

Constructing a Novel ‘Uterine Sandwich’ with Simultaneous Intrauterine Balloon Tamponade and Uterine Compression Sutures to Manage Postpartum Bleeding

Jennifer W.H. Wong MD and Grace K. Wong MD

Abstract

The uterine sandwich is a relatively new surgical technique for managing postpartum hemorrhage, which is the leading cause of maternal mortality worldwide. The purpose of this case series is to describe a novel method of constructing the uterine sandwich by simultaneously combining intrauterine balloon tamponade and uterine compression sutures. Six patients with postpartum bleeding refractory to medical management were successfully treated with this novel method and avoided hysterectomy. There were no additional complications. This novel method of constructing a uterine sandwich appears to be a simple, safe, and effective technique that could be considered in cases of persistent postpartum bleeding. More research is needed to compare the efficacy of various techniques.

Keywords

obstetrics, postpartum hemorrhage, uterine atony

Abbreviations and Acronyms

CD = cesarean delivery

PPH = postpartum hemorrhage

Introduction

Postpartum hemorrhage (PPH) is the leading cause of maternal mortality worldwide.¹ Multiple medical and surgical interventions have been studied and trialed to manage PPH and prevent escalation to hysterectomy as definitive management. Postpartum hysterectomy is associated with loss of fertility and high rates of major complications, including transfusion of red blood cells (84%) and other blood products (34%), fever (11%), subsequent laparotomy (4%), ureteral injury (3%), and death (2%).¹ According to the American College of Obstetricians and Gynecologists, a uterine sandwich surgical technique can be considered in the management of postpartum hemorrhage.² The uterine sandwich has been classically described as uterine compression sutures followed by reassessment of the patient’s bleeding, followed by placement of an intrauterine tamponade balloon as needed for continued bleeding.^{3,4}

The uterine sandwich is a relatively new technique, and only a few small case series and prospective studies have described this technique. Yoon et al. conducted one of the most extensive studies on the uterine sandwich; all patients (n = 11) were successfully treated with uterine compression sutures, followed by intrauterine balloon tamponade for persistent bleeding.³ Variations of the uterine sandwich have been described in

the literature (Table 1). Other modifications target the type of uterine compression sutures, using B-Lynch sutures,³⁻⁵ Hayman sutures,³ or Matsubara-Yano uterine compression sutures,⁶ or the type of intrauterine tamponade, such as gauze.⁵

The most effective technique of constructing the uterine sandwich has yet to be established. The purpose of this case series is to describe a novel method of constructing a uterine sandwich by simultaneously combining intrauterine balloon tamponade and uterine compression sutures for the management of postpartum bleeding.

Methods

Institutional Review Board exemption was obtained from the Hawai‘i Pacific Health Research Institute, and patient consent was not required. Between September 2018 and August 2019, patients with bleeding refractory to conservative treatment were managed with a uterine sandwich constructed by the simultaneous placement of an intrauterine Bakri balloon (Cook Ireland Ltd, Limerick, Ireland) and modified B-Lynch sutures. In all cases, patients were initially managed conservatively with manual uterine massage, intravenous oxytocin (30 IU in 500 mL of normal saline at 300 mL/hour), intramuscular ergometrine (0.5 mg per dose to a maximum of 2 doses, unless contraindicated), intramuscular carboprost (0.5 mg for a maximum of 6 doses, unless contraindicated), and rectal misoprostol (800 mcg, once). Uterine bleeding was refractory to medical management, so a uterine sandwich was constructed.

The uterus was exteriorized from the abdomen. The hysterotomy was closed with 0-Vicryl in a running locking fashion, and a second imbricating layer was done using the same suture. A modified B-Lynch was performed with 1 chromic catgut on a 90 mm curved needle, and the sutures were left untied. The uterus was returned into the abdomen. A skilled assistant inserted the Bakri balloon into the uterine fundus via the vagina, and the Bakri was filled with normal saline until the balloon filled the uterine cavity (maximum 500 mL per the manufacturer’s instructions). The B-Lynch sutures were then cinched down and tied together. Vaginal packing was inserted to prevent expulsion of the Bakri balloon into the vagina (Figure 1). The Bakri balloon and vaginal packing were removed within 24 hours after placement. Treatment success was defined as the management of bleeding without requiring a hysterectomy. Awareness of this novel technique was disseminated throughout the hospital via resident-led Morbidity and Mortality conferences.

