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Peripartum Hysterectomy for Uncontrolled Obstetric Hemorrhage Under Predominantly Emergency Conditions: A 10-Year Single-Center Experience (2015–2025)

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What is known on this subject?

Peripartum/postpartum hysterectomy is a rare but life-saving last-resort intervention for uncontrolled obstetric hemorrhage and is associated with substantial maternal morbidity; worldwide, uterine atony and placenta accreta spectrum (PAS) are the leading indications, and the burden of PAS has increased in parallel with rising cesarean delivery rates, with outcomes and complication profiles strongly shaped by whether PAS is managed in a planned multidisciplinary setting or under urgent/emergent conditions despite stepwise hemorrhage protocols (uterotonics, tranexamic acid, tamponade, and devascularization techniques) and frequent need for intensive care.

What this study adds?

This 10 year single-center series quantifies hemorrhage-related peripartum/postpartum hysterectomy in a setting where PAS is encountered almost exclusively under urgent/emergent conditions, describes real-world stepwise hemorrhage management and perioperative resource use (including transfusion and intensive care unit admission), and clarifies that fetal losses recorded in the atony category reflected intrauterine fetal demise present prior to delivery rather than a direct fetal effect of uterine atony.

ABSTRACT

Introduction: Peripartum/postpartum hysterectomy is a rare but life-saving intervention for uncontrolled obstetric hemorrhage. Placenta accreta spectrum (PAS) and uterine atony are the most common indications; yet their clinical context and operative pathways may differ, particularly in centers where PAS is managed under urgent or emergent conditions. We evaluated indications, surgical management, and outcomes over a 10-year period and explored differences between uterine atony–related and PAS-related cases.

Material and Methods: This retrospective, single-center study included women who underwent peripartum or postpartum hysterectomy for uncontrolled obstetric hemorrhage between January 2015 and June 2025. Cases were classified as uterine atony or PAS/placenta previa–related hemorrhage based on operative findings, clinical course, and pathology. Continuous variables were summarized as median [interquartile range (IQR)] and compared using the Mann–Whitney U test; categorical variables were compared using Fisher's exact test. Effect estimates with 95% confidence intervals (bootstrap for continuous variables) are provided in the tables; comparisons were exploratory.

Results: Among 31,571 deliveries, 34 hemorrhage-related peripartum/postpartum hysterectomies were identified (incidence: 1.1 per 1,000 deliveries): 18 for uterine atony (52.9%) and 16 for PAS-related

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hemorrhage (47.1%). All PAS cases met an a priori definition of urgent or emergent. Transfusion requirements were higher in the uterine atony group than in the PAS group, with median packed red blood cells (PRBCs) of 4 (3-6) vs. 2 (0.8-3.2) units (p=0.003), and median fresh frozen plasma of 2 (2-4) vs. 1 (0-2.2) units (p=0.020). Intensive care unit (ICU) admission occurred in 66.7% of uterine atony cases and in 43.8% of PAS cases (p=0.300).Overall ICU length of stay (including 0.0 days for non-admitted patients) was 1.0 (0.0–2.0) days vs. 0.0 (0.0–1.0) days (p=0.048). Median hospital stay was 6.5 (5.0–11.0) vs. 5.5 (4.0-7.0) days (p=0.265). One maternal death occurred in the uterine atony group; none occurred in the PAS group.

Conclusion: Hemorrhage-related peripartum/postpartum hysterectomy was rare but associated with substantial maternal morbidity. PAS cases were managed predominantly in urgent or emergent conditions. Exploratory comparisons suggested a greater transfusion burden and longer ICU stays among uterine atony cases, underscoring institutional preparedness, timely escalation, and multidisciplinary hemorrhage management.

Keywords: Peripartum hysterectomy, postpartum hemorrhage, placenta accreta spectrum, uterine atony, emergency obstetric care

Introduction

Postpartum hysterectomy remains one of the most dramatic yet life-saving interventions in obstetric practice, representing the final step in the management of uncontrollable obstetric hemorrhage (1). Postpartum hemorrhage continues to be a leading contributor to maternal morbidity and mortality worldwide, and timely escalation from medical and conservative measures to definitive surgical control is critical when bleeding persists (1,2,3,4).

