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Clinical Characteristics of Intrauterine Balloon Tamponade Use in Maternal Deaths Due to Critical Obstetric Hemorrhage: A Nationwide, Descriptive, Registry-Based Study in Japan

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Abstract

Background: The clinical circumstances surrounding intrauterine balloon tamponade (IUBT) use in maternal deaths due to critical obstetric hemorrhage remain unclear. This study aimed to characterize maternal death cases in which IUBT was performed.

Methods: This retrospective, nationwide, registry-based study analyzed maternal death cases reported to the Japan Association of Obstetricians and Gynecologists between 2010 and 2023. Cases in which critical obstetric hemorrhage was the primary cause of death and IUBT had been performed were included. Maternal characteristics, maternal status at IUBT placement, transfusion support, subsequent management, and the interval from IUBT placement to the decision for subsequent management were evaluated.

Results: Among 590 maternal deaths, 104 were attributed to critical obstetric hemorrhage, and IUBT was performed in 20. Most patients had hemorrhagic shock and coagulopathy at IUBT placement, with massive blood loss, profound anemia, and severe hypofibrinogenemia. The main causes were amniotic fluid embolism with severe coagulopathy (n=12), placental abruption (n=5), and placenta accreta spectrum (n=2), conditions for which IUBT alone is unlikely to achieve definitive hemostasis. The decision for subsequent management was made more than 30 min after IUBT in 5 of the 11 evaluable patients. Among 14 women who underwent maternal transfer, transcatheter arterial embolization, or hysterectomy, transfusion had been initiated before the decision for subsequent management in nine patients.

Conclusion: IUBT was frequently used as one of the few available interventions in extremely severe clinical situations. Although these findings do not necessarily indicate that the timing of management contributed to maternal death, the decision for subsequent management was made more than 30 min after IUBT in approximately half of the evaluable patients. These findings highlight the importance of recognizing IUBT as a temporizing intervention within the broader management of critical obstetric hemorrhage.

Categories: Obstetrics/Gynecology, Emergency Medicine
Keywords: critical hemorrhagic shock, disseminated intravascular coagulation, maternal mortality, obstetric hemorrhage, uterine balloon tamponade

Introduction

Maternal mortality remains a major challenge in perinatal care, and critical obstetric hemorrhage is one of its leading causes. In Japan, approximately half of all deliveries occur at obstetric clinics; therefore, rapid decision-making and timely referral to higher level facilities are essential in cases of severe hemorrhage. In this context, multiple professional societies in Japan collaboratively developed national guidelines for the management of critical obstetric hemorrhage in 2010, with subsequent revisions issued every few years [1]. The guidelines recommend that when blood loss reaches ⩾1,000 mL after delivery, or when the shock index, calculated as heart rate divided by systolic blood pressure, exceeds 1.0, clinicians need to continuously assess vital signs, identify the bleeding source, initiate adequate fluid resuscitation, prepare for or administer blood transfusion, and consider transfer to a higher level institution as needed. Intrauterine balloon tamponade (IUBT), which was previously reported to be effective in the management of obstetric hemorrhage [2-4], is one of the treatment options at this stage. However, previous studies have identified coagulopathy, greater blood loss before IUBT placement, and placenta accreta as factors associated with IUBT failure [4-7]. If adequate hemostasis is not achieved, prompt escalation to advanced interventions,

including arterial embolization and surgical procedures, is warranted [2,8,9]. Nevertheless, the clinical circumstances surrounding IUBT use and subsequent management in maternal deaths remain unclear. Therefore, the present study examined maternal death cases in Japan in which IUBT was performed to describe the clinical backgrounds and circumstances surrounding IUBT use, maternal status at IUBT placement, and timing and nature of subsequent management in these fatal cases.