Results

Six cases were identified from 6 different obstetricians. Upon admission, 4 patients were multiparous, and 2 patients were nulliparous. Five patients were of term gestational age, and 1 patient was late preterm. All patients underwent cesarean section, and each had a different underlying risk factor for PPH, including placenta previa, history of PPH, fetal macrocephaly, protracted labor, uterine inversion, grandmultiparity, and chorioamnionitis (Table 2).

Regarding the uterine sandwich, the Bakri balloon was inflated with a volume of normal saline ranging from 180 mL to 450 mL, but 1 patient's Bakri volume was not recorded. Estimated blood loss ranged from 600 mL to 5 000 mL, and the number of packed red blood cells transfused ranged from 0 to 4 units. Five patients did not require additional intervention. One patient was stabilized by the uterine sandwich with minimal bleeding that could have been managed expectantly, but she underwent a precautionary uterine artery embolism due to the hospital's lack of blood products. There were no complications (Table 2).

Table 1. Techniques for Constructing a Uterine Sandwich for Postpartum Hemorrhage Secondary to Uterine Atony			
Author and Year	Study Population	Technique	Complications
Nelson 2007	5	1. Place B-Lynch sutures 2. Reassess bleeding 3. If continued bleeding, place Bakri balloon	None
Yoong 2012	11	1. Place B-Lynch or Hayman sutures 2. Reassess bleeding 3. If continued bleeding, place Bakri balloon	None
Kaplanoglu 2013	1- septate uterus	1. Place B-Lynch sutures 2. Place intrauterine packing with gauze	None
Matsubara 2014	5	1. Place 2 longitudinal and 2 transverse compression sutures in a box-like shape in the upper and mid uterine segments 2. Place a metreurynter, like an intrauterine balloon, into the lower uterine segment. Inflate to 100 mL.	None
Diemert 2012	6	1. Place Bakri balloon 2. Reassess bleeding 3. If continued bleeding, place B-Lynch sutures	1 hysterectomy for placenta increta

