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## The effectiveness of using uterine tampons in treating uterine atony

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### Abstract

Postpartum hemorrhage is excessive bleeding that occurs after delivery due to blood loss of 500 mL in a standard delivery or 1,000 mL in a cesarean delivery. Postpartum hemorrhage is divided into primary and secondary and classified based on the 4 Ts: tone, trauma, tissue, and thrombin. Uterine atony is the most common cause. The use of uterine tamponade is an option to treat postpartum hemorrhage (PPH) because it is relatively non-invasive, with a success rate of more than 80%. Using uterine tamponade is easy and quite simple but requires hands-on training to increase confidence in installing uterine tamponade. The literature sources used are Google Scholar, Pubmed, Science Direct, Hindawi, Medline, and Cochrane. After obtaining appropriate literature, the literature is compiled. Uterine tamponade is a second-line treatment for uterine atony that does not respond to uterotonics. Based on the literature search that has been carried out, uterine tamponade is an effective therapy for PPH, is easy to use, and has a low risk of harm with a success rate of 80-87.3%. The use of uterine tamponade can also significantly reduce the need for invasive procedures. Uterine atony is the most common cause of PPH, which results in morbidity and mortality. Uterine tamponade has been proven to be effective, safe, practical, and cheap to treat PPH in daily practice. Further research may be needed in Indonesia to determine the effectiveness of uterine tamponade in treating uterine atony.

**Keywords:** Uterine Atonia, Uterine Tamponade, Postpartum Hemorrhage

### 1. Introduction

Postpartum hemorrhage (PPH) is excessive bleeding that occurs after childbirth. Blood loss that occurs as much as 500 mL in normal delivery, 1,000 mL in cesarean delivery, or more or signs and symptoms of hypovolemia in the first 24 hours after delivery up to 12 weeks postpartum. Early or primary postpartum hemorrhage occurs in the first 24 hours after delivery and is the most common type. Secondary postpartum hemorrhage occurs after the first 24 hours. The causes of PPH can be classified based on the 4 T mnemonic: tone, trauma, tissue, and thrombin. Uterine atony is the most common cause of PPH, accounting for up to 80% of all cases. Uterine atony is caused by dysfunctional hypercontractility of the myometrium immediately after the baby and placenta are born. Uterine atony may develop in women with leiomyoma, multifetal pregnancies, polyhydramnios, and fetuses that are large for gestational age. Bimanual uterine compression should be considered as first-line management of uterine atony. Second-line management is uterine tamponade with a Foley catheter or other special intrauterine balloon catheter, the effectiveness of which reaches 80-90% (Watkins & Stem, 2020; Feduniw et al., 2020).

The use of uterine tamponade has been used in recent years. The use of uterine tamponade is an option to treat PPH because it is relatively noninvasive with a success rate of more than 80% (Kong & To, 2018). It has been proven that uterine tamponade has a good success rate in women with PPH caused by uterine atony after vaginal delivery (Suarez et al., 2020). Using uterine tamponade is easy and quite simple but requires hands-on training to increase confidence in installing uterine tamponade (Finlayson et al., 2020). Therefore, this study aims to analyze the effectiveness, and safety and examine further uterine tamponade in PPH.

## 2. Method

### Grouping Findings

After the content review is complete, researchers can group relevant findings into several categories or sub-topics, according to the main aspects that need to be discussed in the discussion. For example, information about the definition of uterine atony can be grouped in one category, the mechanisms of occurrence in another, and so on. This grouping helps in presenting data systematically in the discussion section.

### Comparative Analysis

In the discussion, researchers can carry out comparative analysis between various relevant literature sources. This comparative analysis helps in highlighting similarities and differences in views, findings, or methods found in different literatures. Researchers can identify convergences of views or contradictions that need to be clarified.

### Conclusion

After in-depth data analysis, the researcher can draw up conclusions that describe key findings from the literature. This conclusion includes the understanding gained about uterine atony, uterine tamponade, as well as how uterine tamponade is used in the management of uterine atony. Conclusions may also include practical implications of these findings in the context of clinical care.

### Identify Deficiencies or Weaknesses

In the discussion section, researchers can also identify deficiencies or weaknesses in the literature being analyzed. These include potential bias in the study, lack of strong clinical data, or areas of research that need to be deepened. This identification can be the basis for further research suggestions.

### Clinical Relevance

The discussion section may also include an emphasis on the clinical relevance of the findings. Researchers can discuss how knowledge gained from literature analysis can influence clinical practice, treatment policies, or the development of new tools and methods in the management of uterine atony. By completing this data analysis, the study will provide a comprehensive understanding of the topic under study, illustrate its scientific contributions, and provide a basis for readers to understand more deeply the use of uterine tamponade in the management of uterine atony as well as the potential for further research development in the future.

