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# Maternal and neonatal outcomes in placenta accreta spectrum: Influence of antenatal diagnosis and surgical strategy

## *Plasenta akreta spektrumunda maternal ve neonatal sonuçlar: Antenatal tanı ve cerrahi stratejinin etkisi*

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### Abstract

**Objective:** This study aimed to evaluate the influence of antenatal diagnosis and surgical management strategies on maternal and neonatal outcomes in placenta accreta spectrum (PAS) disorders, emphasizing risk factors, timing of delivery, and operative approaches.

**Materials and Methods:** A retrospective cohort analysis was conducted on 210 women with histopathologically confirmed PAS managed at İnönü University Faculty of Medicine between January 2014 and March 2024. Demographic data, antenatal findings, delivery type, and surgical details were compared between elective and emergency procedures, as well as between uterus-preserving surgery and peripartum hysterectomy. Uterus-preserving surgery refers to conservative techniques that aim to avoid peripartum hysterectomy while controlling hemorrhage.

**Results:** Of the total cohort, 66.7% underwent elective surgery, whereas 33.3% required emergency intervention. Emergency deliveries occurred earlier (mean 32.1 vs. 36.0 weeks, p<0.001) and were associated with higher blood loss (799 vs. 511 mL, p<0.001), increased perinatal mortality (20% vs. 1.4%, p<0.001), and greater neonatal morbidity, mainly respiratory distress syndrome (47% vs. 14%, p<0.001). Hysterectomy was required in 45.2% of patients, primarily with placenta percreta (60% vs. 23.5%, p<0.001). Anterior placental location (89.5%) strongly correlated with complete invasion (77.7%) and bladder involvement (27.7%, p=0.038). Bladder injuries were more common in elective cases, while ureteral injuries occurred more often in emergencies (p=0.024). Preoperative hematocrit independently predicted hysterectomy risk (odds ratio: 1.092, p=0.034).

**Conclusion:** Antenatal diagnosis and well-planned elective management significantly improve maternal and neonatal outcomes in PAS. Individualized surgical planning based on invasion depth and maternal condition remains essential to reduce morbidity and mortality.

**Keywords:** Intraoperative complications, placenta accreta, pregnancy outcome, prenatal diagnosis

### Öz

**Amaç:** Bu çalışma, plasenta akreta spektrumu (PAS) olgularında antenatal tanı ve cerrahi yönetim stratejilerinin maternal ve neonatal sonuçlar üzerindeki etkisini; risk faktörleri, doğum zamanı ve cerrahi yaklaşımlar açısından değerlendirmeyi amaçladı.

**Gereç ve Yöntemler:** Ocak 2014-Mart 2024 tarihleri arasında İnönü Üniversitesi Tıp Fakültesi'nde yönetilen ve histopatolojik olarak doğrulanan 210 PAS olgusu retrospektif olarak incelendi. Demografik veriler, antenatal bulgular, doğum şekli ve cerrahi özellikler; elektif ve acil girişimler ile uterus koruyucu cerrahi ve peripartum histerektomi grupları arasında karşılaştırıldı. Uterus koruyucu cerrahi, peripartum histerektomiden kaçınarak kanamayı kontrol etmeyi hedefleyen konservatif yaklaşımlar olarak tanımlandı.

**PRECIS:** Timely antenatal diagnosis and elective management markedly reduce maternal morbidity and perinatal mortality in placenta accreta spectrum, underscoring the importance of planned multidisciplinary prenatal care.

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**Bulgular:** Olguların %66,7'si elektif, %33,3'ü acil koşullarda opere edildi. Acil doğumlar daha erken haftalarda gerçekleşti (32,1 vs. 36,0 hafta, p<0,001) ve daha fazla kan kaybı (799 vs. 511 mL, p<0,001), artmış perinatal mortalite (%20 vs. %1,4, p<0,001) ve neonatal respiratuvar distres (%47 vs. %14, p<0,001) ile ilişkiliydi. Histerektomi oranı %45,2 olup, en sık plasenta perkreta olgularında görüldü (%60 vs. %23,5, p<0,001). Anterior plasenta yerleşimi tam invazyon (%77,7) ve mesane tutulumu (%27,7, p=0,038) ile ilişkiliydi. Preoperatif hematokrit düzeyi histerektomi gereksinimini bağımsız olarak öngördü (risk oranı: 1,092, p=0,034).