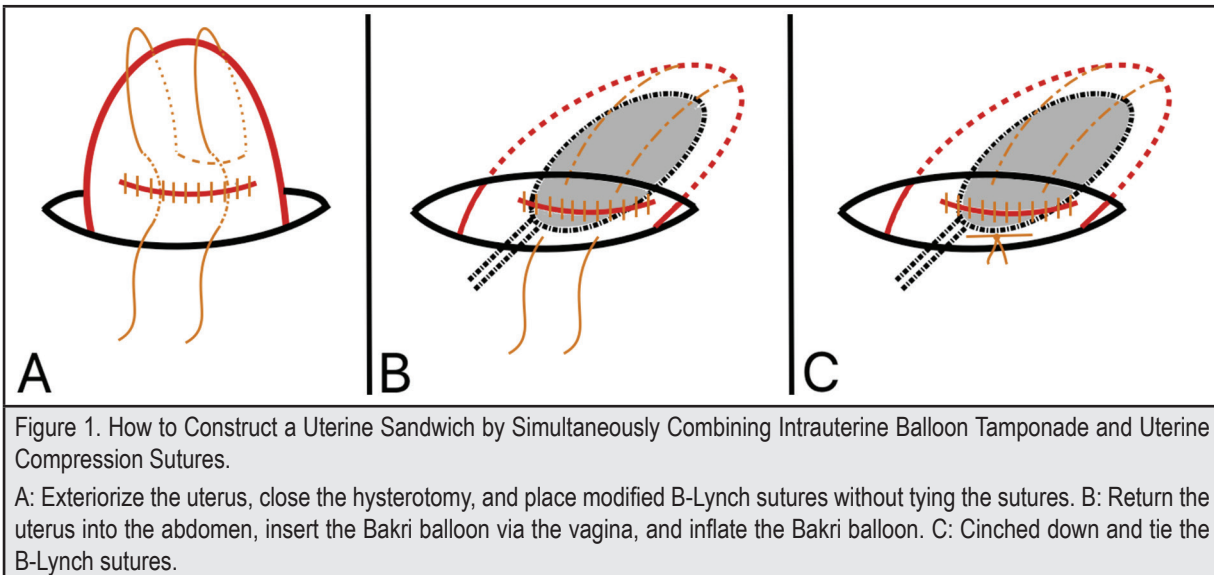


Table 2. Patient Demographics and Management of Persistent Postpartum Bleeding with Novel Uterine Sandwich Method						
Characteristics	Case No.					
	1	2	3	4	5	6
Patient Demographics						
Age, years	31	27	22	27	32	20
Parity upon admission	1	1	1	0	6	0
Obstetrics						
Gestational age, weeks	36 0/7	37 5/7	39 2/7	39 4/7	40 4/7	37 4/7
Risk factors for hemorrhage	Placenta previa	History of PPH	Fetal hydrocephalus	Protracted labor	Uterine inversion, grandmultiparity	Chorio-amnionitis
Mode of delivery	CD	CD	CD	CD	CD	CD
Neonatal birth weight, g	2 620	3 099	3 830	3 634	3 181	3 195
Hemodynamic Status						
Estimated blood loss, mL	5 000	1 500	2 000	600	1 000	1 500
Bakri balloon inflation volume, mL	300	350	450	Unknown	180	200
Packed red blood cells transfused, units	4	0	4	0	0	1
Additional interventions	Uterine artery embolization	None	None	None	None	None
Postpartum						
Complications	None	None	None	None	None	None

Abbreviations: CD, cesarean delivery; PPH, postpartum hemorrhage

Discussion

All 6 cases of postpartum bleeding refractory to conservative management were successfully treated with the uterine sandwich and avoided hysterectomy. There were no complications. This novel method of constructing a uterine sandwich by simultaneously combining intrauterine balloon tamponade and uterine compression sutures appears to be a simple, safe, and effective technique that can be considered in cases of persistent postpartum bleeding.

Intrauterine balloon tamponades are 86% effective at controlling refractory bleeding by placing direct pressure on the uterine sinuses.⁷ Compression sutures are 60% effective at controlling refractory bleeding by physically compressing the myometrium and uterine sinuses.⁷ The classically described uterine sandwich is created in a stepwise fashion, starting with uterine compression sutures as the primary tool for managing hemorrhage. On the other hand, this novel method uses the intrauterine balloon tamponade as its primary tool and compression sutures as an ancillary tool, taking into account their respective rates of effectiveness. Moreover, when considering the mechanism of action for each tool, the classically described method distorts the intrauterine cavity, preventing the plastic cylindrical-shaped intrauterine tamponade balloon from placing direct pressure on the uterine sinuses and decreasing its overall efficacy. This novel uterine sandwich maximizes the intrauterine balloon's efficacy by maintaining the intrauterine cavity shape for which the balloon was designed. In extreme uterine atony cases in which

individual methods are likely to fail, there is likely a synergistic effect of synchronous placement of uterine compression sutures and intrauterine balloon tamponade. More research is needed to compare the efficacy of various techniques.

The literature describes a few other techniques with seemingly subtle but clinically large differences from the method described here. For example, Diemert et al constructed 6 uterine sandwiches in a stepwise fashion, starting with the placement of a Bakri balloon and reassessment of the bleeding. Once hemostasis was deemed inadequate, B-Lynch sutures were placed.⁸ Although the result is essentially the same as the method described here, the increased procedural time will result in increased blood loss, which could be a clinically significant amount, especially when the uterine sandwich is constructed only after failed medical management, and the blood flow to the term gravid uterus is at least 600 mL per minute.⁹ Moreover, this method is technically very challenging to perform and requires above-average surgical skills. The suturing needle needs to incorporate a sturdy bite of thin atonic myometrium without puncturing and destroying a fully inflated tamponade balloon that is pressing firmly against the uterine sinuses to place effective B-Lynch sutures.

In a different study, 53 patients with placenta previa underwent cesarean delivery and planned uterine sandwich. This uterine sandwich was constructed by simultaneously placing 2 transverse compression sutures and a Foley balloon catheter inflated to 80 mL in the lower uterine segment. The authors concluded that this method significantly decreased blood loss.¹⁰

This simultaneous placement of uterine compression sutures and intrauterine balloon tamponade, while seemingly similar, is somewhat different from our novel method. This prophylactic lower uterine segment sandwich was designed to address PPH secondary to placenta previa, a relatively rare condition. Our novel method was intended for PPH secondary to uterine atony, the most common cause of obstetrical hemorrhage, and positioned the balloon tamponade up to the uterine fundus. The balloon tamponade was then inflated to fill the intrauterine cavity, which in this case series ranged from 180 to 450 mL, much more than an 80 mL Foley.

The most effective technique for constructing the uterine sandwich has yet to be determined. Additional research is needed given the relatively high incidence of PPH and its associated morbidities. The current literature describes small studies using variations in bleeding evaluation and stepwise construction, types of intrauterine tamponade, and types of uterine compression sutures (Table 1). In the future, randomized controlled trials are needed to determine which method is the most effective.

