

# Balloon Tamponade in the Management of Postpartum Hemorrhage: Three Years of Experience in a Single Center

Berrin Goktug Kadioglu, Esra Cinar Tanriverdi, Ayse Nur Aksoy\*

Department of Obstetrics and Gynaecology, Nenehatun Hospital, Erzurum, Turkey

Email: \*draysenuraksoy@hotmail.com

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## Abstract

**Introduction:** Postpartum hemorrhage (PPH) is one of the leading causes of maternal death in the world and it is reported to occur in 5% - 8% of pregnancies. **Objective:** This study aimed to present a single centre's experience in treating PPH by balloon tamponade. **Methods:** During the time period between January 2013 and March 2016, 50 patients who had undergone balloon tamponade for postpartum hemorrhage in our clinic were evaluated retrospectively. The patients' age, parity, type of delivery, birth weight, hemoglobin and platelet values, total blood loss from catheter, balloon's staying time, blood and platelet transfusion status, the presence of placenta anomalies and the Bakri balloon hemostasis success rate were evaluated. **Results:** During the study period, there were 27,249 deliveries. The frequency of massive postpartum hemorrhage was 0.61% (n = 168). Among the 168 patients with massive postpartum hemorrhage, there were 50 patients in whom the Bakri balloon catheter was used. Bakri balloons were placed via cesarean section incision in 19 patients and via vagina in 31 patients. The mean staying time of Bakri balloon was 18 hours. In 8 patients, balloon tamponade failed. Two patients underwent hysterectomy; other two patients had surgical ligation of the hypogastric artery. Four cases were referred to a tertiary center. Placental invasion abnormalities were observed in five patients. The overall Bakri balloon hemostasis successful rate was found to be as 84% in all cases. **Conclusion:** Bakri balloon tamponade is an effective, safe and practical approach in the treatment of postpartum hemorrhage.

## Keywords

Postpartum Hemorrhage, Bakri Balloon, Vaginal Delivery, Cesarean Section, Atony

## 1. Introduction

Postpartum hemorrhage (PPH) is one of the leading causes of maternal death in the

world and it is reported to occur in 5% - 8% of pregnancies [1]. Primary PPH is defined as an estimated blood loss of more than 500 ml after vaginal delivery and more than 1000 ml after cesarean section within the first 24 hours. The most common cause of PPH is uterine atony. It is characterized by insufficient contraction of the myometrium following delivery [1].

Operative and non-operative interventions are used in treating PPH. Initially, large vascular access is established, bladder catheter is inserted and together with bimanual uterine compression, oxytocic agents and volume replacement (crystalloid and blood products) are applied. In patients who failed to respond to medical treatment, uterin tamponade, compression sutures, uterine artery ligation or embolization, hypogastric artery ligation and hysterectomy were applied [1] [2]. Recent studies have described the successful use of uterine tamponade in the management of PPH arising from uterine atony that is unresponsive to uterotonic medical treatment [3]-[6]. Various types of balloon catheters including Bakri balloon, the Roush balloon, the Sengstaken-Blakemore tube, or Foley catheters are used in clinics [7]. Bakri balloon tamponade is an alternative and effective method to preserve the uterus in medically intractable cases [8].

In this study, we aimed to evaluate a single centre experience in using balloon tamponade in the treatment of PPH. Also, we compared our results with those reported in the literature.

## 2. Materials and Methods

This study was approved by the Ethics Committee of Erzurum Regional Teaching Hospital, Turkey. We retrospectively reviewed the records of 50 patients treating for PPH by Bakri balloon tamponade who were managed between January 2013 and March 2016 in Nenehatun Hospital, Erzurum, Turkey. Women who developed massive PPH following a vaginal delivery or caesarean section in whom medical treatment had failed were included. Postpartum hemorrhage was defined as >500 ml estimated blood loss after vaginal delivery or >1000 ml after cesarean section [1]. Patients with PPH due to uterine and cervical trauma or retained placental tissue were excluded. Patients who underwent Bakri balloon insertion to control PPH were analysed in terms of demographic and clinical characteristics, treatment outcomes and the need for additional surgery and complications.

