

Bilateral ligation of the anterior trunk of the internal iliac artery in uterine atony secondary to uterine inversion: case report



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Postpartum hemorrhage is one of the leading causes of maternal mortality worldwide. Uterine atony is the main cause, representing up to 90% of cases, and is a risk factor for uterine inversion. Morbidity and mortality occur in 41% of uterine inversion cases, including massive obstetric hemorrhage. Massive obstetric hemorrhage is a medical emergency that puts life and reproductive function at risk, and therefore, its treatment must be timely and immediate. If there is no favorable response with the initial measures, surgical intervention proceeds. When choosing the surgical procedure, priority should be given to the technique with the easiest access and which is the least invasive, the safest, and in which the surgeon has more experience. We present a case report with our technique of bilateral ligation of the anterior trunk of the hypogastric artery, after a uterine compression suture failed, with excellent results and preserved fertility in an adolescent patient. We describe the technique and the result. The response time of the uterus with normal tone was 5 minutes, and postligation bleeding was only 50 mL after the patient had bled 1200 mL without complications; thus, it is an adequate and cost-effective technique. The bilateral ligation of the anterior trunk of the hypogastric artery technique in the case of postpartum hemorrhage is an effective, safe, and fertility-preserving surgical procedure that constitutes an alternative to emergency obstetrical hysterectomy when other, less invasive methods have failed.

Key words: hypogastric artery ligation, obstetrical hemorrhage, uterine atony, uterine inversion

Glossary

BHAL	bilateral hypogastric artery ligation
EOH	emergency obstetric hysterectomy
MOH	massive obstetric hemorrhage
PPH	postpartum hemorrhage
UA	uterine atony

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Introduction

Postpartum hemorrhage (PPH) is defined as blood loss of 500 mL during a vaginal delivery and 1000 mL during a cesarean delivery or any blood loss involving hemodynamic instability that is related to an obstetrical event. It is one of the leading causes of maternal mortality worldwide, accounting for up to 27% of all cases.^{1,2}

Massive obstetric hemorrhage (MOH) occurs when blood loss is >1500 mL and uterine atony (UA) is the leading cause, representing up to 90% of cases.^{3,4} Uterine inversion has an incidence of up to 1 in 1739 cases and is frequently accompanied by PPH and hypovolemic shock. In 85% of cases, it has a benign cause (UA and others), and morbidity and mortality occur in 41% of cases. Treatment is manual or surgical reinversion of the uterus.⁵⁻⁷

MOH is a medical emergency that puts life and reproductive function at risk, and therefore, its treatment must be timely and immediate. If there is no favorable response with the initial measures, surgical intervention should proceed. When choosing the surgical

procedure, priority should be given to the technique that is easier to access, less invasive, safer, and in which the surgeon has more experience. Surgical techniques are definitive or conservative; an emergency obstetric hysterectomy (EOH) is the definitive technique par excellence, although this procedure limits fertility and is associated with surgical complications. Among the conservative techniques, there are currently multiple options, including packing techniques (Bakri balloon) or surgical techniques (compressive sutures such as B-Lynch or bilateral hypogastric artery ligation [BHAL]).^{5,8}

The Hayman compression suture is a simplified modification of the B-Lynch suture. With this technique, hemorrhage control is achieved in around 83% of cases. Complications of uterine compression sutures include pyometra, hematometra, postpartum endometritis, uterine synechiae, intra-abdominal adhesions, uterine rupture in subsequent pregnancies, and necrosis.⁸⁻¹¹

Regarding BHAL, the internal iliac artery originates in the superior inlet of the pelvis, it is 3 to 4 cm long, and it descends behind the posterior

peritoneum, crossing the psoas and piriformis muscles. Posteromedially, it is limited by the hypogastric vein, and laterally, it is limited by the external iliac vein; the ureter is on its internal face. It branches into an anterior and a posterior trunk, with the anterior having 3 parietal branches, namely the inferior gluteal, obturator, and internal pudendal branches, and 6 visceral branches, namely the middle and lower hemorrhoidal, uterine, upper and lower vesical, and vaginal branches. The posterior trunk has 3 parietal branches, namely the superior gluteal, iliolumbar, and lateral sacral branches. These arteries have collateral circulation with anastomoses between them.¹²