Placenta accreta spectrum (PAS) and uterine atony are consistently reported as the two most common indications for peripartum hysterectomy (1). The global increase in cesarean delivery rates has been accompanied by a substantial rise in PAS, which is associated with massive hemorrhage, technical surgical complexity, and high rates of maternal morbidity (5,6,7). Uterine atony, defined by inadequate uterine contraction after delivery, remains the leading cause of postpartum hemorrhage and can rapidly progress to hemorrhagic shock and coagulopathy when unresponsive to uterotonics and conservative surgical techniques (1,2).

Although both etiologies can culminate in hysterectomy, their clinical contexts and operative pathways often differ. In many settings, PAS is increasingly managed through planned, multidisciplinary care in appropriately resourced centers, and the commonly accepted surgical approach is cesarean hysterectomy with the placenta left in situ to avoid catastrophic bleeding (3,6). However, this model is not universally available. In institutions without dedicated perinatology services or structured referral pathways, suspected or unrecognized PAS may present as an emergency, and hysterectomy may be performed under urgent conditions (8). Conversely, atonic hemorrhage typically occurs unexpectedly and demands rapid resuscitation and stepwise escalation (9). Importantly, adverse fetal outcomes observed among cases requiring hysterectomy for uterine atony may reflect the severity of the underlying obstetric condition at presentation [e.g., intrauterine fetal demise (IUFD) or placental abruption] rather than a direct fetal effect of uterine atony.

In Türkiye, published data on postpartum hysterectomy remain limited, and longer-term single-center experiences may provide valuable insight into institutional case-mix, emergency surgical decision-making, and maternal outcomes over time (10).

Therefore, this study aimed to evaluate the indications, surgical management, and outcomes of peripartum/postpartum hysterectomy casesat our institution between 2015 and 2025 and to provide an exploratory comparison of hysterectomy cases for PAS-related hemorrhage and for uterine atony-related hemorrhage, examining differences in operative course, transfusion burden, intensive care unit (ICU) utilization, and maternal morbidity (without implying etiologic equivalence).

Material and Methods

This study was a retrospective, descriptive, single-center analysis conducted in the Clinic of Obstetrics and Gynecology at the University of Gaziosmanpaşa Training and Research Hospital. Archival delivery records were reviewed for the period between January 1, 2015, and June 30, 2025. During this interval, 31,571 deliveries occurred at our institution, and all cases that underwent peripartum/postpartum hysterectomy were retrospectively identified and evaluated.

Ethical Approval

The study was approved by the Clinical Research Ethics Committee of Gaziosmanpaşa Training and Research Hospital (approval number: 147; date: 15.10.2025). Because of the retrospective design of the study, individual informed consent was waived. All data were anonymized in accordance with the Declaration of Helsinki.

Study Population

Women aged ≥18 years who underwent hysterectomy due to uncontrolled obstetric hemorrhage occurring during delivery or in the postpartum period were included. Hysterectomies performed for non-obstetric indications (e.g., benign gynecologic disease or malignancy) and cases with incomplete clinical records were excluded. A small number of hysterectomies performed after vaginal delivery were included and evaluated together with cases following cesarean delivery because the focus of the study was hemorrhage-related hysterectomy regardless of delivery mode.

Case Classification and Clinical Context

Eligible cases were classified into two etiologic groups based on operative notes, clinical course, and pathology reports when available:

1. Uterine atony: Persistent postpartum hemorrhage attributed to inadequate uterine tone and refractory to medical therapy and stepwise conservative surgical interventions.

2. PAS/placenta previa–related hemorrhage: Hysterectomy performed for hemorrhage in the setting of placenta previa and/or suspected PAS intraoperatively and/or confirmed by pathology (accreta, increta, percreta).

In this study, PAS cases were classified as "urgent/emergent" when hysterectomy was performed in a non-elective, unscheduled setting due to an acute obstetric indication, including one or more of the following: (i) unplanned presentation to our unit (transfer-in or direct admission without a scheduled operative plan), (ii) active vaginal bleeding or ongoing hemorrhage, (iii) labor or membrane rupture prompting an urgent delivery, (iv) maternal hemodynamic instability or need for immediate resuscitation, or (v) an emergent indication for cesarean delivery (e.g., fetal distress). Because our institution does not have an in-house perinatology service and does not operate a dedicated PAS program or a structured referral pathway for planned multidisciplinary PAS care, scheduled elective cesarean hysterectomies were not performed during the study period. Accordingly, all PAS hysterectomies included in the analytic cohort met the above urgent/emergent definition.