## 3. Research Results and Discussion

### a) Uterine Atony

#### Definition

Postpartum hemorrhage is a condition of blood loss of more than 500 mL in vaginal delivery and more than 1,000 mL in cesarean section (Bienstock et al., 2021). The American College of Obstetrics and Gynecology in 2017 redefined PPH as a condition of blood loss of more than 1,000 mL accompanied by signs and symptoms of hypovolemia within 24 hours after birth, regardless of the method of birth (Shields et al., 2017). Based on the time, PPH is divided into primary and secondary. Primary postpartum hemorrhage occurs within 24 hours after birth, while those that occur after 24 hours to 12 weeks after birth are called secondary PPH (Kasap et al., 2016). Primary postpartum hemorrhage consists of uterine atony, genital tract laceration, retained placenta, uterine inversion, abnormal placenta, and coagulation disorders. Secondary postpartum hemorrhage consists of retained products of conception, infection, subinvolution of the placental site, and inherited coagulation deficits (Bienstock et al., 2021). (Uterine atony is a condition where contractions of the myometrium decrease so that the uterus, after delivery, becomes flaccid and unable to provide adequate compression for

hemostasis to occur (Ignacio et al., 2020; Kim et al., 2022). Uterine atony is known to be the most common cause of PPH compared to other causes (Li et al., 2022).

### **Epidemiology**

Postpartum hemorrhage is one of the most common causes of mortality and morbidity worldwide (Cochrane Pregnancy and Childbirth Group, et al., 1996). Based on data from the World Health Organization (WHO), every year, 14 million women experience PPH, and this results in around 70,000 maternal deaths globally (Wang et al., 2023). In general, the continent that has the most cases is Africa, namely around 33.9%, followed by Asia, namely 30.8% of cases (Feduniw et al, 2020). A total of 1,320 mothers in Indonesia died due to PPP in 2021. The provinces in Indonesia which has the highest number of cases is West Java, namely 235 cases (Ministry of Health, 2021). Based on the causes of PPH, uterine atony is the most common cause, namely around 60% - 80% and causes maternal deaths around 20-30%. Genital tract lacerations range from 16.7%, placental abnormalities range from 4% - 35%, and coagulopathy, for example, due to anticoagulant treatment or Disseminated Intravascular Coagulation (DIC) disease, is around 7.4% (Feduniw et al., 2020).

### **Mechanism**

Bleeding that continues even though the uterus has appropriately contracted indicates a laceration. Fresh red blood can indicate bleeding originating from the arteries. Constant seepage causes relatively faster blood loss. Some cases show that after separation of the placenta, blood may not come out through the vagina but collects in the uterine cavity to more than 1,000 mL (Pugh, 1981). Uterine atony refers to the inadequate contraction of the myometrial cells of the uterine corpus in response to endogenous oxytocin released during labor. This causes postpartum hemorrhage because placental detachment disrupts the spiral arteries, which uniquely lack muscle and rely on contraction to mechanically compress them into a hemostatic state (Gill et al., 2018).

### **Risk Factors**

Some known risk factors that can cause PPH are a previous history of PPH, chorioamnionitis, uterine overdistension due to multiple pregnancies, complications in pregnancy (maternal anemia, hypertension in pregnancy, gestational diabetes mellitus), macrosomia or polyhydramnios, therapeutic use of magnesium sulfate, general anesthesia, prolonged labor, reduction or augmentation of labor, primiparity, episiotomy, abnormal placenta, amniotic fluid embolism, and congenital abnormalities (such as Von Willebrand disease) (Li et al., 2022; Feduniw et al, 2020).

