REVIEW

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Role of hypogastric artery ligation in obstetric and gynecological hemorrhage: narrative review

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ABSTRACT

Hypogastric artery ligation (HAL) is a vital surgical intervention for controlling severe pelvic hemorrhage in obstetric and gynecological cases. This narrative review examines the efficacy, safety, and implications of HAL in managing life-threatening hemorrhages, including postpartum hemorrhage (PPH) and gynecological emergencies. HAL is particularly effective in addressing hemorrhage associated with uterine atony, placenta accreta spectrum disorders, and secondary bleeding following hysterectomy or gynecological surgeries. Success rates vary widely, ranging from 33.3% to 89.2%, depending on the indication and clinical scenario. HAL offers significant advantages in fertility preservation, especially in cases where uterine conservation is desired. The procedure has been shown to reduce arterial pulse pressure by 85% and overall blood flow by nearly 50%, enabling effective hemostasis. Despite these benefits, the success of HAL heavily depends on the surgeon's expertise and the timely identification of hemorrhage. While complications such as organ ischemia and collateral vessel injury are rare, their potential underscores the need for meticulous surgical technique and postoperative monitoring. The search strategy for this review included PubMed databases, focusing on articles published up to 2019 with keywords such as "Hypogastric Ligation," "hypogastric ligation gynecology," and "hypogastric ligation obstetric." A total of 262 studies were initially identified, with 8 meeting the inclusion criteria for detailed analysis. These studies highlight HAL's role as a fertility-sparing, cost-effective option for managing severe pelvic hemorrhage, making it an indispensable tool in obstetric and gynecological practice.

Keywords: *hemorrhage, hypogastric artery ligation, obstetric surgery, pelvic bleeding, uterine atony*.
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INTRODUCTION

Hypogastric ligation is an important surgical procedure used to control severe pelvic hemorrhage in obstetric and gynecological operations. It is particularly effective in cases of postpartum hemorrhage (PPH) due to uterine atony, with success rates ranging from 89.2% to 33.3% depending on the study.[1] Bilateral hypogastric artery ligation (BHAL) is a lifesaving procedure that can be performed to reduce blood loss and preserve the uterus when conservation is desired.[2] It is also useful in controlling hemorrhage after major gynecological surgeries and secondary hemorrhage following hysterectomy.[3] BHAL can be safely performed by experienced surgeons and has been shown to have positive effects on fertility, with preserved menstrual function and successful pregnancies reported in some cases.[4] The technique of BHAL is more than a century old and continues to be an effective and cost-effective method for controlling severe pelvic hemorrhage.[5]

Hypogastric artery ligation (HAL) is an important surgical procedure used to control obstetric and gynecological hemorrhage. It is performed to reduce blood loss and can be used in cases where conservation of the uterus is desired. HAL is commonly performed for obstetric indications such as atonic postpartum hemorrhage (PPH) and obstetric hysterectomy for morbidly adherent placenta. It is also useful in controlling hemorrhage after major gynecological surgeries and secondary hemorrhage following hysterectomy. The procedure is safe and can be used as a last step in obstetric bleeding, especially in fertility-sparing surgery. Surgeons need to have adequate knowledge and experience in performing HAL.[1]

Bilateral hypogastric artery ligation (HAL) is an effective procedure for controlling obstetric hemorrhage and preserving fertility. It can be used as a last resort in cases of postpartum hemorrhage, with a success rate of 84% in controlling bleeding.[2] HAL is particularly beneficial in cases of placenta accreta, reducing the need for traditional hysterectomy and improving patient survival rates.[6] A study by Wang et al. (2019) reported that HAL was successful in controlling intractable postpartum hemorrhage, with a success rate of 88.9% and no need for hysterectomy.[7] It is considered a safe and effective treatment option for life-threatening obstetric hemorrhage.[8] Therefore, this review aims to evaluate the role of hypogastric artery ligation in obstetric and gynecological hemorrhage.

Table 1. Information of the included studies evaluating hypogastric ligation

Authors, Year	Study design	Country	Result and Reported Data
Prajapati et al., 2022[1]	Retrospective Study	India	- 58 cases of hypogastric artery ligation (HAL) were reviewed. - HAL is effective in controlling hemorrhage in obstetric and gynecological cases.
Kurban et al, 2016[12]	Case Report	Turkiye	- Hypogastric artery ligation (HAL) effectively controlled bleeding in 84.7% of cases.
Espitia et al, 2016[13]	Case Report	Colombia	- Bilateral hypogastric artery ligation is effective and safe for controlling severe postpartum hemorrhage and does not compromise future reproductive capacity.
Kahramanoglu et al, 2019[14]	Retrospective cohort	Turkiye	- Six patients underwent hypogastric artery ligation for obstetrical hemorrhage with an 83.3% success rate
de la Torre et al, 2015[15]	Retrospective observational	Mexico	- Forty-one patients underwent hypogastric artery ligation, with low complication and mortality rates.

