

# An Inflatable Surgical Glove to Control Postpartum Bleeding Following Cesarean Hysterectomy

Ali Elsaman<sup>1</sup>, noha mousa<sup>2</sup>, Tarek Farghaly<sup>1</sup>, Mohammed Khairy<sup>1</sup>, Mohamed Salama<sup>3</sup>, Dina Habib<sup>1</sup>, Esraa Badran<sup>1</sup>, Mostafa Bahlool<sup>1</sup>, Ahmad Yousef<sup>1</sup>, Alshimaa Hassan<sup>1</sup>, Dina Elsaman<sup>4</sup>, and Sherif Shazly<sup>5</sup>

<sup>1</sup>Affiliation not available

<sup>2</sup>University of Sharjah

<sup>3</sup>Ain Shams University Faculty of Medicine

<sup>4</sup>Assiut University Faculty of Medicine

<sup>5</sup>Mayo Clinic

May 5, 2020

## Abstract

Cesarean hysterectomy remains a life-saving surgery mostly performed under critical circumstances to control severe obstetric hemorrhage. Post-hysterectomy pelvic bleeding is a serious complication that may arise despite securing all accessible vascular pedicles. Pelvic compression presents a key last resort in the management of such challenging cases. No procedure-related intraoperative complications were encountered. One patient developed surgical site infection that was treated by antibiotics and secondary closure. In summary, we believe that the present balloon tamponade has employed a low-cost readily available equipment to provide a rapid and simple intervention which can be potentially lifesaving for women with pelvic hemorrhage post-hysterectomy

## Problem

Caesarian hysterectomy is a lifesaving surgery for severe peri-partum hemorrhage. <sup>1-3</sup> Post hysterectomy pelvic hemorrhage is a problematic event -with very limited treatment options- that may occur despite secure ligation of all accessible vascular pedicles. Such resistant, potentially fatal, bleeding is contributed to by complex factors including excessive tissue trauma, coagulopathy, and infection.

Pelvic packing is a well-recognized intervention, that utilizes mechanical compression on blood vessels until physiologic hemostasis is achieved <sup>4,8,9</sup>. Its effectiveness is reported to be between 78-100% <sup>5-7</sup>, particularly in controlling bleeding from oozing surfaces <sup>8-9</sup>. Lap sponge-based packing requires a second laparotomy with an increased risk of febrile morbidity. Pelvic pneumatic balloon tamponade does not require second laparotomy and enables instantaneous monitoring and modification of applied pressure through inflation-deflation. Reported pelvic balloon tamponades include Foley catheter, Bakri balloon, and condom <sup>10-11</sup>. They appear to provide satisfactory outcomes, nevertheless, the inflation capacity of Foley catheter and low tensile strength of condoms may present limitations. Bakri balloon is of high-cost not affordable in low-resourced settings.

## Technique

We describe a tamponade procedure for the control of post-Caesarean hysterectomy bleeding. Dependent on the use of a surgical glove and a sphygmomanometer, the technique was effective to control pelvic bleeding

in three patients who failed to respond to other interventions. The method is easy to perform, low-cost, particularly suitable for the low-resourced settings.

**Summary:** The technique is demonstrated in (Fig. 1, 2 and a brief video). It employs two sterile catheters which are attached to a surgical latex glove; one catheter is connected to a manual air-pump and the other is connected to a sphygmomanometer. The glove is inflated and positioned centrally into the pelvic cavity. The abdominal wall is closed while the stem of the two catheters, the glove ligature, and an intra-abdominal drain are passed through the skin incision. A wound dressing together with an abdominal binder are then applied. The intra-balloon pressure monitored by the sphygmomanometer. Initial deflation should be attempted after 24 hours while observing the amount of blood in the drain. The tamponade is deflated and removed, after ensuring complete hemostasis, at bedside without the need for anesthesia.