Materials And Methods

This retrospective nationwide descriptive registry-based study used data from the maternal death registration system of the Japan Association of Obstetricians and Gynecologists (JAOG), including cases reported between January 2010 and December 2023 [10]. The registry contains standardized anonymized reports describing maternal characteristics, pregnancy and delivery courses, clinical management, the circumstances surrounding each maternal death, and the presumed primary cause of maternal death. Reported maternal death cases were reviewed by the Maternal Death Review Committee of the JAOG, comprising physicians from multiple specialties, including obstetrics, pediatrics, anesthesiology, neurosurgery, and psychiatry. The committee reviewed reports submitted by the treating physicians, medical records, detailed clinical timelines, operative records, and other available clinical information to assess the causes of maternal death and identify potential measures to improve future care. The present study used information collected through this review process. However, laboratory data and precise information regarding the timing of IUBT placement, transfusion initiation, and subsequent management decisions were not consistently available for all cases. Clinical information was retrospectively extracted from these anonymized reports. Cases in which critical obstetric hemorrhage was identified as the primary cause of maternal death and IUBT was performed were included in this study. Maternal death cases attributed to causes other than critical obstetric hemorrhage and those without IUBT were excluded from the analysis.

Clinical parameters included maternal background, facility type (delivery and/or IUBT performed), delivery mode, the underlying cause of critical obstetric hemorrhage, blood loss, the maternal status at IUBT placement (hemoglobin level, fibrinogen level, and the shock index), transfusion status, and subsequent management. The transfusion status was assessed at the following predefined clinical time points: during delivery or within two hours postpartum, at the time of IUBT placement, at arrival at the referral hospital, and at the time the decision for subsequent management was made. Subsequent management was defined as maternal transfer, transcatheter arterial embolization (TAE), or hysterectomy after IUBT placement; the interval from IUBT placement to the decision for subsequent intervention was evaluated. All analyses were descriptive, and no statistical comparisons were performed. Missing values were not imputed, and analyses were performed using available data for each variable. The present study was approved by the Ethics Committees of St. Marianna University School of Medicine, Kawasaki, Japan (no. 6448) and JAOG (no. 202407_1), and was conducted in accordance with the principles of the Declaration of Helsinki. Informed consent was not obtained from the patients or their families because the study was based on an analysis of institutional reporting forms, and patient records and information were anonymized prior to registration.

Results

During the study period, 590 maternal deaths were reported, of which 104 (17.6%) were attributed to critical obstetric hemorrhage. IUBT was performed in 20 of these cases (19.2%), which were included in the present analysis (Figure *1*). The clinical characteristics of the included cases are summarized in Table *1*. Median maternal age was 34.5 years (range, 23-42 years), and 13 patients (65.0%) were nulliparous. Delivery facilities included obstetric clinics (n=9), obstetric hospitals (n=3), and general hospitals or perinatal centers (n=8). The modes of delivery were vaginal delivery (n=6), operative vaginal delivery (n=4), and cesarean section (n=10). The underlying causes of critical obstetric hemorrhage included amniotic fluid embolism with severe coagulopathy and hemorrhage (n=12), placental abruption (n=5), placenta accreta spectrum (PAS) (n=2), and uterine atony (n=1). Median blood loss at delivery was 1,790 mL (range, 525-5,600 mL); among the 18 patients with available data, 16 (88.9%) had blood loss exceeding 1,000 mL and 8 (44.4%) exceeding 2,000 mL. Overall, 16 patients (80.0%) required maternal transfer, including all patients who delivered at obstetric clinics or obstetric hospitals and 4 of the 8 patients who delivered at general hospitals or perinatal centers. The median interval from delivery to arrival at the referral hospital was 190 min (range, 45-1,320 min).