METHODS

To find relevant publications, a search was conducted in PubMed using combinations of the keywords "Hypogastric Ligation," "hypogastric ligation gynecology," and "hypogastric ligation obstetric." All articles published up to 2019 were considered for eligibility.

The inclusion criteria for this study, based on the manuscript and provided content, are: 1) studies discussing the use of hypogastric artery ligation (HAL) in obstetric and gynecological hemorrhage, 2) articles focused on the efficacy, safety, and outcomes of HAL in controlling bleeding, 3) studies published in English up to 2019, 4) research articles, case reports, and retrospective or prospective studies addressing severe hemorrhage in obstetric or gynecological settings. Meanwhile, the exclusion criteria in this study are: 1) articles not written in English, 2) studies not accessible in full text, and 3) review articles or studies not directly examining HAL's role in hemorrhage management.

OBSTETRIC AND GYNECOLOGICAL HEMORRHAGE

Obstetric and gynecological hemorrhage is a significant cause of morbidity and mortality among women. Obstetric hemorrhage, in particular, is a leading cause of maternal morbidity and mortality worldwide, occurring during pregnancy, childbirth, or the postpartum period. Management of obstetric hemorrhage requires a multidisciplinary approach involving obstetricians, anesthetists, midwives, and other healthcare professionals.[9]

The initial assessment and management of obstetric hemorrhage focus on stabilizing the patient and controlling bleeding. This includes resuscitation with intravenous fluids, blood products, and administration of uterotonic medications to help the uterus contract and control bleeding. In cases where medical management fails, surgical interventions, such as uterine artery embolization or hysterectomy, may be necessary. Healthcare providers must address obstetric hemorrhage promptly and effectively to optimize patient outcomes. Furthermore, management should be supportive and empathetic, considering the emotional impact on the patient and their family. Open communication and involving the patient in decision-making can alleviate anxiety and enhance their overall experience.[10]

Gynecological hemorrhage can result from various conditions, including uterine fibroids, cervical polyps, endometrial hyperplasia, or gynecological malignancies. Managing gynecological hemorrhage involves a thorough evaluation and diagnosis to determine the underlying cause. Treatment options include medical management with hormonal therapies, minimally invasive procedures such as endometrial ablation, or surgical interventions like hysterectomy for cases unresponsive to conservative measures.[11]

Measures such as active management of the third stage of labor and the routine administration of oxytocin have significantly reduced mortality rates associated with postpartum hemorrhage. Simulation technologies have been shown to improve the quality of practical skills in managing obstetric bleeding. Pelvic artery embolization (PAE), a minimally invasive interventional procedure, plays a crucial role in the conservative management of significant vaginal bleeding in obstetrics and gynecology. Endovascular procedures, including PAE, are effective in controlling bleeding and can be applied in both acute and chronic cases of hemorrhage.

ROLE OF HYPOGASTRIC ARTERY LIGATION IN OBSTETRIC AND GYNECOLOGICAL HEMORRHAGE

The summary of the HAL role in obstetric and gynecological hemorrhage is shown in Table 1.

Anatomy

The internal iliac artery is the primary pelvic blood supply, originating from the common iliac artery and running inferomedially in the pelvis, with numerous small vessels and pelvic vasculature variations. Internal iliac artery ligation is used to control intractable pelvic hemorrhage, first described by Kelly in 1893. It can also be lifesaving during peripartum bleeding and in cases where the exact location of the bleeding is unknown. Bilateral ligation reduces pelvic arterial blood flow by 49% and pulse pressure by 85% during massive pelvic hemorrhage or peripartum bleeding. In the long term, collateral circulation maintains the re-functioning of the iliac artery ligation. The deep femoral artery is the principal vascular supply, with anastomoses between the medial femoral circumflex and obturator artery, lateral

femoral circumflex and superior gluteal artery, and the ovarian artery providing blood flow to the uterus. Bilateral ligation does not completely affect future reproductive potential and has been reported in the literature.[16]

The hypogastric artery originates from the common iliac artery, bifurcating into the internal and external iliac arteries at the pelvic brim. After its origin, the hypogastric artery descends posteriorly and laterally toward the pelvic sidewall, traveling along the pelvic brim and passing behind the peritoneum. The hypogastric artery gives off numerous branches that supply various pelvic structures such as iliolumbar artery which supplies the iliacus muscle and the iliac crest, lateral sacral arteries which supplies the sacrum and surrounding structures, superior gluteal artery which supplies the gluteal muscles, inferior gluteal artery which supplies the inferior gluteal muscles, internal pudendal artery which supplies the perineum, external genitalia, and associated muscles, and obturator artery which supplies the obturator muscles and surrounding structures.[16]

