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Case Report

Beyond Standard Bifurcation: Internal Iliac Artery Ligation at the Vaginal Cuff for Hemorrhage Control in Placenta Previa-Accreta Spectrum: A Case Report

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Abstract

Background: Placenta accreta spectrum (PAS) disorders pose a significant risk of life-threatening hemorrhage during delivery. Internal iliac artery (IIA) ligation is a key technique for hemorrhage-control ; however, it relies on standard anatomical landmarks, which may be distorted by prior surgeries or congenital variations. **Case:** A multiparous woman (G5P4) with four prior cesarean deliveries was diagnosed with placenta previa totalis and suspected placenta increta by magnetic resonance imaging (MRI). During a planned cesarean hysterectomy, standard retroperitoneal dissection failed to identify the common iliac artery (CIA) bifurcation due to marked bilateral elongation (right: 12 cm; left: 14 cm). Following meticulous dissection, the bifurcation was identified at the level of the vaginal cuff, and the IIAs were successfully ligated. This modified approach controlled hemorrhage despite 3.3 L of blood loss, and the patient was stabilized postoperatively. **Conclusions:** This case highlights that severe anatomical variations of the iliac arteries can displace the bifurcation to the level of the vaginal cuff. It underscores the importance of intraoperative adaptability and suggests a role for preoperative vascular mapping, such as computed tomography angiography (CTA), in high-risk PAS patients with complex surgical histories to anticipate vascular anomalies and guide operative strategy.

Keywords: placenta accreta spectrum; common iliac artery; internal iliac artery; cesarean hysterectomy; case report

1. Introduction

Placenta accreta spectrum (PAS) management relies on accurate prenatal diagnosis via ultrasound and magnetic resonance imaging (MRI), followed by planned cesarean hysterectomy without placental removal to minimize hemorrhage risk. Optimal care requires a multidisciplinary team, including obstetricians, anesthesiologists, interventional radiologists, and blood bank specialists [1]. Hemorrhage-control strategies include prophylactic internal iliac artery (IIA) ligation, balloon occlusion, and uterotonic agents. Delivery timing at 34–36 weeks balances fetal maturity and maternal risks. Postoperative care requires monitoring in critical care and readiness for transfusion, which remain key components of management [2,3].

Herein, we describe a clinical case of placenta previa-accreta. This case underscores the challenges of retroperitoneal dissection during hysterectomy for PAS, particularly when anatomical distortion delays identification of vascular landmarks. Successful ligation at the vaginal cuff level demonstrates the need for intraoperative adaptability when traditional approaches are not feasible. It further supports the use of advanced preoperative imaging to anticipate vascular anomalies and emphasizes the importance of surgical expertise in managing distorted pelvic anatomy.

Significant anatomical variations of the iliac vessels are rare in routine obstetric surgery, even in severe placenta accreta spectrum (PAS). Although PAS is often associated with neovascularization and adhesions, major arterial landmarks usually remain consistent. This case is notable for its extreme bilateral elongation of the common iliac arteries (CIAs; right: 12 cm; left: 14 cm), with internal iliac bifurcations displaced to the level of the vaginal cuff. To our knowledge, no similar cases of this degree of displacement have been reported. Recognition of such variants preoperatively is crucial, as unexpected intraoperative anatomy can pose major surgical challenges. While variations in iliac vessel anatomy are uncommon in standard obstetric procedures, they pose significant challenges in severe PAS cases. Although PAS usually involves new blood vessel growth and adhesions, the main arterial landmarks are generally stable. This report presents a rare case of marked bilateral elongation of the common iliac arteries, with internal iliac bifurcations displaced downward to the vaginal cuff level, an extraordinary form of vascular displacement. By emphasizing this unusual anomaly, we highlight the importance of thorough preoperative vascular assessment and increased anatomical awareness to reduce the risk of life-threatening bleeding during surgery.

Table 1. Chronological sequence of clinical events in the case.