### **Steps:**

- A compression test is first performed using lap sponges to verify that tamponade compression will be effective. Compression should be continued until balloon tamponade is ready for insertion.
- Under sterile conditions, two catheters are passed into a latex glove. The opening of the glove is secured by a silk suture tied around the catheters' stems. One catheter is connected to a manual air-pump and the other to a sphygmomanometer.
- Under general anesthesia, the glove tamponade is inflated and positioned into the pelvis, whereas the lap sponges are carefully removed. An intra-pelvic (IP) drain is inserted, and the partially inflated glove is further inflated to fill the pelvic cavity (Fig. 1).
- The glove tamponade is pressed against the pelvic wall by an assistant and the abdominal wall is closed by the primary surgeon. The abdomen is closed carefully – avoiding puncture of the glove - while the catheters' stems and the ligature is kept outside the skin.
- A multilayered gauze dressing is applied to the abdominal incision together with 2-3 lap sponges to support the incision line. A broad adhesive tape is applied over the dressing, followed by an abdominal binder to stabilize the tamponade in place (Fig. 2). Inflation continues until no bleeding is observed in the drain. Pneumatic pressure is monitored using the sphygmomanometer.
- Initial deflation test is initiated 24 hours after procedure with observation of IP drain output. The glove is removed, at bedside without anesthesia, 24 hours after deflation and persistent hemostasis.

### **Cases:**

The reported patients were referred from secondary care to the Women Health Hospital, a tertiary care center affiliated with Assiut University. Admission data indicated that hysterectomy was performed after failure of conservative options to control severe peri-partum hemorrhage. The condition was further complicated by severe bleeding following hysterectomy. Bleeding continued despite various surgical measures, and eventually pelvic packing using lap sponges was applied. Nonetheless, trials to remove the lap sponges resulted in recurrent bleeding, thus re-packing was performed- in each of the three patients- prior to transfer to our center. Furthermore, two patients underwent angiographic embolization of pelvic vessels and one had internal iliac artery ligation, with no success (Table 1). At admission, initial assessment and hemodynamic stabilization were performed, followed by patient transfer to the operative theatre. Previously inserted lap sponges were removed cautiously, one at a time; however, considerable bleeding was invariably observed in the three patients. Bleeding originated from the friable pelvic side wall tissue, vaginal vault, and traumatized tissue by previous surgical maneuvers. Stitches were taken to achieve hemostasis; however, bleeding was only stopped by re-application of the sponge compression, which we replaced with the glove tamponade. We found that an intra-glove pressure between 40-60 mmHg was most effective to achieve and maintain hemostasis. A deflation test was conducted 24-48 hours afterwards; two patients did not show further bleeding. The drain of the third patient showed fresh bleeding upon deflation. Accordingly, the balloon was re-inflated for additional 24 hours. Thereafter, the balloon was deflated but left in place for 24 hours as a backup plan in case of recurrent bleeding. Once hemostasis was ensured, the tamponade was finally removed. The total duration of the procedure declined from 75 minutes in the first patient to 35 minutes in the third patient. Two patients had uncomplicated postoperative course, while one had a superficial wound infection (Table

2).

**Acknowledgement:** We would like to thank the patient who approved the publication of the video of the procedure.

**Disclosure:** The authors declare no conflict of interest relevant to this work.

### Contributions to Authorship

AE has conceived the idea, planned and performed the procedure, and contributed to writing the first draft of the manuscript. NM edited and revised the final version of the manuscript. TF contributed to the idea and planning of the procedure. MK, MS and DH carried out the procedure. DH, MB, AY, EB, and SS contributed to obtaining data and writing the work. AE and DE designed the diagrams and the video.

