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Case Report

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Uterine rupture requiring hysterectomy in a primigravida after Bakri™ uterine tamponade balloon placement for postpartum hemorrhage

Abstract

Introduction: Uterine atony is the most frequent cause of post-partum hemorrhage (PPH). Management may include medical, mechanical, and surgical methods. A commercially available uterine tamponade balloon, the Bakri™ tamponade balloon catheter (Cooper Surgical®) is frequently employed to manage PPH due to uterine atony and reported side effects or complications are generally rare.

Case presentation: A primigravida developed terminal fetal bradycardia in the setting of suspected placental abruption in the second stage of induced labor. She underwent a low forceps assisted vaginal birth followed by postpartum hemorrhage due to atony, requiring multiple uterotonics and placement of a Bakri™ uterine compression balloon with cessation of hemorrhage. Within an hour of placement, the patient felt and heard a "pop" with significant abdominal pain and hypotension. On examination, abdominal viscus was present in the vagina consistent with uterine rupture. Laparotomy revealed a total uterine rupture requiring hysterectomy.

Conclusion: Bakri™ balloon remains an available tool in management of atony; however, complications may arise. Clinicians should carefully weigh the potential risks of uterine tamponade balloons against alternative management strategies for uterine atony.

Keywords: postpartum hemorrhage (PPH), uterine rupture, Bakri balloon, atony

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Matthew Zuber,[1] Melissa Kozakiewicz,[1] Kaitlin Burchett[2]

[1]Wake Forest University School of Medicine, Winston-Salem, NC, USA

[2]Wayne State University School of Medicine, Detroit, MI, USA

Correspondence: Matthew Zuber, MD, Wake Forest University School of Medicine, Winston-Salem, NC, USA

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Introduction

Uterine atony is the most frequent etiology of post-partum hemorrhage. If unrecognized or untreated, atony may result in significant postpartum blood loss, hypovolemic shock, and associated maternal morbidity or mortality. Initial management of atony includes bimanual uterine massage and judicious use of oxytocic agents and medical therapies to aid in uterine contraction. It is important to exclude other etiologies in the initial evaluation of suspected atony. When uterine atony is confirmed and conservative management is warranted for post-partum hemorrhage, other mechanical methods harnessing compression forces are available. In the United States, a commercially widely available Bakri™ balloon can be employed to generate internal uterine cavity tamponade upon insufflation.[1] Most studies have reported good response with use of these tamponade devices in the management of hemorrhage; however, systematic reviews clearly show that the quality of the available evidence supporting their use and safety is low.[2,3] Clinicians need to be aware that potential complications may arise, including severe complications, and further quality research should be conducted to guide clinical practice.

Case report

Written informed consent was obtained from the patient for publication of this report and associated pathology image. A primigravid patient was diagnosed with gestational hypertension at term and an induction of labor was recommended. Her past medical history included class I obesity and hereditary spherocytosis status post splenectomy. She had no prior uterine surgeries or procedures. The induction course was uncomplicated; however, vaginal bleeding was noted during the second stage of labor. Terminal fetal bradycardia ensued, and placental abruption was suspected secondary to active vaginal bleeding while pushing. As the patient was found to be an appropriate candidate for operative vaginal birth as opposed to emergent cesarean, a low forceps assisted delivery was performed for non-reassuring fetal status remote from delivery. Delivery was at 38w5d with birth of a 3500 g infant with APGAR of 1, 4 and 7 at 1, 5 and 10 minutes respectively. Umbilical cord gases were reassuring but neonate was admitted to NICU for CPAP. Thorough exam was conducted and there were no lacerations or bruising of the scalp or face. A third degree perineal laceration obstetric anal sphincter injury (OASIS) was diagnosed and immediately surgically repaired in the delivery room. Approximately 30 minutes after delivery of the placenta, a primary postpartum hemorrhage occurred with significant vaginal bleeding noted by the obstetrician. Several uterotonic medications were administered and a thorough physical exam was carried out including manual assessment of the uterine cavity and running of the cervix with ringed forceps under direct visualization to rule out previously undiagnosed lacerations. This assessment confirmed uterine atony as the source of the PPH. The patient was hemodynamically stable at the time after establishing postpartum hemorrhage with increasing blood loss > 1000 mL in the delivery room. Therefore, a Bakri™ uterine compression device was placed under direct ultrasound guidance and instilled with 250 mL of sterile saline, confirming the appropriate location within the uterine cavity by transabdominal sonography and resulting in substantial improvement in bleeding. Within 30 minutes of device placement, the patient heard an audible "pop" and had significant abdominal pain despite labor epidural analgesia still in place. Acute hypotension then quickly occurred and on vaginal examination, the Bakri™ balloon was found to be expelled superiorly from the lower uterine segment and abdominal viscus/small intestine was palpable in