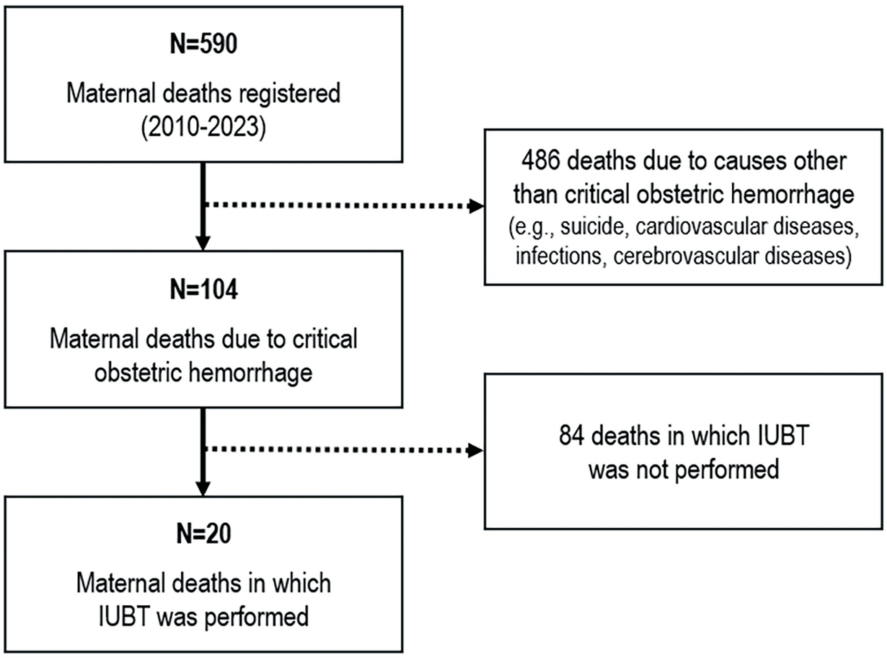


FIGURE 1: Flow diagram of case selection from the Japan Association of Obstetricians and Gynecologists maternal death registration system (2010-2023).

Among 590 maternal deaths, 104 (17.6%) were due to critical obstetric hemorrhage. Intrauterine balloon tamponade (IUBT) was performed in 20 cases (19.2% of critical obstetric hemorrhage-related deaths), which were included in the present analysis.

Maternal and delivery characteristics	Total (N=20)
Maternal age, years, median (range)	34.5 (23-42)
Nulliparous, n (%)	13 (65.0)
Gestational age at delivery, weeks, median (range)	38 (31-41)
Mode of delivery, n	
Vaginal delivery	6
Operative vaginal delivery	4
Cesarean section	10
Blood loss at delivery, mL, median (range)/N=18	1,790 (525-5,600)
Blood loss >1,000 mL, n (%)	16 (88.9)
Blood loss >2,000 mL, n (%)	8 (44.4)
Delivery facility and maternal transfer	
Facility type, n	
Obstetric clinic	9
Obstetric hospital	3
General hospital/perinatal center	8
Cases transferred to a higher level institution, n†	16
Time from delivery to arrival at the referral hospital, min, median (range)	190 (45-1,320)
Causative disorder of critical obstetric hemorrhage, n	
Amniotic fluid embolism with severe coagulopathy and hemorrhage	12
Placental abruption	5
Placenta accreta	2
Atonic bleeding	1

TABLE 1: Clinical characteristics and causative disorders of critical obstetric hemorrhage (N=20)

†All cases delivered at obstetric clinics or obstetric hospitals were transferred to a higher level institution. Among the eight cases delivered at general hospitals or perinatal centers, four were subsequently transferred to another higher level institution.

The characteristics of IUBT implementation and the maternal status at initiation are summarized in Table *2*. IUBT was performed at the delivery facility in nine patients, including three who delivered at obstetric clinics and six who delivered at general hospitals or perinatal centers. The remaining 11 patients underwent IUBT after maternal transfer. The interval from delivery to IUBT placement ranged from immediate placement during cesarean section to more than 180 min after delivery, with 9 patients (45.0%) undergoing IUBT more than 2 h after delivery. At IUBT initiation, cumulative blood loss exceeded 2,000 mL in 17 of the 18 patients (94.4%), including more than 4,000 mL in 9 patients (50.0%). The median hemoglobin level was 4.9 g/dL (range, 1.2-7.4; n=12). Fibrinogen levels were below 110 mg/dL in all 11 patients with available results, including four with values below the detection limit. Among the remaining seven patients with quantifiable fibrinogen levels, the median was 63 mg/dL (range, 22-107). Among the 12 patients with shock index data, in 11 (91.7%), the shock index was >1.0 and in 6 (50.0%), it was >1.5, indicating advanced hemorrhagic shock and coagulopathy.