Date	Phase	Key event/action	Outcome/details
17 Dec 2023	Antenatal Imaging	Obstetric ultrasound: - Placenta previa totalis (covers the internal os). - Thin subplacental hypoechoic zone. - Suspected placenta accreta.	Patient declined a transvaginal scan (TVS). MRI recommended for evaluation.
20 Dec 2023	MRI Confirmation	Pelvis MRI: - Placenta previa totalis with focal bulge consistent with placenta accreta. - Severe myometrial thinning suggestive of placenta increta.	No evidence of bladder invasion or extrauterine extension.
23 Dec 2023	Intraoperative	Delivery: - Breech delivery of a male neonate (2.43 kg; Apgar scores are 3/5/6 in 1/5/10 minutes respectively). - Placenta retained, confirming placenta accreta .	Baby transferred to the neonatal intensive care unit (NICU) due to prematurity.
24 Dec 2023	Postoperative	Plan: - Vital sign and per vaginal (PV) bleeding monitoring. - Enoxaparin prophylaxis. - Intravenous (IV) antibiotics (cefuroxime + metronidazole).	Placental specimen sent for histopathology. Foley catheter kept for 24 hours.

MRI, magnetic resonance imaging; NICU, neonatal intensive care unit; IV, intravenous; TVS, transvaginal scan; PV, per vaginal.

2. Case Presentation

This clinical case report was prepared in accordance with the CARE guidelines. The case presentation scenario is summarized in Table 1.

A 34-week pregnant multiparous woman (G5P4) with four prior cesarean deliveries presented with placenta previa totalis and suspected placenta accreta. The chronological timeline of clinical management from antenatal diagnosis to postoperative care is summarized in Table 1. Given her high-risk profile and MRI findings (Fig. 1) suggestive of placenta increta, a multidisciplinary plan for cesarean hysterectomy was implemented in the context of suspected PAS.

Physical examination revealed placenta previa totalis with complete coverage of the cervical os. MRI confirmed severe myometrial thinning with a focal placental bulge, suggestive of increta. Prenatal laboratory results were unremarkable; intraoperative venous blood gas (VBG) showed a hemoglobin level of 9.2 g/dL. Ultrasound, limited by gestational age, raised suspicion for accreta, subsequently corroborated by MRI (Fig. 1), which excluded percreta, with no evidence of bladder invasion. Key challenges included the inability to perform a transvaginal ultrasound due to patient refusal and distorted pelvic anatomy, which complicated retroperitoneal dissection.

The procedure was performed under general anesthesia. A vertical midline incision was extended above the umbilicus, providing access to the peritoneal cavity without adhesions. A classical uterine incision was then made to deliver a breech-presenting male neonate, who was transferred to the neonatal intensive care unit (NICU) due to prematurity. Following delivery, the uterine incision was closed in a single layer. The hysterectomy was then initiated with elevation and traction of the uterus, followed by bladder dissection and sequential ligation of the round and infundibulopelvic ligaments. The uterine arteries and adjacent vessels were skeletonized and secured.

During this stage, an acute life-threatening hemorrhage occurred (3.3 L), necessitating an emergency rescue ligation of the internal iliac arteries rather than a prophylactic approach. Identification of the bifurcation was severely complicated by anatomical distortion from prior cesarean deliveries and extensive placental invasion. Abnormally elongated CIAs (right: 12 cm; left: 14 cm) were identified Fig. 2 and Fig. 3, prompting immediate adaptation of the surgical strategy. Meticulous downward dissection was performed, culminating in bilateral ligation of the IIAs at the level of the vaginal cuff using 2-0 silk sutures. Immediately following distal ligation, a marked and visible reduction in arterial bleeding was observed, allowing for the stabilization of the surgical field. Total hysterectomy was then completed with closure of the vaginal cuff. Hemostasis was reinforced with figure-of-eight sutures at the angles, and the absence of bladder injury was confirmed via methylene blue instillation. Absorbable hemostatic agents were applied, and a pelvic drain was placed. The fascial layer was closed with looped 1-0 polydioxanone suture (PDS), followed by subcutaneous and skin approximation. The patient remained hemodynamically stable postoperatively following transfusion of 3 units of packed red blood cells (PRBCs).

