of intrauterine balloon tamponade in the management of PPH associated with placenta previa and PAS, with particular emphasis on hemorrhage control, transfusion requirements, need for hysterectomy, and maternal and neonatal outcomes

Materials and Methods

This prospective observational cohort study was conducted over one year in the Department of Obstetrics and Gynecology at a tertiary-care teaching hospital in Western Gujarat, India. Pregnant women undergoing cesarean delivery

with placenta previa and/or placenta accreta spectrum (PAS) who developed postpartum hemorrhage (PPH) requiring conservative management with intrauterine balloon tamponade (IUBT) were included. Placenta previa was diagnosed by antenatal ultrasonography, while suspected PAS was identified by antenatal imaging and/or intraoperative findings, with histopathological confirmation wherever available. Patients with adequate clinical, operative, and postoperative records were included after obtaining written informed consent.

All patients underwent routine preoperative assessment and antenatal imaging, including ultrasonography with Doppler; MRI was performed when clinically indicated. High-risk cases were managed by a multidisciplinary team, with blood and blood products arranged as required. Cesarean delivery was performed according to obstetric indications and maternal-fetal status. Initial PPH management included uterine massage and uterotonic agents. IUBT was used as a second-line conservative intervention when bleeding persisted despite medical management.

IUBT was performed under aseptic conditions following cesarean delivery and appropriate placental management. A balloon catheter, predominantly a Bakri balloon, was inserted into the uterine cavity and gradually inflated with sterile fluid according to clinical response and device specifications. Balloon volume, duration of placement, and response to tamponade were recorded. Inflation volumes generally ranged from 200–500 mL, with most patients receiving 200–300 mL, and the balloon was usually maintained for 12–24 hours. Patients were monitored for hemodynamic stability and ongoing blood loss, with additional surgical intervention performed

when required. The primary outcome was successful control of PPH with IUBT without the need for definitive surgical intervention. Failure was defined as persistent or recurrent hemorrhage requiring additional surgical management, including uterine artery ligation, other conservative procedures, or obstetric hysterectomy. Maternal outcomes included blood loss, transfusion requirements, duration of surgery, balloon volume and duration, additional procedures, hysterectomy, postoperative complications, mortality, and hospital stay. Neonatal outcomes included birth weight, Apgar scores, live/stillbirth, and NICU admission.

Data were collected using a structured proforma covering demographic, obstetric, placental, operative, IUBT, transfusion, maternal, and neonatal variables. Data were entered into a computerized database and analyzed using appropriate statistical software. Continuous variables were expressed as mean $\pm$ SD or median with IQR, and categorical variables as frequencies and percentages.

The Chi-square or Fisher's exact test was used for categorical variables, while Student's t-test or Mann-Whitney U test was used for continuous variables, as appropriate. A p-value <0.05 was considered statistically significant. The study was conducted after Institutional Ethics Committee approval, and written informed consent was obtained from all participants.

Results

A total of 76 patients with placenta previa and/or placenta accreta spectrum (PAS) complicated by postpartum hemorrhage and managed with intrauterine balloon tamponade (IUBT) were considered for the present analysis.

Table 1: Baseline Obstetric Characteristics of the Study Population (N=76)

Variable	Category	n (%)
Gravida	Primigravida	9 (11.8)
	Multigravida (2–4)	52 (68.4)
	Grand multigravida (>4)	15 (19.7)
Gestational age	30–34 weeks	8 (10.5)
	34–36 weeks 6 days	30 (39.5)
	37–39 weeks 6 days	36 (47.4)
	40–42 weeks	2 (2.6)
Presenting symptoms	Vaginal bleeding	42 (55.3)
	Abdominal pain	21 (27.6)
	No complaint/antenatally diagnosed	13 (17.1)
Mode of delivery	Emergency LSCS	62 (81.6)
	Elective LSCS	14 (18.4)

The study population predominantly comprised multigravida women (68.4%), while 11.8% were primigravida and 19.7% were grand multigravida. Nearly half of the women (47.4%) delivered between 37 and 39 weeks 6 days, while 50.0% delivered before 37 weeks. Vaginal bleeding was the most common presenting symptom (55.3%), followed by abdominal pain (27.6%); 17.1% were antenatally diagnosed without presenting complaints. Emergency LSCS was performed in 81.6% of cases, whereas 18.4% underwent elective LSCS.

