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The outcomes of surgical treatment modalities to decrease "near miss" maternal morbidity caused by peripartum hemorrhage

N. DANISMAN, S. KAHYAOGLU, S. CELEN, B. AKSELIM, E.G. TUNCER[1], H. TIMUR, O. KAYMAK, I. KAHYAOGLU[2]

Department of High Risk Pregnancies, Zekai Tahir Burak Women's Health and Research Hospital, Ankara, Turkey
[1]Department of Blood Transfusions, Zekai Tahir Burak Women's Health and Research Hospital, Ankara, Turkey
[2]Department of Obstetrics and Gynecology, Faculty of Medicine, Ufuk University, Ankara, Turkey

Abstract. – BACKGROUND: The treatment of patients with peripartum hemorrhage is unfortunately characterized by inadequate treatment that does not adhere to standard therapeutic measures.

AIM: Assessment of different management strategies among patients with severe hemorrhage, particularly the ones with "near-miss" maternal morbidity and mortality to establish clinically useful guidelines for the prevention and management of peripartum hemorrhage.

PATIENTS AND METHODS: In this study, the medical records of 458 patients who have experienced peripartum hemorrhage between March 2009 and March 2012 in a tertiary perinatal center were retrospectively reviewed. Specific surgical treatment modalities utilized to 61 patients with severe peripartum hemorrhage with respect to the procedure timing and effectivity were compared according to the outcomes and efficiency.

RESULTS: Sixty-one patients who have been diagnosed as severe peripartum hemorrhage have been included to the study. Six (75%) of the 8 patients who were treated with B-Lynch brace suture for uterine atony and 9 (60%) of the 15 patients who were treated with the Bakri balloon tamponade system for uterine atony or placenta accreta required hysterectomy following the initial therapeutic measures. The patients who have been treated with bilateral hypogastric artery ligation and B-Lynch brace suture or Bakri balloon uterine tamponade system were less likely to need a complementary hysterectomy for definitive treatment of peripartum hemorrhage when compared with patients treated with either B-Lynch brace suture or Bakri uterine tamponade balloon system alone.

CONCLUSIONS: The efficiency of B-Lynch compression brace sutures and the Bakri balloon uterine tamponade system is unpredictable in terms of the need for hysterectomy for peripartum hemorrhage patients diagnosed as either uterine atony or placenta previa. Regardless of the initial diagnosis, these modalities seem to be more effective in alleviating peripartum hemorrhage when accompanied by hypogastric artery ligation.

Keywords:
Perinatal mortality, Materno-fetal medicine, Peripartum hemorrhage, Pregnancy complications, Surgery.

Introduction

Annually; 125,000 women die from peripartum hemorrhage (PPH). Hemorrhage of more than 500 ml after birth is defined as postpartum hemorrhage. The risk factors for PPH, a potentially life-threatening complication of both vaginal and cesarean deliveries, have been clearly defined as recurrent and non-recurrent conditions among women of reproductive age[1]. Different rates for PPH have been reported from various countries[2]. Maternal "near miss" cases may be defined as those women with an acute organ system dysfunction requiring critical intensive care that could result in death if not appropriately treated[3]. In some previous studies, severe hemorrhage of more than 1000 ml of blood has been included in the definition of 'near-miss' maternal morbidity caused by obstetric hemorrhage[4,5].

Inadequate medical care that does not adhere to generally accepted standard measures and a lack of knowledge and clinical skills regarding treatment are major problems associated with the treatment of PPH[6]. The treatment modalities of severe PPH include surgery and/or medical management with blood product transfusion and uterotonic drugs. Uncontrolled bleeding usually necessitates sophisticated treatment methods such as recombinant factor VIIa administration, B-Lynch or uterine brace sutures, ligation and/or embolization of

Corresponding Author: Serkan Kahyaoglu, MD; e-mail: mdserkankahyaoglu@gmail.com

the internal iliac and uterine arteries[7-10]. The effectiveness of these therapies has not been evaluated in large randomized controlled trials. Women who underwent a peripartum hysterectomy to control hemorrhage generally have a B-Lynch/Brace suture or Bakri uterine tamponade balloon prior to requiring a hysterectomy. Only nine case reports about the clinical efficiency of B-Lynch sutures for the treatment of PPH have been previously reported in the English literature[11]. In this descriptive study, we evaluated patients with PPH according to the diagnoses and therapeutic modalities performed for PPH and considered the requirement for additional management strategies such as hysterectomy. We also aimed to assess different management strategies among patients with severe hemorrhage, particularly the ones with "near-miss" maternal morbidity and mortality to establish clinically useful guidelines for the prevention and management of PPH.