The severity of the hemorrhage was reflected in the patient's physiological status, with a nadir blood pressure of 74/38 mmHg and a peak heart rate of 138 beats per

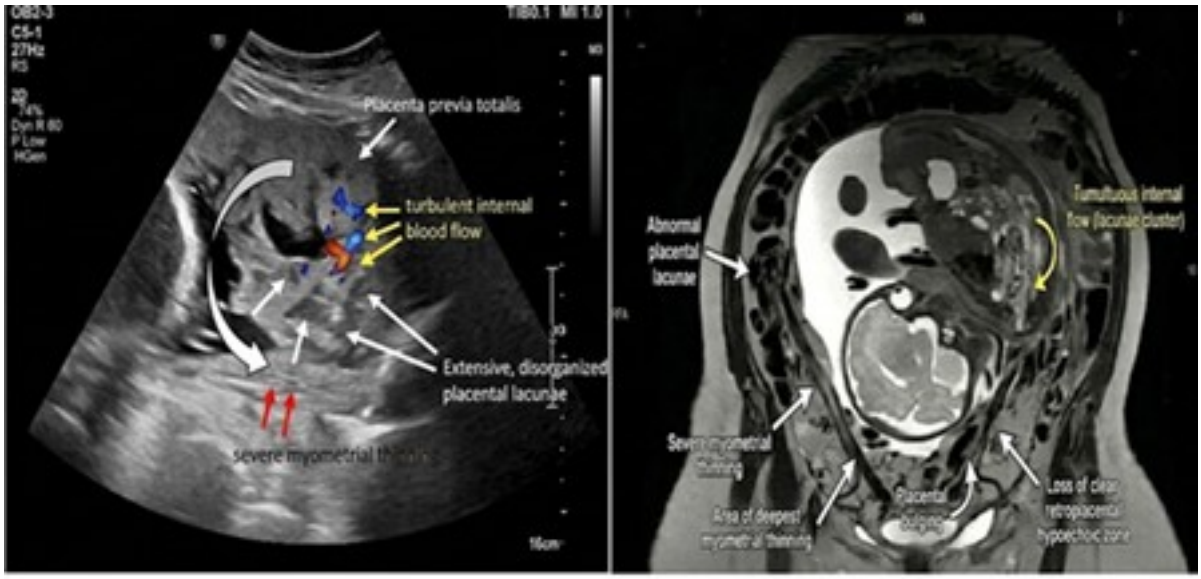

Figure 1A (US) Figure 1B (MRI)

Fig. 1. Prenatal imaging findings suggestive of placenta accreta. **(**A) Color Doppler ultrasound demonstrating placental lacunae and turbulent flow. (B) T2-weighted MRI confirming severe myometrial thinning and placental bulging. MRI, magnetic resonance imaging.

minute. Intraoperative arterial blood gases (ABG) analysis confirmed metabolic stress (pH: 7.28, lactate: 4.2 mmol/L). Hemodynamic stability was restored only after successful rescue ligation of the IIAs and administration of 3 units of PRBCs and hemostatic adjuncts, with blood pressure returning to 110/65 mmHg prior to skin closure.

Postoperatively, the patient was stabilized under continuous monitoring. A 6-hour postoperative complete blood count (CBC), reflecting an intraoperative hemoglobin of 9.2 g/dL, guided administration of an additional 3 units of fresh-frozen plasma and 3 units of cryoprecipitate. A standard protocol was followed, including enoxaparin thromboprophylaxis initiated at 12 hours, intravenous (IV) antibiotics continued for 24 hours, Foley catheter removal after 24 hours, and diet advancement as tolerated. The patient was discharged on postoperative day 3 following an uneventful recovery. The hysterectomy specimen was submitted for histopathological examination, which confirmed the diagnosis of PAS. The successful outcome underscored the importance of adaptive surgical techniques and multidisciplinary coordination in managing complex pelvic anatomy and hemorrhage risk.

The patient's immediate postoperative course was stable, and she was discharged on postoperative day 3. Given residence in a remote area with limited access to tertiary care, she attended a single in-person follow-up visit at 2 weeks for assessment of the surgical wound healing and clinical recovery. The incision had healed by primary intention, and she reported no pelvic pain or neurological symptoms. Subsequent follow-up was conducted via telecommunication at 6 weeks, during which she confirmed a full return to daily activities with no delayed complications.

