Zagazig University Medical Journal
www.zumj.journals.ekb.eg
https://doi.org/10.21608/zumj.2023.235586.2883 Volume 30, Issue 4, July 2024
Manuscript ID ZUMJ-2309-2883 (R1)
DOI 10.21608/ZUMJ.2023.235586.2883
ORIGINAL ARTICLE

Study of Role of Conservative Surgical Methods during Cesarean Section to Reduce Postpartum Haemorrhage

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Submit Date 2023-09-10
Revise Date 2023-09-23
Accept Date 2023-09-26

ABSTRACT

Background: Conservative surgical methods in the management of postpartum hemorrhage (PPH) cover operations that preserve fertility and prevent the need for a hysterectomy. They provide simplicity, safety and efficacy. Efficacy is defined as the ability to stop the bleeding after the hemostatic technique has been performed. This study aimed to assess the effectiveness of conservative surgical methods in the reduction of blood loss and management of PPH to avoid hysterectomy.

Methods: Stepwise uterine devascularization and uterine compressive sutures were performed for 78 patients in this interventional cohort study to control intractable PPH not responding to classic management. This study entailed four procedures: compressive sutures, bilateral uterine artery ligation, bilateral utero-ovarian artery ligation and internal iliac artery ligation. All patients were divided into four groups, and we did one single procedure in each group, so if bleeding was not controlled by one procedure a second procedure was done then third and fourth procedure until bleeding stopped.

Results: We found that the success rate of uterine compression suture + ovarian artery ligation + uterine artery ligation was 25.9%. Finally, the success rate of the combined four methods of conservative surgical management was 75%, the most prevalent intraoperative and postoperative complications are bladder injury and admission to the intensive care unit (ICU) (7.8 and 14 % of cases respectively).

Conclusions: To achieve a high success rate of conservative surgical management for early PPH, we recommend that obstetricians decide to perform early conservative surgical procedures.

Keywords: Conservative surgical methods; Cesarean section; Postpartum hemorrhage.

INTRODUCTION

Approximately 25% of all maternal deaths are attributable to postpartum hemorrhage (PPH), making it one of the leading causes of maternal mortality globally. Most maternal deaths happen in low and middle-income nations, where the rate can be anything from 15 to 443 per 100,000 births (LMIC). This is why there are national initiatives and public policies aimed at lowering the rate of maternal mortality [1].

The World Health Organization (WHO) defines primary postpartum hemorrhage as "a loss of 500 ml or more of blood within 24 hours after giving delivery," making it the most prevalent type of obstetric hemorrhage while hemorrhage that occurs after 24 hours to 12 weeks after birth is considered a secondary postpartum hemorrhage [2].

Multidisciplinary teams treating patients with PPH need to be methodical and coordinated in their approach. The treatments will get more complex as time passes past the "golden hour" for PPH treatment. The goal of treating PPH within the golden hour is to decrease mortality and complications caused by tardy treatment. It's well known that prolonged bleeding after delivery is linked to worse maternal outcomes. Hypovolemic shock, which includes hypothermia, acidosis, as well as coagulopathy, can be fatal if bleeding management is delayed. At this point, any strategy to avoid collapse or death can be unsuccessful [3].

Surgical techniques that preserve fertility and don't involve a hysterectomy are part of the conservative surgical management of PPH. Hemostatic sutures, also known as ligation of pelvic vessels (LPV) ligation and uterine compressive suturing (UCS), are among the most frequently performed surgical operations. The success rate will be affected by many factors, including the type of operation chosen and the surgeon's skill, as well as the reason, severity, and bleeding site [4].

Conservative surgical methods are defined by their ease, safety, and effectiveness. Once the hemostatic approach has been applied, its efficacy is measured by its capacity to stop bleeding [5].

The aim of this study is to assess the effectiveness of each conservative surgical method separately and the combination between them in reduction of blood loss and management of PPH to avoid hysterectomy.

METHODS

Seventy-eight women who had cesarean sections and required intervention to limit blood loss throughout cesarean section were included in this Interventional Cohort Study undertaken by the Obstetrics and Gynecology Department of the Faculty of Medicine at Zagazig University in the duration of 6 months from January 2023 to June 2023.

Inclusion criteria: We included females aged from 18 to 45 years, with primary PPH, and their condition requiring intervention to control blood loss during cesarean section.

Exclusion criteria: It was decided not to include women who exhibited any of the following characteristics: vaginal deliveries, secondary PPH, placenta previa and accreta, abnormal adherence of placenta as well as general causes of bleeding like; blood disorders, anticoagulant therapy, and hepatic disorders.

After institutional review board approval of IRB (#9987/11-10-2022), written informed consent was obtained from all participants. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

All the participating pregnant women were subjected to the following: complete history taking (medical and obstetric history) including: personal data, and obstetric history:(gravidity, birth defects, abortions, parity, previous birthing methods, the first day of the last menstrual cycle, the gestational age and frequency of labor pains. General abdominal as well and gynecological examinations were performed. Routine laboratory investigations included: complete blood count (CBC), random Blood sugar, liver, and kidney functions. Transabdominal ultrasound examination was done for estimation of the gestational age, fetal growth as well as the fetal biophysical profile during the antenatal follow-up.