Neonatal outcomes were recorded where applicable. Stillbirth events were interpreted in their clinical context. In this cohort, stillbirth reflected IUFD that was present prior to delivery at admission or prior to the onset of delivery)rather than fetal compromise attributable to uterine atony itself.

A single non-hemorrhagic postpartum hysterectomy case, related to mechanical ileus secondary to inadequate uterine involution, was documented as an additional clinical observation and not included in the hemorrhage-focused analytic cohort.

Data Collection and Outcomes

Data were obtained through a detailed review of patient files, operative reports, laboratory results, discharge summaries, and pathology reports. The following variables were recorded: maternal age; parity; body mass index (BMI); number of previous cesarean deliveries; gestational age; indication for delivery; mode of delivery; type of hysterectomy (total or subtotal); hemostatic techniques (e.g., uterine artery ligation; internal iliac/hypogastric artery ligation; compression sutures; intrauterine balloon tamponade); transfusion requirements [packed red blood cells (PRBCs), fresh frozen plasma (FFP), and platelet suspension]; need for admission to the ICU; length of hospital stay; postoperative complications; and maternal mortality. Postoperative complications were graded according to the Clavien-Dindo classification (10). ICU length of stay is recorded in the electronic record for all patients; non-admitted patients are coded as 0.0 days. Therefore, ICU admission (yes/no) and ICU length of stay were analyzed and reported separately, and length of stay among ICU-admitted patients was additionally summarized. ICU admission was defined as transfer to the ICU for postoperative management due to clinical instability or the need for advanced monitoring/support, including hemodynamic instability or vasopressor requirement; massive transfusion/ongoing resuscitation; invasive hemodynamic monitoring; ventilatory/respiratory support; persistent coagulopathy [e.g., disseminated intravascular coagulation (DIC)]; or other organ dysfunction requiring ICU-level care.

All collected data were entered into an anonymized electronic database by the investigators. Data quality control was performed through verification sampling by two independent researchers. ICU-related variables were cross-checked for internal consistency, and ICU admission was defined a priori as described above.

Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 29.0 (IBM Corp., Armonk, NY, USA). The normality of continuous variables was assessed by the Shapiro–Wilk test and by visual inspection of the distributions. If the Shapiro–Wilk test yielded $p<0.05$ or visual inspection suggested non-normality, non-parametric methods were preferred. Given the small sample size and skewed distributions for key outcomes, continuous variables are reported as median [interquartile range (IQR)] and compared using the Mann–Whitney U test. Categorical variables are presented as n (%) and compared using Fisher's exact test. Effect estimates are reported as median differences (atony-PAS)

with 95% confidence intervals (CIs) obtained via bootstrap resampling (20,000 resamples) for continuous variables, and as odds ratios with 95% CI for categorical variables. Two-sided p values are reported for exploratory comparisons. Available-case analysis was used for variables with missing values. Given the retrospective design and limited sample size, the findings were interpreted cautiously.

Results

During the study period (January 2015-June 2025), a total of 31,571 deliveries were performed at our institution. Within the hemorrhage-focused analytical cohort, 34 patients underwent peripartum or postpartum hysterectomy due to uncontrolled obstetric hemorrhage, corresponding to an incidence of 1.1 per 1,000 deliveries.

The etiologic categories of hemorrhage-related hysterectomy were uterine atony (n=18, 52.9%) and PAS or placenta previa-related hemorrhage (n=16, 47.1%). No hysterectomies performed for non-obstetric gynecologic indications (e.g., benign disease or malignancy) were included in the analytic cohort.

Demographic and Obstetric Characteristics

Maternal demographic and obstetric characteristics are summarized in Table 1.

In the uterine atony group, the median maternal age was 33.0 (29.2-37.8) years, and the median BMI was 27.5 (26.0-28.0) kg/m^2. The Median gestational age at delivery was 38.0 (35.5-39.0) weeks. The median parity was 3.0 (1.2-4.0), and the median number of previous cesarean deliveries was 2.0 (0.0-3.0). In 94.4% of cases, delivery was by cesarean section.

In the PAS group, median maternal age was 31.0 (28.0-38.0) years and median BMI was 27.5 (26.0-28.0) kg/m^2. Median gestational age at delivery was 36.5 (34.0-37.2) weeks. Median parity and median number of previous cesarean deliveries were both 3.0 (2.0-3.0). All PAS cases were delivered by cesarean section. All PAS cases in this cohort were managed under urgent or emergent conditions.