In our clinic, Bakri® intrauterine balloon catheter (Cook Medical Inc., Bloomington, IN) is only available as intrauterine balloon device. The Bakri balloon designed as uterine tamponade device have a silicone balloon holds 500 mL of saline and a drainage lumen that allows blood loss monitoring. Bakri intrauterine balloon catheter was inserted in cases of postpartum hemorrhage uncontrolled with uterotonics. Bakri balloon insertion was made according to the method originally described by Bakri *et al.* [5]. In vaginal deliveries, Bakri balloon was inflated with the guidance of ultrasound after it was passed the inner mouth of the cervix. During caesarean section, it was placed from uterine incision directed to the vaginal canal. The balloon, which was inserted in to the intrauterine cavity, was inflated by about 250 - 500 ml of saline. Pursing suture was placed and

vaginal tampon was applied in cases with large cervical dilatation. Following balloon inserted, low-dose intravenous oxytocin infusion was maintained during 24 hours. Blood drainage was controlled hourly for the first 6 hours postinsertion, and then every 4 hours (if drainage is less than 100 mL per hour) until its removal. In cases which the balloon was successful, it was removed around 24 hours later either in two stages or in a single stage. In all patients, Foley catheter was inserted in order to monitor urine output and broad-spectrum antibiotics were applied for prophylaxis. Pain condition was evaluated hourly using Visual Analog Scale (VAS). When VAS score was assessed as  $\geq 7$ , 25 mg pethidine was given intramuscularly.

Demographic characteristics (age, parity), type of delivery, birth weight, hemoglobin and platelet values, total blood loss from catheter, balloon's staying time, blood and platelet transfusion status, the presence of placenta anomalies, the necessity of surgery (ligation of the hypogastric artery and/or hysterectomy) and the interval time between the delivery and application of Bakri balloon were recorded.

### 3. Results

During the study period, there were 27,249 deliveries in our clinic. The frequency of massive postpartum hemorrhage was 0.61% ( $n = 168$ ). Among the 168 patients with massive postpartum hemorrhage, there were 50 patients in whom the Bakri balloon catheter was used. Bakri balloon was inserted vaginally in 31 patients and it was placed via uterine incision directed to the vaginal canal in 19 patients. The mean staying time of Bakri balloon was  $19.4 \pm 4.1$  hours. Hemostasis success rate of Bakri balloon application was 84% in all cases. Eight cases have failed. Two patients underwent hysterectomy; other two patients had surgical ligation of the hypogastric artery. Four cases were referred to a tertiary center. Placental invasion abnormalities were observed in five patients; two were managed with hysterectomy, three others were referred to a tertiary center. The ages of the patients ranged between 18 and 45 years (average  $30.5 \pm 14.5$  years). Forty eight patients were primary PPH and two patients were secondary PPH (one of them was on the fourth postpartum day; the other was on the seventh postpartum day). Nine cases were primiparous and others were multiparous. The average number of live births per woman was  $3 \pm 2.2$ . The mean birth weight was  $2873 \pm 34.6$  g. Nineteen cases (38%) were delivered by cesarean section. The mean age of cases performed cesarean was  $28 \pm 13$  years. The mean age of the patients who had vaginal delivery was  $32 \pm 6.7$  years. The mean labor time (from admission to the hospital until delivery) was  $3.7 \pm 5.4$  hours. Oxytocin was needed in 15 patients (30%). At the time of admission to the hospital, the mean hemoglobin value of cases was  $12.3 \pm 1.7$  g/dl; the mean platelet value was  $224,762 \pm 72,942$  /mm<sup>3</sup>. Immediately before Bakri balloon application, the mean hemoglobin value of patients was  $7.6 \pm 0.8$  gr/dl; the mean platelet value of patients was  $194,040 \pm 58,099$ /mm<sup>3</sup>. The mean of 3 units (2 - 6) of erythrocyte suspension and 2 units (0 - 2) of fresh frozen plasma were transfused to the patients. The mean staying time of Bakri balloon was  $19.4 \pm 4.1$  hours. The mean drainage amount from the Bakri balloon was  $111.6 \pm 88.6$  ml (Table 1). The most common risk

factor for PPH was unsuccessful birth induction (n = 20%, 40%) (Table 2). All patients were followed up for 5 months postpartum. There were no complications caused by the use of Bakri balloon.

**Table 1.** Demographic and clinical characteristics of the of the 50 patients applied Bakri Balloon Tamponade.

Parameter	Mean ± SD
Age (years)	30.5 ± 14.5
Cesarean section (n = 19%, 38%)	28 ± 13
Vaginal delivery (n= 32%, 62%)	32 ± 6.7
Gravida	5 ± 2.4
Parity	3 ± 2.2
Week of pregnancy	38 ± 3.0
Labor time (hour)	3.7 ± 5.4
Body mass index (kg/m <sup>2</sup> )	27 ± 1.3
Fetal weight (gram)	2873 ± 34.6
Hemoglobin value at the entrance to the hospital (g/dL)	12.3 ± 1.7
Hemoglobin value before Bakri Balloon application (g/dL)	7.6 ± 0.9
Platelet count at the entrance to the hospital (/mm <sup>3</sup> )	224,762 ± 72,942
Platelet count before Bakri Balloon application (/mm <sup>3</sup> )	194,040 ± 58,099
Bakri Balloon staying time (hour)	19.4 ± 4.1
The amount of drainage from Bakri Balloon (ml)	111.6 ± 88.6

Results are presented as the mean ± standard deviation.

