

# Patient Blood Management: Obstetrician, Gynecologist's Perspectives

Won Moo Lee

Division of Gynecologic Oncology and Gynecologic Minimally Invasive Surgery, Department of Obstetrics and Gynecology, Hanyang University College of Medicine, Seoul, Korea

Obstetricians and gynecologists frequently deal with hemorrhage so they should be familiar with management of patient blood management (PBM). We will review to summarize the alternative measures and interventions used in bloodless surgery in the field of obstetrics and gynecology. In the obstetric field, PBM has been developed as an evolving evidence-based approach with a number of key goals: (i) to identify, evaluate, and manage anemia; (ii) reduce iatrogenic blood loss; (iii) optimize hemostasis; and (iv) establish decision thresholds for transfusion. Transfusion, mechanical method including balloon tamponade and uterine artery embolization, and intraoperative cell salvage were introduced for PBM. In the gynecologic field, PBM is not significantly different from that in the obstetric field. Preoperative managements include iron supplement, erythropoietin administration, autologous blood donation, and uterine artery embolization. Meticulous hemostasis, short operative time, hypotensive anesthetic techniques, hemodilution during operation, blood salvage and pharmacological agents were introduced to intraoperative management. Postoperative measures include meticulous postoperative monitoring of the patient, early detection of blood loss, reduction of blood sampling, appropriate use of hemopoiesis, normalization of cardio-pulmonary function and minimization of oxygen consumption. In conclusion, each obstetrician and gynecologist should be aware about the appropriate method for blood conservation and use in practice. A comprehensive approach to coordinating all members of the bloodless agent and surgical team is essential.

**Key words:** Patient blood management; Obstetrics and gynecology; Transfusion; Cell salvage; Uterine artery embolization

**Corresponding Author:** Won Moo Lee  
Division of Gynecologic Oncology and  
Gynecologic Minimally Invasive Surgery,  
Department of Obstetrics and Gynecology,  
Hanyang University College of Medicine,  
222 Wangsimni-ro, Seongdong-gu, Seoul  
04793, Korea  
Tel: +82-2-2290-8403  
Fax: +82-2-2296-8472  
E-mail: leewmoo@hanyang.ac.kr

**Received** 12 Oct 2017

**Revised** 25 Jan 2018

**Accepted** 12 Feb 2018

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

## INTRODUCTION

Obstetrics and gynecology is a subject that deals with a lot of blood. Obstetrics is also called "bloody business." The rate of severe postpartum hemorrhage (PPH) requiring transfusion increase from 30.4 to 96.4 per 10,000 delivery hospitalizations between 1998 and 1999 to 2008 and 2009, respectively [1]. Gynecology is also closely related to blood. Large vessel injury is one of the major complications in gynecologic oncologic surgery. This is a result of massive transfu-

sion. However, blood transfusion has potential dangerous effects which can be classified as infectious and non-infectious risks as well as immunologic causes [2]. Implications of blood transfusion occur more often in patients treated for hematologic disorder or malignancy at a rate of 1% to 6% [3,4].

Concern about viral infection such as the human immunodeficiency virus, hepatitis B and C viruses, Epstein-Barr virus, cytomegalovirus, non A and non B hepatitis viruses are growing [5,6]. Transfusion errors contribute to non-infectious complications of

blood transfusion and the rate was reported at 1 in 12,000 transfusions performed. Fatality rates was 1 death in 600,000 transfusion errors [7,8]. Adult respiratory distress syndrome, hypothermia, hemosiderosis, arrhythmia, hypocalcemia and hypomagnesemia are small outbreaks of non-infectious complications [2]. Among the effects of immunologic etiology, as a result of blood transfusion, are reactions of acute and delayed hemolysis, fever, allergic reactions, post-transfusion purpura and transfusion-related acute lung injury [9].

Recently, advances of technology and procedures in the field of medicine make issues that restrict allogenic blood transfusion. Nevertheless, even in the obstetrics and gynecologic fields, surgeons should be informed of the needs of patients who wish for application of blood transfusion. Ignorance of appropriate patient blood management (PBM) is one of the reasons.

In this article, we will introduce the accurate information of PBM in the obstetrics and gynecologic field.

## OBSTETRICS FIELD

In recent years, PBM has been developed as an evolving evidence-based approach with a number of key goals: (i) to identify, evaluate, and manage anemia; (ii) reduce iatrogenic blood loss; (iii) optimize hemostasis; and (iv) establish decision thresholds for transfusion. Several obstetric societies recommended guidelines for PBM including transfusion and pharmacologic agent.

