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Role Of Bilateral Uterine Artery Ligation In Reducing Incidence Of Postpartum Hemorrhage In Cesarean Section In Patients At Risk Of Uterine Atony A Randomized Controlled Trial

Walid Abo El-Abbas Mohammed Mostafa
M.Sc of Obstetrics and Gynecology (2018) Faculty of Medicine Boys- Cairo - Al-Azhar Universit,
drwalidabbas1234@gmail.com

Fahd Abd Elal El-Omda
Professor of Obstetrics and Gynecology Faculty of Medicine Boys – Cairo - Al-Azhar University

Ahmed Taha Abd El-Fattah
Professor of Obstetrics and Gynecology Faculty of Medicine Boys - Cairo - Al-Azhar Universit

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ORIGINAL ARTICLE

Role of Bilateral Uterine Artery Ligation in Reducing Incidence of Postpartum Hemorrhage in Caesarean Section in Patients at Risk of Uterine Atony

Walid Abo El-Abbas Mohammed Mostafa*, Fahd Abd Elal El-Omda, Ahmed Taha Abd El-Fattah

Obstetrics and Gynecology Faculty of Medicine Boys, Al-Azhar University, Cairo, Egypt

Abstract

Background: **The most common cause of postpartum hemorrhage is uterine atony. One of the simplest and most efficient surgical procedures for PPH control is uterine artery ligation (UAL). It allows future childbirth, is relatively safe, and is simple to perform.**

Patients and methods: **A prospective randomized controlled clinical trial. The patients were chosen from among the laboring women who were scheduled to have caesarean sections. Patients were randomized to 2 groups.**

Results: **Intraoperative blood loss after placental separation and the first 6 h postoperative vaginal bleeding and total blood loss have been significantly reduced in the study group than the control group ($P < 0.001$).**

The study group had a significantly lower occurrence of PPH and blood transfusions than the control group ($P < 0.001$). Thus, the study group's incidence of PPH was decreased as a result of bilateral uterine artery ligation.

Conclusion: **Bilateral uterine artery ligation is beneficial during caesarean sections before placental separation as a prophylaxis against postpartum bleeding. During and following a caesarean section, it may significantly lessen the loss of blood.**

Keywords: Postpartum hemorrhage, Uterine artery ligation, Uterine atony

1. Introduction

Postpartum hemorrhage is still one of the main reasons for maternal mortality in both industrialized and developing countries. Postpartum hemorrhage should be prioritized for national guideline development due to its significance as a major factor in maternal morbidity and death, as well as the evidence of substandard care in the majority of lethal cases.[1]

Within 24 h of giving birth, PPH can be described as a loss of blood of 500 ml or more, whereas severe PPH can be described as a loss of blood of 1000 ml or more within 24 h.[2]

PPH is classified into two categories: minor (500−1000 ml) and major (>1000 ml). Major can be classified as moderate (1000−2000 ml) or severe (>2000 ml).[3]

According to national statistics in Egypt, hemorrhage prior to and following delivery was the primary direct reason for maternal mortality (43%), with the majority of hemorrhage-related mortality being caused by postpartum hemorrhage. For every 100,000 live births, there have been 32 hemorrhaging maternal fatalities. Other causes, such as hypertensive illnesses (18/100,000), ruptured uteruses (7/100,000), sepsis (7/100,000), C.sections (6/100,000), obstructed labor (4/100,000), anemia (9/100,000), and heart disease (11/100,000), were far less common than hemorrhage.[4]

PPH has many risk factors, but uterine atony is the commonest cause, i.e. failure of contraction and retraction of the uterus after delivery of the fetus.

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* Corresponding author. Obstetrics and Gynecology, Faculty of Medicine, Al-Azhar University, Cairo, Egypt.
E-mail address: drwalidabbas1234@gmail.com (W.A.E.-A. Mohammed Mostafa).