Primary postpartum hemorrhage is defined as loss of ~ 500 ml of blood during the first 24 hours after birth of the infant that affects the general condition of the mother (signs or symptoms of hypovolemia). The lines of management followed to control the hemorrhage were manual massage and bimanual compression of the uterus; administration of dilute oxytocin 40 to 60 IV added to 1 L of intravenous fluid; methylergonovine, 0.2 mg given intramuscularly (if the patient was not hypertensive); intramuscular injection of 0.25 mg of I5-methyl prostaglandin F2",; blood transfusion and other available restorative measures; exploration of the uterus and removal of any retained placental parts or membranes. After failure of these procedures to control the hemorrhage, the patients were scheduled for stepwise uterine devascularization and uterine compressive sutures techniques instead of hysterectomy. Postpartum hemorrhage occurred as a result of uterine atony, bleeding from placental bed, traumatic causes.

The estimated blood loss ranged from 500 to 3500 ml. Stepwise uterine devascularization (**according to** Abdrabo [5] stepwise ligation of uterine and ovarian vessels in the management of postpartum haemorrhage) and uterine compressive sutures techniques (B-Lynch suture, Hayman suture, Cho suture, Pereira suture, Matsubara-Yano suture or transverse lower uterine segment compression suture one of them or more included four single procedures and eleven combined procedures. All patients were divided into four groups and we did

one single procedure in each group: compressive sutures, bilateral uterine artery ligation, bilateral utero-ovarian artery ligation or internal iliac artery ligation; so if single procedure technique failed to stop bleeding, we added another single procedure in another six groups of two combined procedures: compressive sutures & bilateral uterine artery ligation, compressive sutures & bilateral utero-ovarian artery ligation, compressive sutures & internal iliac artery ligation, bilateral uterine artery ligation & bilateral utero-ovarian artery ligation, bilateral uterine artery ligation & internal iliac artery ligation or bilateral utero-ovarian artery ligation and internal iliac artery ligation; so if two combined procedures techniques failed to stop bleeding, we added another single procedure in another four groups of three combined procedures: compressive sutures + bilateral uterine artery ligation + bilateral utero-ovarian artery ligation, compressive sutures + bilateral uterine artery ligation + internal iliac artery ligation, compressive sutures bilateral utero-ovarian artery ligation + internal iliac artery ligation and bilateral uterine artery ligation + bilateral utero-ovarian artery ligation + internal iliac artery ligation; ; so if three combined procedures techniques failed to stop bleeding, we added another single procedure in another group of four combined procedures: compressive sutures + bilateral uterine artery ligation + bilateral utero-ovarian artery ligation + internal iliac artery ligation (as shown in Figures 1S to 6S)

The cases that failed to be controlled by combined of all four procedures were undergone to hysterectomy.

Maternal outcomes and complications according to every group: *Intraoperative complications:* including injury of any of the following: urinary bladder, ureters, intestinal, or vascular injury and any blood loss or need of blood transfusion. *Postoperative complications:* including ICU admission, disseminated intravascular coagulopathy, reoperation, wound infection, postpartum collapse, duration of postoperative hospital stay (days) and mortality.

Statistical analysis:

Microsoft Excel was used to code, process, and analyze data gathered from a patient's medical history, physical examination, laboratory tests, and outcome measurements. Then, the information was transferred into SPSS for the Social Sciences (SPSS version 25.0) (Statistical Analysis Software for the Social Sciences). Data were tested for normal distribution using the Shapiro Walk test. Qualitative data were represented as frequencies and relative percentages. Differences between qualitative variables were determined using the Chi-square ($\chi 2$) test and the Fisher exact test. Parametric quantitative variables were analyzed using the Independent T test, and non-parametric ones were analyzed using the Mann Whitney test.

RESULTS

The average age of the participants was 35, and the average body mass index was 28.49 kg/m^2. The average number of children born to each woman in the sample was 1.74, and the average length of gestation was 36.96 weeks. In 51.3% of patients, PPH was caused by uterine atony; in 33.3% of patients, it was caused by bleeding from the placental bed without evidence of placenta previa; and in 14.4% of patients, it was caused by trauma (Table 1).

We found that rate of success of uterine compression suture was 6.4%, success rate of bilateral ovarian artery ligation was 3.8%, while it was 6.4 % in cases of bilateral ligation of uterine and internal arteries. We found that success rate of uterine compression suture +ovarian artery ligation was 3.3%, success rate of uterine compression suture + ligation of uterine artery was 9.9% while it was 16.6%. in cases of uterine compression suture +internal artery ligation. We found that rate of success of uterine compression suture + ligation of ovarian artery+ ligation of uterine artery was 25.9%, rate of success of ligation of bilateral internal arteries + ligation of bilateral ovarian arteries+ ligation of bilateral uterine arteries was 37 % while rate of success of uterine compression suture + ligation of bilateral uterine arteries + ligation of bilateral internal arteries and uterine compression suture +ligation of uterine artery + ligation of internal artery and uterine compression suture + bilateral internal artery + ligation of bilateral ovarian arteries and uterine compression suture +internal artery + ligation of ovarian artery was 11.1%. Success rate of combined four methods of conservative surgical management was 75%. Hysterectomy was done in 1.2% of studied cases (Table 2).

