

**Hypogastric artery ligation for obstetrical haemorrhage: cohort analysis of a single
surgeon experience**

Running title: Hypogastric artery ligation

**Obstetrik hemorajide hipogastrik arter ligasyonu: tek cerrah deneyiminin kohort
analizi**

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Abstract

Introduction

Hypogastric artery ligation (HAL) is a life-saving procedure for severe postpartum haemorrhage (PPH). It should be performed as fast as possible when needed. In this study, a single surgeon's experience in HAL for controlling PPH was presented.

Methods

Cases in whom HAL performed in emergency setting by the same surgeon in between 2015 and 2018 were included in this retrospective cohort study. The technique of the procedure was the same for all cases. Data were extracted from hospital's records.

Results

A total of 6 patients were included into the analysis. Indications for HAL were as follows: uterine atony in 3 (50%) cases, placenta previa in 2 (33.3%) cases and ablatio placenta in one case (16.7%). There were no intraoperative complication. The success rate of HAL was 83.3%, as one of the 6 patient underwent re-laparotomy. Within a median follow-up time of 13 months, only one patient attempted to conceive and succeeded.

Conclusion

HAL is an effective procedure for the management of PPH. Entering to the retroperitoneum directly over the hypogastric artery may fasten the procedure.

Keywords: hypogastric artery, internal iliac artery, haemorrhage, B-Lynch

Özet

Giriş

Hipogastrik arter ligasyonu, ciddi postpartum kanamada hayat kurtarıcı bir işlemdir. Gerekğinde mümkün olan en hızlı şekilde uygulanmalıdır. Bu çalışmada, tek cerrahın postpartum kanama kontrolünde hipogastrik arter ligasyonu deneyimi sunulmuştur.

Metod

Bu retrospektif kohort çalışmaya, 2015-2018 yılları arası, acil koşullarda aynı cerrah tarafından hipogastrik arter ligasyonu uygulanan hastalar dahil edilmiştir. Tüm vakalarda aynı işlem tekniği uygulanmıştır. Veriler, hastane kayıtlarından elde edilmiştir.

Bulgular

Toplam 6 hasta, analize dahil edilmiştir. Hipogastrik arter ligasyonu endikasyonları şu şekilde olmuştur: 3 vaka (%50) uterin atoni, 2 vaka (%33.3) plasenta previa ve 1 vaka (%16.7) ablasyo plasenta. İntraoperatif komplikasyon bulunmadı. Altı hastadan biri relaparotomiye alındığı için, hipogastrik arter ligasyonun başarı oranı %83.3 olarak bulundu. 13 aylık ortanca takip süresince, sadece bir hasta gebe kalmak istedi ve kaldı.

Sonuç

Hipogastrik arter ligasyonu, postpartum kanama kontrolünde etkili bir yöntemdir. Retroperitona direk hipogastrik arter üzerinden girmek, işlemi hızlandırabilir.

Anahtar kelimeler: hipogastrik arter, internal iliak arter, hemoraji, B-Lynch

Introduction

Postpartum haemorrhage (PPH) has been one of the most common causes of maternal mortality, causing 25% of all deaths [1]. Early suspicion and intervention are crucial in the

management. Otherwise, severe loss of blood may lead to hypovolemic shock and coagulopathy resulting from reduced coagulation factors. Uterine massage and medical therapy with uterotonics have been used as first steps in the management of PPH. When these methods are not adequate to reduce bleeding, surgical techniques should be performed.

To date, various surgical techniques such as compression sutures, uterine artery ligation, use of intrauterine balloon tamponade have been described in PPH [2]. In addition, hypogastric artery ligation (HAL) can be performed in experienced hands to preserve uterus. However, hysterectomy should always be kept in mind as the final option to save the mother's life.

HAL has been shown to decrease pelvic and uterine perfusion up to 80% without affecting fertility [3]. The need for detailed anatomical knowledge and surgical experience are the main obstacles for that procedure is not used more prevalently. As there is a race against time during surgery of PPH, rapid ligation of hypogastric arteries is important.

In this study, we tried to evaluate the clinical outcome of HAL along with other surgical techniques performed by the same surgeon to control PPH.

Material and Methods

This retrospective cohort study was conducted at the Department of Obstetrics and Gynecology of Cerrahpasa School of Medicine, Istanbul University. Patients who underwent HAL between 03/2015 and 05/2018 were retrospectively evaluated. The data including age, gravida-parity, details regarding birth and surgery, gestational week at the time of birth, pre- and postoperative whole blood count parameters, transfused blood components, maternal and neonatal morbidities and mortalities were extracted from patients' medical charts. A total of 19 patients were found. Patients who underwent 'elective' HAL (prophylactic HAL for placenta accreta: n=3) or those cases performed by another surgeon (n=10) were excluded. Finally, six

patients who underwent HAL performed by I.K. in emergency setting were included into analysis.

Intervention for PPH was as follows: Uterine fundal massage was performed to stimulate contractions. As a first line pharmacological therapy, oxytocin up to 60 IU and ergometrine were administered. Bilateral uterine arteries were ligated in all cases. B-Lynch compression suture was placed in 3 cases with uterine atony. Bilateral HAL was performed in all cases.

The technique of HAL was as follows for all of the included cases: The bowels are packaged and the surgical area was cleared off the bowel segments. The peritoneum over the common iliac artery bifurcation down to the anterior surface of the hypogastric artery was incised and enlarged in such a way that a distance between the ureter and the hypogastric artery is kept. The capsular soft tissue surrounding the hypogastric artery was opened. Hypogastric artery was freed and ligated 2-3 cm distal to the origin using two separated absorbable sutures.