### 1. Transfusion

Major obstetric hemorrhage needs massive transfusion. It should be recommended when there is uncontrolled hemorrhage or when use of more than 10 unit packed cells is anticipated [10]. Early transfusion is helpful to avoid dilutional coagulopathy in PPH. However, there is no consensus on how to transfuse the women who suffered from PPH. Previous studies showed results that used packed red blood cell (pRBC) and FFP in a ratio of 1:1 and 1:2 and targeted use of platelets in an effort to avoid dilutional coagulopathy with regular measurement of hemoglobin and clotting by conventional tests [11]. Transfusion has advantages such as decrease in mortality and multi-organ failure. Disadvantages of transfusion are lung injury, cardio-pulmonary volume overload, dilutional coagulopathy and iron overload. These can be avoided by regular examination of hemoglobin and clotting time to guide transfusion.

## 2. Mechanical Methods

### 1) Balloon tamponade

The various types of balloons used are Foley's catheter, Bakri balloon, or sterile glove and condom. Balloon tamponade was effective in 91.5% of cases and it was recommended that, this was relatively simple technology and should be a part of the existing protocol in the management of PPH [12]. This intervention as a tamponade test serves as first line surgical management. A positive test controls PPH following inflation and a negative test occurs when bleeding does not stop with inflation, which is likely result from a genital organ laceration. Cases with negative balloon tamponade test and failure to arrest bleeding by intra uterine balloon tamponade in uterine atony requires immediate surgical intervention.

### 2) Radiological management

Uterine artery embolization is useful in situations in which preservation of fertility is desired when surgical options have been exhausted in controlling PPH, both atonic and traumatic. Complications include local hematoma formation at the site of injection site, infection, and ischemic phenomenon including uterine necrosis, although rarely. It can be done as an elective or emergency intervention [13]. Emergency indications are persistent atonic PPH and surgical complications, uterine tears at the time of cesarean section, and bleeding following hysterectomy. Access to the anterior division of internal iliac artery is via a femoral artery approach and is done by injecting gelatin particles. Use of polyvinyl alcohol particles is however, permanent. It usually offers a very high success rate of 75–100%.

Hysterectomy was avoided in 10 out of 14 cases of major PPH by arterial embolization [14].

### 3. Intraoperative cell salvage

Intraoperative cell salvage is an option in women who refuse traditional blood transfusion as well as in MOH? situations. It may not be substituted for allogenic blood transfusion but is an adjunct to acute resuscitation in PPH and also can reduce the exposure to allogenic blood transfusion and its associated risks. It is also cost effective. It contains only red cells with essentially no platelets or clotting factors. The risk of amniotic fluid embolism is very low if a leukocyte depletion filter is used. Infection is also uncommon [15].

## GYNECOLOGIC FIELD

Major gynecologic oncologic surgeries have a chance of massive

hemorrhage and an emergency intervention are often required to control acute blood loss. However, there is no organized consensus for bloodless surgery in gynecologic oncology.

### 1. Preoperative measures

#### 1) Preoperative counselling

Appropriate preoperative counseling is the most important step for gynecologic oncologic patients who are hesitant to receive blood transfusion. Gynecologic oncologist should be informed of the advanced non-blood techniques; they should introduce the patient to alternatives to transfusion, discuss the risk and benefit of all methods, and propose the best strategies. A specially prepared consent form that clearly outlines the necessary therapeutic options in each case and the strategies accepted by the patient should be offered preoperatively. Each and every woman is considered responsible for any decision concerning management of her health and has the right to accept or refuse an applied treatment option. Similarly, gynecologic oncologists should respect patients' beliefs and informed choices.

#### 2) Iron supplement

Oral or intravenous iron supplement would be the best option for optimizing the preoperative hemoglobin level and stimulation the red blood cell formation. The best choice is oral iron but intravenous iron is sometimes recommended due to complication of oral iron or some weeks intervals? [2]. An acceptable preoperative hemoglobin level would be 13 g/dL [16].

#### 3) Erythropoietin administration

Another method for the correction of preoperative anemia is the administration of erythropoietin stimulating agents (ESA). Its main action is known to cause bone marrow expansion and increase red blood cell mass [17]. Nevertheless, the use of ESA has provoked concerns about thromboembolism and cardiovascular events [18]. Moreover, the use of ESA in cancer patients has been reported that such agents might be a stimulator for certain tumor growth [19]. For these reasons, FDA discourages the use of ESA in oncologic patients for correcting anemia related to chemotherapy [18].

#### 4) Autologous blood donation

Another method is preoperative autologous blood donation. The donation of whole blood preparation at 4 units before surgery. The blood is then stored and used as autologous blood transfusion during surgery [20]. Autologous donation is not recommended to pa-

tients with less than 11 g/dL and those with a focus of infection [2].