We found that success rate of success rate of combined three methods of conservative surgical management 85.18%, success rate of combined two methods of conservative surgical management was 55%. and success rate of combined four methods of conservative surgical management was 75% (Table 3).

The success rate of combined three methods of conservative surgical management was the highest (85.18%) followed by combined four methods of conservative surgical management (75%) with highly significant differences between them (Table 4).

Bladder injuries account for 7.8% of all intraoperative complications. This was because of the high levels of adhesions in the pelvis and the difficulty of bladder dissection. Only one woman (2.7% of the total) died as a result of severe hemorrhage and cardiac arrest; 3.8% of the women developed DIC; 14.1% of the women were admitted to the intensive care unit after surgery; 1.2% of the women experienced postpartum collapse; 3.8% of the women required additional surgery (two for evacuation of hematoma and one for removal of abdominal packs left for controlling pelvic hemorrhage after hysterectomy). The average length of postpartum hospitalization was 4 days (Table 5).

The average amount of blood lost during surgery was about 2 liters. Median transfusion of 4 units of PRBCs (Packed red blood cells) was required for 33 cases. With a median of 2 units, fresh frozen plasma (FFP) transfusion rates were overall 86.3%. The transfusion rates for women were 11.1% for platelets, 16.6% for whole blood, and 5.5% for cryoprecipitate (Table 6).

About 61.6 percent of the births were girls, while just 39.4 percent were males. 53.8% of pregnancies made it to full term. The fetal outcome was positive in 79.4% of deliveries. The mean weight at birth was 2.87± 0.487.5 kg (Table 7).

Table 1: Demographic data, indications of CS, causes of postpartum hemorrhage in the studied groups.

Variables	**Mean ± SD**	
Age (years)	35.30±5.506	
BMI (kg/m^2)	28.49±2.827	
Parity	1.74±0.914	
Gestational age (weeks)	36.96±1.527	
Indication of CS	**N =78**	**%**
Cephalopelvic disproportion	11	14%
Previous cesarean delivery	49	63.2%
Multiple pregnancy	6	7.6%
Breech presentation	6	7.6%
Cervical mass	6	7.6%
Cause of postpartum hemorrhage	**N =78**	**%**
Uterine atony	40	51.3%
Bleeding from placental bed	26	33.3%
Traumatic cause	12	14.4%

BMI: body mass index

Table 2: Success rate of one method, combined two methods, combined three, and combined four methods of conservative surgical management

Type of conservative surgical management		
One method	**(N =78)**	
	N	**%**
Uterine compression suture	**5**	**6.4%**
Bilateral ovarian artery ligation	**3**	**3.8%**
Bilateral Uterine artery ligation	**5**	**6.4%**
Bilateral Internal artery ligation	**5**	**6.4%**
Combined two methods	**(N =60)**	
	N	**%**
Uterine compression suture + bilateral ovarian artery ligation	**2**	**3.3%**

Bilateral uterine artery ligation + bilateral ovarian artery ligation	**5**	**8.3%**
Bilateral ovarian artery ligation + bilateral internal artery ligation	**5**	**8.3%**
Bilateral uterine artery ligation + bilateral internal artery ligation	**10**	**16.6%**
Uterine compression suture + bilateral uterine artery ligation	**6**	**9.9%**
Uterine compression suture + bilateral internal artery ligation	**5**	**8.3%**
Combined three methods	**(N =27)**	
	N	**%**
Uterine compression suture + bilateral ovarian artery ligation + bilateral uterine artery ligation	**7**	**25.9%**
Bilateral internal artery ligation + bilateral ovarian artery ligation + bilateral uterine artery ligation	**10**	**37%**
Uterine compression suture + bilateral uterine artery ligation + bilateral internal artery ligation	**3**	**11.1%**
Uterine compression suture + bilateral internal artery + bilateral ovarian artery ligation	**3**	**11.1%**
Combined four methods	**(N =4)**	
	Success	**Failure**
Uterine compression suture + bilateral internal artery ligation+ bilateral uterine artery ligation + bilateral ovarian artery ligation	**3**	**75%**

Table 3: Success rate of methods of conservative surgical management

Type of conservative surgical management	**(N =78)**	
	N	**%**
Success rate of one methods of conservative surgical management (n=78)	**18**	**23.07%**
Success rate of combined two methods of conservative surgical management (n=60)	**33**	**55%**
Success rate of combined three methods of conservative surgical management (n=27)	**23**	**85.18%**
Success rate of combined four methods of conservative surgical management (n=4)	**3**	**75%**

Table 4: Success rate of success of different methods of conservative surgical management

	One methods of conservative surgical management		**Combined two methods of conservative surgical management**		**Combined three methods of conservative surgical management**		**Combined four methods of conservative surgical management**		**P**
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	
Success rate	**18**	**23.07%**	**33**	**55%**	**23**	**85.18%**	**3**	**75%**	**0.001**
Failure rate	**60**	**76.93%**	**27**	**45%**	**4**	**14.82%**	**1**	**25%**	**0.001**