3. Discussion

Prophylactic management of severe postpartum hemorrhage in high-risk PAS cases includes either hypogastric artery balloon occlusion or surgical ligation. Balloon occlusion offers a temporary, reversible alternative; with studies reporting inconsistent reductions in total blood loss compared with more invasive approaches [4,5,6,7,8]. In contrast, bilateral IIA ligation is a definitive surgical intervention that significantly reduces distal pulse pressure by 77–85%, thereby facilitating rapid clot formation without causing ischemic injury due to the presence of immediate collateral circulation [9]. While ligation is typically performed 3–4 cm distal to the bifurcation, anatomical anomalies, such as markedly elongated CIAs exceeding 10 cm, can displace vascular landmarks to the level of the vaginal cuff. Successful outcomes for both techniques depend on a multidisciplinary strategy and meticulous retroperitoneal dissection. However, ligation remains a cornerstone for hemorrhage control when conservative measures fail, provided that surgical technique is adapted to significant anatomical variation encountered in complex pelvic surgery.

The primary surgical risk in cases of extreme CIA elongation is iatrogenic ligation of the external iliac artery or ureteric injury due to displacement along the anomalous vascular course. When standard landmarks at the lumbosacral prominence fail to reveal a bifurcation, ligation of the first visible large-caliber vessel should be avoided. Instead, meticulous caudal retroperitoneal dissection toward the vaginal cuff is mandatory to definitively identify the origin of the IIA. This "distal-first" identification strategy ensures effective hemostasis while preserving lower limb perfusion.