The study was approved by the Ethics Committee of Istanbul University Cerrahpasa School of Medicine. The manuscript was prepared in accordance with the STrengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline [4].

Standart descriptive statistics were applied in the analysis. Statistical Package for the Social Sciences (SPSS) version 16.0 (SPSS Inc., Chicago, IL, USA) was used.

Results

Clinical characteristics of the study cohort are presented in Table 1. The mean age of the patients was 31.1 years. Among 6 patients, two were nulliparous and remaining were multiparous. Mean gestational age was 37.3 weeks and mean birth weight of the infants was 2790 grams. Mean preoperative platelet count was 227000. Mean preoperative and postoperative hemoglobin 6 hours after surgery were 11.6 g/dL and 9.3 g/dL, respectively. The

mean duration of surgeries was 69.5 minutes. Almost 3 units of erythrocyte suspension and 3 units of TDP were given to the patients. Only one patient received 3 units of fibrinogen, as it was not available in our hospital at the time surgeries of the remaining 5 patients.

Indications for HAL were uterine atony in 3 (50%) cases, placenta previa in 2 (33.3%) cases and ablatio placenta in one case (16.7%) (Table 2).

There were no intraoperative complications (Table 3). One of the 6 patients went to ICU postoperatively and stayed for 3 days. This patient was underwent a second surgery for a suspicion of a continued bleeding and total hysterectomy was performed. Another patient developed acute renal insufficiency on postoperative 1st day and resolved on the postoperative 3rd day.

Within a median follow-up time of 13 months, only one patient attempted to concieve. She had an ongoing pregnancy at the time of submission of the study.

Discussion

As the leading cause of maternal mortality, PPH is responsible for 35% of maternal deaths [5]. Developing countries experiences higher number of maternal deaths compared to developed countries [6]. PPH-related morbidities and mortality can easily be prevented with medical and surgical interventions. In this study, we showed that HAL along with medical and other surgical steps may be used successfully in the management of PPH.

HAL has been accepted as an effective way of controlling PPH. Burchell [7] showed that HAL reduces pelvic blood flow and pulse pressure by 49% and 85%, respectively. The clinical success rate was reported to be between 40% and 100% [8]. In our cohort, the success rate of HAL was 83.3%, as one of the 6 patient underwent re-laparotomy.

The delay in applying surgical steps when conservative methods have failed is one of the reasons that PPH becomes fatal [9]. The another reason may be the loss of time during

surgical management. When other surgical steps such as uterine artery ligation, compression sutures, uterine balloon tamponade have failed, bilateral HAL should be performed as quickly as possible. Even though time was not counted during HAL in our study, we assume that both hypogastric arteries may be ligated within 5 minutes in experienced hands. Reaching the retroperitoneum may be the main reason of time taking step in HAL. Surgeon can reach retroperitoneal iliac arteries using one of two ways: First, a peritoneum between round ligament and infundibulopelvic ligaments is opened parallel to the infundibulopelvic ligament. After dissection of loose tissue, the vessels and the ureter are seen. Secondly, the anatomy of common iliac artery bifurcation and the course of hypogastric artery are examined over the peritoneum. Afterwards, the peritoneum over the hypogastric artery is cut while observing the ureter. In our points of view, the latter is the easiest and fastest way of reaching hypogastric artery, considering the distance between peritoneum and the hypogastric artery. Even minor bleeding that occur while dissecting the soft tissue may block the clear view of the anatomy, induce panic and cause waste of time in the first method. After the hypogastric artery is reached, the fascia surrounding the artery should be dissected. After the artery is freed, right-angle is passed just under the artery, caring for hypogastric and external iliac veins. Even though some authors suggest that passing the clamp from lateral to medial is safer because of the risk of damage to the external iliac vein, we believe that after dissection of hypogastric artery, it is up to surgeon's preference in emergent conditions. One of the most important point is the posterior branches of the hypogastric artery. A fast palpation of the posterior surface of the arterial part where the clamp will pass may be helpful in avoiding a possible damage to the posterior arterial branches.

The major strength of our study is that all procedures were performed by the same surgeon in the same fashion. The main limitation is its retrospective design and the small number of included patients.

In conclusion, once conventional medical and surgical managements fail, HAL is an effective and safe method in controlling PPH and preserving fertility. We suggest that peritoneum over the hypogastric artery should be used for timely HAL.

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Table 1. Demographic and clinical variables of the patients.

Characteristics	Mean±SD
Age (years)	31.1±4
Gravidity (n)	2.1±0.2
Parity (n)	1.6±0.2
Gestational age (weeks)	37.3±4.1
Birth weight (grams)	2790±923
Preoperative platelet ($\times 10^3$ count)	227±70
Preoperative hemoglobin (g/dL)	11.6±0.9
Postoperative hemoglobin 6 hours after surgery (g/dL)	9.3±0.9
Duration of operation (minutes)	69.5±28.1
Transfusion of erythrocyte suspension (units)	3.1±2.7
Transfusion of TDP suspension (units)	2.9±2
Transfusion of thrombocyte suspension (units)	0.1±0.9
Transfusion of fibrinogen suspension (units)	0.5±2.5

Table 2. Indications for hypogastric artery ligation.

Indications	n (%)
Uterine atony	3 (50)
Placenta previa	2 (33.3)
Ablatio placenta	1 (16.7)

Table 3. Maternal outcome within perioperative period.

	n (%)
Intraoperative complication	0
ICU admission	1 (16.6)
Acute renal insufficiency	1 (16.6)
Death	0