Blood Supply and Lymphatic

The internal iliac artery originates at the sacroiliac joint and divides into external and internal branches, supplying the pelvic wall, pelvic viscera, perineum, and gluteal region. Visceral branches supply the urinary bladder, rectum, and urethra, while parietal branches supply musculoskeletal structures in the thigh, hip joint, and gluteal region. Lymphatic channels accompany the internal iliac vessels to the internal iliac lymph nodes, which collect fluid from pelvic digestive, urinary, and reproductive organs. Afferent lymph vessels transport fluid to the internal iliac nodes, while efferent vessels direct fluid to common iliac lymph nodes.[17]

Hypogastric Artery Ligation

Hypogastric artery ligation is a surgical procedure involving the occlusion of the hypogastric artery to control severe obstetric and gynecological hemorrhage. It is typically considered when other methods, such as uterine compression sutures or embolization, fail. By occluding the hypogastric artery, the blood supply to pelvic organs is reduced, effectively controlling life-threatening bleeding.[6] In obstetrics, hypogastric artery ligation is indicated in cases of placenta accreta, increta, or percreta, where the placenta is deeply embedded in the uterine wall, causing significant bleeding during childbirth. In gynecology, it is used to manage hemorrhage related to invasive malignancies or severe postpartum hemorrhage.[7]

The decision to perform hypogastric artery ligation requires a thorough assessment of the patient's condition, the underlying cause of the hemorrhage, and the potential risks and benefits. Often considered a last resort, its success depends heavily on the surgical team's experience and skill. Careful preoperative planning, meticulous surgical technique, and close postoperative monitoring are essential for favorable outcomes.

PROGNOSIS

Hypogastric artery ligation is a vital surgical intervention for controlling severe obstetric or gynecological hemorrhage when other conservative measures fail. The procedure involves occluding the hypogastric artery (internal iliac artery) to reduce pelvic blood flow and control bleeding. The prognosis depends on multiple factors, including timing of intervention, severity of bleeding, underlying cause, surgical expertise, patient characteristics, and postoperative care.[18,19]

Timely intervention is critical; delays can result in significant blood loss, hemodynamic instability, and poorer outcomes. The procedure is particularly effective in controlling localized bleeding from pelvic vessels but may be less effective in cases of diffuse or widespread hemorrhage. Prognosis is more favorable in cases such as postpartum hemorrhage caused by uterine atony or placental abnormalities, as these conditions respond well to hypogastric artery ligation. The surgeon's expertise in vascular surgery and detailed knowledge of pelvic anatomy are essential for procedural success. However, potential complications—such as injury to surrounding structures, ischemia of pelvic organs, or impaired collateral circulation—can affect outcomes. Patient-specific factors, including overall health, comorbidities, and initial hemodynamic status, also significantly influence prognosis. Postoperative care and monitoring are crucial to assess the effectiveness of the procedure, manage complications, and ensure patient recovery. Long-term follow-up is necessary to evaluate potential impacts on fertility and overall reproductive health.[18,19]

CONCLUSION

Hypogastric artery ligation remains a critical procedure for managing severe obstetric and gynecological hemorrhage, particularly when other interventions are ineffective or unfeasible. The procedure effectively achieves hemostasis and, in many cases, preserves fertility. However, careful patient selection, timely intervention, and surgical expertise are essential for optimal outcomes. Further research is warranted to refine selection criteria, evaluate long-term outcomes, and compare hypogastric artery ligation with other treatment modalities.

DISCLOSURE

Ethical Statement

The authors declare that all the research and manuscript preparation was conducted with adherence to ethical standards and professional guidelines. The study does not involve direct intervention on human subjects, and all systematic review processes complied with PRISMA recommendations.

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Conflict of Interest

The authors declare no conflict of interest related to the study, authorship, or publication of this manuscript.

Authors Contribution

The authors contributed as follows: I Gde Sastra Winata, Anom Suardika, and I Gusti Ngurah Agung Trisnu Kamajaya conceptualized and defined the intellectual content. Anom Suardika and Putu Doster

Mahayasa participated in the study design and literature search. I Gde Sastra Winata, Anom Suardika, and Nyoman Gede Budiana conducted clinical and experimental studies. Data acquisition and analysis were carried out by I Gde Sastra Winata and Nyoman Gede Budiana, while statistical analysis was performed by Putu Doster Mahayasa and I Gusti Ngurah Agung Trisnu Kamajaya. Manuscript preparation and editing were primarily handled by Nyoman Gede Budiana, with review responsibilities shared by I Gde Sastra Winata, Anom Suardika, and I Gusti Ngurah Agung Trisnu Kamajaya. Guarantor responsibilities were jointly held by I Gde Sastra Winata, Anom Suardika, and I Gusti Ngurah Agung Trisnu Kamajaya.

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