IUBT implementation characteristics and maternal status at initiation (N=20)	
IUBT setting	Total (N=20)
Facility type at which IUBT was performed, n	
Obstetric clinic	3
Obstetric hospital	0
General hospital/perinatal center	17
IUBT performed at a delivery facility, n	9
IUBT performed after maternal transfer, n	11
Time from delivery to IUBT (min), n	
0 (during cesarean section)	2
<30	4
>30 to 60	1
>60 to <120	4
>120 to <180	4
>180	5
Maternal status at IUBT initiation	
Estimated blood loss before IUBT placement (mL), n/N=18	
<1,000	0
>1,000 to <2,000	1
>2,000 to <3,000	4
>3,000 to <4,000	4
>4,000	9
Hemoglobin level (g/dL), median (range)/N=12	4.9 (1.2-7.4)
Fibrinogen level (mg/dL), median (range)/N=7	63 (22-107)†
Shock index, median (range)/N=12	1.39 (0.67-3.08)

TABLE 2: Characteristics of intrauterine balloon tamponade (IUBT) implementation and the maternal status at initiation (N=20)

†Fibrinogen results were available in 11 patients, of whom 7 had quantifiable values and 4 had values below the detection limit. The median and range were calculated using the seven quantifiable values.

Subsequent management after IUBT was performed in 14 patients and consisted of maternal transfer (n=6), TAE (n=5), and hysterectomy (n=3). The interval from IUBT placement to the decision for subsequent management was available in 11 of these patients and is shown in Figure *2*. The decision for subsequent management was made within 30 min in 6 patients (54.5%), whereas the remaining patients required longer intervals. In the remaining six patients, systemic management, including endotracheal intubation, vasopressor support, and blood transfusion, was provided; however, they were too hemodynamically unstable to undergo subsequent management. Clinical characteristics and subsequent management

according to the facility where IUBT was performed are summarized in Table 3. The distribution of underlying causes of hemorrhage was broadly similar between the two groups. Transfusion had been initiated by the time of IUBT placement in 3 of 9 patients (33.3%) at the delivery facility and 5 of 11 patients (45.5%) after maternal transfer. Subsequent management was performed in all 9 patients (100%) who underwent IUBT at the delivery facility and in 5 of 11 patients (45.5%) who underwent IUBT after maternal transfer, with maternal transfer, TAE, or hysterectomy performed as subsequent management (Table 3).

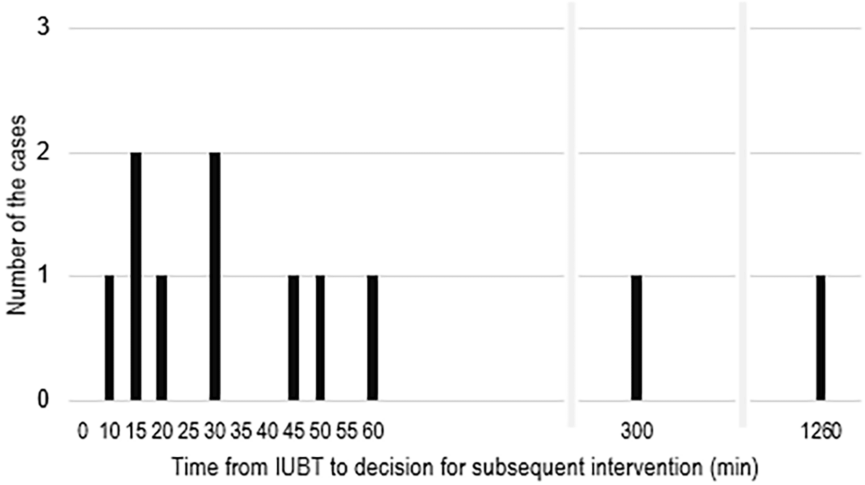


FIGURE 2: Time from intrauterine balloon tamponade (IUBT) initiation to the decision for subsequent management.