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PPH in the past pregnancy is a main risk factor and each attempt should be done to decide its intensity and reason.[5]

Many factors participate to complications of PPH in developing countries. The initial is a decrease of experience in staff that can professionally manage PPH if happened, Shortage of demand blood transfusion and anesthetic services, and operation facilities also plays a role.[6]

Uterine stimulants involve oxytocin (syntocinon), ergot alkaloids, and prostaglandins and carbitocin. Oxytocin induce the upper uterine segment for contraction regularly, which constricts spiral arteries and reduce uterine blood flow.[7]

Bilateral ligation of the uterine artery is the initial stage of a gradually uterine devascularization that affords good hold of PPH.[8]

This work aimed to evaluate the efficiency of prophylactic bilateral uterine arterial ligation in patients who are at risk for atony of the uterus in lowering the occurrence of postpartum hemorrhage during caesarean sections.

2. Patients and methods

This clinical trial, a prospective randomized controlled study, took place from January 2020 to December 2022 at Al Hussein University Hospital. The patients were chosen from among the laboring ladies who would be having caesarean sections. Patients were randomized into two groups. 240 patients who were scheduled for caesarean sections and at risk for uterine atony had bilateral uterine artery ligation and were given oxytocin. Another 240 patients who required caesarean sections and were at risk for uterine atony only received oxytocin.

2.1. Inclusion criteria

Women who had a minimum of one of the following conditions and had C.sections for an obstetric reason have been involved:

Anemia in the mother (not less than 7 gm%), A macrosomic baby weighing more than 4 kg, High-order gestation and twin gestation, Grand multipara, Polyhydramnios, Previous history with atonic postpartum bleeding, emergency LSCS, chorioamnionitis, and prolonged vaginal delivery.

2.2. Exclusion criteria

Women without a risk of uterine atony, women who have antepartum hemorrhage, women who have congenital or acquired bleeding tendencies, and women with placenta previa.

Ethical approval

The Obstetrics and Gynecology Department of Al-Azhar University's Faculty of Medicine received approval from the research ethics committee. Before enrolling any participants in the study and after fully describing its objectives and methods, all participants provided written informed consent.

2.3. Methodology

The participants underwent the following procedures after providing their informed written consent: a thorough history-taking process that focused in particular on prior medical, past obstetric, and previous menstrual histories.

General and abdominal examination.

Baseline laboratory tests: activated partial thromboplastin time (aPTT), prothrombin time (PT), and complete blood count (CBC).

The patients were monitored for the occurrence of postpartum hemorrhage in the form of intraoperative blood loss, intraoperative or postoperative need for surgical measures to stop bleeding, postoperative vaginal bleeding, as well as a decrease in hemoglobin and hematocrit 24 h postoperatively, aside from the requirement for transfusion of blood and the incidence of endometritis for 6 weeks postpartum.

2.4. Statistical analysis

IBM SPSS Statistics (Statistical Package for Social Sciences) software, version 22.0, IBM Corp., Chicago, USA, 2013, has been utilized to code, tabulate, and statistically analyze the obtained data.

Quantitative normally distributed data have been subjected to descriptive statistics, which included the range's minimum and maximum, mean ± SD (standard deviation), and mean ± SE (standard error), whereas qualitative data were subjected to descriptive statistics in the form of numbers and percentages.

Quantitative variables underwent inferential analysis employing 95% CI (confidence intervals), independent t-tests where the results have been normally distributed between two independent groups, and paired t-tests when the results have been normally distributed between two dependent groups. Employing the Chi square test for differences between proportions, inferential analyses for independent variables have been performed on qualitative data. P values < 0.050 are deemed

significant; otherwise, they are not. The *P* values are a statistical estimate of the possibility that the outcomes of a study might have happened by chance.

3. Results

Table 1–7.

This table demonstrates that there were no significant differences in the study and control groups' demographic characteristics (Table 2).