**Table 2.** Evaluation of risk factors in patients in terms of postpartum hemorrhage.

Risk factors	Patients n (%)
Polyhydramnios	2 (4)
Operative delivery	8 (16)
Multiple pregnancy	1 (2)
Failed induction or prolonged labor	20 (40)
Preeclampsia	1 (2)
Primiparous	9 (18)
Placental location anomaly	5 (10)
Macrosomia	3 (6)
Advanced maternal age	10 (20)
Previous cesarean section	7 (14)
Maternal obesity	5 (10)
A history of postpartum hemorrhage	4 (8)

## 4. Discussion

In this retrospective study, we presented our centre's experience in treating PPH by balloon tamponade. We identified a total of 50 cases with PPH; 42 of them was successfully treated by Bakri balloon. Thus, the overall success rate of Bakri balloon alone was found to be as 84%.

Primary postpartum hemorrhage is defined as more than 500 ml of bleeding within the first 24 hours after a vaginal birth and more than 1000 ml of bleeding after cesarean section [1]. Postpartum hemorrhage is examined in four categories etiologically including tone, tissue, trauma and thrombin. Uterine tamponade methods are used for a long time to control severe uterine bleedings. Sengstaken-Blakemore tube, Rusch balloon, foley catheter, condom catheters have been adapted for similar clinical studies [3] [7] [8]. The most common cause of postpartum hemorrhage is uterine atony [1]. Despite the original Bakri balloon has used for cases with placenta previa, it has been used effectively for other cases with PPH caused by uterine atonia [9] [10] [11].

Dabelea *et al.* [8] applied intrauterine balloon tamponade to 23 patients with postpartum hemorrhage who were unresponsive to medical therapy and they reported a 100% success rate in cases with hemorrhage due to uterine atony. Also, they reported an 80% success rate for bleeding due to retained placenta. Kucukbas *et al.* [9] used balloon tamponade in 4 cases diagnosed with PPH (one placental abruption, two atonia, and one placenta previa) that were unresponsive to the medical treatment and they reported successful hemostasis in all cases. Consistent with these results, we treated 50 cases diagnosed with PPH unresponsive to medical treatment by balloon tamponade and we reported an 84% successful hemostasis rate in these patients.

Various types of balloon catheters for uterine tamponade were used clinically [3]. Doumouchtsis *et al.* [7] presented 27 patients with intractable PPH who had placement of the Sengstaken-Blackmore catheter to provide homeostasis. They achieved hemostasis in 22 patients (81%). However, this catheter was not practical to use because it had two separate balloons. On the other hand, Bakri balloon is practical and it can be placed in 5 - 10 minutes in patients who have vaginal or abdominal delivery. Depending on the width of uterine cavity, the balloon is inflated with 250 - 500 ml saline, thus it applies strong pressure on lower uterine segment. Moreover, drainage lumen of Bakri balloon enables monitoring the blood loss [5]. In a recent study, Gao *et al.* [10] analyzed a total of 109 patients with PPH who underwent Bakri balloon insertion after unsuccessful first line medication. They reported a 93.6% hemostasis successful rate. In addition, they notified similar hemostasis success rate in patients who had vaginal delivery compared to the patients who had cesarean section. Parallel to these results, we observed no significant difference between patients with vaginal delivery and cesarean section in terms of successful hemostasis rate.

Bakri balloon application is reported to contraindicate in cases with uterine abnormalities, cervical cancer, and purulent genital tract infection and arterial bleeding [6]. At the same time, factors affecting adversely the success rate in providing hemostasis by Bakri balloon implementation are listed as one or more previous cesarean history, ante-

rior placentation, thrombocytopenia, disseminated intravascular disorder during the application of catheter and more than 500 ml drainage volume within the first hour after catheter placement [11]. In our study, 5 of the 8 patients that hemostasis could not be provided by Bakri balloon, had sticking placental abnormalities. On the other hand, complications such as uterine perforation, cervical complications, trauma and infection may occur during the fitting process depending on the installation of Bakri balloon or during inflation of the balloon. In this current study, there were no complications caused by Bakri balloon. One of the factors that prevented complications may be suggested as insertion of Bakri balloon with ultrasound guidance. Supporting these results, no complications were reported in the literature due to the implementation of Bakri balloon [7] [10] [11].

There are studies in the literature evaluating the efficacy and safety of the Bakri balloon in the treatment of PPH [10] [12]. However, our study is important in terms of reflecting 3 years of our experience. Our study has a limitation. We have no data about patients referred to a tertiary center because of failing to provide hemostasis by Bakri balloon.

## 5. Conclusion

In conclusion, Bakri balloon is an effective, safe and simple method in the treatment of PPH. Also, uterine balloon tamponade is a life-saving application if the team does not have an experience about surgical intervention such as artery ligation and B-Lynch suture.

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