Table 5: Intraoperative and postoperative complications of the studied population

Variable	(N=78)	
Intraoperative	**N**	**%**
Bladder injury	**10**	**7.8**
Ureteric injury	**3**	**3.8**
Intestinal injury	**2**	**2.5**
Vascular injury	**1**	**1.2**
Variable	**(N=78)**	
Postoperative	**N**	**%**
DIC	**3**	**3.8**
ICU admission	**11**	**14.1**
Reoperation	**3**	**3.8**
Postpartum collapse	**1**	**1.2**
Mortality	**1**	**1.2**
Duration of postoperative hospital stay (days): **Range** **Median**	**1 - 23** **4**	

Table 6: Estimated intraoperative blood loss and blood transfusion in included women

Variable	(N=78)
Estimated Blood Loss (L) **Range** **Median**	**0.5.-9 L** **2 L**
RBCs Transfusion **Number of cases** **Range** **Median**	**33 (91.7%)** **1-14 units** **4**
Whole blood Transfusion **Number** **Range** **Median**	**6 (16.6%)** **1-6 units** **2**
FFP Transfusion **Number of cases** **Range** **Median**	**30 (83.3%)** **1-15 units** **2**
Platelet Transfusion	**4 (11.1%)**
Cryoprecipitate Transfusion	**2 (5.5%)**

RBCs: Red blood cells, FFP: Fresh frozen plasma

Table 7: Fetal outcomes of the studied cases

Variable	(N=78)	
	N	**%**
Sex **Male** **Female**	 **30** **48**	 **38.4** **61.6**
Term **Full term** **Preterm**	 **42** **36**	 **53.8** **46.2**
Outcome		

Good	**62**	**79.4**
Neonatal ICU admission	**13**	**16.6**
IUFD (Intrauterine fetal demise)	**1**	**1.2**
Neonatal death	**2**	**2**
Birth weight (kg):		
Mean ± SD	**2.87 ± 0.487**	
Range	**2.5-4**	

DISCUSSION

Uterine massage, bimanual uterine compression, and medical treatment make up the foundation of treatment for PPH. Women who do not want children, who have unstable hemostasis, and who have not responded to medical or conservative surgical care should consider having a hysterectomy during or immediately after childbirth if other treatments have failed [7].

Conservative surgical methods, including intrauterine balloon tamponade, uterine compression sutures, closure of the uterine and utero-ovarian arteries, ligation of the internal iliac artery, and arterial embolization should be offered if future fertility is desired. The empirical evidence suggests that this method of management has an 84.0 to 91.7% success rate [8].

The current study showed that the average age of the participants was 35 years, and the average body mass index was 28.49 kg/m^2. The mean parity was 1.74, while mean gestational age was 36.96 weeks. These results agreed with Mohamed et al. [9], who showed that common in age over 35 years. As regard Gravidity (2.85 ± 1.395), Parity (4.82 ± 1.402), G.A (34.42 ± 3.553), while our results were in disagreement with that of Bais et al. [10] who found that nulliparous women had a greater risk of developing PPH than women who had already given birth.

In the present study, indication of CS percent in previous cesarean delivery, cephalopelvic disproportion, multiple pregnancy, breech presentation, and cervical mass were 63.2%, 14%, 7.6%, 7.6% and 7.6% respectively. We agreed with Knight et al., [11] and Ohkuchi et al., [12] who showed that the likelihood of PPH, abnormal placentation, peripartum hysterectomy, and uterine rupture increases after a previous CS delivery. In contrast to the above studies, previous CS wasn't a risk factor for PPH (OR 2.05, 95% CI 0.92-4.55) [13, 14]

In the present study in 51.3% of patients, PPH was caused by uterine atony; in 33.3% of patients, it was caused by bleeding from the placental bed without evidence of placenta previa; and in 14.4% of patients, it was caused by trauma. This was in agreement with **AbdRabbo** who accounted for 51.3% of patients, followed by bleeding from the placental bed without evidence of placenta previa (33.3%) and traumatic cause 14.4% [6]. This agreed also with Stones et al. [15] who found a relative risk (RR) for major obstetric bleeding of 13.1 (95% CI 7.47-23), of uterine atony. Fyfe et al. [16] reported that, ante partum hemorrhage occurred in 5.2% of their nulliparous cohort study, making the increased risk for PPH in women having a history of antepartum hemorrhage from any reason other than placenta previa clinically relevant.

Our study found that success rate of one method of conservative surgical management was (23.07%), (uterine compression suture was 6.4%, and success rate of bilateral ovarian artery ligation was 3.8%, while it was 6.4 % in cases of bilateral ligation of uterine and internal arteries)**.** In agree with the present study**,** Li et al. [17] reported that compressing the uterus with sutures seems like attractive method. Compression sutures tissue, like the B-Lynch suture, have seen widespread use because of their perceived efficacy and safety. In disagree with the present study, in another study, the B-Lynch uterine compression suture technique was the most frequently used, and it had a satisfactory success rate of 60% [18]. Based on their findings, this method is suitable for use in any healthcare facility, as it necessitates less time for training, makes use of simple instruments, permits a quick operative time, and has few difficulties. This disagreement with our results may be due to difference in severity of bleeding and small sample size in our study.