The age distribution remained predominantly in the 21–30-year group. Approximately 58% of women were aged 21–30 years, while 12% were ≤ 20 years and 30% were 31–40 years. Labourers constituted the largest occupational group, followed by housewives and women employed in private-sector occupations. Most women belonged to the lower and upper-lower socioeconomic groups. Educational attainment was predominantly at primary or middle-school level, with a smaller proportion having high-school or graduate-level education.

Table 2: Previous Uterine Surgery and Placental Characteristics

Variable	Category	n (%)
Previous cesarean/uterine surgery	Present	52 (68.4)
	Absent	24 (31.6)
Placental diagnosis	Low-lying placenta	35 (46.1)
	Placenta previa	21 (27.6)
	Focal placenta accreta	10 (13.2)
	Complete placenta accreta	6 (7.9)
	Placenta previa + PAS	4 (5.3)

Previous cesarean delivery or other uterine surgery was present in approximately two-thirds of the study population (68.4%). Among women with previous uterine surgery, previous two LSCS represented the most frequent surgical history, followed by previous one LSCS. Previous three LSCS was less frequent, while isolated histories of myomectomy and previous postpartum/post-abortion curettage constituted only a small proportion of cases. Low-lying placenta was the most frequently observed placental abnormality (46.1%), followed by placenta previa (27.6%). Focal placenta accreta accounted for 13.2%, complete placenta accreta for 7.9%, and combined placenta previa with PAS for 5.3% of cases.

Table 3: Intrauterine Balloon Tamponade and Hemorrhage Control

Parameter	Category	n (%)
IUBT/associated procedure	Placenta previa + IUBT	36 (47.4)
	Focal PAS + IUBT	8 (10.5)
	Placenta previa + uterine artery ligation + IUBT	28 (36.8)
	PAS + IUBT + uterine artery ligation	3 (3.9)
	PAS + IUBT + partial myomectomy + uterine artery ligation	1 (1.3)
Balloon type	Bakri	70 (92.1)
	Other balloons	6 (7.9)
IUBT inflation volume	200–300 mL	40 (52.6)
	300–400 mL	14 (18.4)
	400–500 mL	22 (28.9)
Time to balloon deflation	≤ 12 hours	11 (14.5)
	12–24 hours	63 (82.9)
	> 24 hours	2 (2.6)
Blood/blood-product transfusion	Preoperative	8 (10.5)
	Intraoperative	46 (60.5)
	Postoperative	22 (28.9)

IUBT was used as an important conservative component of PPH management, either alone or in combination with uterine artery ligation and other conservative surgical procedures. The Bakri balloon was the predominant device, accounting for approximately 92% of cases. The most commonly used inflation volume was 200–300 mL (52.6%), followed by 400–500 mL (28.9%). In the majority of patients (82.9%), balloon deflation was performed within 12–24 hours. Blood and blood products were required most frequently during the intraoperative period (60.5%), followed by the postoperative period (28.9%) and preoperative period (10.5%). Other balloon devices constituted approximately 8% of cases and included Elavi, C.G. and conventional condom balloon systems.

Table 4: Maternal and Neonatal Outcomes

Outcome	Category	n (%) / Value
Obstetric hysterectomy	Intraoperative	6 (7.9)
	Postoperative	0
Maternal outcome	Satisfactory recovery	76 (100.0)
	Maternal mortality	0
Major comorbidities	Gestational hypertension	20 (26.3)
	Diabetes	8 (10.5)
	Severe pre-eclampsia	4 (5.3)
	Epilepsy	3 (3.9)
	Bronchial asthma	1 (1.3)
	Allergy	1 (1.3)
	Alive at birth	69 (90.8)
Neonatal outcome	IUFD	4 (5.3)
	Early neonatal death	3 (3.9)
	Mean birth weight	2.37 ± 0.37 kg
	Male/Female	32/44

Gestational hypertension was the most frequently reported maternal comorbidity (26.3%), followed by diabetes (10.5%) and severe pre-eclampsia (5.3%). Epilepsy was reported in approximately 4% of patients, while bronchial asthma and allergy were each observed in approximately 1% of cases. Overall maternal recovery was satisfactory, with no maternal mortality reported. Obstetric/peripartum hysterectomy was required in approximately 8% of cases, with no postoperative hysterectomy recorded.

