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Case Report

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Postpartum Hemorrhage: Use of Bakri Balloon During Cesarean Delivery, a Case Report and Review

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Abstract

The American College of Obstetricians and Gynecologists recently revised the definition of postpartum hemorrhage (PPH) to a cumulative blood loss of ≥ 1,000 mL (or) blood loss associated with signs or symptoms of hypovolemia within 24 h of the birth process. PPH is one leading cause of maternal mortality across the world. Prompt identification of the risk factors is proven to be helpful in earlier detection of PPH and is critical in preventing severe complications and related maternal morbidity and mortality. In this case report, we discuss a 29-year-old patient who had PPH at the time of cesarean delivery. This was effectively controlled by placement of an intraoperative Bakri balloon. The purpose of this review was to discuss and describe the indications and technique of Bakri balloon at the time of cesarean delivery complicated by PPH. Bakri balloon tamponade is usually indicated as a second-line treatment for severe PPH only when initial trials of bimanual compression of the uterus and uterotonic drugs fail to control bleeding. This appears to have minimal adverse effects on subsequent menstrual and reproductive function when intrauterine balloon tamponade is used for the management of severe PPH. Early use of intrauterine balloon tamponade is a way of effectively limiting ongoing uterine blood loss while initiating other measures, and can be readily implemented by providers with minimal training. Bakri balloon tamponade can be a life-saving intervention at the time of PPH and can reduce the need for a hysterectomy.

Keywords: Bakri balloon; Postpartum hemorrhage; Cesarean delivery

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Introduction

Definition of postpartum hemorrhage (PPH)

PPH is traditionally defined as an estimated blood loss of more than 500 mL after a spontaneous vaginal delivery, (or) more than 1,000 mL after cesarean delivery [1]. However, the American College of Obstetricians and Gynecologists reVITALize program revised its definition to a cumulative blood loss of ≥ 1,000 mL (or) blood loss associated with signs or symptoms of hypovolemia within 24 h of the birth process A [2].

PPH is the leading cause of maternal mortality across the world [3].

Identification of the risk factors, prevention and early detection of PPH is critical to avoid severe complications and associated maternal morbidity and mortality.

Etiology and risk factors

When evaluating a patient with PPH, it is useful to remember the commonly used mnemonic with "4 Ts", which are, tone, tissue, trauma and thrombin [4].

Tone

Uterine atony is the most common cause of PPH and constitutes to about 70-80% of PPH cases [5]. Decreased uterine tone and reduced contraction of the myometrium reduces compression of the blood vessels supplying to the placental bed, thus increasing blood loss after delivery [5]. Some of the risk factors for uterine atony are multiple gestations, polyhydramnios, macrosomia, prolonged labor, excessive and prolonged use of oxytocin, high parity, fibroid, uterine inversion and use of magnesium sulfate.

Trauma

PPH is also caused by trauma-related bleeding as a result of lacerations of vulva, vagina, cervix and uterus. Trauma can occur during a normal vaginal delivery or from an operative

vaginal delivery from forceps or a vacuum.

Tissue

Retained products of conception, such as portions of the placenta, is another cause of PPH. Risk factors for retained products are abnormal placentation in the uterus such as placenta accreta, abnormal placenta formation such as succenturiate lobe, or incomplete placenta delivery.

Thrombin

Abnormal coagulation cascade, or inability to properly clot, can be an additional cause of PPH. Risk factors for abnormal coagulation include hemolysis, elevated liver enzymes, low platelets (HELLP) syndrome, preeclampsia, Von Willebrand disease, hemophilia, sepsis, amniotic fluid embolism, disseminated intravascular coagulation and anticoagulation.

Evaluation

Timely recognition and prompt management of PPH is essential in the prevention of maternal morbidity and mortality. Early intervention may prevent the development of potentially lethal complications. Management of PPH is a multidisciplinary team approach and should involve an obstetrician, anesthesiologist, nursing staff, blood bank personnel and interventional radiologist whenever possible. It is vital to have written protocols for the departments for proper interdisciplinary care.