the vagina with a large uterine defect palpable toward the left lower uterine segment suggesting uterine rupture had occurred. Emergency abdominal laparotomy revealed a total uterine rupture extending from the left uterine cornu through the left broad ligament and toward the uterocervical junction without vaginal involvement. Given the extent of the rupture, abdominal supracervical hysterectomy and bilateral salpingectomy were performed. Gross pathology post hysterectomy showed a 902 g uterine specimen measuring 22 cm sagittal and 14 cm cornu to cornu (Figure 1). There was a 12 cm full thickness defect extending from the lower uterine round ligament extending through the entire left broad ligament and through the fundus, with an additional 6 cm partial thickness defect on the right lower uterus. By microscopy, the endometrium showed clotted blood and myometrium measured between 1 to 2.8 cm thick without mural nodules. The placental microscopy showed hemosiderin-laden macrophages in the chorionic plate without meconium. Total estimated blood loss including delivery room and surgery measured 4500 mL with massive transfusion protocol of 7 units packed red blood cells, 4 units fresh frozen plasma, 1 unit platelets and 1 unit cryoprecipitate. She recovered well in the immediate post-operative period and was seen as an outpatient post-delivery with appropriate interval recovery post hysterectomy.

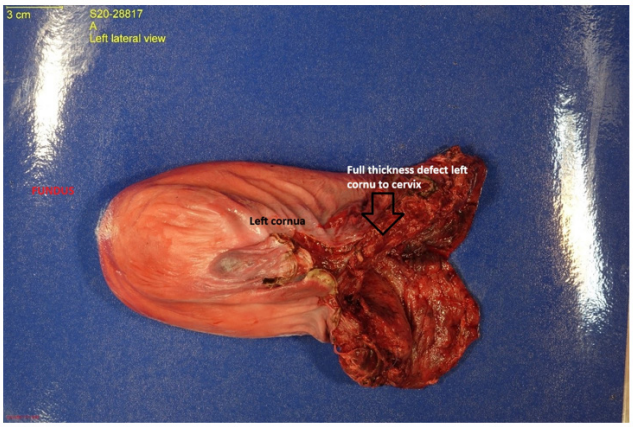

Figure 1 Uterus status post hysterectomy, showing a large uterine defect consistent with uterine rupture through the left broad ligament after Bakri™ balloon placement.