The first to perform a BHAL to completely cutoff the pelvic blood supply was Howard Kelly in 1894, however, the blood flow was only decreased by 50% because the collateral circulation provided by the posterior trunk of the internal iliac artery reperfused into the anterior trunk; this can be avoided by ligating only the anterior trunk of the hypogastric or internal iliac artery with a greater decrease in flow with an adequate technique, because only the flow from the ovarian and Sampson arteries remains.^{13,14}

There are cases reported in literature of the efficacy of this technique in other obstetrical procedures as a method to avoid MOH and to preserve the uterus and therefore fertility with good results, including during septic abortion.^{13,14}

There is currently no study reported in literature that describes only the bilateral ligation of the anterior trunk of the hypogastric artery as a therapeutic option in EOH because of uterine inversion with UA when compressive sutures have not been sufficient, and therefore, we want to present the following successful case at our institution.

Case report

A 16-year-old primigravida patient was admitted to the emergency room with a pregnancy diagnosis of 37.6 weeks of gestation based on the date of last menstruation, a pregnant uterus with a viable intrauterine pregnancy and a fetal heart rate of 143 beats per minute, a fetus

situated longitudinally with cephalic presentation, back to the left, the cervix 6 cm dilated, 70% effaced, station +1, intact membranes, mild edema of the extremities, and normal osteotendinous reflexes. An obstetrical ultrasound was performed and showed a pregnancy of 37+0 weeks of gestation with posterior body placenta maturation grade III, an amniotic fluid index of 8.7 cm (5th percentile of 50 for gestational age), a biophysical profile of 8/8, Hadlock of 34.2%, and weight of 3033 grams.

It was decided to continue labor monitoring, and spontaneous rupture of the membranes occurred at 7 cm dilation. Labor progressed over 5 hours and the patient had an effective labor with 4 contractions every 10 minutes that lasted 40 to 45 seconds without the need for uterotonic agents until the patient was moved to the labor room when fully dilated with 100% clearance, a station of +3, and the fetus in left occiput anterior position.

A live newborn was delivered with Apgar scores of 7 and 9, a gestational age of 40 weeks, and a height 48 cm and weight of 2650 grams. Using the Schulz mechanism, the placenta came out with normal characteristics, however, the patient presented with grade III uterine inversion; maneuvers for manual reinversion were performed without success. The patient presented with a total blood loss of 1200 mL and UA despite maneuvers and the use of oxytocin, carbetocin, and misoprostol and presented with persistent uterine inversion. Therefore, it was decided to perform an exploratory laparotomy.

With the patient under general anesthesia and in the surgery room, the uterine inversion was evaluated and the reinversion was successful, however, the UA persisted and, consequently, the PPH. It was decided to place a Hayman hemostatic suture without response, and thus, bilateral ligation of the anterior trunk of the hypogastric artery was performed with immediate recovery of uterine tone and cessation of PPH. The uterus regained tone in approximately 5 minutes, and postligation bleeding was only 50 mL of the total blood loss of 1200 mL (Figures 1 and 2).

During the transoperative period, 2 bags of packed red blood cells were transfused because the gasometry showed a hemoglobin level of 7 g. The patient was transferred to the recovery room and later to the medical intensive care unit. The next day, she was transferred to a hospital room with a normal diet, ambulation, spontaneous uresis, normal peristalsis, and breastfeeding and was discharged on the second day without postoperative complications.