In our study success rate of over all combined two methods of conservative surgical management was 55%. In agree with the present study, high success rates have also been seen in other studies when gynecologic oncologists conducted combined vascular ligations. However, training is necessary for these processes. Previous research has shown that uterine and ovarian artery ligations have a 70-96% success rate [19].

In the current study we found that success rate of combined three methods of conservative surgical management was (85.18), this agree with study of AbdRabbo [6] while success rate of uterine compression suture + bilateral uterine artery ligation + bilateral internal artery ligation, uterine compression suture + uterine artery ligation + internal artery ligation and uterine compression suture + bilateral Internal artery + bilateral ovarian artery ligation uterine compression suture + internal artery + ovarian artery ligation was 11.1%). Also, in agree with our study, bilateral ligation of the hypogastric arteries has been used to treat PPH that does not respond to other treatments [20]. Step-by-step uterine devascularization, in which the ascending uterine, ovarian, and hypogastric arteries are bilaterally ligated with an ovarian survival rate of 87%, has been described more recently [21].

In the present study success rate of combined four methods of conservative surgical management was 75%, In agree with the present study, results from a meta-analysis comparing the success rates of balloon tamponade (84%), uterine compression suture (91.7%), iliac artery ligation (84%), and arterial embolization (84.6%) indicated no statistically significant variations in efficacy [22]. Similar success rates (66.7% for Bakri balloon tamponade and 75.7% for uterine compression suture) were found in a different study; both were slightly lower than the study by Kaya et al. [23] (79.1% and 80%).

The results of this study showed that conservative surgical therapy had a very high success rate (98.8%). One instance (1.2%) had a hysterectomy, which is within a reasonable range based on data from prior research (75-97.1%) [4,24,25]. In agree also with our study Shehata et al. who reported that several small case series supported the idea that preserving the uterus with conservative treatment was a viable option. On the other hand, cautious management is not always the key to success [26]. Tindell et al. [25] who conducted a systematic assessment of the literature, found that uterine balloon tamponade had the best success rate (97.1%).

Conservative treatment with uterine preservation has been shown to be a viable option in a number of minor case series. Conservative management, however, does not ensure a prosperous business [23]. Hysterectomy is required for life-threatening severe bleeding not responding to conservative measures [27].

In the present study, the average amount of blood lost during surgery was about 2 liters. Median transfusion of 4 units of PRBCs (Packed red blood cells) was required for 33 cases. With a median of 2 units, fresh frozen plasma (FFP) transfusion rates were overall 86.3%. The transfusion rates for women were 11.1% for platelets, 16.6% for whole blood, and 5.5% for cryoprecipitate.

It was nearly the same as Li et al. [5] who showed that a total of 2000-4600 mL of blood was lost (mean: 2586±495 mL), while between 600 and 2000 mL of blood was transfused with a mean of, 1160 ± 429 ml.

The results of our work disagreed with that of Sergent et al. [28] who found that the mean of estimated blood loss (1.39-3L) this difference could be explained by high percentage of high risk cases in our study.

In the current study bladder injuries account for 7.8% of all intraoperative complications. This was because of the high levels of adhesions in the pelvis and the difficulty of bladder dissection, Only one woman (2.7% of the total) died as a result of severe hemorrhage and cardiac arrest, 3.8% of the women developed DIC, 14.1% of the women were admitted to the intensive care unit after surgery, 1.2% of the women experienced postpartum collapse, and 3.8% of the women required additional surgery (two for evacuation of hematoma and one for removal of abdominal packs left for controlling pelvic hemorrhage after hysterectomy). The average length of postpartum hospitalization was 4 days. This agree with study of Robinson et al. [29] who found that maternal mortality was 6.8% and significant maternal morbidity, including massive hemorrhage, massive blood transfusion, disseminated intravascular coagulation, hysterectomy, bladder and ureteric trauma while our results disagree with Pal et al. [30] who reported that urologic complications include bladder lacerations were 26%.

The current study showed that about 61.6% of the births were girls, while just 39.4 percent were males. 53.8% of pregnancies made it to full term. The fetal outcome was positive in 79.4% of deliveries. The mean weight at birth was 2.87± 0.487.5 kg. In agree with our result Kramer et al., [٣1], Prata et al., [٣2] they also demonstrated no associated PPH with macrosomia.

On the other hand, Jolly et al. [٣3] examined 350311 completed singleton pregnancies in London and found that PPH was higher in women with fetal macrosomia (OR 2.01, 95% CI 1.93-2.10). Magann

et al. [٣4] found that, macrosomia is strongly associated risk factors for PPH (OR 1.4, 95% CI (1.4-2.3).

To our knowledge, the present study is a novel work to evaluate the conservative surgical management of early PPH using each method separately and in combinations, as this study aimed to assess the effectiveness of conservative surgical methods in reducing blood loss and management of PPH to avoid hysterectomy, which are considered good strength points of our study. The current study was done in one center on a relatively small sample size. It is required to do additional research, including longer follow-up and multicenter practice.