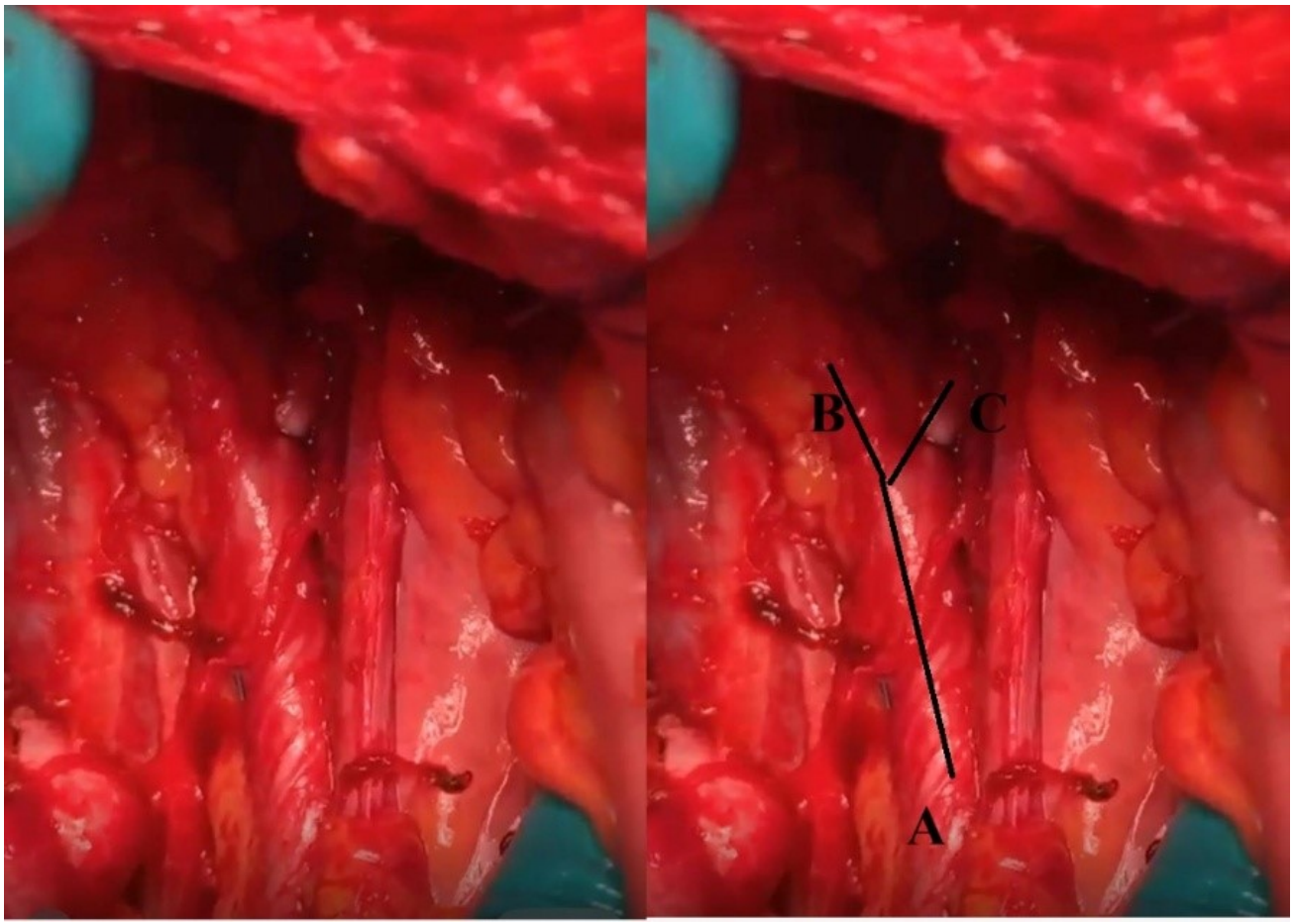

Fig. 2. Intraoperative anatomy and ligation of elongated iliac vessels. (A) Left common iliac artery (CIA; ~14 cm), (B) left external iliac artery, and (C) left IIA ligated. CIA, common iliac artery; IIA, internal iliac artery.

In this report, "vaginal cuff-level ligation" is defined as surgical occlusion of the IIA at its point of origin from the CIA, located at the horizontal plane of the vaginal vault (the cephalad limit of the vagina post-hysterectomy). Anatomically, this represents an extreme caudal displacement of the iliac bifurcation from the standard L5-S1 level to the deep pelvic space. This descriptor alerts surgeons that, in cases of extreme arterial elongation, the functional landmark for devascularization shifts from the pelvic brim to the level of the vaginal cuff.

Koziej M et al. [10] meta-analysis (n = 5785) reports a mean CIA length of 5.59 mm, with anomalies rarely exceeding 7.5 cm. In contrast, the present case featured bilateral CIA elongation (>10 cm), far exceeding the reported range and necessitating dissection of the vaginal cuff for identification of the bifurcation, a deviation from typical L4-level origins. This underscores the variability of CIA anatomy and its surgical implications. While Koziej M et al. [10] highlight the value of standardized anatomic data to reduce operative risk, our case exemplifies how extreme outliers require intraoperative adaptability, reinforcing the need for preoperative vascular mapping in high-risk pelvic surgery to anticipate rare vascular variations.

A case series by El-Agwany AS [11] highlights rare CIA anomalies encountered during gynecologic surgery. Case 1 described a rare bilateral absence of CIAs, with the IIAs arising directly from the aortic bifurcation. These IIAs were unusually elongated (≈10 cm) and similar in caliber to the external iliac arteries, a variation attributed to embryonic regression of the proximal segments of the umbilical arteries. The anatomical anomaly complicated retroperitoneal dissection, as standard iliac bifurcation landmarks were absent. A conservative surgical approach was employed to preserve fertility, consisting of bilateral internal iliac (hypogastric) artery ligation and transverse compression sutures, which successfully controlled hemorrhage without hysterectomy. Case 2 demonstrated bilateral kinked and looped external iliac arteries. Case 3 featured non-bifurcating CIAs, which descended into the pelvis to supply pelvic branches before continuing as external iliac arteries. These variations, including absent or short CIAs, looping external iliac arteries, and altered bifurcation patterns, underscore the anatomic diversity of the pelvic vasculature. Such anomalies warrant meticulous retroperitoneal dissection and vascular identification during pelvic procedures, emphasizing the importance of preoperative aware-