Description of the technique of bilateral ligation of the hypogastric artery in its anterior trunk

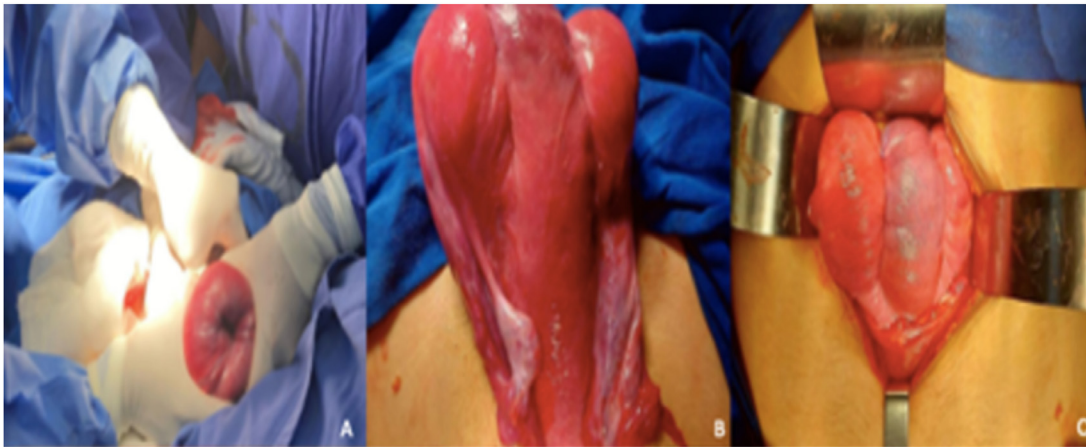
The 3 to 4 cm lateral to the sacral promontory is taken as the initial anatomic reference from where the retroperitoneum is incised until the bifurcation of the common iliac artery is identified. The critical step at this time is the correct identification of the decussation of the ureter above the artery to avoid injury. Once the structures have been identified, the retroperitoneum is dissected parallel to the entire course of the hypogastric artery until its bifurcation in the anterior and posterior trunk is visualized. The anterior trunk is carefully dissected until it is completely freed and ligated with absorbable catgut suture 1-0. Hemostasis is checked and the same procedure is performed contralaterally (Figures 3 and 4).^{12,13}

Discussion

Our patient had 2 known risk factors for developing UA as a teenage mother and also had an accelerated labor. However, up to 61% of patients with UA who require transfusion do not present with any known risk factors.^{1,4,5}

Techniques involving external compression of the uterus with the application of sutures have a success rate of >95%, however, the remaining 5% of cases do not respond to these measures, as was the case with our patient, and that is when the knowledge and mastery of this technique proposed by the gynecologist should have an impact, because ligation of the hypogastric artery before its division into the anterior and posterior branches is not enough, as discussed previously.⁴