CONCLUSIONS

The overall success rate of conservative surgical management for early PPH was high (98.8%). Highest success rate was the combined three methods of conservative surgical management (85.18%) of which the best was bilateral internal artery ligation + bilateral utero ovarian artery ligation+ bilateral uterine artery ligation (success rate was 37%). Based on our findings, in order to achieve a high success rate of conservative surgical management for early PPH, we recommend that obstetricians decide to perform early conservative surgical procedures in the form of (bilateral internal artery ligation + bilateral ovarian artery ligation+ bilateral uterine artery ligation).

Conflict of Interest: None

Financial Disclosures: None

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To Cite:

Ali, A., Mohamed, A., Mohamed, M., Diab, W. Study of the Role of Conservative Surgical Methods During Cesarean Section to Reduce Postpartum Hemorrhage. *Zagazig University Medical Journal*, 2024; (1257-1269): -. doi: 10.21608/zumj.2023.235586.2883

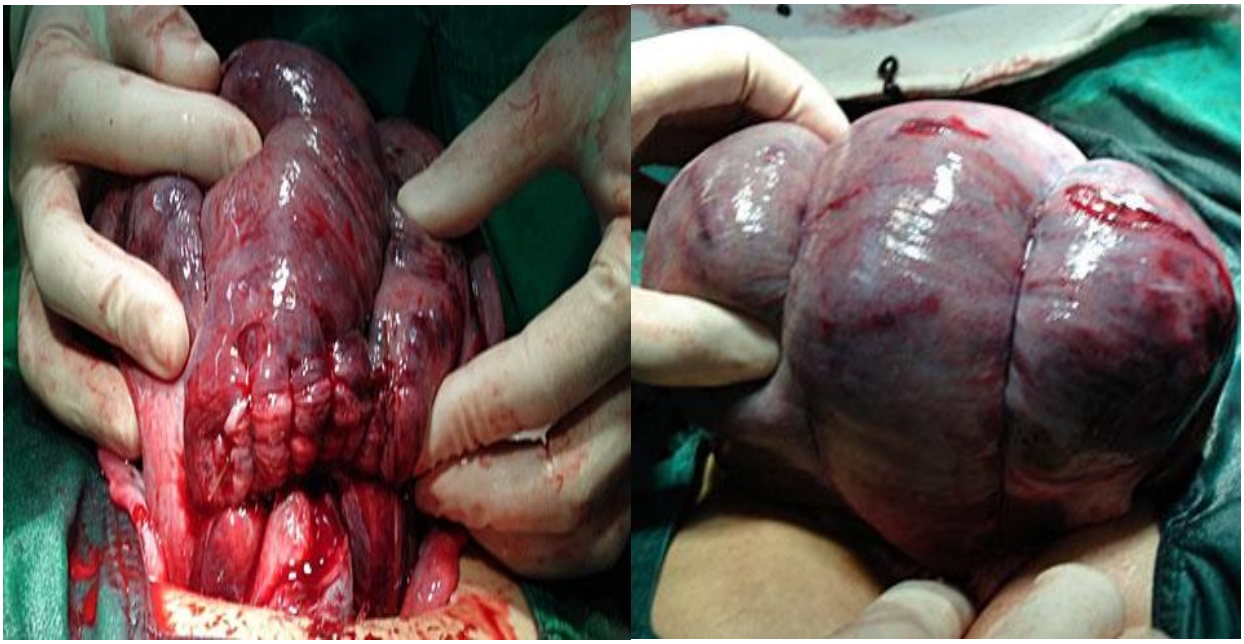

Figure (S1): B-Lynch anterior and posterior view. B-Lynch suture technique

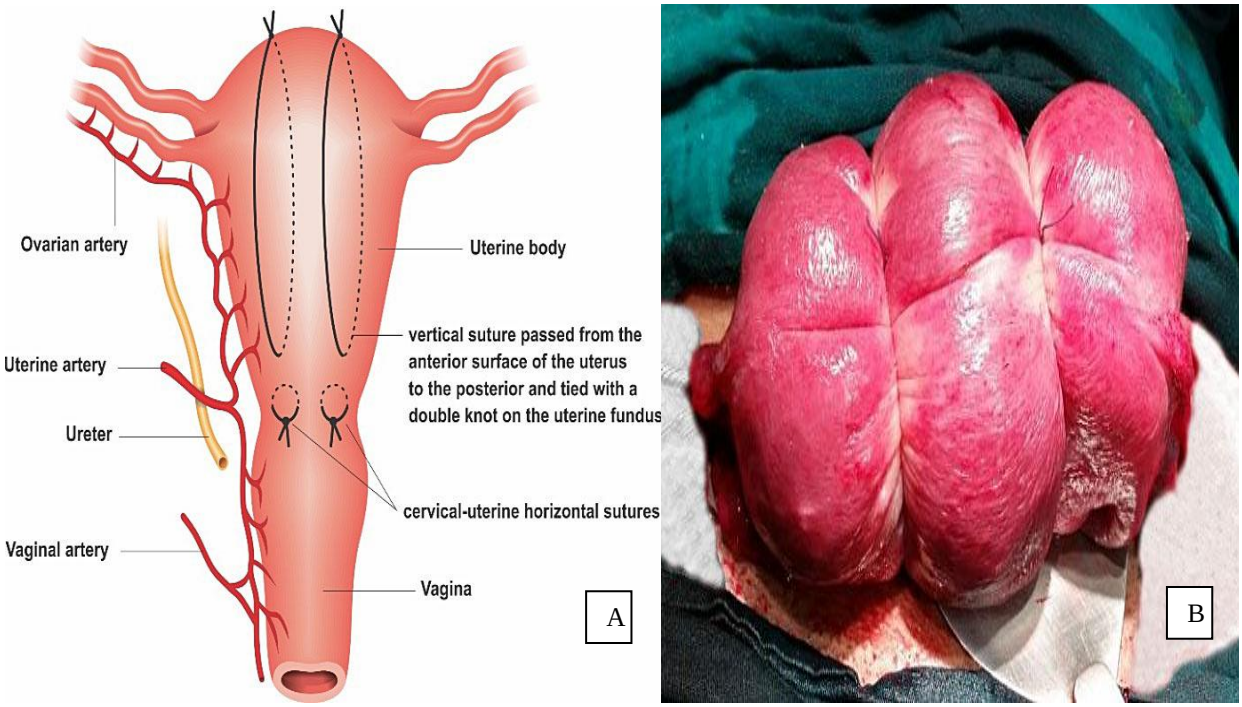

Figure (S2): (A) Hayman suture anterior view. (B) the superior view of Hayman's uterus suture after uterine atony