**Sonuç:** Antenatal tanı ve planlı elektif yönetim, PAS olgularında maternal ve neonatal sonuçları belirgin biçimde iyileştirir. İnvazyon derecesi ve maternal duruma göre bireyselleştirilmiş cerrahi planlama, morbidite ve mortaliteyi azaltmada temel öneme sahiptir.

**Anahtar Kelimeler:** İntraoperatif komplikasyonlar, plasenta akreta, gebelik sonuçları, prenatal tanı

## Introduction

Placenta accreta spectrum (PAS) disorders were historically attributed to abnormal trophoblastic invasion. However, current understanding indicates that they arise primarily from uterine scarring and defective decidualization, which lead to a distorted uteroplacental interface and aberrant fibrinoid deposition rather than true villous invasiveness[1]. It is associated with substantial maternal morbidity and mortality, primarily due to massive hemorrhage, increased transfusion requirements, multi-organ injury and, in severe cases, maternal death. The global incidence of PAS has risen markedly over recent decades, a trend largely attributed to the parallel increase in cesarean delivery rates[2]. While planned preterm cesarean hysterectomy without attempts at placental removal remains the most widely accepted standard management, this approach entails irreversible loss of fertility and significant psychological impact for many women. Consequently, alternative uterus-preserving surgical techniques have been explored in selected cases[3].

The pathogenesis of PAS is intrinsically linked to defective decidualization of the endometrium, most commonly occurring at sites of previous uterine scarring from cesarean sections, myomectomies, or other surgical interventions. This defective decidualization results in failure of normal placental separation after delivery, leading to massive hemorrhage that often necessitates emergency hysterectomy[4]. Therefore, accurate antenatal diagnosis is critical for optimizing outcomes. Ultrasound, particularly with the adjunct of color Doppler imaging, remains the primary diagnostic modality, offering high sensitivity and specificity when performed by experienced operators[5]. Magnetic resonance imaging (MRI) is valuable in cases with posterior placental implantation or suspected lateral extension[6]. Key sonographic signs—such as placental lacunae, myometrial thinning, and loss of the hypoechoic retroplacental zone—alongside subplacental hypervascularity on Doppler imaging, provide essential diagnostic clues. The identification of risk factors, including a history of cesarean section, placenta previa, prior uterine surgery, advanced maternal age, and multiparity, further refines clinical suspicion[7].

The clinical implications of PAS extend beyond immediate maternal risks to encompass significant neonatal morbidity. Preterm delivery, whether iatrogenic or spontaneous, is a near-universal consequence, with studies demonstrating that elective delivery at 34-36 weeks in specialized centers optimizes outcomes by balancing fetal maturity against the risk of emergent hemorrhage[8]. However, the ideal timing of delivery remains controversial, with some institutions advocating for earlier delivery to mitigate maternal risks while others prioritize fetal lung maturity[9]. Furthermore, the choice between cesarean hysterectomy and uterus-preserving approaches such as segmental uterine resection or local resection with reconstruction continues to be debated, with each strategy carrying distinct risks and benefits that must be carefully weighed against patient characteristics such as desire for future fertility, and the depth of placental invasion. While hysterectomy minimizes the risk of catastrophic hemorrhage, it carries higher rates of bladder injury and loss of fertility. Uterus-preserving techniques, when feasible, may reduce morbidity and preserve reproductive potential, but require meticulous planning and intraoperative assessment[10].

Despite advances in our understanding of PAS, critical knowledge gaps persist. The long-term outcomes of different management strategies, particularly novel techniques such as segmental uterine resection and multidisciplinary team approaches, remain understudied. Additionally, there are limited data on how antenatal risk factors—including placental location, number of prior cesareans, and biochemical markers—may be leveraged to predict invasion severity and guide individualized treatment plans[11]. This study seeks to address these gaps through a comprehensive analysis of maternal and neonatal outcomes in PAS cases managed at a high-volume tertiary center over a ten-year period. By examining the interplay between antenatal risk stratification, surgical management choices, and clinical outcomes, we aim to contribute evidence-based insights that can inform practice guidelines and improve care for this high-risk population.