Neonatal outcomes are presented in Table 1. The median birth weight was 2970.0 (2717.5-3422.2) g in the uterine atony group and 2745.0 (2367.5-3066.2) g in the PAS group. Three cases in the uterine atony group had a stillbirth; in all three, IUFD was present at presentation/admission prior to delivery. All neonates in the PAS group were born alive. The median 1-minute Apgar score was 9.0 (5.5-9.0) in the uterine atony group and was 9.0 (9.0-9.0) in the PAS group. An American Society of Anesthesiologists score ≥3 was recorded in 5.6% of uterine atony cases and 6.2% of PAS cases.

Intraoperative and Surgical Characteristics

Intraoperative management is presented in Table 2.

Among patients in the uterine atony group, 61.1% had intraoperative atony and 38.9% developed postoperative atony. All patients received medical treatment; tranexamic acid was administered in 88.9% of patients and an intrauterine balloon (Bakri) was used in 27.8% of patients. Hemostatic procedures included uterine artery ligation (88.9%),internal iliac/hypogastric artery ligation (83.3%),and uterine compression sutures (61.1%).

In the PAS group, hysterectomy was performed following cesarean delivery as part of hemorrhage control. Prophylactic salpingectomy was performed in 87.5% of PAS cases and 88.9% of uterine atony cases. Total hysterectomy was performed in 55.6% of uterine atony cases and in 75.0% of PAS cases. Intraoperative bladder injury occurred in 16.7% of uterine atony cases and in 18.8% of PAS cases.

Transfusion requirements are shown in Table 2. In the uterine atony group, transfusion requirements were higher, with a median of 4 (3-6) units of PRBCs and 2 (2-4) units of FFP, compared with medians of 2 (0.8-3.2) PRBC units and 1 (0-2.2) FFP unit in the PAS group. Platelet transfusion was uncommon in both groups [median 0 (0-0) units].

Postoperative Outcomes and Complications

Postoperative outcomes are summarized in Table 3.

The median length of hospital stay was 6.5 (5.0-11.0) days in the uterine atony group and 5.5 (4.0-7.0) days in the PAS group. ICU admission (ICU stay >0 days) was required in 66.7% of uterine atony cases and in 43.8% of PAS cases. Overall ICU length of stay (including 0.0 days for non-admitted patients) was 1.0 (0.0-2.0) days in the uterine atony group and 0.0 (0.0-1.0) days in the PAS group; among ICU-admitted patients, it was 2.0 (1.0-3.8) vs. 1.0 (1.0-1.0) days, respectively. No rehospitalizations after discharge were documented. One maternal death occurred in the uterine atony group (Clavien-Dindo grade V); no deaths were recorded in the PAS group. The patient underwent an emergency hysterectomy for uncontrolled obstetric hemorrhage, required postoperative intensive care, and, despite ongoing resuscitative management, died in the early postoperative period from DIC. Spinal anesthesia was used in most cases (Table 3).

Early postoperative complications in the uterine atony group included single cases of acute kidney injury, sepsis, shock, and coronavirus disease-2019 (COVID-19) infection. In the PAS group, one case of pneumothorax was reported. No late postoperative complications were observed during the follow-up period. According to the Clavien-Dindo

classification, complications of grade II or higher occurred in 38.9% of uterine atony cases and 25.0% of PAS cases.

Histopathological examination of PAS specimens demonstrated grade 1 invasion in 43.8% of cases, grade 2 in 37.5% of cases, and grade 3 in 18.8% of cases.

Additional Observation

One patient underwent hysterectomy on postoperative day 3 due to progressive mechanical ileus following elective cesarean delivery. Despite conservative management, serial imaging demonstrated persistent bowel distension and minimal intra-abdominal fluid. Exploratory laparotomy revealed no intestinal injury; however, the uterus was markedly enlarged (17×15×9 cm) and compressing adjacent bowel loops. A supracervical hysterectomy was performed; symptoms resolved afterward, and the patient was discharged on postoperative day 5. Histopathological examination demonstrated PAS (grade 1)with no evidence of infection or necrosis. This case was not included in Tables 1-3 because the indication for hysterectomy was non-hemorrhagic and clinically distinct from hemorrhage-related hysterectomy.

