Bakri balloon tamponade to treat postpartum hemorrhage

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To the Editor: Postpartum hemorrhage (PPH) is a serious complication of childbirth and a leading cause of maternal morbidity and mortality worldwide. Therefore, the correct and proactive treatment of PPH is key to reducing maternal mortality rates. The Bakri balloon is one treatment method for PPH. Here, we investigated the therapeutic effect, advantages, and disadvantages of the Bakri balloon to provide a theoretical basis for seeking appropriate pathological occasions and optimal timing for placing the Bakri balloon (Cook Inc., Spencer, IN, USA) and develop a more reasonable and effective method for treating PPH.

This study was approved by the Ethics Committee of Maternal and Child Health Hospital of Hubei Province. All included women provided written informed consent for the therapeutic procedures and the publication of their data.

We retrospectively analyzed 169 cases of PPH treated with a Bakri balloon during delivery in our hospital between January 1, 2016, and December 31, 2019. Before Bakri balloon placement, all selected patients underwent normal hemostatic measures such as uterotonic agent injection (including carboprost, tromethamine, and carbetocin), uterine massage, and/or various sutures for obvious bleeding during cesarean section (including multiple “8” sutures, uterine B Lynch sutures, lower uterine segment constriction suture, and ascending uterine artery ligation). If these conventional hemostatic measures failed to control the bleeding, Bakri balloon tamponade was considered.

The Bakri balloon was inserted directly into the uterine cavity through a surgical incision during cesarean section or through the vagina and cervix after vaginal delivery or cesarean section. To avoid balloon slippage, one to four toothless oval forceps were used to fit the upper and lower lip of the cervix to the clamps at the 3 and 9 o’clock positions (depth to the fornix on both sides) before the balloon was placed transvaginally or before the water injection through the surgical incision, leaving only a gap that could accommodate the width of the balloon catheter [Figure 1]. (It is worth noting that such a procedure can be omitted for those with a tight and tough cervix.) After the clamping was completed, the decision should be made whether to place sterile gauze in the posterior vault of the vagina. The balloon indwelling time was 8 to 48 h. The balloon fluid was released at different times according to its hemostatic effect. First, toothless oval forceps were taken away; secondly, the balloon was removed.

Bakri balloon hemostasis was judged as a success or failure. When uterine drainage fluid < 100 mL/h was observed, the color was dark red, bleeding gradually decreased or stopped, uterine contractions were normal, balloon hemostasis was considered effective. If the uterine cavity drainage fluid was ≥ 100 mL/h, the color was bright red, the uterine contractions were poor, or the intractable uterine contractions were weak, other measures should be adopted to treat it; the effect of balloon hemostasis was deemed invalid. All parameters were compared between the success and failure groups.

All statistical analyses were performed using SPSS (version 26.0; IBM Corp, Armonk, NY, USA). The measurement data of PPH patients in the two groups are expressed as mean ± standard deviation. T-test and receiver operator characteristic curve analyses were used for the intergroup comparisons. Counting data are expressed as percentages, and Fisher’s exact test was used to examine those who did not meet the χ² test condition when the sample size was small. If the P value was < 0.05, intergroup differences in various observation indicators were considered statistically significant.

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There was no signiﬁcant embolization was adopted for all failed hemostasis necrosis. Bilateral uterine/internal iliac artery intervention to the cervix to the clamps at the 3 and 9 o’clock positions (depth to the fornix on both sides) before the balloon was placed transvaginally or before the water injection through the surgical incision, leaving only a gap that could accommodate the width of the balloon catheter.

Figure 1: To avoid balloon slippage, one to four toothless oval forceps were used to ﬁt the upper and lower lip of the cervix with the toothless oval forceps. The use of oval non-toothed forceps to clamp the cervix with the balloon in situ revealed no cervical necrosis. Bilateral uterine/internal iliac artery interventional embolization was adopted for all failed hemostasis cases and there were no cases of hysterectomy or maternal death. Statistically, there were no signiﬁcant intergroup differences in maternal age, gestational age, number of pregnancies, history of abortion, history of cesarean section, history of uterine ﬁbroids/adenomyomas, singleton versus/multiple births, delivery mode, or newborn birth weight (P > 0.05).