Discussion

Uterine rupture related to post-partum hemorrhage tamponade balloon (Bakri™) is a seemingly rare event. A review of the available literature finds four prior case reports of uterine rupture in the setting of Bakri™ placement (Table 1),[4–7] each of which involved either management of secondary hemorrhage with an instrumented uterus or a cervical laceration. To our knowledge this is the first reported case of uterine rupture in an unscarred uterus following Bakri™ balloon placement for primary PPH. Rupture of the gravid uterus is more common among multiparous patients, perhaps related to the increasing likelihood of prior uterine manipulations, and the most significant risk factor appears to be prior hysterotomy.[8,9] For our patient, risk factors for rupture included induced labor (increased risk of myometrial thinning and atony) and instrumented delivery (increased risk of obstetric laceration)- however careful evaluation of the upper vagina and lower uterus by the provider ruled out spontaneous rupture prior to tamponade balloon placement. The literature has exceedingly few reports of uterine rupture in a primigravida or related to Bakri™ balloon placement (Table 1). The safety of these devices have been generally accepted, however the currently available literature lacks the rigorous study design to prove efficacy and lacks sufficient power to evaluate rare but potentially serious outcomes such as the outcome described herein. It should be noted that rare albeit serious outcomes may be under-captured in the literature due to underdiagnosis and/or publication biases. We suggest that registry databases or multi-center trials may help clarify the effectiveness and safety of these clinical devices in comparison to alternatives. For obstetric care providers to avoid such a complication in the future, the authors suggest several steps. First, evaluation prior to uterine balloon placement should include a thorough physical examination to rule out obstetric laceration or arterial bleeding as the source and to evaluate uterine size to assess anticipated volume of filling (up to 500 mL). Each patient will have a unique filling volume that balances successful tamponade while limiting intrauterine expansive pressure and potential expulsion of the balloon from the lower segment and into the vagina where it would be rendered ineffective: for example, a patient with twin gestation and polyhydramnios at term will have a larger cavity and potentially require more filling volume than a premature birth with fetal growth restriction in which the uterine cavity is of lower anticipated volume. When clinically available, point-of-care transabdominal ultrasonography should be utilized to both evaluate the cavity and to ensure appropriate intrauterine placement of the balloon once filled. Lastly, clinicians should maintain a high index of clinical suspicion for potential uterine rupture when there is unexplained persistent abdominal pain, refractory hypotension or hemodynamic instability. Risk factors for uterine rupture or perforation during instrumentation including TOLAC or scarred or otherwise thinned or boggy uteri should be taken into context. Despite all these precautions, this case goes to show that risk of this procedure is not entirely avoidable. In addition, different mechanisms than compression tamponade, such as vacuum devices that utilize wall suction, are available[10] and their mechanism may be able to avoid such catastrophic albeit rare side effects in the appropriate clinical settings. The mechanism of suction within the cavity as opposed to increased pressure outwardly generated by tamponade balloons within the uterine cavity may theoretically reduce this risk and future studies should consider this possibility. Prospective evidence to suggest improved maternal safety outcomes of vacuum device versus balloon tamponade is currently lacking. The considerations surrounding deploying uterine tamponade balloons may be different in high versus low resource settings and clinicians are advised to continue judicious use while weighing risks, benefits or alternatives while keeping a low threshold of suspicion for a uterine rupture in a clinically unstable postpartum patient.

Table 1 Cases of uterine rupture after Bakri™ balloon placement

Literature case	Clinical scenario
Ajayi et al.[4]	Uterine rupture and hysterectomy performed after uterine curettage followed by balloon used for managing severe secondary PPH 25 days postpartum after a periviable birth
Leparco et al.[6]	Uterine curettage caried out after secondary PPH 18 days post birth; balloon placed under US guidance, but atony did not improve, laparotomy revealed balloon in broad ligament and hysterectomy performed
Rocher et al.[7]	Patient with 3 prior births and unscarred uterus had right vaginal and cervical laceration during delivery, balloon placed for atony- 5 hrs later there was hemodynamic collapse and uterine rupture noted, bleeding controlled with vessel ligation and massive transfusion without hysterectomy
Bahuguna et al.[5]	Secondary PPH 17 days post vaginal birth underwent manual removal of retained placenta and balloon placement- 6 hrs later had clinical deterioration and bedside ultrasound showed uterine rupture- managed with laparotomy and repair without hysterectomy

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Conclusion

Uterine rupture is a rare but serious obstetric complication. While Bakri™ balloons remain an important clinical tool in the management of obstetric hemorrhage secondary to uterine atony, here we describe a potential rare complication of uterine rupture in an unscarred uterus. Careful placement of the device in appropriate patients under direct ultrasound guidance may help mitigate potential risks. Obstetric care providers should always consider uterine rupture in a peripartum patient with clinical deterioration, as this complication may happen even without major risk factors.

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Statement of ethics

This study protocol was reviewed and approved by Atrium Health Wake Forest Baptist IRB. The patient gave written informed consent to publish this report (including medical images).

Author contributions

M.Z was involved in project development and manuscript writing. M.K. and K.B. were involved in project development and manuscript editing.

Data availability statement

All data relevant to this study are included in this article. Further enquiries can be directed to the corresponding author.

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Conflicts of interest

Dr. Zuber is an obstetrics topic editor for DynaMed®, EBSCO Industries. The other authors have no conflicts of interest to declare.

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