Discussion

Postpartum hysterectomy remains one of the most critical and life-saving procedures in obstetric practice. Although uncommon, it continues to represent a severe maternal morbidity ("near-miss") event and is typically performed for uncontrolled obstetric hemorrhage (11). Reported rates vary by setting and case-mix, with systematic reviews and population-based data generally placing emergency peripartum hysterectomy around approximately 1 per 1,000 births, while acknowledging wide between-country variation (1,12). In our institution, the hemorrhage-related peripartum/postpartum hysterectomy rate over the 2015–2025 period was 1.1 per 1,000 deliveries, which falls within the range reported in the literature (1).

In this cohort, the leading etiologies were uterine atony and PAS, consistent with contemporary obstetric hemorrhage

Table 1. Maternal, delivery, and neonatal characteristics of hemorrhage-related peripartum/postpartum hysterectomy cases, presented by etiologic group

Variable	Uterine atony (n=18)	PAS (n=16)	p value
Maternal characteristics			
Age (years)	33.0 [29.2-37.8]	31.0 [28.0-38.0]	0.904[a]
BMI (kg/m²)	27.5 [26.0-28.0]	27.5 [26.0-28.0]	0.839[a]
Parity	3.0 [1.2-4.0]	3.0 [2.0-3.0]	0.331[a]
Gestational age at delivery (weeks)	38.0 [35.5-39.0]	36.5 [34.0-37.2]	0.053[a]
Number of prior cesarean deliveries	2.0 [0.03.0]	3.0 [2.0-3.0]	0.112[a]
Mode of delivery			
Cesarean delivery	17 (94.4%)	16 (100%)	1.000[b]
Vaginal delivery	1 (5.6%)	0 (0%)	—
Neonatal outcomes			
Birth weight (g)	2970.0 [2717.5-3422.2]	2745.0 [2367.5-3066.2]	0.129[a]
1 minute Apgar score	9.0 [5.5-9.0]	9.0 [9.0-9.0]	0.038[a]
Live birth	15 (83.3%)	16 (100%)	0.230[b]
IUFD at admission (pre-delivery)[†]	3 (16.7%)	0 (0%)	—
Preoperative status			
ASA score ≥3	1 (5.6%)	1 (6.2%)	1.000[b]
Antepartum/obstetric context			
Placental abruption	2 (11.1%)	0 (0%)	0.487[b]
Fetal macrosomia	1 (5.6%)	0 (0%)	1.000[b]

Data are presented as median [IQR] or n (%). Between-group inferential comparisons were performed using the Mann–Whitney U test. [a]For continuous variables and Fisher's exact test, [b]for categorical variables. For complementary binary categories (e.g., cesarean/vaginal delivery; live birth/IUFD), the p value is shown once for readability. Available-case analysis was used for variables with missing values. [†]IUFD indicates intrauterine fetal demise present prior to delivery (at presentation/admission) and is reported to provide clinical context; it is not interpreted as a fetal effect attributable to uterine atony

BMI, Body mass index, PAS, Placenta accreta spectrum, IUFD: Intrauterine fetal demise, ASA: American Society of Anesthesiologistss

Table 2. Intraoperative and surgical characteristics of hemorrhage-related peripartum/postpartum hysterectomy cases, presented by etiologic group

Variable	Uterine atony (n=18)	PAS (n=16)	Effect estimate [median difference (atony-PAS), 95% CI]/ odds ratio (atony vs. PAS), 95% CI	p value
Transfusion requirements				
PRBC transfused (units)	4 [3-6]	2 [0.8-3.2]	Δmedian 2 (0.5-4)	0.003[a]
FFP transfused (units)	2 [2-4]	1 [0-2.2]	Δmedian 1 (0-3.5)	0.020[a]
Platelets transfused (units)	0 [0-0]	0 [0-0]	Δmedian 0 (0-0)	0.179[a]
Atony-specific hemorrhage-control measures				
Perioperative atony timing (intraop/postop)	Intraop 11 (61.1%); postop 7 (38.9%)	N/A	—	—
Medical treatment	18 (100.0%)	N/A	—	—
Tranexamic acid use	16 (88.9%)	N/A	—	—
Intrauterine balloon (Bakri)	5 (27.8%)	N/A	—	—
Internal iliac (hypogastric) artery ligation	15 (83.3%)	N/A	—	—
Uterine artery ligation	16 (88.9%)	N/A	—	—
Uterine compression sutures	11 (61.1%)	N/A	—	—
Procedure characteristics				
Type of hysterectomy: total/supracervical	Total 10 (55.6%); supracervical 8 (44.4%)	Total 12 (75.0%); supracervical 4 (25.0%)	OR 0.42 (0.10-1.80)	0.297[b]
Prophylactic salpingectomy	16 (88.9%)	14 (87.5%)	OR 1.14 (0.14-9.21)	1.000[b]