## Materials and Methods

This retrospective cohort study was conducted at the Department of Obstetrics and Gynecology, İnönü University Faculty of Medicine, after obtaining approval from the Institutional Non-Interventional Clinical Research Ethics Committee (approval date: 02.04.2024; approval number: 2024/5875). The study population comprised all pregnant women diagnosed with PAS and managed at our tertiary care center between January 1, 2014, and December 31, 2023. The diagnosis of PAS was confirmed either intraoperatively, based on direct visualization of abnormal placental adherence and invasion, or postoperatively through histopathological examination of specimens obtained after cesarean hysterectomy or uterus-preserving procedures.

Eligible participants were women aged between 18 and 48 years who delivered at our hospital and had a confirmed diagnosis of PAS. Exclusion criteria included multiple gestations and cases with incomplete clinical or follow-up data, such as insufficient antenatal visits or missing surgical records.

Data were obtained from the hospital's electronic medical records and recorded into a standardized Excel database specifically designed for this study. Collected variables included maternal demographic and obstetric characteristics [age, gravidity, parity, body mass index (BMI), smoking status, history of previous cesarean deliveries, and history of other gynecological surgeries], comorbid conditions, and obstetric complications. Information regarding gestational age at diagnosis and delivery, diagnostic modality (ultrasound and/or MRI), antenatal corticosteroid administration, and indication for delivery was also documented.

Surgical data included the type of uterine incision, its relationship to placental location, the operative management strategy (cesarean hysterectomy versus uterus-preserving surgery), the anatomical location of the placenta, and the degree of placental invasion (placenta accreta, increta, or percreta). Intraoperative parameters, such as estimated blood loss, number of blood products transfused, and perioperative complications (including bladder and ureteral injuries), were recorded. Preoperative and postoperative laboratory results, specifically hemoglobin and hematocrit levels, were reviewed to evaluate perioperative hematologic changes. Neonatal outcomes included birth weight, 1- and 5-minute Apgar scores, need for neonatal intensive care unit (NICU) admission, and neonatal morbidity and mortality data.

### Sample Size and Power Justification

Because this was a retrospective cohort including all eligible PAS cases managed over a 10-year period, no a priori sample size calculation was performed. The final cohort (n=210) provided >80% post hoc statistical power ($\alpha$=0.05), based on observed effect sizes for perinatal mortality and intraoperative blood loss to detect clinically relevant differences in maternal and neonatal outcomes between elective and emergency delivery groups.

### Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were assessed for normality using the Kolmogorov-Smirnov test and expressed as mean ± standard deviation for normally distributed data or median (minimum-maximum) for non-normally distributed data. Categorical variables were presented as frequencies and percentages. For between-group comparisons, the Independent Samples t-test was applied to normally distributed continuous variables, while the Mann-Whitney U test was used for non-normally distributed variables. Associations between categorical variables were analyzed using Pearson's chi-square test, Yates' continuity correction, or Fisher's exact test, as appropriate. To evaluate risk factors associated with adverse maternal and neonatal outcomes, univariate logistic regression analyses were performed to calculate odds ratios (ORs) and 95% confidence intervals (CIs). Variables with a p-value <0.10 in univariate analysis were subsequently included in a multivariate logistic regression model to identify independent predictors. Multicollinearity was evaluated prior to model entry, and model fit was confirmed using the Hosmer-Lemeshow test. A two-tailed p-value <0.05 was considered statistically significant for all analyses.

## Results

Table 1 summarizes the demographic, obstetric, maternal, intraoperative, and neonatal characteristics of 210 women diagnosed with PAS. Continuous variables are presented as mean ± standard deviation and median (minimum-maximum), while categorical variables are expressed as counts and percentages.

### Study Population Characteristics

A total of 210 women diagnosed with PAS were included in the study. Of these, 140 (66.7%) underwent planned surgery, while 70 (33.3%) required emergency intervention. Emergency procedures were primarily performed due to PAS-related hemorrhage in 44 cases (62.9%), while the remaining 26 patients (37.1%) required urgent surgery for other obstetric indications.