When PPH is suspected, an immediate careful and thorough assessment should be undertaken, which includes a detailed physical examination of the vulva, perineum, vagina and cervix to exclude lacerations. The bladder must be drained, and a bimanual pelvic examination is conducted to evaluate the uterine tone.

A thorough inspection of the placenta should be performed for its completeness; one should have a low threshold to perform bedside ultrasonography or intrauterine manual examination to diagnose retained products.

Investigations

While the assessment is ongoing, concurrent laboratory investigations should be done, such as complete hemogram with differential, coagulation profile, blood grouping and cross-matching if not done previously. Hemoglobin and hematocrit are not precise markers of acute blood loss. Coagulation studies such as prothrombin time, activated partial thromboplastin time and fibrinogen concentration should be repeated every 30 - 60 min until bleeding is controlled [6, 7].

Fibrinogen is the first coagulation factor to use up in PPH. The risk of progression to severe PPH is increased by 2.63-fold for each 1 g/L decrease in fibrinogen concentration [6-8]. Another study results showed a low fibrinogen level at PPH diagnosis is associated with a high risk of severe PPH independent of other lab findings [9, 10].

Complications

PPH can lead to a wide range of complications if not managed promptly and effectively. A large volume of blood loss can cause hemodynamic instability leading to poor perfusion of vital organs resulting in multi-organ failure, shock and eventually death [11, 12]. PPH accounts for around 12% of maternal deaths in the United States annually [13].

Management of hemodynamic complications by fluid replacement may result in volume overload and pulmonary edema. Blood transfusions also lead to various complications like immune reactions, infections and electrolyte disturbances [12].

Anemia is a significant complication of PPH. Hemoglobin < 11 g/dL at 1 week or < 12 g/dL at 8 weeks postpartum is defined as postpartum anemia. Patients may require iron supplements and blood transfusions depending on the severity of the signs and symptoms of anemia [12].

Postpartum pituitary necrosis, or Sheehan's syndrome, is a rare, life-threatening complication of PPH. Pituitary gland enlarges in size to meet the demands during pregnancy, in case of acute hypovolemia in PPH, it can lead to ischemic infarction of pituitary. It can have an extensive, varied presentation of symptoms and can present in the immediate postpartum for years after delivery [12, 14]. Another rare complication is abdominal compartment syndrome due to intra-abdominal bleeding [14]. Asherman syndrome can develop as a complication of PPH and uterine compression sutures for management of PPH can lead to the development of synechiae [15, 16]. This can, in turn, result in infertility. Other complications include adult respiratory distress syndrome and disseminated intravascular coagulation.

Treatment

Treatment of PPH mainly aims towards correcting the underlying cause of bleeding. The source of the bleeding must be identified; first, a complete vaginal-rectal and abdominal examination is performed to identify any source of bleeding.

Case Report

We describe here a patient who had PPH during cesarean delivery which was controlled by placement of an intraoperative Bakri balloon.

The patient is 29 years old, gravida 4 and para 3, who was scheduled for elective repeat cesarean delivery at 39 weeks of gestation. Her prenatal period was uneventful. She had prior three low transverse cesarean deliveries, which were uncomplicated.

The patient received spinal analgesia; a Pfannenstiel incision was made on the skin and carried down to the underlying

layers of fascia by using diathermy. Rectus fascia was dissected, the peritoneum was entered sharply and abdominal cavity was explored for adhesions, but none were found. A bladder flap was created, and bladder was pushed away from the lower uterine segment.

A transverse incision was made in the lower uterine segment and stretched, amniotomy was performed and the fetus was delivered without difficulty. A posterior uterine segment placenta was delivered spontaneously. Intravenous Pitocin infusion was started immediately after delivering the fetus. Examination of the hysterotomy site relieved no extensions and was closed in the running and locking fashion. Uterus was found to be boggy and flaccid; a thorough fundal massage was performed and uterine cavity was examined for lacerations and products, and a blunt curette with a sponge lap was performed to clean the uterine cavity. Intramuscular methergine injection was given with simultaneous massage of the atonic uterus. On examination, approximately 1,000 mL of blood loss was estimated, and the uterus was still atonic. Maternal vital signs were found to be stable. Immediately PPH protocol was initiated, anesthesia and blood bank were informed, additional nurses were mobilized for help and labs were drawn - intramuscular hemabate was administered with simultaneous assessment of the tone of the uterus. Per rectal Cytotec was also given. The usual uterotonic medications like pitocin, methergine and hemabate did not improve her bleeding, and the uterus was still found to be boggy.