Data are presented as median [IQR] or n (%). Between-group comparisons were performed using the Mann–Whitney U test. [a]For continuous variables and Fisher's exact test. [b]For categorical variables. Effect estimates are reported as median difference (Atony-PAS) with 95% CI (bootstrap, 20,000 resamples) for continuous variables and odds ratio (Atony vs. PAS) with 95% CI for categorical variables. p values are reported for variables applicable to both groups; atony-specific management variables are shown descriptively (N/A for PAS)

PRBC: Packed red blood cells, FFP: Fresh frozen plasma, PAS: Placenta accreta spectrum, N/A: Not applicable, IQR: Interquartile range, CI: Confidence interval, OR: Odds ratio

literature and guidelines (3,13). Rising cesarean delivery rates are recognized as a major driver of PAS, and the history of prior cesarean deliveries commonly observed among PAS cases in our series aligns with this established association (6,13).

The operative course for hemorrhage-related hysterectomy typically follows a stepwise escalation strategy: it begins with medical therapy, progresses through conservative surgical measures, and proceeds to definitive surgery if bleeding remains uncontrolled. This approach is consistent with major guidelines and hemorrhage bundles emphasizing rapid recognition, early escalation, and structured algorithms for postpartum hemorrhage management (3,14,15). In our series, uterotonics, tranexamic acid, balloon tamponade, vascular ligation procedures, and compression sutures were used as part of hemorrhage control, with hysterectomy performed when these measures did not achieve adequate hemostasis (16).

PRBC and FFP transfusion requirements were higher in the uterine atony group than in the PAS group (Table 2), with median PRBC of 4 (3-6) vs. 2 (0.8-3.2) units and median FFP of 2 (2-4) vs. 1 (0-2.2) units, respectively. These differences should be interpreted cautiously, given the retrospective design and limited sample size, and should be viewed as exploratory estimates with associated uncertainty (effect estimates with 95% CIs are provided in Table 2). A possible explanation is that severe uterine atony may progress rapidly despite sequential medical and surgical hemorrhage control measures, resulting in ongoing blood loss before a definitive hysterectomy is undertaken. Although PAS cases in this cohort were also managed under urgent/emergent conditions, the surgical team may have entered the procedure with greater anticipation of major hemorrhage and earlier preparation for transfusion. This interpretation is hypothesis-generating and should be considered in light of the retrospective design and limited sample size. The

Table 3. **Postoperative outcomes and complications of hemorrhage-related peripartum/postpartum hysterectomy cases, presented by etiologic group**