This table demonstrates that the atony risks among the study and control groups aren't significantly different (Table 3).

This table shows that in the current study, intraoperative blood loss after placental separation has been significantly lower in the study group in comparison with the control group ($P < 0.001$) (Table 4).

This table shows that in the current study, in the first 6 h following surgery, vaginal hemorrhage was significantly less in the study group in comparison with the control group ($P < 0.001$).

This table demonstrates that in the current investigation, there wasn't a statistically significant difference in basal hemoglobin levels (p0.304) across study groups. 24 h postoperatively, hemoglobin levels in the study group have been significantly greater than those in the control group ($P < 0.001$). Hemoglobin decline was significantly less in the study group in comparison with the control group ($P < 0.001$).

This table shows there wasn't a statistically significant difference in basal hematocrit (p0.560)

Table 1. Characteristics of both groups' demographics.

Variables	Group I ($N = 240$)	Group II ($N = 240$)	*P*
Age (years)			
Mean ± SD	30.0 ± 3.2	29.9 ± 2.6	[a]0.751
Range	21.0–38.0	23.0–37.0	
Parity (*n*, %)			
Primigravida	70 (29.2%)	85 (35.5%)	[b]0.138
Multipara	170 (70.8%)	155 (64.5%)	
No. of CS			
P1CS	43 (17.9%)	38 (15.8%)	[b]0.138
P2CS	38 (15.8%)	36 (15%)	[b]0.138
P3CS	46 (19.1%)	40 (16.6%)	[b]0.138
P4CS	43 (17.9%)	41 (17%)	[b]0.138
GA (weeks)			
Mean ± SD	39.0 ± 0.6	39.0 ± 0.6	[a]0.938
Range	38.0–41.0	38.0–41.0	
BMI (kg/m^2)			
Mean ± SD	28.9 ± 2.4	29.1 ± 2.5	0.345
Range	22.4–35.7	22.8–34.8	

[a] Independent *t*-test.
[b] Chi square test.

Table 2. Atony risks for both groups.

Variables	Group I ($N = 240$)	Group II ($N = 240$)	[a]*P*
Multiparity	170 (70.8%)	155 (64.5%)	0.138
Anemia	60 (25%)	63 (26.2%)	0.751
Emergency section	52 (21.6%)	54 (22.5%)	0.825
Prolonged delivery	16 (6.66%)	17 (7.08%)	0.857
Polyhydramnios	14 (5.83%)	15 (6.25%)	0.848
Chorioamnioitis	13 (5.41%)	12 (5%)	0.837
Multiple pregnancy	11 (4.58%)	9 (3.75%)	0.648
Macrosomic baby	8 (3.33%)	11 (4.58%)	0.482

[a] Chi square test.

Table 3. Intraoperative loss of blood (mL) in both groups after placental separation.

Measures	Group I ($N = 240$)	Group II ($N = 240$)	[a]*P*
Mean ± SD	523.4 ± 41.0	619.6 ± 36.1	**<0.001**[b]
Range	402.0–688.0	528.0–720.0	
95% CI	518.1–528.7	614.9–624.2	
Value of uterine artery ligation			
Items		**Mean ± SE**	**95% CI**
Loss reduction		96.2 ± 3.6	89.2–103.3

CI, Confidence interval.
[a] Independent *t*-test.
[b] Significant.

Table 4. Vaginal hemorrhage (mL) occurred in both groups within the first 6 h following surgery.

Measures	Group I ($N = 240$)	Group II ($N = 240$)	[a]*P*
Mean ± SD	246.1 ± 21.4	326.1 ± 18.5	**<0.001**[b]
Range	198.0–334.0	276.0–369.0	
95% CI	243.3–248.9	323.7–328.5	
Value of uterine artery ligation			
Items		**Mean ± SE**	**95% CI**
Loss reduction		80.0 ± 1.9	76.3–83.6

CI, Confidence interval.
[a] Independent *t*-test.
[b] Significant.