Subsequent management included maternal transfer, interventional radiology, and hysterectomy. Data were available for 11 of the 14 patients who underwent subsequent management.

	At the delivery facility (N=9)	After maternal transfer (N=11)
Causative disorder of critical obstetric hemorrhage, n		
Amniotic fluid embolism with severe coagulopathy and hemorrhage	6	6
Placental abruption	2	3
Placenta accreta	1	1
Atonic bleeding	0	1
Transfusion initiated by the time of IUBT placement, n (%)	3 (33.3)	5 (45.5)
Subsequent management after IUBT†, n (%)	9 (100)	5 (45.5)
Maternal transfer	5	1§
TAE	3	2
Hysterectomy	1	2
Interval from IUBT placement to the decision for subsequent management‡, min, median (range)	25 (10-1,260)/N=8	50 (45-60)/N=3

TABLE 3: Clinical characteristics and subsequent management according to the facility where intrauterine balloon tamponade (IUBT) was performed

†Subsequent management after IUBT included maternal transfer, TAE, and hysterectomy.

‡Data on the interval from IUBT placement to the decision for subsequent management were available for eight patients who underwent IUBT at the delivery facility and three patients who underwent IUBT after maternal transfer.

§One patient was subsequently transferred to another higher level medical facility.

TAE: transcatheter arterial embolization

Transfusion support during the clinical course was also evaluated. Transfusion had been initiated in 6 of the 20 patients (30.0%) during delivery or within two hours postpartum and in 8 (40.0%) by the time of IUBT placement. Among the 15 patients with available transfusion data who underwent maternal transfer, 9 (60.0%) had received transfusion by the time of their arrival at the higher level institution; the remaining 6 patients had delivered at obstetric clinics (n=5) or an obstetric hospital (n=1). Among the 14 patients who proceeded to subsequent management after IUBT, in 9 (64.3%) patients, transfusion had been initiated by the time the decision for subsequent management was made. Of the remaining five patients who had not received transfusion by that time, three had undergone IUBT at general hospitals or perinatal centers.

Discussion

This nationwide registry-based study included all reported maternal deaths in Japan in which IUBT was performed during the study period. Although the analysis was limited to 20 maternal death cases, the results provide unique insights into the clinical circumstances surrounding IUBT use in fatal cases of critical obstetric hemorrhage. IUBT was frequently performed in patients with extremely severe hemorrhage and advanced disseminated intravascular coagulation (DIC), conditions in which its hemostatic efficacy was expected to be limited. Furthermore, despite current recommendations that IUBT be performed as a temporary trial hemostatic procedure, the decision for subsequent interventions was made more than 30 min after IUBT in approximately half of the evaluable patients. Transfusion had also not been initiated before the decision for subsequent management in some patients. Although these findings do not necessarily indicate that the timing of management contributed to maternal death, they characterize important aspects of the clinical course surrounding IUBT use in these extremely severe cases.