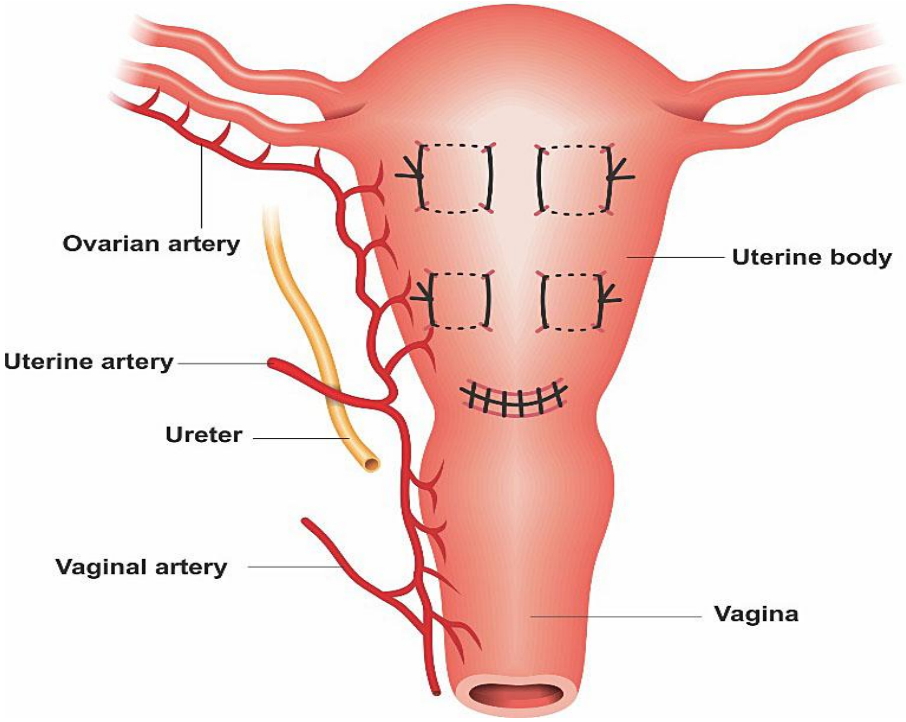

Figure (S3): Cho suture anterior view

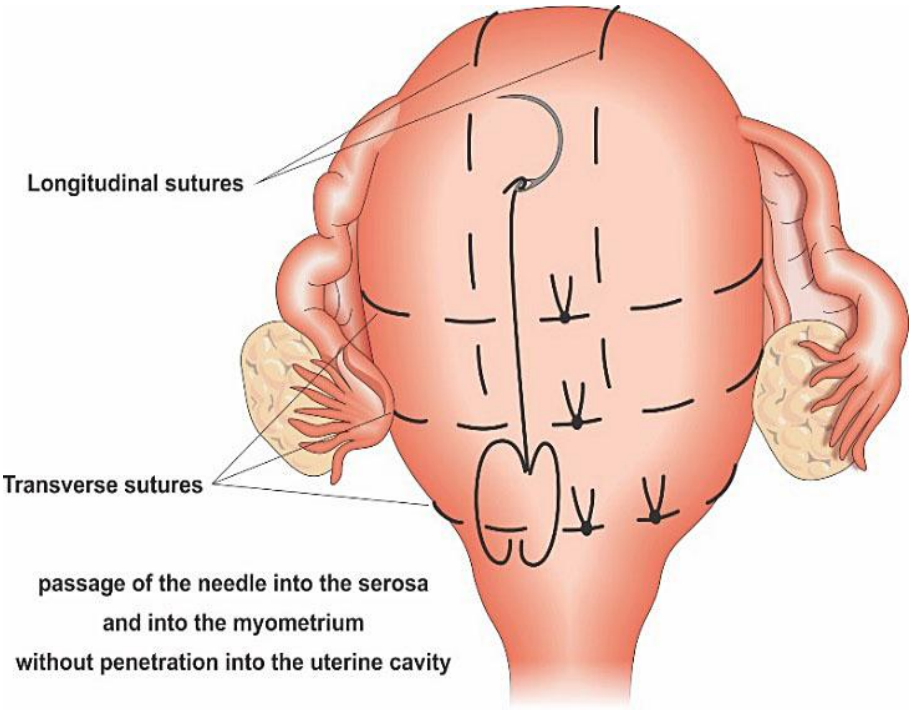

Figure (S4): Pereira suture anterior view

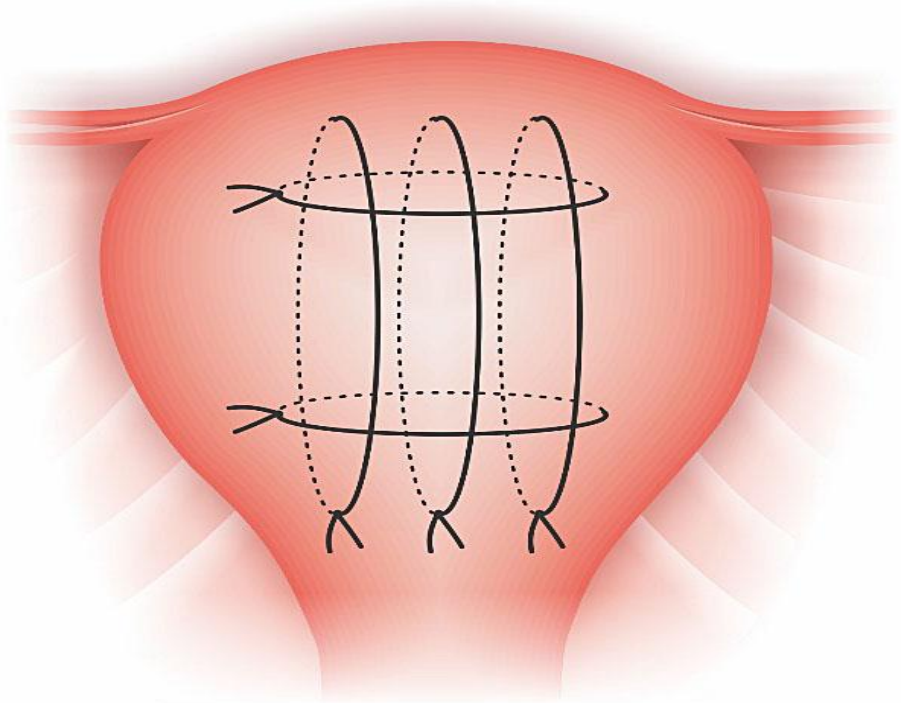