Table 5. Hemoglobin concentration (gm/dL) in the two groups.

Time	Measures	Group I ($N = 240$)	Group II ($N = 240$)	[a]*P*
Before	Mean ± SD	10.4 ± 0.9	10.5 ± 1.0	0.304
	Range	7.8–13.2	7.5–12.8	
	95% CI	10.3–10.5	10.4–10.6	
24 h After	Mean ± SD	8.6 ± 0.9	7.9 ± 1.0	<0.001[c]
	Range	5.9–11.2	5.0–10.4	
	95% CI	8.5–8.7	7.8–8.0	
Change	Mean ± SD	1.8 ± 0.1	2.6 ± 0.1	<0.001[c]
	Range	1.5–2.1	2.3–2.9	
	95% CI	1.8–1.8	2.6–2.6	
[b]*P*		<0.001[c]	<0.001[c]	
Value of uterine artery ligation				
Items			Mean ± SE	95% CI
Difference in reduction			0.8 ± 0.0	0.8–0.8

CI, Confidence interval.
[a] Independent *t*-test.
[b] Paired *t*-test.
[c] Significant.

Table 6. Hematocrite (%) among the both groups.

Time	Measures	Group I ($N = 240$)	Group II ($N = 240$)	$\mathcal{P}$
Before	Mean ± SD	30.7 ± 3.1	30.9 ± 3.5	0.560
	Range	21.9–40.1	20.7–38.8	
	95% CI	30.3–31.1	30.4–31.3	
24 h After	Mean ± SD	25.7 ± 3.1	23.6 ± 3.2	<0.001*
	Range	17.5–36.0	14.0–30.7	
	95% CI	25.3–26.1	23.2–24.0	
Change	Mean ± SD	4.9 ± 2.0	7.2 ± 2.0	<0.001*
	Range	0.6–10.6	1.9–12.6	
	95% CI	4.7–5.2	7.0–7.5	
#*P*		<0.001*	<0.001*	
Value of uterine artery ligation				
Items			Mean ± SE	95% CI
Difference in reduction			2.3 ± 0.2	2.6–1.9

across the study groups in the current research. Hematocrit levels 24 h postoperatively were significantly greater in the study group in comparison with the control group ($P < 0.001$). Hematocrit decrease in the study group was significantly lower in comparison with the control group ($P < 0.001$).

According to (Table 7), the occurrence of PPH and transfusions of blood have been significantly lower in the study group in comparison with the control group.

In comparison to the control group, which included 21 participants, five participants in the study group had PPH with a blood loss of more than 1000 cc. As a result, the study group's occurrence of PPH was decreased by bilateral uterine artery ligation.

Five patients in the study group required additional surgery; only one required a hysterectomy, three required B-lynch compression sutures, and one required bilateral internal iliac artery ligation.

10 participants in the control group had additional surgeries to halt the hemorrhage. In addition to 2 participants having bilateral internal iliac artery ligations, 5 participants also required bilateral uterine artery ligations. Three women had hysterectomy procedures.

There were 22 study patients and 20 control patients, with no statistically significant difference between both groups, who were readmitted to the hospital for endometritis during the 6 weeks postpartum in the form of fever, offensive vaginal discharge, lower abdominal pain, uterine tenderness, generalized malaise, and leukocytosis; all were managed with medical treatment and parenteral antibiotics.

4. Discussion

The strength of our study: Is large number of patients, multiple variations in inclusion criteria, measurement of blood loss both intra and postoperative.

Only the research conducted by Wei-Min Liu et al.[9] examined its usage as prophylaxis; other investigations focused primarily on using bilateral uterine artery ligation as a therapy for PPH rather than as a prophylactic measure.[9]

Our study's sample size is greater than that of other studies because it included both a control group of 240 women and a study group of 240 women.

In the research conducted by Wei-Min Liu et al.,[9] there were 22 women in the control group and 26 in the study group.

