Internal Iliac Artery Ligation for Severe Postpartum Hemorrhage

Podwiązanie tętnicy biodrowej wewnętrznej w ciężkim krwotoku poporodowym

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Abstract

Objective: *To evaluate the outcomes of bilateral internal iliac artery ligation (IIAL) in severe postpartum hemorrhage (PPH).*

Design: *Multi-center, retrospective study.*

Methods: *The study was performed from January 2005 to December 2010, at the Obstetrics and Gynecology Clinic, Dicle University Medical Faculty and Maternity Hospital, Diyarbakir, Turkey. Life-threatening cases of severe postpartum hemorrhage, which could not be controlled with conservative medical and surgical treatments and finally managed with IIAL, were retrospectively evaluated.*

Results: *Totally 53 patients who underwent IIAL procedures were included in the study. All patients were hemodynamically unstable. The mean shock index and transfused units of blood were 1.17±0.46, 5.49±3.04, respectively. Uterine atony was the leading cause of severe postpartum hemorrhage and the need for IIAL. Coagulopathy developed in 26 (49.1%) patients during the postoperative follow-up period. Uterus was preserved in 17 (32.0%) cases. Three patients died of complications and/or morbidity associated with hemorrhage.*

Conclusion: *Serious PPH is most frequently associated with uterine atony and IIAL should be considered in cases with severe PPH unresponsive to other treatment modalities. If, in the antenatal period, patients have risk factors of postpartum hemorrhage, they must be transferred to appropriate centers to prevent a possibly fatal outcome.*

Key words: **postpartum hemorrhage** / **hysterectomy** / **iliac artery** / **ligation** /

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Streszczenie

Cel pracy: *Ocena wyników podwiązania tętnicy biodrowej wewnętrznej (IIAL) w ciężkim krwotoku poporodowym (PPH).*

Metoda: *Wieloośrodkowe retrospektywne badanie przeprowadzono w okresie od stycznia 2005 do grudnia 2010 w Klinice Położnictwa i Ginekologii w Dickle University Medical Faculty and Maternity Hospital, Diyarbakir, Turcja. Oceniono przypadki zagrażającego życiu krwotoku poporodowego, który nie poddawał się leczeniu zachowawczemu i operacyjnemu i u których ostatecznie wykonano IIAL.*

Wyniki: *Do badania włączono 53 pacjentki, które przeszły procedurę IIAL. Wszystkie pacjentki były niestabilne hemodynamicznie. Średni wskaźnik wstrząsu i ilość przetoczonych jednostek krwi wynosiły odpowiednio, 1,17±0,46, 5,49±3,04. Główną przyczyną ciężkiego krwotoku poporodowego i konieczności wykonania procedury IIAL była atonia macicy. Koagulopatia rozwinęła się u 26 pacjentek w okresie pooperacyjnym. Macicę zachowano w 17 przypadkach. Trzy pacjentki zmarły z powodu powikłań i stanów związanych z krwotokiem.*

Wnioski: *Ciężki krwotok poporodowy jest najczęściej związany z atonią macicy a procedura IIAL powinna być rozważona w przypadkach ciężkiego krwotoku po porodzie niepoddającego się innemu leczeniu. Jeśli w okresie przedporodowym pacjentka ma czynniki ryzyka krwotoku poporodowego, powinna być przekazana do odpowiedniego centrum aby zapobiec możliwym śmiertelnym następstwom.*

Słowa kluczowe: **krwotok poporodowy** / **histerektomia** / **tętnica biodrowa** / / **podwiązanie** /

Introduction

Decreasing the maternal mortality rate is the first and most important goal in obstetric care. Severe postpartum hemorrhage (PPH) is defined as loss of 1000 ml or more of blood in the first 24 hours after delivery, and remains to be a leading cause of maternal mortality worldwide and also in Turkey [1]. Early diagnosis and treatment with the use of uterotonics, suturing the lacerations, and fundal massage, are important practices in the first stage [2]. Appropriate surgical intervention should not be delayed when hemorrhage does not stop, despite aggressive medical treatment. Surgical treatment method depends on the number of living children in the family, patient desire for childbearing in the future, intensity of the hemorrhage and experience of the surgeon. Historically, the only available treatment to control PPH was peripartum hysterectomy [3,4]. The desire to preserve fertility and the fact that, in some situations, hysterectomy alone does not always succeed to control the hemorrhage, have led to the development of other methods, like pelvic embolization and internal iliac artery ligation (IIAL) [5,6]. Sagarra (1960) was the first to define IIAL in PPH [7]. This method has since been used widely as a life-saving and fertility-preserving procedure in all types of PPH cases.