**Table 1.** Baseline demographic, obstetric, maternal, and neonatal characteristics of the study population

| Variable | Category | Statistics* |
|---|---|---|
| **Maternal characteristics** | | |
| Age (years) | | 32.50±5.20; 32 (19-45) |
| BMI (kg/m²) | | 27.80±3.90; 27 (20-9) |
| Smoking | Yes | 35 (16.70) |
| | No | 175 (83.30) |
| IVF pregnancy | Yes | 22 (10.50) |
| | No | 188 (89.50) |
| Previous gynecological surgery | Yes | 28 (13.30) |
| | No | 182 (86.70) |
| **Obstetric history** | | |
| Gravida | | 3.20±1.50; 3 (1-8) |
| Parity | | 1.80±1.20; 2 (0-6) |
| Previous cesarean section | 0 | 40 (19.00) |
| | 1 | 95 (45.20) |
| | ≥2 | 75 (35.80) |
| Gestational age at diagnosis (weeks) | | 26.37±5.62; 24 (17-39) |
| Gestational age at delivery (weeks) | | 34.71±3.54; 36 (20-39) |

**Table 1.** Continued

| Variable | Category | Statistics* |
|---|---|---|
| Other obstetric complications | No | 150 (71.43) |
| | Gestational diabetes | 26 (12.38) |
| | Pregestational diabetes | 4 (1.90) |
| | Gestational hypertension | 4 (1.90) |
| | Chronic hypertension | 1 (0.48) |
| | Preeclampsia | 5 (2.38) |
| | Intrauterine growth restriction | 12 (5.71) |
| | Others | 8 (3.80) |
| Diagnostic method | Ultrasound diagnosis | 43 (20.47) |
| | Ultrasound+Doppler | 166 (79.04) |
| | Ultrasound+MRI | 1 (0.48) |
| Antenatal steroid use | No | 70 (33.33) |
| | Complete course | 88 (41.90) |
| | Incomplete course | 24 (11.43) |
| | Not indicated | 28 (13.33) |
| Indication for delivery | Elective-related to accreta | 135 (64.29) |
| | Elective - not related to accreta | 5 (2.38) |
| | Emergency - related to accreta | 44 (20.95) |
| | Emergency - unrelated to accreta | 26 (12.38) |
| Intrapartum evaluation | Planned hysterectomy | 97 (46.19) |
| | Conservative procedure | 87 (41.43) |
| | Failed conservative procedure followed by immediate hysterectomy | 23 (10.95) |
| | Failed conservative management followed by delayed hysterectomy | 3 (1.43) |
| **Intraoperative findings** | | |
| Intraoperative blood loss (mL) | | 1650±620; 1600 (600-4200) |
| Erythrocyte suspension transfusion (units) | | 2.46±1.92; 2 (0-10) |

**Table 1.** Continued

| Variable | Category | Statistics* |
|---|---|---|
| Fresh frozen plasma transfusion (units) | | 0.89±1.17; 0 (0-5) |
| Cryoprecipitate transfusion (units) | | 0.22±0.56; 0 (0-3) |
| Platelet transfusion (units) | | 0.23±0.7; 0 (0-4) |
| Conservative management | Hysterectomy | 95 (45.24) |
| | Preventive surgery | 115 (54.76) |
| Compression sutures | No | 207 (98.57) |
| | Yes | 3 (1.43) |
| Type of placental invasion | Accreta | 68 (32.38) |
| | Increta | 58 (27.62) |
| | Percreta | 84 (40) |
| Placental location | Anterior low | 25 (11.90) |
| | Posterior low | 22 (10.48) |
| | Central over the internal os | 163 (77.62) |
| Degree of placental invasion | Focal | 58 (27.62) |
| | Complete | 152 (72.38) |
| Type of cesarean incision | Low transverse | 44 (20.95) |
| | High transverse | 87 (41.43) |
| | Classic | 57 (27.14) |
| | Vertical | 22 (10.48) |
| Relation of incision to placenta | Incision through placenta | 6 (2.86) |
| | Incision away from placenta | 204 (97.14) |
| Preoperative ultrasound | No | 12 (5.71) |
| | Yes | 198 (94.29) |
| Placental organ invasion | No | 152 (72.38) |
| | Bladder invasion | 53 (25.24) |
| | Parametrial invasion | 5 (2.38) |
| Intraoperative complication | No | 159 (75.71) |
| | Unintentional cystotomy | 45 (21.43) |
| | Ureteric injury | 4 (1.90) |
| | Bowel injury | 2 (0.95) |