The hemostatic mechanism of IUBT is considered to involve mechanical compression of the bleeding surface and a reduction in uterine blood flow, which collectively promote uterine contractions [11]. A systematic review and meta-analysis reported a high success rate of IUBT for uterine atony (87.1%), whereas the success rate was lower for placenta accreta spectrum (PAS) (66.7%) [4]. Furthermore, Revert et al. reported that coagulopathy was independently associated with IUBT failure (odds ratio, 5.6) [5], while Kong and To also identified coagulopathy and placenta accreta as factors associated with IUBT failure [6]. These findings suggest that the effectiveness of IUBT may be limited in conditions such as PAS, amniotic fluid embolism with severe coagulopathy, or advanced DIC with massive active bleeding. In the present study, most patients had already developed severe hemorrhage and coagulopathy at the time of IUBT placement, as demonstrated by massive cumulative blood loss, profound anemia, severe hypofibrinogenemia, and advanced hemorrhagic shock. Furthermore, the underlying causes of hemorrhage in many cases included amniotic fluid embolism with severe coagulopathy and PAS, for which IUBT alone is unlikely to achieve definitive hemostasis. These findings indicate that IUBT was frequently performed in patients with clinical conditions in which its hemostatic effectiveness may be limited. On the other hand, IUBT was conducted after maternal transfer in 11 patients, suggesting that clinicians selected one of the few interventions that may be implemented immediately despite extremely severe clinical conditions. Therefore, the present results do not necessarily imply the inappropriate use of IUBT itself, but may instead reflect the clinical reality that IUBT is often used as an initial temporizing intervention in critically ill patients. The additional descriptive analysis according to the facility where IUBT was performed showed that all patients who underwent IUBT at the delivery facility received subsequent management, including maternal transfer or additional hemostatic interventions. This finding further highlights the role of IUBT as a temporary measure before subsequent interventions or maternal transfer.

The results obtained herein also have important implications regarding the clinical use of IUBT. IUBT is recommended to serve as a trial hemostatic procedure, with its effectiveness being assessed within a short period and prompt transition to subsequent interventions if adequate hemostasis cannot be achieved [2,8,9]. Although the decision for subsequent management was made within 30 min after IUBT placement in approximately 50% of evaluable patients, the interval was substantially longer in several cases. Representative examples are shown in two patients. One patient with placental abruption complicated by DIC underwent vaginal delivery followed by IUBT, repeated balloon replacement, and transfusion. Despite persistent hemorrhage, the decision to proceed with TAE was not made until 300 min after IUBT placement, by which time cumulative blood loss had reached approximately 4,500 mL. Another patient with placenta previa accreta underwent intraoperative IUBT and transfusion during cesarean section. Despite continuous postoperative bleeding exceeding 2,000 mL from the drain within 3 h, vasopressor requirement, and profound anemia, conservative management was continued. The decision for maternal transfer was not made until after cardiac arrest, approximately 1,260 min after IUBT placement, when cumulative blood loss had reached 7,600 mL.

Another notable finding was the timing of transfusion support. Among the 14 patients who subsequently underwent maternal transfer, TAE, or hysterectomy, transfusion had already been initiated in only nine by the time subsequent management was decided. Notably, three of the remaining five patients had undergone IUBT at general hospitals or perinatal centers, where blood transfusion was expected to have been readily available. These findings demonstrate that transfusion had not yet been initiated at the time of the decision for subsequent management in some patients. However, because detailed information regarding the clinical rationale, availability of blood products, and rapidly evolving maternal condition was not consistently available, the appropriateness of transfusion timing could not be determined from the registry data. Timely transfusion support needs to be regarded as an integral component of the initial management of severe obstetric hemorrhage and must not be unnecessarily delayed while assessing the effectiveness of IUBT.

This study has several limitations that need to be addressed. First, the small sample size (n=20) limits the generalizability of the findings. Since the database only included maternal deaths, successful IUBT cases were not captured; therefore, the present study characterizes the clinical backgrounds of fatal cases rather than evaluating the efficacy of IUBT itself. Importantly, because no comparison group of surviving patients or maternal death cases without IUBT was available, the present study cannot determine whether the observed timing of IUBT, transfusion, or subsequent interventions was associated with maternal death. In addition, the registry did not consistently capture the clinical rationale underlying individual treatment decisions, limiting our ability to assess the appropriateness of the timing of subsequent interventions. Furthermore, laboratory data and clinical information, including transfusion timing and volume, were incomplete in some patients. The retrospective registry-based design may also have introduced selection, information, and reporting biases, potentially affecting the representativeness of the study population and the completeness and accuracy of the collected data. Details regarding the type of balloon device, operator experience, institutional treatment protocols, and the availability of transfusion support were not evaluated. Moreover, many patients in the present cohort had amniotic fluid embolism with severe coagulopathy or advanced DIC with massive active bleeding, making it difficult to determine whether strict adherence to the principles of IUBT as a trial hemostatic procedure would have altered their outcomes. Nevertheless, adherence to the principles of IUBT as a trial hemostatic procedure may still be important to maximize opportunities for life-saving interventions in patients with critical obstetric hemorrhage.