In present study, we aimed to evaluate the indications and the clinical outcomes for IIAL in severe postpartum hemorrhage.

Materials and methods

The study was conducted between January 2005 and December 2010, at the Obstetrics and Gynecology clinics of Dicle University Hospital (Center A) and Diyarbakir Maternity Hospital (Center B), Turkey. Center A is a tertiary referral center in the Southeastern Anatolian Region, and accepts complicated pregnancies that transferred from hospitals of 11 surrounding cities. Life-threatening cases of severe postpartum hemorrhage, which could not be controlled with conservative medical and surgical treatments (uterine fundal massage, oxytocin, methergine, misoprostol) and instead were managed with bilateral IIAL, were evaluated retrospectively. During the defined period of the study time the total number of deliveries at the study centers was recorded. Cases of less than 20 weeks gestation were not included in the study. We included the patients, who referred from other health centers due to uncontrolled PPH and underwent IIAL in our clinics. During re/laparotomy, the retroperitoneal space was entered at the level of common iliac artery bifurcation and internal iliac artery was identified. Internal iliac artery was ligated at 4 cm distally to the bifurcation of the common iliac artery.

Abnormal placentation comprises a spectrum of situations defined as placenta accreta, increta, and percreta depending on the degree of uterine invasion [8]. The following relevant data were recorded; maternal age, gravidity, parity, number of living children, obstetric pathology that led to IIAL, estimated blood loss, shock index (heart rate/systolic blood pressure), volume of blood transfusion, uterus preservation and length of hospital stay. The medical records were also used to detect maternal complications including injury to bladder or ureter, coagulopathy (platelets of ≤100 000/μL, international normalized ratio of ≥1.2, and/or fibrinogen of ≤200 mg/dL), occurrence of intra-abdominal infection and maternal death. The cause of death was recorded for the patients who died.

Hysterectomy was defined as subtotal or total excision of the uterus. In cases where the uterus was preserved, in addition to IIAL, either B-Lynch sutures, primary sutures to the bleeding foci, repair of the uterine rupture or ligation of ligamentum proprium ovariae were observed in the relevant condition.

Statistical analysis was performed with SPSS 15.0 program. Descriptive statistics are presented. The study was approved by the Medical Ethics Committee of Dicle University.

Results

There were 123,847 births and 53 IIAL procedures during the study period. The mean patient age and the mean hospital stay were 32.55±6.24 years and 10.09±9.18 days, respectively.

The average number of living children was 2.75±2.52 in the atony group, 5.15±2.44 in the uterine rupture group and 2.08±1.0 in the placenta accreta group. All patients were hemodynamically

Table I. Maternal characteristics in the study of internal iliac artery ligation for severe postpartum hemorrhage.

Characteristics	Mean±SD, *(Minimum-maximum)*
Age (years)	*32.55±6.24, (19-46)*
Gravidity	*5.62±2.98, (1-14)*
Parity	*4.06±3.0, (1-14)*
Number of living children	*3.58±2.63, (0-12)*
Gestational age (weeks)	*35.83±3.91, (22-41)*
Postoperative length of stay (days)	*10.09±9.18, (1-60)*
Shock index	*1.17±0.46, (0.80-3.75)*
Blood transfusion (unit)	*5.49±3.04, (1-12)*
Estimated blood loss (liter)	*3001±806, (1500-4700)*

Note: SD= standard deviation.

unstable. The mean shock index was 1.17±0.46 and the mean number of units of transfused blood was 5.49±3.04. Other clinical findings and demographic characteristics are presented in Table I. Hysterectomy was performed in 36 (68.0%) patients, while the uterus was preserved in 17 (32.0%) cases. Unilateral adnexectomy was performed in 12 of the patients who had had hysterectomy. Twelve patients were transferred from outside hospitals due to PPH: 6 patients had bleeding after the postpartum hysterectomy and 6 patients had intra-abdominal and/or vaginal bleeding after the caesarean section. IIAL was performed in 16 patients because of the postpartum atony; 13 of these cases had developed after vaginal birth, and 3 after caesarean section. The uterus was preserved in 9 patients in the postpartum uterine atony group. Additional procedures, ligation of the ligamentum proprium ovariae and B-Lynch suture were performed in 3 and 4 patients, respectively. In the uterine rupture group, all cases of the rupture were identified at the sidewalls of the uterine cervico-isthmic area. Pathological conditions of severe PPH and uterine preservation data are presented in Table II.

The following intraoperative complications, due to the pathology or iatrogenically, were observed: bladder injuries: 5, ureter ligation: 1 and external iliac vein laceration: 1. Coagulopathy developed in 26 patients during the postoperative follow-up. In the early postoperative period, 4 patients were rehospitalized due to infection (wound infection: 2, intra-abdominal abscess: 2). Maternal death occurred in three patients, clinical parameters and causes of exitus are presented in Table III.