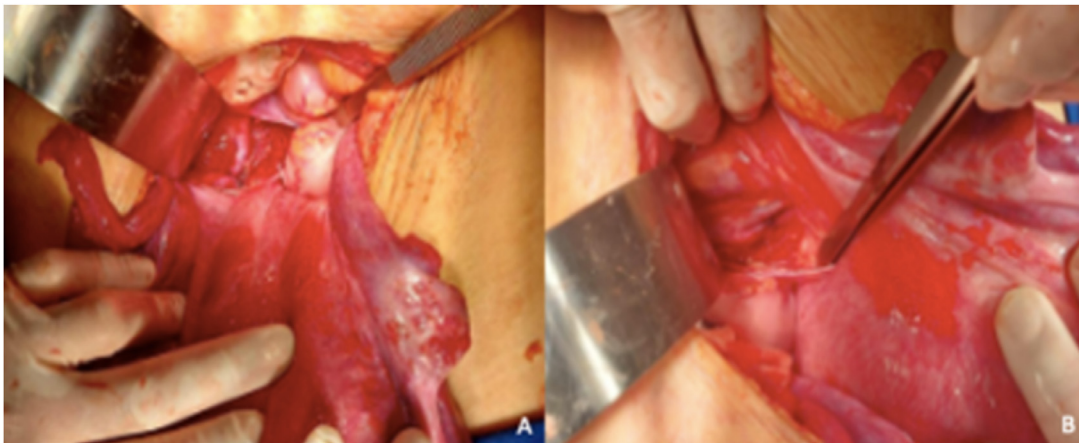
FIGURE 1
Surgical procedure



A, Postpartum uterus with atony and uterine inversion. **B**, Uterus with persistent atony despite the placement of the Hayman-type hemostatic suture. **C**, Uterus with recovered tone immediately after bilateral ligation of the hypogastric artery in its anterior branch.

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FIGURE 2
Opening of the broad ligament to locate the hypogastric artery



A, Left hypogastric artery. **B**, Right hypogastric artery.

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It is worth mentioning that our patient did not need admission to the intensive care unit. Transfer to a hospital room was performed with early promotion of breastfeeding and rapid recovery and hospital discharge 48 hours after surgery.

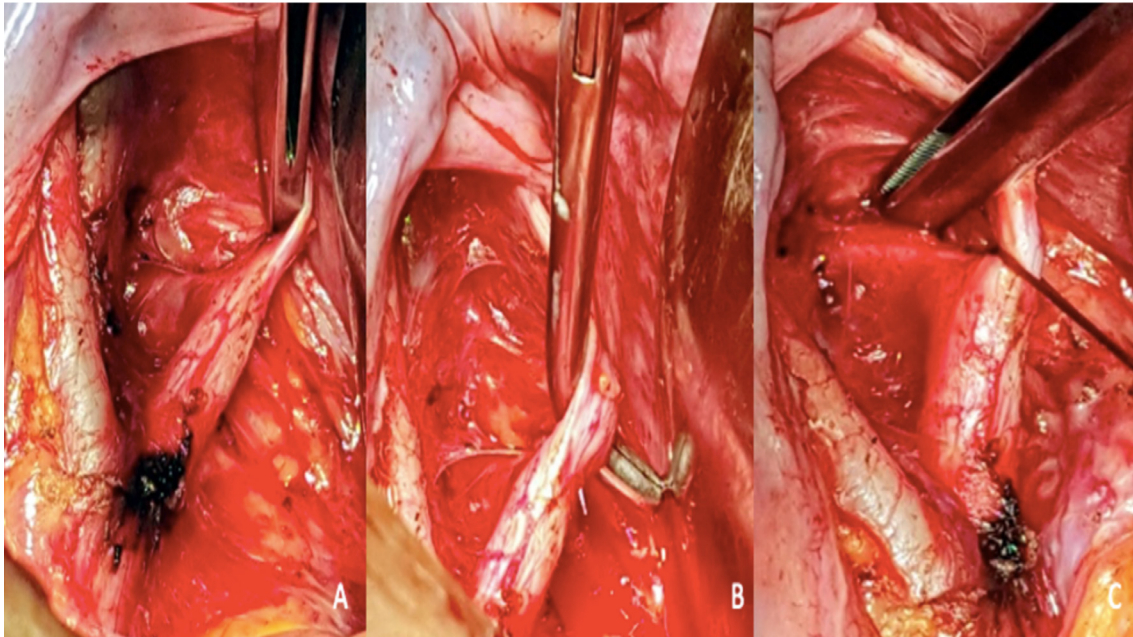
The overall rate of ischemic complications reported during a BHAL is approximately 23%, and this includes gluteal claudication, gluteal necrosis, colonic ischemia, spinal cord ischemia, and bladder necrosis. However, this

occurs when the artery is ligated at its beginning, involving both the anterior and posterior trunks, and it is higher among patients who present with prothrombotic states. In obstetrical patients, this percentage is lower, because they are young patients and the collaterals of the hypogastric arteries may be permeable because of the low incidence of atherosclerotic disease at that age and because elevated estrogen levels can help keep vessels dilated,

which lowers systemic vascular resistance and leads to increased pelvic blood supply. To date, there have been no complications with this technique of ligating only the anterior trunk of the hypogastric artery bilaterally in our patients. In expert hands, this technique saves time, resources, lives, and fertility without complications.^{11,15}