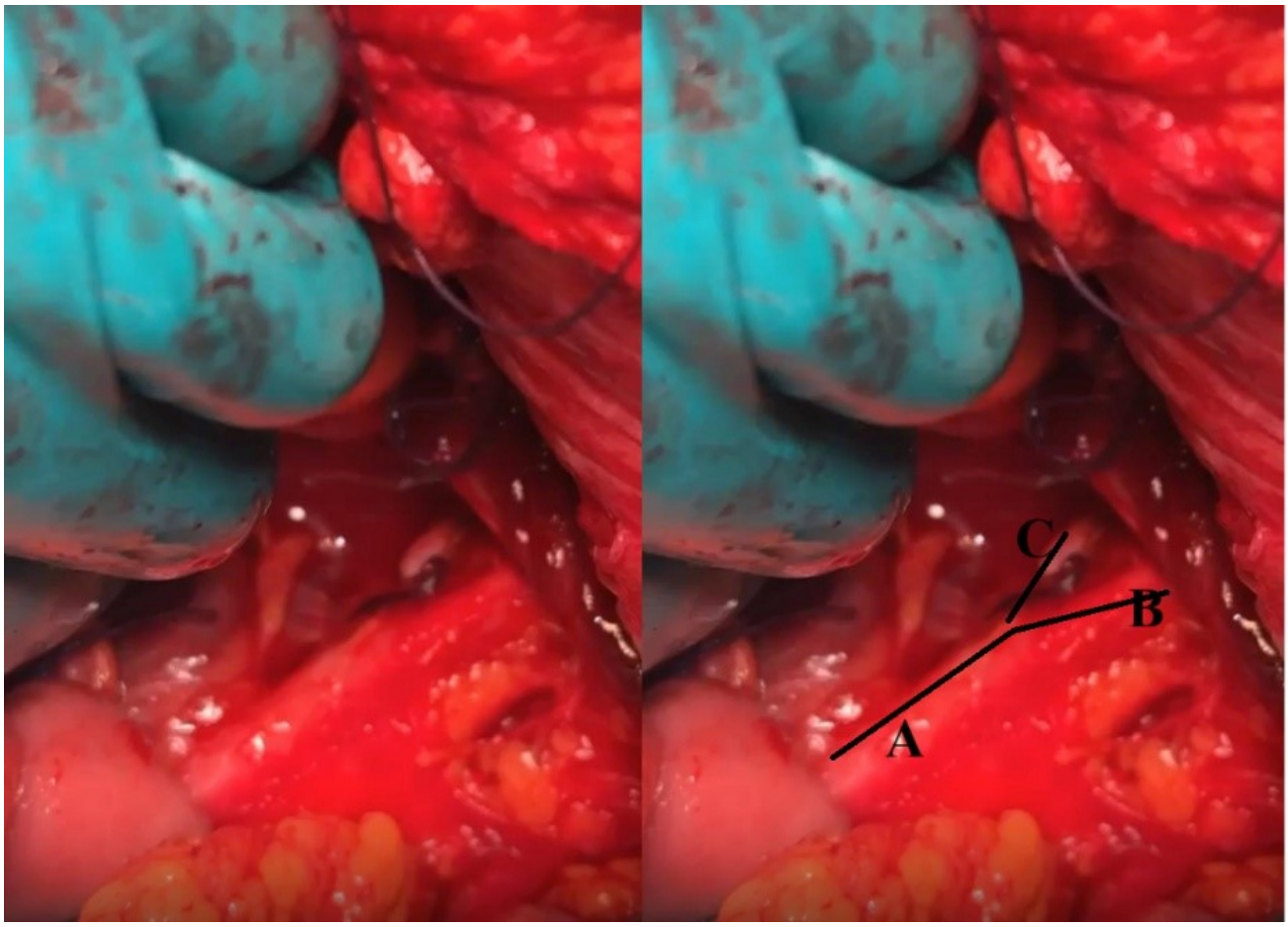

Fig. 3. Intraoperative right iliac vessel anatomy and internal iliac artery ligation. (A) Right CIA (~12 cm), (B) right external iliac artery, and (C) right IIA ligation. CIA, common iliac artery; IIA, internal iliac artery.

ness to mitigate iatrogenic injury and optimize surgical outcomes.

Regarding the specific vascular anomalies identified intraoperatively, the literature suggests that the lengths of the CIA and the IIA are usually inversely proportional. Bergman RA et al. [12] and Hadley G [13] reported that the IIA typically measures 3–4 cm but may be significantly longer when the CIA is short. The present case is unique for the opposite and rarer extreme configuration: markedly elongated CIAs that displaced the bifurcation landmark well below the standard L4–L5 level.