Discussion

Severe PPH or estimated blood loss more than 1000 ml is observed in 1-5% of patients during the postpartum period. Uterine atony is the most common cause of PPH and constitutes 80% of the cases [9]. Traditionally, hysterectomy is the treatment choice to control PPH. Peripartum hysterectomy procedure is observed in severe PPH cases, especially complicated with the uterine atony, uterine rupture and placental invasion abnormalities [2, 10, 11]. In cases where preservation of the uterus is desired, or when hysterectomy is not sufficient in controlling the bleeding, IIAL is a life-saving and fertility-preserving method. In this study, uterine atony was the most frequent indication for IIAL, as reported in previous studies [6, 9].

In addition to the known risk factors (past medical history of PPH, multiple pregnancy, polyhydramnios, a large baby, induction or augmentation of labor), uterine atony can also occur unexpectedly, and there is a risk of it during every delivery [12]. The pelvic cavity has a rich collateral vascular anastomosis, horizontally and vertically. The success rate for IIAL is between 40% and 100%, and prevents hysterectomy by 50%. IIAL is reported to be less successful in hysterectomy prevention in cases with uterine atony when compared to other cases of postpartum hemorrhage [13]. It may be caused by the anastomosis of the medial branch of the ovarian artery and the uterine artery. Burchell has examined pelvic hemodynamics after IIAL and reported that pelvic blood flow decreased by 49%, venous pressure dropped to 85% and have led to hemostasis control [14]. In present study, uterine preservation was succeeded in 9 of 16 (56.2%) cases with atony, and it was determined that an additional procedure, ligation of ligamentum proprium ovariae or B-Lynch suture, was needed in the atony group for preservation of uterus.

Uterine rupture was the second pathology of severe postpartum hemorrhage. All ruptures occurred in non-scarred uterus and the mean number of living children was 5.15±2.44 in patients with ruptured uterus, therefore uterus preservation was decided in only one patient. We previously reported the non-scarring uterine ruptures, and found that 95.6% of the non-scarred uterine ruptures occurred in the entry and exit points of the uterine vessels in the lower side corners of the uterus [15].

Table II. Indications for internal iliac artery ligation in 53 patients with severe postpartum hemorrhage.

	n (%)	Number of living children (Mean±SD)	Uterus preservation
Uterine atony	16 (30.2)	2.75±2.52	9
Uterine rupture	13 (24.5)	5.15±2.44	1
Placenta accreta	12 (22.6)	2.08±1.0	5
Transferred cases	12 (22.6)	4.05±3.06	2

Table III. Characteristics and clinical parameters of maternal mortality.

Cases	Age (years)	G, P, L	Shock index	Length of hospital stay (days)	Cause of exitus
1*	42	7, 7, 7	3.75	16	Sepsis+ DIC+ ARF
2**	45	7, 7, 5	1.75	60	Sepsis+ARF
3***	37	13, 13, 13	1.18	1	Massive intra-abdominal hemorrhage, External iliac vein laceration

Note: 1* = Referred to clinic because of intra-abdominal bleeding after caesarean section,
2** = Due to uterine atony hysterectomy was performed at sender previous health center and referred to our clinic because of intra-abdominal bleeding,
3*** = Referred to the clinic because of uterine rupture and massive intra-abdominal hemorrhage,
G, P, L = Gravidity, Parity, Number of living children, DIC = Disseminated intravascular Coagulation, ARF = Acute renal failure

The reason for uterine ruptures to occur frequently in cervico-isthmic area is thought to be due to the thinning of the cervix during delivery having less contractile cells compared to the uterine area [16]. We reported that the non-scarring uterine ruptures happen more frequently, especially on the sidewalls of the cervico-isthmic area because uterine vessels enter the uterus from this region and cause a relative weakness [15]. Vascular structure can be damaged in the uterine ruptures. The open ends of uterine vessels in the rupture areas should be tied. If the open ends of these vessels cannot be located, IIAL should be applied to avoid adnexal or retroperitoneal hematoma.

Abnormal placentation was the third pathology, which required the IIAL for postpartum hemorrhage control in this study. The traditional treatment choice is hysterectomy in abnormal placentation. However, conservative methods have also been described in the recent years. The necessity of IIAL in cases of abnormal placentation has been declared in previous studies in either hysterectomy or preserved uterus cases [3, 8, 14].