#### 5) Uterine artery embolization

Uterine artery embolization is introduced as an effective preoperative technique to reduce blood loss during surgery [21,22]. Decreasing fertility, post embolization pain and infection are known as potential risks [23].

### 2. Intraoperative measures

Meticulous hemostasis, short operative time, hypotensive anesthetic techniques, hemodilution during operation, blood salvage and pharmacological agents were introduced as intraoperative management for blood loss.

#### 1) Hypotensive anesthetic techniques

Hypotensive states with mean blood pressure reaching as low as 60 mmHg, using general anesthetic agents with nitroglycerine, effectively reduce bleeding during major gynecologic surgery [24]. This method is not recommended to patients with cerebrovascular disease, severe renal and hepatic failure, cardiovascular disease, hypovolemic status and peripheral vascular disease [24].

#### 2) Perioperative blood salvage

Intraoperative blood salvage is a technique that collects blood from the abdomen or pelvis of a patient during surgery followed by leukocyte depletion filters or irradiation measures [25,26] and then transfused back to the patient being operated [9]. This method usually is utilized in patients with benign gynecologic disease and has limitation in the patient with malignancy due to the potential hematogenous spread of tumor cells [27-29]. Nevertheless, previous studies showed that perioperative blood salvage has no such potential risk in the gynecologic oncologic field [25,27,30].

### 3. Postoperative measures

Postoperative measures include meticulous postoperative monitoring of the patient, early detection of bleeding [20,31], reduction of blood sampling [20], appropriate use of hemopoiesis [29], normalization of cardio-pulmonary function [32] and minimization of oxygen consumption [33]. Continuous albumin infusion in the early postoperative period might stabilize blood pressure and establish fluid load [34]. ESA can be helpful in the cancer patient with anemia under chemotherapy [35]; similarly, Granulocyte-colony-stimulating factors and platelet growth factor could be considered in the treatment of chemotherapy-induced thrombocytopenia [2].

## CONCLUSION

In the obstetrics and gynecologic field, each obstetrician and gynecologist should be informed about the available blood conservation methods and order their application if needed, optimizing the patients' outcome. A multidisciplinary approach is essential with the coordination of all members of the bloodless medicine and surgery team such as surgeons, anesthesiologists, hemato-oncologists, nurses, and pharmacists. Additionally, prediction and assessment of blood loss remains the cornerstone for prompt and effective management of peri-operative bleeding.