Patients and methods

We evaluated the medical records of our Delivery Unit between March 2009 and March 2012. Four hundred and fiftyeight patients were determined to have obstetric hemorrhage defined as 500 ml and 1000 ml blood loss following vaginal and abdominal deliveries respectively. Of those patients; 61 patients with severe PPH who had been aggressively treated for "near miss" maternal morbidity related to obstetric hemorrhage were included in the study. Based on the case definition from the United Kingdom Obstetric Surveillance System (UKOSS) 2008 study, patients with peripartum hemorrhage of more than 1500 ml and/or a decrease in hemoglobin levels of ≥ 4 g/dL and/or acute blood transfusion of 4 or more units were included in the study[12-15]. These patients had also been treated with one or more treatment modalities such as B-Lynch brace suture, the Bakri uterine tamponade system, hypogastric artery ligation and hysterectomy besides relevant blood transfusions when needed. The effectiveness of the treatment modalities according to cause of the PPH, timing of the treatment, associated complications and the need for additional hysterectomy were reviewed.

Statistical analysis

Statistical analysis was performed with the pearson chi-square test. $p < 0.05$ was considered as significant and relative risk assessment was determined as the odds ratio (OR) by using SPSS Version 19, IBM software (SPSS Inc., Chicago, IL, USA).

Results

Sixty-one patients who had received therapy specifically for severe peripartum hemorrhage were identified from the medical records at the delivery unit. The mean ± SD values of the patients for age, body mass index, hemoglobin deficiency, gestational age at delivery and the number of the blood products used were 29±5.6, 29±2.7, 5.87±1.56, 36±3.6, 14±9 respectively. Seventeen patients (28%) delivered vaginally and 44 patients (72%) delivered by cesarean section (Table I). The diagnoses of patients at admission to the delivery unit, the number of hysterectomies performed and initial drop in hemoglobine (Hbg) values according to the corresponding diagnoses are presented in Table II. The mean±SD values of drop in hemoglobin were not statistically significant between the different groups according to the diagnoses. Patients with atony and placenta accreta had hemoglobin drop values of 5.73±1.53 and 5.35±1.02 respectively ($p > 0.05$). The need for hysterectomy following birth was observed in 30% or 29% of the patients with vaginal or abdominal deliveries, respectively ($p = 0.96$). Although statistically insignificant, the rate of additional complications related to blood transfusions and/or surgery was slightly higher among patients who underwent cesarean sections as opposed to vaginal births upon admission to the delivery unit, regardless of the specific diagnosis ($p = 0.39$) (OR = 1.26, 95% CI = 0.7-2.2). Six (75%) of the 8 patients who were treated with B-Lynch brace suture for uterine atony and 9 (60%) of the 15 patients who were treated with the Bakri balloon tamponade system for uterine atony or placenta accreta required hysterectomy after undergoing the initial therapeutic measures ($p = 0.65$; OR = 1.2; 95% CI = 0.70-2.22). Among patients who have been treated with Bakri balloon tamponade system, 3 patients (100%) with uterine atony and 6 (50%) of the 12 with placenta accreta required hysterectomies ($p = 0.18$, OR = 2.1; 95% CI = 0.86-2.98). Twelve (48%) of the 25 patients who had delivered before 38 weeks of gestation and 6 (21%) of the 29 patients who have delivered at/after 38 weeks of gestation required hysterectomy after application of the initial therapeutic measures ($p = 0.034$, OR = 2.32; 95% CI = 1.02-5.27).