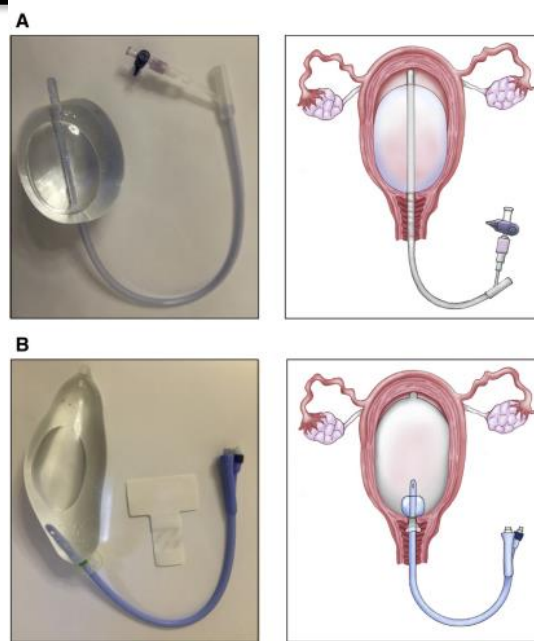
## **b) Uterine Tamponade**

### **Definition**

Uterine tamponade is an effective method used to control PPH caused by uterine atony, which is not effective with the use of uterotonic drugs (Balki & Wang, 2021). Uterine tamponade is a device consisting of a silicone rubber or plastic balloon that will be inserted into the uterine cavity. Then, the balloon will be inflated using sterile fluid (Figure 1). The inflated balloon will exert outward pressure on the uterus, achieving a tamponade effect to prevent further bleeding. Uterine tamponade can be administered using improvised or specially designed devices. The improvised trap he was referring to would be a balloon catheter. Balloon catheters are designed for purposes other than treating PPH. Uterine tamponades designed explicitly for the treatment of PPH are the Bakri balloon, the Ebb (Belfort-Dildy) tamponade system, the Ellavi balloon, and the BT-Cath balloon (Pinggrav et al., 2021).

Figure 1

*Uterine tamponade. A. balloon bakri. B. catheter tamponade 4*



### **Mechanism**

The working procedure for uterine tamponade is to facilitate blood in the uterine blood vessels and small vacuoles from the rough surface to clot, thereby stopping PPH. Therefore, balloon tamponade should be performed as early as possible before DIC occurs. Positive pressure exerted on the myometrial wall in the uterus and the base of the endometrial arteries, as well as changes in the uterine wall due to distension are also mechanisms of uterine tamponade in stopping PPH (Seidel et al., 2018; Philips et al., 2023). Hemostasis can also be due to hydrostatic pressure on the radial artery, which is exposed to the placental bed (Seidel et al., 2018).

### **Types and How to Use**

#### **Traditional Balloon Tamponade**

##### **1) Intrauterine balloon tamponade**

An intrauterine balloon may be placed after a vaginal or cesarean delivery. Techniques used for placement include transvaginal placement, with or without ultrasound guidance, or hysterotomy at the time of cesarean delivery. Insertion during cesarean delivery, the balloon is inflated after hysterotomy closure. This is so that the balloon does not get sewn up during closing. Vaginal packing is recommended in dilated cervixes to avoid expulsion. The Ebb balloon is a 2-chamber system, one placed intrauterine and the other external to the cervix as additional tamponade and to avoid expulsion (Philips et al., 2023).

##### **2) Condom Catheter**

World Health Organization (WHO) recommends the use of balloon catheters because their use has been proven to be simple, effective, and cheap. Muchlis et al. (2021), stated that catheter condoms require a longer time than Bakri balloons to achieve hemostatic conditions. How to use it is: (1) label each condom, (2) insert the catheter into the condom, (3) tie the condom to the catheter using a 10 cm string at 3 cm from the end of the condom, (4) connect the catheter to the macro IV infusion tube and infusion bottle, (5) placing the condom on a flat table, (6) simultaneously administering the fluid infusion by releasing the clamp, (7) starting a fluid infusion of 500 mL to a maximum volume of 5000 mL (based on theory), (8) leaving it for 2 x 24 hours (Muchlis et al, 2021).

World Health Organization published new recommendations on the use of uterine balloon tamponade for the treatment of PPH. Uterine balloon tamponade is recommended for the treatment of PPH due to uterine atony after vaginal delivery in women who do not respond to standard first-line treatment with met conditions such as surgical intervention and access to blood products can be achieved quickly if necessary. The first-line treatment protocol for primary PPH (including the use uterotonics, tranexamic acid, intravenous fluids) is available and applied routinely, pother causes of postpartum hemorrhage (retained placental tissue, trauma) can be ruled out reasonably, this action is carried out by health workers who are trained and skilled in the management of PPH including the use of uterine balloon tamponade, the mother's condition can be monitored regularly and adequately for immediate identification of signs decline (World Health Organization, 2021; Weeks et al., 2022).

### c) Relationship between Uterine Atonia and the Use of Uterine Tamponade

A study conducted by Tindel et al. (2013) from 13 studies of 241 patients found that uterine tamponade successfully treated PPH in 234 patients. This study concluded that uterine tamponade is an effective therapy for PPH, is easy to use, and has a low risk of harm (Tindell et al., 2013). This is in line with research by Dey et al. (2020), which states that the success of uterine tamponade in treating PPH is 80%, so it is recommended for therapy for refractory PPH (Dey et al., 2022). Research conducted by Suarez et al. (2020) from 91 studies with 4729 patients, cited in the study by Phillips et al. (2023), also obtained similar results. The success rate for uterine tamponade in treating PPH is 86%, with the highest success rate in cases of uterine atony, namely 87%. This study also states that the success rate for using tamponade for PPH in vaginal delivery is higher, namely 87%, compared to 82% for cesarean delivery. A study conducted by Phillips et al. (2023) stated that the use of uterine tamponade after being given uterotonics provided significantly lower results for invasive procedures compared to the group that did not use uterine tamponade. Research conducted by Suarez et al. (2020) concluded that the success of condom-type uterine tamponade was comparable to Bakri balloon uterine tamponade.