While Naveen NS et al. [14] have documented morphological variations in IIA branching patterns in large cohort studies, these were primarily observed at the level of the superior edge of the greater sciatic notch. In contrast, the present finding of a bifurcation displaced to the level of the vaginal cuff represents a substantially more distal displacement than previously reported. Furthermore, while Mansfield and Howard [15] described a complete congenital absence of the CIA, the present case provides a rare intraoperative example of extreme CIA elongation, emphasizing the need for deep retroperitoneal exploration into the pelvis when standard anatomical landmarks are not identifiable.

Panagouli E et al. [16], in a cadaver study (n = 76), reported mean CIA lengths of 6.12 cm (left) and 6.03 cm (right), with variability linked to torso height. In contrast, the present case demonstrated bilateral CIA elongation (>10 cm), far exceeding these averages, highlighting extreme anatomic deviation. While their findings emphasize CIA variability, our case illustrates how such extremes can critically alter surgical landmarks (e.g., bifurcation at vaginal cuff), thereby complicating retroperitoneal dissection. These observations reinforce Panagouli E et al.'s recommendation for preoperative vascular awareness, particularly in high-risk cases, to anticipate rare anatomical anomalies and optimize surgical safety.

Limitations

This case report is limited by the lack of postoperative vascular imaging, such as computed tomography angiography (CTA) or magnetic resonance angiography (MRA), to confirm the anatomical variant, relying instead on retrospective review of preoperative MRI. The patient declined additional imaging after recovery. Extensive pelvic distortion from prior surgeries and placental invasion may have hindered preoperative identification of anatomical land-

marks. Nevertheless, the diagnosis was supported by detailed intraoperative measurements and narrated surgical video documentation.

Implications for surgical practice: This case underscores the need for preoperative vascular mapping via computed tomography (CT) angiography in suspected PAS to identify elongated iliac vessels. Recognition of such anatomical variations preoperatively allows surgeons to anticipate the distal bifurcation level, thereby preventing intraoperative delays. This proactive approach converts unexpected intraoperative findings into planned adaptive surgical strategies, enhancing safety and educational value in complex pelvic dissections.

To improve preoperative detection of rare vascular variants, clinicians should consider advanced imaging modalities like color Doppler ultrasound or MRI angiography, which identify elongated iliac vessels and atypical bifurcation patterns without radiation exposure. Incorporating these into the evaluation of high-risk PAS cases may improve surgical planning and reduce unexpected intraoperative findings.

Ultimately, although advanced imaging like MRA may provide a preoperative roadmap, the rarity and congenital unpredictability of CIA elongation limit its predictive certainty. Surgeons should maintain a high index of suspicion and rely on direct retroperitoneal exploration to confirm vascular anatomy rather than relying solely on standard radiological landmarks, which may be distorted by the placental mass in PAS.

4. Conclusions

This case highlights the importance of recognizing major vascular anomalies during PAS surgery when standard anatomical landmarks are obscured. Warning signs include the absence of a palpable arterial bifurcation at the pelvic brim, the presence of a single large-caliber trunk extending into the mid-pelvis, and excessive retroperitoneal tortuosity. If present, careful caudal dissection toward the vaginal cuff is essential to identify the origin of the IIA and avoid vascular injury.

Availability of Data and Materials

All data in this manuscript are available from the corresponding author upon reasonable request, subject to patient privacy considerations.

Author Contributions

KA and EA designed the research study, performed the surgical procedures and data collection, and drafted the initial manuscript. ASAH analyzed the clinical data, provided expert anatomical and surgical consultation, and performed the literature review. All authors contributed to the critical revision of the manuscript for important intellectual content. All authors read and approved the final manuscript. All authors have participated sufficiently in the work to take public responsibility for the content and have agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

This case report was conducted in accordance with the ethical principles set forth in the Declaration of Helsinki. Consistent with the policy of our institution, formal Institutional Review Board (IRB) approval is not required for a single case report. Written informed consent was obtained from the patient for the publication of this case report and any accompanying clinical images.

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Conflicts of Interest

The authors declare no conflicts of interest.

Supplementary Material

Supplementary material associated with this article can be found, in the online version, at https://doi.org/10.31083/CEOG52608.

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