Variable	Uterine atony (n=18)	PAS (n=16)	Effect estimate (95% CI)	p value
Hospital course				
Hospital stay (days), median [IQR]	6.5 [5.0-11.0]	5.5 [4.0-7.0]	Δmedian 1.0 (−1.5 to 4.5)	0.265[a]
ICU length of stay (days), median [IQR][†]	1.0 [0.0-2.0]	0.0 [0.0-1.0]	Δmedian 1.0 (−0.5 to 2.0)	0.048[a]
ICU length of stay (days), among ICU-admitted, median [IQR]	2.0 [1.0-3.8]	1.0 [1.0-1.0]	Δmedian 1.0 (0.0 to 3.5)	0.054[a]
ICU admission (ICU stay >0 days), n (%)	12 (66.7%)	7 (43.8%)	OR: 2.57 (0.64-10.34)	0.300[b]
Rehospitalization, n (%)	0 (0%)	0 (0%)	—	—
Maternal mortality, n (%)	1 (5.6%)	0 (0%)	OR: 2.83 (0.11-74.46)*	1.000[b]
Anesthesia and intraoperative complication				
Anesthesia: spinal, n (%)	15 (83.3%)	13 (81.2%)	OR: 1.15 (0.20-6.74), p: 1.000[b]	1.000[b]
Anesthesia: general, n (%)	3 (16.7%)	3 (18.8%)	—	—
Intraoperative bladder injury/perforation, n (%)	3 (16.7%)	3 (18.8%)	OR: 0.87 (0.15-5.06), p: 1.000[b]	1.000[b]
Early postoperative complications, n (%)				
Any early postoperative complication	4 (22.2%)	1 (6.2%)	OR: 4.29 (0.43-43.14)	0.340[b]
Acute kidney injury	1 (5.6%)	0 (0%)		—
Sepsis	1 (5.6%)	0 (0%)		—
Shock	1 (5.6%)	0 (0%)		—
COVID-19 infection	1 (5.6%)	0 (0%)		—
Pneumothorax	0 (0%)	1 (6.2%)		—
Clavien-Dindo grade, n (%)				
Clavien-Dindo grade ≥II (composite)	7 (38.9%)	4 (25.0%)	OR: 1.91 (0.44-8.35)	0.477[b]
Grade I	0 (0%)	0 (0%)		—
Grade II	1 (5.6%)	0 (0%)		—
Grade III[a]	0 (0%)	0 (0%)		—
Grade III[b]	3 (16.7%)	4 (25.0%)		—
Grade IV	2 (11.1%)	0 (0%)		—
Grade V	1 (5.6%)	0 (0%)		—
Pathology (PAS invasion grade), n (%)				
PAS grade 1	N/A	7 (43.8%)		—
PAS grade 2	N/A	6 (37.5%)		—
PAS grade 3	N/A	3 (18.8%)		—

*Data are presented as median [IQR] or n (%). Between-group comparisons were performed using the Mann–Whitney U test. [a]For continuous variables and Fisher's exact test. [b]For categorical variables. Effect estimates are reported as median difference (Atony-PAS) with 95% C I(bootstrap, 20,000 resamples) for continuous variables and OR with 95% CI for categorical variables. ICU length of stay (days), median [IQR][†] includes non-admitted patients coded as 0.0 days in the electronic record; ICU admission is therefore reported separately, and ICU length of stay among ICU-admitted patients is additionally shown. *Mortality OR uses a continuity correction due to a zero cell*

ICU: Intensive care unit, PAS: Placenta accreta spectrum, IQR: Interquartile range, OR: Odds ratio, COVID-19: Coronavirus disease 2019, N/A: Not applicable

higher rates of internal iliac artery ligation in uterine atony cases reflect the need for escalating pelvic devascularization in refractory hemorrhage.

A key contextual factor in interpreting our PAS cases is the absence of an in-house perinatology service and a structured referral pathway for planned PAS management. As a result, PAS-related hysterectomies in this cohort were managed under urgent or emergent conditions rather than as scheduled elective cesarean hysterectomies. This is clinically relevant because planned, multidisciplinary PAS management is widely

recommended to optimize preparedness, blood product availability, surgical support, and perioperative coordination (6,13,17). Our experience, therefore, reflects the realities faced by many centers where suspected or unrecognized PAS may present as emergencies, reinforcing the importance of strengthening referral networks and institutional readiness.

The choice between subtotal and total hysterectomy is typically individualized and driven by bleeding site (especially lower uterine segment and cervical involvement), anatomic distortion, and the patient's hemodynamic condition. In our cohort, both approaches were used, reflecting pragmatic intraoperative decision-making under hemorrhagic conditions. Current guidance similarly emphasizes tailoring the surgical approach to operative findings and available expertise rather than a single universal technique (3).

Urinary tract injury, particularly bladder injury, is a recognized complication of cesarean hysterectomy and is commonly discussed in the PAS literature due to adhesions, distorted anatomy, and the surgical planes encountered at the vesicouterine interface (6,13,18). In our series, bladder injuries occurred in both etiologic categories and were identified intraoperatively and repaired immediately. Importantly, even in cases classified as uterine atony, factors such as prior uterine surgery, emergency operative conditions, limited visualization, and hemodynamic instability can increase the risk of iatrogenic injury during rapid dissection. Documentation of intraoperative recognition and immediate repair, together with postoperative follow-up, remains essential for contextualizing these events and assessing longer-term sequelae.