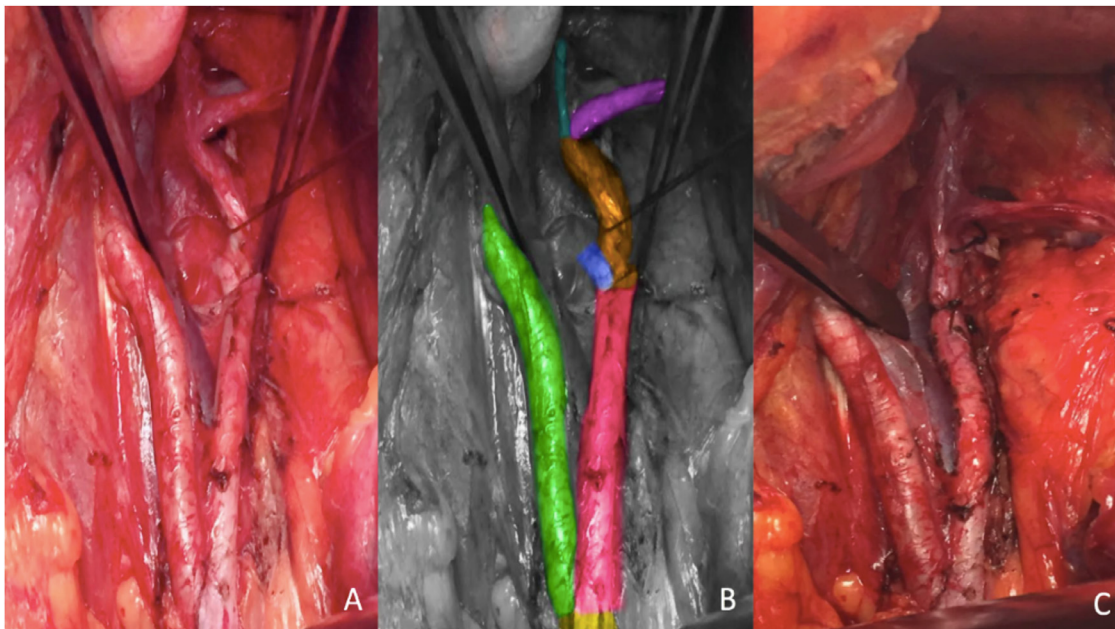
Women with a history of PPH have an up to 15% risk for recurrence in a subsequent pregnancy, however, we do

FIGURE 3
Anterior trunk ligation technique of the left iliac artery



A, Dissection separating the anterior trunk of the hypogastric artery. **B**, Angle clamp lifting the anterior trunk. **B**, Anterior trunk with suture already tied. Millan. Bilateral ligation of the anterior trunk of the iliac artery. *Am J Obstet Gynecol Glob Rep* 2022.

FIGURE 4
Ligation of the anterior trunk of the internal iliac arteries



A, Anterior trunk of hypogastric artery tied with suture. **B**, Color signaling of the pelvic vasculature. *Yellow*, common iliac artery; *green*, external iliac artery; *red*, internal iliac artery; *blue*, posterior trunk of the internal iliac artery; *orange*, anterior trunk of the internal iliac artery; *turquoise*, superior vesical artery; *purple*, uterine artery. **C**, Anterior trunk of the internal iliac artery ligated.

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not yet have experience in performing this procedure twice in a single patient.¹⁶

Conclusion

The bilateral ligation of the anterior trunk of the hypogastric artery technique in the case of PPH is an effective, safe, and fertility-preserving surgical procedure that is an alternative to EOH when other less invasive methods have failed. ■

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