According to a study conducted by Kong & To (2018), of the 81 cases of uterine tamponade use, cited in a study conducted by Phillips et al. (2023) stated that the use of uterine tamponade <1,400 mL with a positive tamponade test is a predictor of successful use of uterine tamponade. A positive tamponade test is defined as blood drained from the uterus  $\leq 50$  mL after 30 minutes of uterine tamponade installation (Phillips et al., 2023). Based on a study conducted by Dey et al. (2020) stated that 4-6 hours is sufficient to overcome PPP effectively. This is in line with a retrospective cohort study of 274 patients conducted by Phillips et al. (2023); this study states that removal of uterine tamponade is recommended <12 hours after bleeding has improved to reduce the frequency of postpartum fever. Dey et al. (2020) stated in their study that antibiotic prophylaxis is recommended to prevent the risk of infection from using uterine tamponade. This statement was also mentioned in research conducted by Leduc et al. (2018), This study also states that oxytocin infusion may be needed when using tamponade, even after PPH has resolved, to maintain uterine tone. A study conducted by Ching et al. (2019) stated something similar, where uterine tamponade was used together with oxytocin infusion to facilitate uterine contractions.

Bakri balloon tamponade is recommended to treat severe PPH because of its large capacity of 500 mL, a central drainage tube to prevent blood accumulation and clotting, and ease of use (Dey et al., 2020). The double compression method can be used after the Bakri balloon fails to treat PPP. A study conducted by Guo et al. (2018) on 305 cases of PPH found that the success rate of using uterine tamponade was 87.3% (124 of 142 patients) compared to the group using the double compression method, namely 96.3% (157 of 163 patients).

Double compression can help stop active bleeding from the detachment surface of the placenta in uterine atony. Applying double pressure to the uterus with an abdominal compression bandage and uterine tampon is an economical and practical method. This method is also safe and does not cause uterine rupture or necrosis, other complications, or the risk of post-operative morbidity (Guo et al., 2018).

Another method used to treat PPH is a uterine sandwich. This method applies sutures into and above the uterus as external compression of the uterus to maintain uterine compression in combination with uterine tamponade. Balki et al. (2021) stated that the success rate using this method reached >95%. Another method reported in a study conducted by Kinugasa et al. (2015) was an intrauterine balloon catheter covered with gauze impregnated with tranexamic acid. There were two cases of refractory PPH with bleeding of approximately 2,800 mL and 5,000 mL who had been given uterotonics reported in the study. The patients' postpartum hemorrhage resolved after using this method, and both patients were discharged from the hospital stable. This method is a combination of mechanical compression and the use of topical antifibrinolytic agents, which results in complete hemostasis without the need for additional therapy. Further research is needed to determine the effectiveness and safety of this method (Kinugasa et al., 2015).

A study conducted by Kamencic et al. (2020) on 133 cases of severe PPH with 54 cases of uterine atony, 75 of whom had vaginal births and 65 of whom had cesarean deliveries, concluded that women with PPH are at risk of experiencing PPH in subsequent pregnancies. The study also concluded that the use of uterine tamponade with the Bakri balloon had no adverse effects on subsequent pregnancies. Lin et al (2019), stated that if a Bakri balloon is not available, a condom attached to a Foley catheter or a condom catheter can also be used as uterine tamponade in PPH. However, this study also reminds us that the size of one Foley balloon is not large enough for uterine tamponade because it has the possibility of disrupting active bleeding by blocking the cervical canal.

Research conducted by Lin et al. (2019), found that the group that used uterine tamponade to treat PPH showed a lower reduction in fibrinogen levels, less frequent packed red cells (PRC) transfusions, and a shorter duration of hospitalization compared to the group who do not use uterine tamponade. Soued et al. (2020) in their research also stated that the use of uterine tamponade was concluded to be effective and safe and significantly reduced the need for invasive procedures such as radiological embolization, arterial ligation, and/or emergency hysterectomy which carries a risk of morbidity. A study by Kellie et al. (1996) stated that patients using Bakri balloons lost less blood on average during and after surgery than patients with square uterine sutures. A study conducted by Dey et al. (2020) also stated that with uterine tamponade, patients do not need a laparotomy to treat PPH, and it is safe and easy to use.

#### **4. Conclusion**

Uterine atony is the most common cause of PPH, which results in morbidity and mortality. One management of PPH that has been proven to be effective, safe, practical, and cheap is the use of uterine tamponade. The use of uterine tamponade has also been proven to reduce invasive procedures so that it can be considered in daily practice in patients with uterine atony. Further research may be needed to determine the effective use of uterine tamponade to treat uterine atony in Indonesia.

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