Table I. Patients' characteristics upon admission to the delivery unit (N:61)

Patients' characteristics	Number (N)	Mean	Min-Max	Percent (%)
Age	61	29	16-41	-
Primiparity	18	–	–	29
Multiparity	43	–	–	71
Gestational week	61	36	26-41	100
<38 weeks	32			53
≥38 weeks	29			47
Body Mass Index (Total)	61	–	–	
18.5-24.9 (normal)	2			3
25-29.9 (overweight)	34			56
>30 (obese)	25			41
Initial Hb deficiency	61	–	–	
4-6 gr/dL	47			77
7-10gr/dL	14			23
Delivery route	61	–	–	
Vaginal	17			28
Cesarean	44			72
Blood products used	61	16	4-46	–
Total	61	–	–	–

Table II. Diagnoses of patients at admission to the delivery unit, number of hysterectomies performed and initial drop in hemoglobin (Hbg) values according to the diagnoses (N:61)

Diagnosis	N	Percent (%)	Hysterectomy (N)	Hysterectomy Percent (%)	Drop in Hbg value (mean±SD)**
Uterine atony	26	42%	10	38%*	5.73±1.53***
Placenta previa	23	38%	15	65%*	5.35±1.02***
Pelvic hematoma	3	5%	0	0	7.00±1.73
Genital laceration	3	5%	0	0	6.00±2.00
Uterine rupture	3	5%	0	0	5.33±1.15
Placental ablation	2	3%	0	0	4.00±0.00
HELLP syndrome	1	2%	0	0	6.00±0.00
Total	61	100%	25	41%	5.87±1.56

*p value= 0.06 (Chi-square test) ; **p value= 0.16 (Anova test); ***p value= 0.58 (Student t test).

Table III. Number of hysterectomies and additional complications according to the treatment modalities (N:61).

Treatment Modality	N	Hysterectomy equirement*	Percent (%)	Additional complications**	Percent (%)	Hysterectomy percent and p value
B-Lynch brace suture	8	6	75*	8	100	17%***
Bakri balloon tamponade	15	9	60*	4	26	
Blood transfusion	5	0	0	2	40	
B-Lynch+Hypogastric ligation	8	0	0	7	87	65%***
Bakri +Hypogastric ligation	9	3	33	5	55	
Repair of uterine rupture	3	0	0	0	0	
Drainage of hematoma	6	0	0	2	33	
Hysterectomy	7	7	100	6	8	
TOTAL	61	25	41%	34	56%	

*p value= 0.65(Fisher's Exact test; p value is for comparison of B-Lynch brace suture and Bakri balloon tamponade system)
**Rectovaginal fistula formation, disseminated intravasculary coagulation, intracranial bleeding, bladder and ureter injury, ileus, plevral effusion, ARDS, relaparotomy ,pneumotorax, wound infection, pelvic hematoma formation
***p value= 0.004 (Fisher's Exact test; p value is for comparison of the patients who have been treated with bilateral hypogastric artery ligation and B-Lynch brace suture or Bakri balloon uterine tamponade system and patients who have been treated with either B-Lynch brace suture or Bakri uterine tamponade balloon system alone.

The patients who have been treated with bilateral hypogastric artery ligation and B-Lynch brace suture or Bakri balloon uterine tamponade system were less likely to need a complementary hysterectomy for definitive treatment of PPH when compared with patients treated with either B-Lynch brace suture or Bakri uterine tamponade balloon system alone (17% versus 65%; N = 40, p = 0.004, OR: 0.27; 95% CI: 0.09-0.78) (Table III). Unlike 3 (33%) of 9 patients who have been treated with bilateral hypogastric artery ligation and Bakri balloon uterine tamponade system, all of the 8 patients who have been treated with bilateral hypogastric artery ligation and B-Lynch brace suture were successfully treated without an additional hysterectomy procedure (p = 0.20, OR = 0.96; 95% CI = 0.54-4.38).

Discussion

Maternal near-miss cases involve women who nearly died but survived a complication during pregnancy, childbirth or the postpartum period. Near-miss events occur more frequently than maternal mortality[16-18]. Hypovolemia, particularly resulting from obstetric hemorrhage, represents the leading cause of near-miss maternal morbidity. Recently, increased rates of cesarean section worldwide have resulted in an increased appearance of placental implantation disorders, especially placenta accreta, which is the heightened risk of obstetric hemorrhage. Patients with risk factors for peripartum hemorrhage need to be identified before acute insult deteriorates their hemodynamic status[19]. These patients at high-risk for near-miss morbidity should be managed in centers by experienced surgeons with access to the equipment necessary to promptly reverse acute hypovolemia[20,21]. B-Lynch compression brace suture, Bakri balloon uterine tamponade, hypogastric artery ligation/embolization and hysterectomy are frequently used to treat PPH. The efficiency of these treatment modalities has not previously been studied with respect to the timing of therapy, ongoing bleeding, and the requirement for hysterectomy. The elaboration of a "near-miss patient management guide" for PPH patients is mandatory to allow clinicians to select the most appropriate treatment modality at the most appropriate time for the appropriate patient. By employing a competent staff and ensuring the availability of blood products, our institution has been able to treat many of these cases from the interior Anatolian region of Turkey. In this study, we evaluated the near-miss women who suffered from peripartum hemorrhage and who were managed with different surgical treatment options to alleviate obstetric hemorrhage.