Discussion

The frequent history of previous cesarean delivery or uterine surgery in our cohort is consistent with the recognized association between prior uterine scar and abnormal placentation. The predominance of multigravida women and the frequent presentation with vaginal bleeding indicate the substantial hemorrhagic risk associated with placenta previa and PAS. The high proportion of emergency cesarean deliveries further highlights the need for rapid hemorrhage-control strategies in this population. In this context, IUBT represents a readily available conservative intervention that can be incorporated into a stepwise approach to PPH management before proceeding to more definitive surgical procedures.

The effectiveness of IUBT in the present study is broadly consistent with previous evidence supporting uterine balloon tamponade as an effective method for controlling obstetric hemorrhage. Kumru et al. [9] evaluated the Bakri balloon specifically in 25 women with severe PPH associated with placenta previa and reported successful tamponade in 88% of cases, with only three failures requiring additional surgical procedures or hysterectomy. In the present study, the Bakri balloon was used in 92.1% of cases, indicating its predominant role in clinical practice.

Similarly, Ozgen et al. [10], in a study of 128 women with placenta previa and/or PAS, reported a 91.3% success rate with Bakri balloon tamponade, with hysterectomy required in 8.7% of patients and no maternal mortality. The approximately 8% hysterectomy rate observed in our study is therefore comparable with the experience reported by Ozgen et al. [11], suggesting that IUBT can provide effective hemorrhage control while potentially avoiding definitive surgery in a substantial proportion of appropriately selected patients.

The findings also support the importance of differentiating placenta previa from invasive PAS when interpreting the effectiveness of balloon tamponade. The systematic review and meta-analysis by Suarez et al. [12], which included 91 studies and 4729 women, reported an overall pooled success rate of 85.9% for uterine balloon tamponade. Importantly, the success rate was higher for placenta previa (86.8%) but substantially lower for PAS (66.7%). This difference is clinically understandable because bleeding in PAS is related to abnormal placental invasion and extensive neovascularization, which may not be adequately controlled by simple intrauterine mechanical pressure. In the present study, IUBT was frequently combined with uterine artery ligation or other conservative procedures, particularly in cases with PAS. Thus, the role of IUBT in PAS may be better interpreted as an important component of a stepwise hemorrhage-control strategy rather than as an isolated definitive treatment.

The findings of the present study are also consistent with the multicentre randomized trial by Wei et al. [13], which compared intrauterine double-balloon tamponade with gauze packing in women with placenta previa. Successful hemostasis was achieved in 93.1% of women receiving the balloon compared with 91.2% with gauze packing, while

the balloon group had significantly lower 24-hour blood loss and a lower proportion with blood loss ≥ 1000 mL. These findings support the practical advantage of balloon tamponade as a rapid and controlled method of uterine packing in placenta previa. In our study, the Bakri balloon was predominantly inflated to 200–300 mL and was maintained for 12–24 hours in most patients, demonstrating that effective tamponade could generally be achieved with moderate balloon volumes and relatively short-term placement. The frequent requirement for intraoperative transfusion in our cohort nevertheless emphasizes that IUBT should be considered a component of comprehensive PPH management rather than a replacement for timely blood-product support and surgical intervention when required.

The management of PAS remains more complex, as emphasized by Peng et al. [14] and Zhao et al. [15]. Peng et al. [14] studied 104 women with PAS complicated by placenta previa and found that prophylactic internal iliac artery balloon occlusion did not significantly reduce blood loss or transfusion requirements overall, particularly among women with invasive placentation. They further reported that extensive placental invasion and abnormal vascular filling were associated with a greater likelihood of hysterectomy, while vascular complications such as arterial thrombosis were also observed. Similarly, Zhao et al. [15] highlighted that the optimal interventional approach in pernicious placenta previa with PAS remains controversial and should be individualized according to the grade and extent of placental invasion. These observations support the approach in the present study, where IUBT was used as a conservative hemorrhage-control measure and was combined with uterine artery ligation or other procedures when necessary. The absence of maternal mortality and the satisfactory maternal recovery observed in our cohort further suggest that timely balloon tamponade within a structured multidisciplinary PPH-management strategy may contribute to favorable maternal outcomes, although the observational nature and relatively small sample size of the present study limit conclusions regarding comparative efficacy.

Conclusion

The present study suggests that intrauterine balloon tamponade is a useful conservative option for controlling postpartum hemorrhage associated with placenta previa and PAS. It may help achieve hemostasis and reduce the need for definitive surgery in appropriately selected patients. However, extensive or invasive PAS may require additional surgical or interventional measures, emphasizing the importance of timely diagnosis, multidisciplinary management, and readiness for definitive surgery when conservative measures fail.

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