At this time, a Bakri balloon was removed under aseptic conditions and was placed in the uterine cavity, and 150 mL of normal saline was used to distend the balloon (review discussion part of the case report for full details of the technique of placement). Slowly the tamponade effect of the Bakri balloon improved bleeding. The layers of the abdominal wall were closed.

The patient was monitored in post-anesthesia care unit for 3 - 4 h, and her vital signs were stable. Twenty-four hours later, Bakri balloon was deflated and removed. Patient's bleeding has improved with no further hemorrhage. Her hemoglobin dropped 3 g/dL from her PPH. Her hemodynamic status was not affected. She was discharged home on postoperative day 3 in a stable condition. The patient was seen in the office one week later without complications, and she expressed minimal lochia.

Discussion

The purpose of this review was to discuss and describe the indications and technique of Bakri balloon at the time of cesarean delivery complicated by PPH.

Role of Bakri balloon in preventing PPH during cesarean sections

The Bakri balloon catheter is the first ever uterine tamponade balloon system utilized for the management of PPH refractory to first-line uterotonic agents [17]. It consists of a silicone balloon connected to a silicone catheter which has a central lumen. The collapsed balloon is inserted into the uterus and inflated with saline to fill the uterine cavity to tamponade uterine bleeding. The lumen in the catheter allows drainage and is designed to monitor ongoing bleeding above the level of the balloon. The device is intended for one-time use. It acts by application of inward to outward hydrostatic pressure against the uterine wall resulting in compression of uterine blood vessels that decrease blood flow and enable clotting [18].

Technique

After the cesarean delivery, the uterus is effaced, and the balloon catheter is inserted from the introitus into the uterine cavity and inflated with normal saline. This reduces the risk of accidental needle perforation of the balloon during uterine closure if the balloon is inserted before the uterine effacement. Furthermore, while inflating the balloon, one can visualize the amount of distension and tension on the hysterotomy closure. We recommend inflating the balloon with about 200 - 300 mL of normal saline and close monitoring is required as there is a risk of uterine rupture.

Indications

Balloon tamponade is generally indicated as a second-line treatment for severe PPH when bimanual compression of the uterus and uterotonic drugs fail to control bleeding. Bakri balloon tamponade is used in 1) uterine atony resulting in acute PPH; 2) cesarean delivery with placenta previa, low lying placenta, or a focally invasive or adherent placenta [19]; 3) acute or recurrent uterine inversion [20]; and 4) secondary PPH (24 h to 12 weeks after delivery) [21].

Contraindications

Contraindications include 1) allergy to the device components; 2) retained products of conception; 3) suspected uterine rupture; and 4) infection of vagina, cervix or uterus.

Complications

Complications include 1) uterine rupture; 2) balloon prolapse; 3) endometritis when placed for more than 24 h [22]; and 4) air embolism when inflated with air or carbon dioxide.

Future course

There appear to be minimal adverse effects on following menstrual and reproductive function when intrauterine balloon tamponade is used for the management of severe PPH. The pregnancy outcome was similar to those managed conservatively with uterotonic agents alone [23]. In one in-

stance, there was infarction of the myometrium, which led to a hysterectomy. The infarction was determined to be a result of prolonged hemorrhage [24]. Obesity seemed to be a risk factor of failure of the Bakri balloon catheter, and the late placement of Bakri balloon for persistent PPH is less likely to be successful [25].

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Financial Disclosure

None.

Conflict of Interest

The authors have no conflict of interest to disclose.

Informed Consent

Not applicable.

Author Contributions

LSP is the primary physician involved in the case, and wrote the case report, TT also contributed to write the paper. MM performed collection of references, and wrote the paper. SKB designed the paper and provided expert clinical knowledge to revise critically.

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