Postoperative morbidity was substantial in this cohort, with frequent ICU utilization and a spectrum of complications. Such findings are consistent with the clinical reality that postpartum hysterectomy represents an endpoint of severe hemorrhage and physiologic decompensation rather than an isolated surgical event (3,12). ICU admission and ICU length of stay likely reflected both clinical severity and postoperative monitoring needs(e.g., hemodynamic instability, hemorrhagic shock/resuscitation requirements, transfusion burden, invasive monitoring or ventilatory support, and postoperative complications). As ICU length of stay is recorded for all patients in the electronic record—with non-admitted patients coded as 0.0 days—ICU admission (yes/no) and ICU length of stay were reported separately; length of stay among ICU-admitted patients was additionally summarized. In the uterine atony group, isolated events such as acute kidney injury, sepsis, shock, and COVID-19 infection were observed; in the PAS group, pneumothorax occurred in one case. Given the sample sizes inherent in hysterectomy cohorts, reporting these complications as counts, in addition to percentages, is important to avoid overinterpretation.

In addition, dispersion in postoperative length-of-stay metrics warrants careful interpretation. Variability in hospital length of stay, particularly for the uterine atony group, likely reflects heterogeneity in hemorrhage severity, hemodynamic instability, transfusion burden, postoperative complications, and recovery after emergency surgery. Given the small sample size and skewed distributions, length-of-stay outcomes were summarized using medians IQR and reported with effect estimates and 95% CIs (Table 3). Medians are less sensitive to extreme values than means.

Interpretation of fetal outcomes in hemorrhage-related hysterectomy requires careful consideration of the clinical context. Uterine atony is defined as inadequate uterine tone after delivery and does not represent a direct fetal pathophysiologic mechanism. In our cohort, stillbirths recorded under the uterine atony category reflected IUFD that was present at presentation/admission prior to delivery, rather than fetal compromise attributable to uterine atony. This distinction is essential to avoid misleading causal inferences and accurately reflect the acuity and severity of the underlying obstetric presentation.

We documented a single non-hemorrhagic case of progressive postoperative mechanical ileus associated with a markedly enlarged postpartum uterus and bowel compression, in which hysterectomy resulted in rapid clinical improvement. Pathology demonstrated a grade 1 PAS. Although rare and not included in the hemorrhage-focused analytic cohort, this observation underscores that postpartum surgical follow-up may reveal uncommon mechanical complications, and that atypical clinical trajectories warrant prompt evaluation.

Study Limitations

This study has limitations inherent to retrospective, single-center analyses, including reliance on documentation quality and limited generalizability. The sample size, although representative of a single-center hysterectomy cohort, reduces the granularity of subgroup analyses and limits causal inference. The absence of a planned PAS program and referral pathway at our institution shifts the case-mix toward more urgent/emergent presentations, which should be considered when interpreting operative characteristics and outcomes. Because the study focused on hysterectomy cases, it does not quantify the total number of uterine atony or PAS cases managed without hysterectomy over the same period and therefore does not provide hysterectomy conversion rates for these conditions.

Detailed information regarding antenatal PAS diagnosis and referral pathways was not uniformly documented in the retrospective records, limiting more granular analysis of planned versus unplanned presentations.

Between-group analyses were exploratory, and we, therefore, emphasized transparent reporting of effect estimates and CIs alongside p-values to reflect statistical uncertainty.

Conclusion

Peripartum/postpartum hysterectomy remains a rare but essential life-saving intervention for uncontrolled obstetric hemorrhage and is associated with substantial maternal morbidity. Institutional preparedness, including standardized hemorrhage protocols, timely escalation of care, rapid access to blood products, surgical expertise, and multidisciplinary coordination, is critical for optimizing outcomes, particularly in settings where PAS frequently presents under urgent or emergent conditions.

Ethics

Ethics Committee Approval: The study was approved by the Clinical Research Ethics Committee of Gaziosmanpaşa Training and Research Hospital (approval number: 147; date: 15.10.2025).

Informed Consent: Because of the retrospective design of the study, individual informed consent was waived.

Footnotes

Authorship Contributions

Surgical and Medical Practices: E.S.C., H.B.B., Concept: E.S.C., Design: E.S.C., Data Collection or Processing: E.S.C., H.B.B., Analysis or Interpretation: E.S.C., H.B.B., Literature Search: E.S.C., Writing: E.S.C.

Conflict of Interest: No conflict of interest was declared by the authors.

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