Compared with first trimester pregnancies, second and third trimester pregnancies were found to have a greater tendency to near-miss morbidity when associated with PPH (Table I). Multiparity and increased body mass index seemed to involve a greater risk for obstetric hemorrhage. Currently, increasing prevelance of placenta accreta parallel to the increasing cesarean section numbers among women makes this entity a major problem for the obstetricians because of the significantly high PPH risk. Not surprisingly, most of the patients with PPH were delivered by cesarean section, which reflects the urgent nature of the situation. Although additional complications related to blood transfusions and/or surgery were slightly more frequent among women who underwent cesarean sections than those who delivered vaginally, the route of delivery was not found to be a significant risk factor for the need for hysterectomy after the application of other treatments for PPH. In spite of the low patient numbers, all of the patients with uterine atony treated initially with either a B-Lynch compression brace suture or the Bakri balloon uterine tamponade system required hysterectomies for definitive treatment. The requirement for hysterectomy after application of the Bakri balloon uterine tamponade system was observed among 50% of the patients diagnosed with placenta accreta, which reflects the moderate efficiency of this treatment modality in patients with placenta accreta as opposed to uterine atony. Patients who have delivered before 38 weeks of gestation more frequently required hysterectomy after the application of initial therapeutic measures than patients who deliver at/after 38 weeks of gestation. Before 38 weeks of gestation, the severity of the pathological process that increases the risk of PPH seems to be more resistant to initial surgical treatment modalities other than hysterectomy.

Our study demonstrated that either B-Lynch uterine brace suture or Bakri balloon uterine tamponade system is not completely effective treatment modalities for relieving PPH when used primarily regardless of the patient's cause of peripartum bleeding. In this study, only 40% of patients with PPH who have been treated with Bakri ballon uterine tamponade system and 25%

of the patients treated with B-Lynch uterine brace suture showed clinical improvement respectively. When used concomitantly with bilateral hypogastric artery ligation, B-Lynch uterine brace suture shows better promising results to treat PPH related to uterine atony than Bakri balloon uterine tamponade system. The Bakri balloon uterine tamponade system's effectivity to stop PPH alone seems to be unpredictable for either uterine atony or placenta accreta. Hypogastric artery ligation decreases uterine artery pulse pressure and facilitates the therapeutic action of these two surgical modalities to treat PPH.

Clinicians familiar with hypogastric artery ligation can use B-Lynch uterine brace suture or Bakri uterine balloon tamponade system confidentially when they encounter PPH. It remains debatable to recommend these surgical therapeutic modalities alone for PPH treatment because of the treatment failure probability. However, Bakri balloon uterine tamponade system has some efficiency on successful surgical management of PPH related to placenta accreta.

Conclusions

Surgical methods for treatment of peripartum hemorrhage have increasingly been used with some success without a logical information about the selection of the most appropriate method at the best time. The efficiency of B-Lynch compression brace suture and Bakri balloon uterine tamponade system is unpredictable in terms of the need for hysterectomy for the patients either diagnosed with uterine atony or placenta previa that yield peripartum hemorrhage. Regardless of the initial diagnosis, these two treatment modalities seem to be more effective to alleviate PPH when accompanied by hypogastric artery ligation. However, it is not possible to make a clear-cut decision that hypogastric artery ligation works in all peripartum hemorrhage cases regardless of the application of additional therapeutic measures like B-Lynch brace suture and Bakri uterine balloon tamponade system. Prospective randomized controlled studies with higher patient numbers are needed to constitute a patient management guide for near-miss maternal morbidity patients who suffer from PPH and in order to be certain that hypogastric artery ligation increases the efficiency of B-Lynch brace suture and Bakri uterine balloon tamponade system.

Conflict of interest notification

We have no financial conflicts of interest related to the material in this manuscript.

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