In our investigation, there wasn't a significant difference between the study and control groups in regards to the characteristics of the patient (age, weight, body mass index, parity, and gestational age).

Patients' characteristics in the two groups in the research carried out by Wei-Min Liu et al.[9] had similar characteristics, and there was not a statistical difference between both groups.

According to our findings, bilateral uterine artery ligation significantly reduces hemorrhage both during and following c.section. In the study group's overall loss of blood from placental delivery to 6 h after surgery (770.5 ± 51.3 ml) has been significantly

Table 7. Postoperative complications among the studied groups.

Measures	Group I ($N = 240$)	Group II ($N = 240$)	$\mathcal{P}$	RR (95% CI)
PPH	5 (2.08%)	21 (8.75%)	<0.001[a]	0.37 (0.15–0.76)
Blood transfusion	5 (2.08%)	23 (9.6%)	<0.001[a]	0.34 (0.17–0.82)
Further surgery	5 (2.08%)	10 (4.2%)	0.189	0.66 (0.32–1.36)
Bilateral UAL	–	5 (2.08%)		
B-lynch Sutures	3 (1.25%)	–		
Bilateral I I artery ligation	1 (0.4%)	2 (0.83%)		
Hysterectomy	1 (0.4%)	3 (1.25%)		
Endometritis	22 (9.1%)	20 (8.3%)	0.138	1.05 (0.78–1.43)
Bladder injury	1 (0.4%)	2 (0.83%)	0.562	0.67 (0.13–3.30)

#Chi square test.

CI, Confidence interval; RR, Relative risk.

[a] Significant.

lower than that of the control group (945 ± 39.8 ml) ($P < 0.001$). These results are consistent with the results of the previously described study.

With the exception of the fact that their study just measured intraoperative blood loss, their findings support other research.

Bilateral uterine artery ligation significantly decreased the amount of blood lost during C-sections in patients with fibroid uteri (254 ± 92.3 ml) in the study group versus (278 ± 160.5) in the control group, according to a prior investigation by Wei-Min Liu et al.[9]

As shown in Table 5, the results of our research showed that after surgery, the study group's hemoglobin levels were significantly greater than the control group's ($P < 0.001$), and the study group's hemoglobin reduction was also significantly less than that of the control group ($P < 0.001$).

Also, postsurgical hematocrit has been significantly greater in the study group compared to the control group ($P < 0.001$), and hematocrit decrease has been significantly lower in the study group compared to the control group ($P < 0.001$), as shown in Table 6.

Wei-Min Liu et al.[9] found no significant differences in preoperative baseline hemoglobin readings among the two groups in their study. Intraoperative blood loss has been reduced in group I individuals, and first-day postsurgical hemoglobin levels were higher, but there wasn't a significant difference among the two groups, which could be due to the study's small specimen size.

In our investigation, the operative time didn't significantly differ among the two groups. The Wei-Min Liu et al.[9] study also found that group I participants required somewhat more time during surgery than did group II participants. But this was statistically insignificant as well.

Patients at risk for uterine atony, such as those with multiple pregnancies, twin pregnancies, pregnancies ending in emergency caesarean sections, macrosomic babies, polyhydramnios, or patients with anemia or chorioamnionitis, have been included in our research.

The other research included women who underwent caesarean sections for obstetric reasons and had fibroid uteruses.

Our study's drawbacks include the fact that there was no long-term follow-up with regards to women's menstrual cycle continuance or future fertility, only short-term follow-up for puerperal endometritis six weeks after delivery.

However, other investigations found that menstruation continued and future fertility increased following bilateral uterine artery ligation.

4.1. Conclusions

According to the findings of this study, bilateral uterine artery ligation during caesarean section and before placental separation is beneficial as a prophylaxis against postpartum bleeding. It could significantly decrease the loss of blood both during and following a caesarean section.

Conflicts of interest

None declared.

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