There was no signiﬁcant difference in balloon infusion volume between the successful and failed groups. However, postpartum blood volume and red blood cell transfusion differed signiﬁcantly between groups (P < 0.05) [Supplementary Table S2, http://links.lww.com/CM9/B183]. The receiver operating characteristic curve analysis indicated a signiﬁcant increase in the failure rate of balloon hemostasis in the case of PPH volume >1460 mL [Supplementary Figure S1, http://links.lww.com/CM9/B183].

This approach effectively prevents the balloon from slipping. Furthermore, the application of oval forceps to the cervix did not merely block part of the blood vessels distributed in the uterus but also facilitated uterine contractions through reﬂective stimulation to reduce colporrhagia.

Of the 169 cases of Bakri balloon hemostasis, 148 were successful for a success rate of 87.6%, supporting most previous domestic and international reports. Many studies have suggested that once PPH is diagnosed, Bakri balloon hemostasis should be used in a timely manner when ﬁrst-line hemostatic drugs and other methods cannot effectively control the bleeding.[12] This study found that the hemostatic effect of Bakri balloons was remarkable when the postpartum bleeding volume was <1460 mL, but the failure rate increased signiﬁcantly when the bleeding volume reached 1460 mL. Therefore, once bleeding exceeds 1460 mL, other hemostatic methods should be considered.

In this study, Bakri balloons were successfully placed through a surgical incision in eight patients who had undergone a cesarean section. Bakri balloons are mainly used for those with poor uterine contraction, diffuse bleeding in the uterine cavity, and low suture compliance. With improvement in surgical suture skills, hemostasis can be achieved in most cases during cesarean section using ﬁrst-line hemostatic drugs and various suture techniques. In the case of heavy intraoperative bleeding and diﬃculty suturing, the adoption of balloons can temporarily achieve hemostasis and reduce the amount of bleeding to save time for further hemostatic measures such as uterine/internal iliac artery interventional embolization therapy, thus effectively reducing the rate of uterine resection. Rapid diagnosis or prognosis of PPH combined with early use of the Bakri balloon is more effective for controlling PPH.[3]

In this study, 15 of 21 failure cases were related to placental factors, including 11 cases (52.4%) of placental adhesion with placental accreta, suggesting that placental accreta was an important factor leading to Bakri balloon hemostasis failure. This is probably because the retained placenta leads to an uneven inner wall of the uterine cavity and an irregular shape, which is against the effective ﬁtting of the balloon and uterine cavity, thus imposing a negative inﬂuence on the hemostatic eﬀect of balloon compression. Furthermore, the residual placenta continued to bleed, resulting in balloon hemostasis failure. Therefore, Bakri balloons may not be the optimal treatment for hemostasis in cases of placental accreta, especially in large areas, or even in cases of placental penetration. Soyama et al.[4] pointed out that invasive treatment is unavoidable for patients with placental retention to stop the bleeding. If continuous bleeding in the intrauterine drainage tube is caused by placental retention, further hemostasis should be performed immediately.[5] After a series of basic treatments, such as the removal of placental tissue and the suturing of the bleeding site, if the balloon is placed to stop the bleeding, any blood in the catheter should be closely observed and interventional embolization or hysterectomy should be performed as needed. Bakri balloons reportedly have an insigniﬁcant effect on patients with placental penetration. However, before more invasive procedures, prepositioned Bakri balloons may be a good choice in cases of placental accreta/penetration.[6] The Bakri balloon can play a temporary role in compression hemostasis and eﬀectively control the rapidly opened blood sinus. Although it may fail as a treatment, it can slow the bleeding and save time for further invasive procedures, such as uterine/internal iliac...
artery embolization or hysterectomy, and the safe transfer of the patient to a superior medical treatment center.\(^5\)

In conclusion, Bakri balloons are an effective treatment for PPH but have an insignificant effect in cases of placental retention. Cervical clipping with toothless oval forceps can effectively prevent hemostasis failure caused by balloon prolapse. When the PPH volume exceeds 1460 mL, the hemostatic effect of the Bakri balloon is greatly reduced. In cases in which invasive surgical intervention may be the only option for controlling PPH, the application of a balloon can temporarily lower blood loss, thus avoiding fatal hemorrhage before surgical intervention.

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**Conflicts of interest**

None.

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