A strength of this novel uterine sandwich is its simplicity. It requires a limited amount of equipment, which should be available in nearly all obstetric operating rooms. This technique is easy to learn and within the skill set of an obstetrician. All 6 cases were successfully performed by different obstetricians, which increases the generalizability of this study. A limitation of this novel uterine sandwich is that proper placement of the intrauterine balloon via the vagina requires a skilled assistant. If a skilled assistant is unavailable, the intrauterine balloon can be inserted by the surgeon through the hysterotomy, using ringed forceps to place the drain through the cervix. This approach would be advantageous in managing patients whose cervixes are closed, but care must be taken to avoid needling the intrauterine balloon when suturing the hysterotomy. Notable limitations of this study include its small sample size and retrospective nature, limiting the data to chart review.

In conclusion, this novel method of constructing a uterine sandwich by simultaneously combining intrauterine balloon tamponade and uterine compression sutures appears to be a simple, safe, and effective technique that can be considered in cases of persistent postpartum bleeding. This novel method has multiple advantages over the originally described stepwise approach and could be more effective than the original uterine sandwich. More research, particularly comparative and randomized controlled trials, is needed to determine the most effective method of constructing a uterine sandwich given the severe complications associated with PPH.

Conflict of Interest

None of the authors identify a conflict of interest.

Acknowledgments

We would like to thank the University of Hawai'i Obstetrics and Gynecology Residency Program and the Kapiolani Medical Center for Women and Children in Honolulu, Hawai'i for their dedication to patient care.

Authors' Affiliations:

- Female Pelvic Medicine and Reconstructive Surgery, Department of Obstetrics and Gynecology, University of California San Francisco, San Francisco, CA and Division of Female Pelvic Medicine and Reconstructive Surgery, Department of Obstetrics and Gynecology, Kaiser Permanente East Bay, Oakland, CA (JWHW)
- Department of Obstetrics, Gynecology, and Women's Health, John A. Burns School of Medicine, University of Hawai'i, Honolulu, HI (GKW)

Correspondence to:

Jennifer W.H. Wong MD; 1319 Punahou Street Suite #824, Honolulu, HI 96826;
Email: jwhwong@hawaii.edu

References

1. Shellhaas C, Gilbert S, Gabbe S. The frequency and complication rates of hysterectomy accompanying cesarean delivery. *Obstet Gynecol.* 2009;114:224–9. DOI: 10.1097/AOG.0b013e3181ad9442
2. The American College of Obstetricians and Gynecologists (ACOG). Postpartum Hemorrhage. ACOG Practice Bulletin Number 183, October 2017. DOI: 10.1097/AOG.0000000000002351
3. Yoong W, Ridout A, Memtsa M, et al. Application of uterine compression suture in association with intrauterine balloon tamponade ('uterine sandwich') for postpartum hemorrhage. *Acta Obstet Gynecol Scand.* 2012;91:147–51. DOI: 10.1111/j.1600-0412.2011.01153.x
4. Nelson WL, O'Brien JM. The uterine sandwich for persistent uterine atony: combining the B-Lynch compression suture and an intrauterine Bakri balloon. *Am J Obstet Gynecol.* 2007;196(5):e9–10. DOI: 10.1016/j.ajog.2006.10.887
5. Kaplanoglu M. The uterine sandwich method of placenta previa accrete in mullerian anomaly: combining the B-Lynch compression suture and an intrauterine gauze tampon. *Case Rep Obstet Gynecol.* 2013;2013:1–3. DOI: 10.1155/2013/236069
6. Matsubara S, Kuwata T, Bara Y, et al. A novel 'uterine sandwich' for haemorrhage at caesarean section for placenta praevia. *Aust N Z J Obstet Gynaecol.* 2014;54:283–6. DOI: 10.1111/ajo.12184
7. Likis FE, Sathe NA, Morgans AK, Hartmann KE, Young JL, Carlson-Bremer D, et al. Management of postpartum hemorrhage. Comparative Effectiveness Review No 151. Agency of Healthcare Research and Quality (AHRQ) Publication No. 15-EHC013-EF. Rockville, MD. AHRQ. 2015.
8. Diemert A, Ortmeyer G, Hollwitz B, et al. The combination of intrauterine balloon tamponade and the B-Lynch procedure for the treatment of severe postpartum hemorrhage. *Am J Obstet Gynecol.* 2012;206(1):65.e1–65.e4. DOI: 10.1016/j.ajog.2011.07.041
9. Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS. (2014). *Williams Obstetrics*. New York: McGraw-Hill Education.
10. Sallam HF, Shady NW. A sandwich technique (N&H variation technique) to reduce blood loss during cesarean delivery for complete placenta previa: A randomized controlled trial. *J Matern Fetal Neonatal Med.* 2019;32(19):3145–53. DOI: 10.1080/14767058.2018.1457643