**Funding:** This work was not funded

### References

1. Van den Akker T, Brobbel C, Dekkers OM, Bloemenkamp KW. Prevalence, Indications, Risk Indicators, and Outcomes of Emergency Peripartum Hysterectomy Worldwide: A Systematic Review and Meta-analysis. *Obstet Gynecol.* 2016 Dec;128(6):1281-1294
2. Rossi AC, Lee RH, Chmait RH. Emergency postpartum hysterectomy for uncontrolled postpartum bleeding: a systematic review. *Obstet Gynecol.* 2010 Mar;115(3):637-44
3. Pala Ş, Atilgan R, Başpınar M, Kavak EÇ, Yavuzkır Ş, Akyol A, Kavak B. Comparison of results of Bakri balloon tamponade and caesarean hysterectomy in management of placenta accreta and increta: a retrospective study. *Journal of Obstetrics and Gynaecology.* 2018 Feb 17;38(2):194-9
4. Logothetopoulos K. Eine absolut sichere blutstillungsmethode bei vaginalen und abdominalen gynäkologischen operationen. An absolutely certain method of stopping bleeding during abdominal and vaginal operations. *Zentralbl Gynakol* 1926;50:3202-4
5. Touhami O, Marzouk SB, Kehila M, Bennisr L, Fezai A, Channoufi MB, Magherbi HE. Efficacy and safety of pelvic packing after emergency peripartum hysterectomy (EPH) in postpartum hemorrhage (PPH) setting. *Eur J Obstet Gynecol Reprod Biol.* 2016 Jul;202:32-5
6. Touhami O, Bouzid A, Ben Marzouk S, Kehila M, Channoufi MB, El Magherbi H. Pelvic Packing for Intractable Obstetric Hemorrhage After Emergency Peripartum Hysterectomy: A Review. *Obstet Gynecol Surv.* 2018 Feb;73(2):110-115
7. Deffieux X, Vinchant M, Wigniolle I, Goffinet F, Sentilhes L. Maternal outcome after abdominal packing for uncontrolled postpartum hemorrhage despite peripartum hysterectomy. *PLoS One.* 2017 Jun 1;12(6):e0177092
8. Parente JT, Dlugi H, Weingold AB. Pelvic hemostasis: a new technic and pack. *Obstet Gynecol* 1962;19:218-21
9. Burchell RC. The umbrella pack to control pelvic hemorrhage. *Conn Med* 1968;32:734
10. Atilgan R, Aslan K, Can B, Sapmaz E. Successful management of pelvic bleeding after caesarean hysterectomy by means of Foley catheter-condom balloon tamponade. *BMJ Case Rep.* 2014 May 14;2014. pii: bcr2014204770
11. Charoenkwan K. Effective use of the Bakri postpartum balloon for posthysterectomy pelvic floor hemorrhage. *Am J Obstet Gynecol.* 2014. Jun;210(6):586.e1-3

### Figure legends

*Figure 1:* Application and inflation of the glove-based tamponade through the abdominal incision

*Figure 2:* Application of external pressure after complete inflation of the balloon to maintain tamponade pressure

Video: Demonstration of the glove-based tamponade technique

<https://drive.google.com/file/d/1woiP4-4b3sGIbOVZEqKS3OMgj7IjvOYy/view?usp=sharing>

**Table 1: Baseline data of patients managed with the balloon tamponade procedure**

Variable	Patient 1	Patient 2	Patient 3
Age (years)	34	38	37
Parity	4	5	5
Time since delivery (days)	2	3	4
Hemoglobin at admission (gm/dl)	9.1	10.0	9.3
White blood cell count (cell/ $\mu$ L)	11,100	15,250	12,920
Pre-admission interventions	Pelvic packing and angiographic embolization	Pelvic packing twice and internal iliac artery ligation	Pelvic packing twice
Pre-admission laparotomies (since delivery)	1	2	2

**Table 2: Intraoperative and postoperative data of three patients managed by the balloon tamponade procedure**

Outcome	Patient 1	Patient 2	Patient 3
Operative time (minutes)	75	40	35
Intraoperative complication	None	None	None
Postoperative compression duration (hours)	48	24	72
Duration of tamponade retention (hours)	72	48	96
Postoperative complications	Surgical site infection	None	None
Fresh blood transfusion (units)	4	2	2
Packed RBC (units)	3	-	1
Fresh frozen plasma (units)	3	-	4
HB concentration at discharge (gm/dl)	11	11.5	10
Postoperative hospital stay (days)	14	6	7