Conclusions

This nationwide registry-based study clarified the clinical circumstances surrounding IUBT use in maternal deaths due to critical obstetric hemorrhage. IUBT was frequently performed in patients with severe hemorrhage and advanced coagulopathy, and prolonged intervals from IUBT placement to the decision for subsequent management were observed in some cases. Although the small sample size and absence of a comparison group preclude conclusions regarding treatment effectiveness or causality, these findings highlight the importance of established recommendations that IUBT should be used as a temporary hemostatic measure, with prompt assessment of its effectiveness and timely escalation to subsequent interventions when necessary. Further multicenter observational studies including both fatal and nonfatal cases are warranted to clarify the optimal indications for IUBT, its effectiveness, and the appropriate timing of escalation to subsequent interventions.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Ethics Boards of St. Marianna University School of Medicine, Kawasaki, Japan, and the Japan Association of Obstetricians and Gynecologists issued approval 6448 and 202407_1. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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References

1. Guidelines for the management of critical obstetric hemorrhage, revised 2022. [Article in Japanese] . (2022). Accessed: July 30, 2026: https://www.jsog.or.jp/activity/pdf/shusanki_taioushishin2022.pdf.
2. Escobar MF, Nassar AH, Theron G, et al.: FIGO recommendations on the management of postpartum hemorrhage 2022. Int J Gynaecol Obstet. 2022, 157:3-50. 10.1002/ijgo.14116
3. Overton E, D'Alton M, Goffman D: Intrauterine devices in the management of postpartum hemorrhage . Am J Obstet Gynecol. 2024, 230:S1076-88. 10.1016/j.ajog.2023.08.015
4. Suarez S, Conde-Agudelo A, Borovac-Pinheiro A, Suarez-Rebling D, Eckardt M, Theron G, Burke TF: Uterine balloon tamponade for the treatment of postpartum hemorrhage: a systematic review and meta-analysis. Am J Obstet Gynecol. 2020, 222:293.e1-e52. 10.1016/j.ajog.2019.11.1287
5. Revert M, Cottenet J, Raynal P, Cibot E, Quantin C, Rozenberg P: Intrauterine balloon tamponade for management of severe postpartum haemorrhage in a perinatal network: a prospective cohort study. BJOG. 2017, 124:1255-62. 10.1111/1471-0528.14382
6. Kong CW, To WW: Prognostic factors for the use of intrauterine balloon tamponade in the management of severe postpartum hemorrhage. Int J Gynaecol Obstet. 2018, 142:48-53. 10.1002/ijgo.12498
7. Xu TY, Fu Q: Risk factors for Bakri balloon tamponade failure in the management of postpartum hemorrhage. Int J Gynaecol Obstet. 2023, 160:685-90. 10.1002/ijgo.14349

8. Makino S, Takeda J, Hirai C, Itakura A, Takeda S: Uterine balloon tamponade as a test to assess further treatment. Acta Obstet Gynecol Scand. 2015, 94:556. 10.1111/aogs.12599
9. World Health Organization: WHO Recommendation on Uterine Balloon Tamponade for the Treatment of Postpartum Haemorrhage [Internet]. World Health Organization, Geneva; 2021.
10. Japan Association of Obstetricians and Gynecologists. Maternal death reporting system . Accessed: October 21, 2026: https://www.jaog.or.jp/about/project/document/fr_system/.
11. Georgiou C: Balloon tamponade in the management of postpartum haemorrhage: a review . BJOG. 2009, 116:748-57. 10.1111/j.1471-0528.2009.02113.x