Figure (S5): Anterior view of the original Matsubara-Yano (M-Y) suture

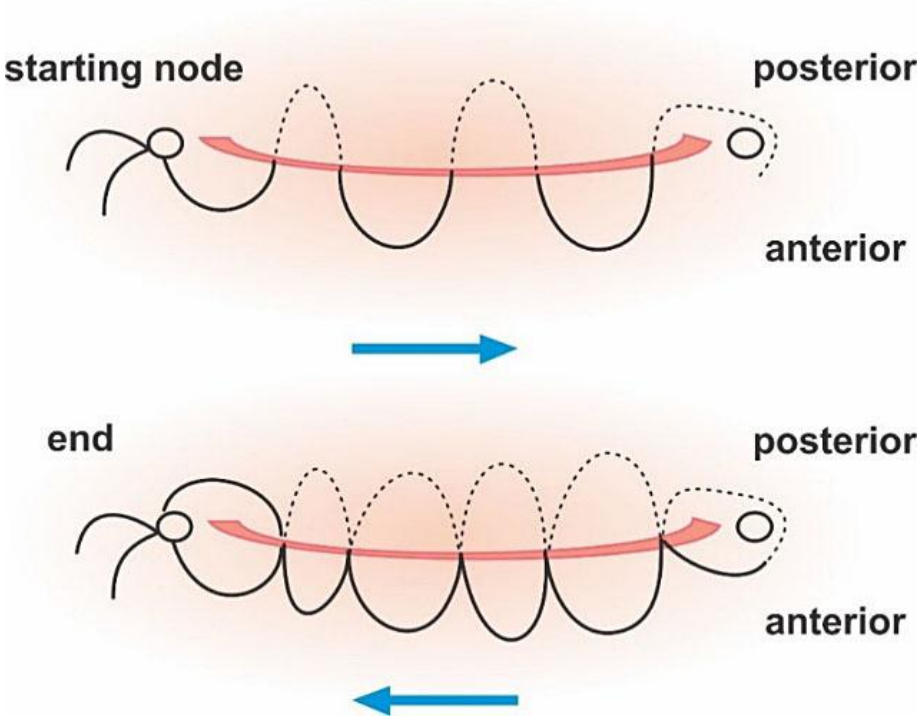

Figure (S6): Technique of transverse lower uterine segment compression suture