Selective angiographic embolization is used as alternative method to IIAL in control of the postpartum hemorrhage. Internal iliac artery embolization is done prophylactically, and is not performed in cases of unexpected or urgent hemorrhage control or during laparotomy. If severe intraoperative bleeding is anticipated, an arterial catheter can be placed before the delivery/operation. Trained personnel and special equipment for the embolization procedure is required [17]. Pelvic embolization is not performed in the clinics where the study was conducted.

Morbidity in PPH is related to the amount of blood loss. Coagulopathy developed in 49.1% of the cases in this study. In case of two patients, transferred to our clinic because of severe PPH, the bleeding was controlled but they died due to morbidities developed on the 16th and 60th postoperative day. A patient transferred from another health center with hypovolemic shock, uterine rupture and massive intra-abdominal hemorrhage, was operated immediately in Center B. External iliac vein was lacerated at the time of entrance to the retroperitoneal area (probably iatrogenically), due to urgent and careless intervention without a clear vision of the hemorrhage area in the ruptured side. Although hemorrhage was controlled in the ruptured area and external iliac vein was repaired immediately, the patient unfortunately died because of hypovolemic shock. Delayed diagnosis and intervention, the insufficient infrastructure of the center may lead to death in patients with severe PPH.

Conclusion

In conclusion, IIAL should be considered in severe PPH unresponsive to other treatment modalities. If, in the antenatal period, patients have risk factors of postpartum hemorrhage, they must be transferred to appropriate centers to prevent a possibly fatal outcome.

In some cases, the uterus can be preserved, and morbidity and mortality can be reduced.

References

1. Khan K, Wojdyla D, Say L, [et al.]. WHO analysis of causes of maternal death: a systematic review. *Lancet.* 2006, 367, 1066-1074.
2. Parker L, Bruner J. Obstetric Problems. In: Te Linde's Operative Gynecology. 9th ed. Ed. Rock J, Jones H. *Lippincott Williams &Wilkins.* 2003, 829-845.
3. Breen J, Neubecker R, Gregori C, Flanklin J. Placenta accreta, increta and percreta. A survey of 40 cases. *Obstet Gynecol.* 1977, 49, 43-47.
4. Porreco R, Stettler R. Surgical remedies for postpartum hemorrhage. *Clin Obstet Gynecol.* 2010, 53, 182-195.
5. Ornan D, White R, Pollak J, Tal M. Pelvic embolization for intractable postpartum hemorrhage: long-term follow-up and implications for fertility. *Obstet Gynecol.* 2003, 102, 904–910.
6. Papp Z, Tóth-Pál E, Papp C, [et al.]. Hypogastric artery ligation for intractable pelvic hemorrhage. *Int J Gynaecol Obstet.* 2006, 92, 27-31.
7. Sagarra M, GlasserS, Stone M. Ligation of the internal iliac vessels in the control of postpartum hemorrhage. A case report. *Obstet Gynecol.* 1960, 15, 698-701.
8. Oyelese Y, Smulian J. Placenta previa, placenta accreta, and vasa previa. *Obstet Gynecol.* 2006, 107, 927–941.
9. Joshi V, Otiv S, Majumder R, [et al.]. Internal iliac artery ligation for arresting postpartum haemorrhage. *BJOG.* 2007, 114, 356-361.
10. Evsen M, Sak M, Ozkul O, [et al.]. Emergency peripartum hysterectomy. *Dicle Medical Journal.* 2009, 36, 23-27.
11. Yalinkaya A, Güzel A, Kangal K. Emergency peripartum hysterectomy: 16-year experience of a medical hospital. *J Chin Med Assoc.* 2010, 73, 360-363.
12. Stones R, Paterson C, Saunders N. Risk factors for major obstetric haemorrhage. *Eur J Obstet Gynecol Reprod Biol.* 1993, 48, 15-18.
13. Iwata A, Murayama Y, Itakura A, [et al.]. Limitations of internal iliac artery ligation for the reduction of intraoperative hemorrhage during cesarean hysterectomy in cases of placenta previa accreta. *J Obstet Gynaecol Res.* 2010, 36, 254-259.
14. Burchell R. Physiology of internal iliac artery ligation. *J Obstet Gynaecol Br Commonw.* 1968, 75, 642–651.
15. Evsen M, Sak M, Bozkurt Y, [et al.]. Uterine rupture: Regional incidence, causes and treatment. *Dicle Medical Journal.* 2008, 35, 260-264.
16. Cunningham F, Gant N, Leveno K, [et al.]. Williams Obstetrics. 21st ed. Philadelphia: *McGraw-Hill,* 2001, 646-652.
17. Ornan D, White R, Pollak J, Tal M. Pelvic embolization for intractable postpartum hemorrhage: long-term follow-up and implications for fertility. *Obstet Gynecol* 2003, 102, 904-910.