## REFERENCES

- Callaghan WM, Creanga AA, Kuklina EV. Severe maternal morbidity among delivery and postpartum hospitalizations in the United States. *Obstet Gynecol* 2012;120:1029-36.
- Santoso JT, Lin DW, Miller DS. Transfusion medicine in obstetrics and gynecology. *Obstet Gynecol Surv* 1995;50:470-81.
- Brittingham TC, Chaplin H Jr: Febrile transfusion reactions caused by sensitivity to donor leucocytes and platelets. *JAMA* 1957;165:819.
- Heddle NM, Klama LN, Griffith L, Roberts R, Shukla G, Kelton JG. A prospective study to identify the risk factors associated with acute reactions to platelet and red cell transfusions. *Transfusion* 1993;33:794-7.
- Dodd RY. Current safety of the blood supply in the United States. *Int J Hematol* 2004;80:301-5.
- Goodnough LT, Brecher ME, Kanter MH, AuBuchon JP. Transfusion medicine. First of two parts--blood transfusion. *N Engl J Med* 1999;340:438-47.
- Linden JV, Paul B, Dressler KP. A report of 104 transfusion errors in New York State. *Transfusion* 1992;32:601-6.
- Nicholls MD. Transfusion: morbidity and mortality. *Anaesth Intensive Care* 1993;21:15-9.
- Santoso JT, Saunders BA, Grosshart K. Massive blood loss and transfusion in obstetrics and gynecology. *Obstet Gynecol Surv* 2005;60:827-37.
- Gutierrez MC, Goodnough LT, Druzin M, Butwick AJ. Postpartum hemorrhage treated with a massive transfusion protocol at a tertiary obstetric center: a retrospective study. *Int J Obstet Anesth* 2012;21:230-5.
- Duchesne JC, Hunt JP, Wahl G, Marr AB, Wang YZ, Weintraub SE, et al. Review of current blood transfusions strategies in a mature level I trauma center: were we wrong for the last 60 years? *J Trauma* 2008;65:272-6; discussion 6-8.
- Georgiou C. Balloon tamponade in the management of postpartum haemorrhage: a review. *BJOG* 2009;116:748-57.
- Royal College of Obstetricians and Gynaecologists. The role of emergency and elective interventional radiology in postpartum haemorrhage. Royal College of Obstetricians and Gynaecologists Good Practice Guideline No. 6. Royal College of Obstetricians and Gynaecologists, London. <http://www.rcog.org.uk/womens-health/clinical-guidance/role-emergency-and-electiveinterventional-radiology-postpartum-haem>. Published 2007.
- Penney G, Brace V. Near miss audit in obstetrics. *Curr Opin Obstet Gynecol* 2007;19:145-50.
- Allam J, Cox M, Yentis SM. Cell salvage in obstetrics. *Int J Obstet Anesth* 2008;17:37-45.
- Gaspy J, Cavill I. Role of iron in optimizing responses of anemic cancer patients to erythropoietin. *Oncology (Williston Park)* 1999;13:461-73; discussion 77-8, 83-8.
- Fried W. Erythropoietin. *Annu Rev Nutr* 1995;15:353-77.
- FDA Alert: Information for healthcare professionals: erythropoiesis stimulating agents (ESA) [Aranesp (darbepoietin), Epogen (epoetin alfa), and Procrit (epoetin alfa)], Rockville, MD: Food and Drug Administration. 2007, Accessed May 25, 2007, at <http://www.fda.gov/cder/drug/infoSheets/HCP/RHE2007HCP.htm>.
- Steinbrook R. Erythropoietin, the FDA, and oncology. *N Engl J Med* 2007;356:2448-51.
- Shander A. Surgery without blood. *Crit Care Med* 2003;31:S708-14.
- Nagarsheth NP, Shander A, Malovany R, Tzeng J, Ibrahim I. Bloodless surgery in a Jehovah's Witness patient with a 12.7-kg uterine leiomyosarcoma. *J Surg Educ* 2007;64:212-9.
- Takemura M, Yamasaki M, Tanaka F, Shimizu H, Okamoto E, Hisamatu K, et al. Transcatheter arterial embolization in the management of gynecological neoplasms. *Gynecol Oncol* 1989;34:38-42.
- Butori N, Tixier H, Filipuzzi L, Mutamba W, Guieu B, Cercueil JP, et al. Interest of uterine artery embolization with gelatin sponge particles prior to myomectomy for large and/or multiple fibroids. *Eur J Radiol* 2011;79:1-6.
- Powell JL, Mogelnicki SR, Franklin EW 3rd, Chambers DA, Burrell MO. A deliberate hypotensive technique for decreasing blood loss during radical hysterectomy and pelvic lymphadenectomy. *Am J Obstet Gynecol* 1983;147:196-202.
- Mirhashemi R, Averette HE, Deepika K, Estape R, Angioli R, Martin J, et al. The impact of intraoperative autologous blood transfusion during type III radical hysterectomy for early-stage cervical cancer. *Am J Obstet Gynecol* 1999;181:1310-5; discussion 5-6.
- Hansen E, Knuechel R, Altmeppen J, Taeger K. Blood irradiation for intraoperative autotransfusion in cancer surgery: demonstra-

- tion of efficient elimination of contaminating tumor cells. *Transfusion* 1999;39:608-15.
27. Nagarsheth NP, Sharma T, Shander A, Awan A. Blood salvage use in gynecologic oncology. *Transfusion* 2009;49:2048-53.
  28. Hardy JF. Pharmacological strategies for blood conservation in cardiac surgery: erythropoietin and antifibrinolytics. *Can J Anaesth* 2001;48:S24-31.
  29. Yamada T, Yamashita Y, Terai Y, Ueki M. Intraoperative blood salvage in abdominal uterine myomectomy. *Int J Gynaecol Obstet* 1997;56:141-5.
  30. Connor JP, Morris PC, Alagoz T, Anderson B, Bottles K, Buller RE. Intraoperative autologous blood collection and autotransfusion in the surgical management of early cancers of the uterine cervix. *Obstet Gynecol* 1995;86:373-8.
  31. Despotis G, Avidan M, Lublin DM. Off-label use of recombinant factor VIIA concentrates after cardiac surgery. *Ann Thorac Surg* 2005;80:3-5.
  32. Habler O, Voss B. [Perioperative management of Jehovah's Witness patients. Special consideration of religiously motivated refusal of allogeneic blood transfusion]. *Anaesthesist* 2010;59:297-311.
  33. deCastro RM. Bloodless surgery: establishment of a program for the special medical needs of the Jehovah's witness community--the gynecologic surgery experience at a community hospital. *Am J Obstet Gynecol* 1999;180:1491-8.
  34. Fiorica JV, Roberts WS, Hoffman MS, Barton DP, Finan MA, Lyman G, et al. Concentrated albumin infusion as an aid to postoperative recovery after pelvic exenteration. *Gynecol Oncol* 1991;43:265-9.
  35. Goodnough LT. The role of recombinant growth factors in transfusion medicine. *Br J Anaesth* 1993;70:80-6.