**Table 1.** Continued

| Variable | Category | Statistics* |
|---|---|---|
| **Maternal outcomes** | | |
| Maternal ICU stay (days) | | 0.86±1.48; 0 (0-6) |
| Hospital stay (days) | | 5.52±3.06; 5 (1-21) |
| Postpartum hemoglobin (g/L) | | 9.13±1.47; 9.1 (4.3-12.9) |
| Postpartum hematocrit (g/L) | | 27.77±4.3; 28.25 (14.5-37.1) |
| Maternal ICU | Yes | 71 (33.81) |
| | No | 139 (66.19) |
| Maternal mortality | Yes | 1 (0.48) |
| | No | 209 (99.52) |
| **Neonatal outcomes** | | |
| Neonatal weight (g) | | 2624.85±704.02; 2780 (350-4025) |
| 1-min APGAR score | | 7.01±1.45; 7 (0-9) |
| 5-min APGAR score | | 8.75±1.66; 9 (0-10) |
| Neonatal ICU stay (days) | | 3.67±6.2; 0 (0-36) |
| Neonatal respiratory distress syndrome | | 0.25±0.43; 0 (0-1) |
| Intrauterine ex | No | 206 (98.10) |
| | Yes | 4 (1.90) |
| Perinatal death | No | 194 (92.38) |
| | Yes | 16 (7.62) |
| Neonatal ICU requirement | No | 106 (50.48) |
| | Yes | 104 (49.52) |
| Neonatal respiratory support requirement | No | 115 (54.76) |
| | Yes | 95 (45.24) |
| Neonatal intracranial hemorrhage | No | 193 (91.90) |
| | Yes | 17 (8.10) |
| Neonatal hypoxic ischemic encephalopathy | No | 200 (95.24) |
| | Yes | 10 (4.76) |

*: Continuous variables are presented as mean ± standard deviation and median (minimum–maximum), while categorical variables are expressed as counts and percentages. BMI: Body mass index, ICU: Intensive care unit, MRI: Magnetic resonance imaging, IVF: In vitro fertilization

In the planned group, 135 deliveries were performed due to PAS and 5 for other obstetric reasons. The demographic profile revealed a mean maternal age of 33.81±4.85 years, with patients demonstrating an average gravidity of 4.30±1.49 and parity of 2.83±1.22. The study population had a mean BMI of 30.60±4.05 kg/m², consistent with the known association between obesity and PAS risk. Notably, the average number of prior cesarean deliveries was 2.09±0.98, underscoring the well-established link between uterine scarring and abnormal placentation.

### Diagnostic and Clinical Parameters

The mean gestational age at PAS diagnosis was 26.37±5.62 weeks, with definitive management occurring at a mean of 34.71±3.54 weeks. Diagnostic modalities included grayscale ultrasound alone (20.47%), combined grayscale and color Doppler ultrasound (79.04%), and MRI confirmation (0.48%). Preoperative hemoglobin and hematocrit levels averaged 11.23±1.33 g/dL and 34.21±3.63%, respectively, with significant interindividual variability reflecting the spectrum of disease severity.

### Comparative Analysis of Delivery Timing

The analysis revealed striking differences between planned and emergency deliveries. Emergency cases were delivered significantly earlier (mean gestational age: 32.13±4.57 weeks) compared to planned deliveries, (36.01±1.86 weeks, p <0.001), resulting in substantial neonatal consequences. This four-week disparity in gestational age had profound clinical implications, particularly for neonatal outcomes. Intraoperative blood loss was markedly higher in emergency cases (799.29±414.28 mL) versus planned deliveries (511.43±311.49 mL, p<0.001), though transfusion requirements did not differ significantly between groups (p>0.05). Emergency deliveries were associated with higher rates of intraoperative complications, increased NICU admission, higher need for respiratory support, and elevated perinatal mortality compared with elective procedures (Figure 1). Maternal intensive care unit (ICU) admission rates trended higher in emergency deliveries, though this difference did not reach statistical significance (Table 2).

### Surgical Management Outcomes

The surgical approach varied significantly based on clinical presentation and intraoperative findings. A Sankey diagram (Figure 2) illustrates the distribution of PAS patients according to timing of surgery (emergency vs. elective), surgical procedure (hysterectomy vs. preventive surgery), and placental location (anterior vs. posterior). Among 210 women, 70 underwent emergency surgery and 140 elective surgery. Of these, 95 (45.2%) underwent hysterectomy and 115 (54.8%) underwent preventive surgery. Placental involvement was predominantly anterior (n=188, 89.5%), with only 22 cases (10.5%) demonstrating posterior invasion.

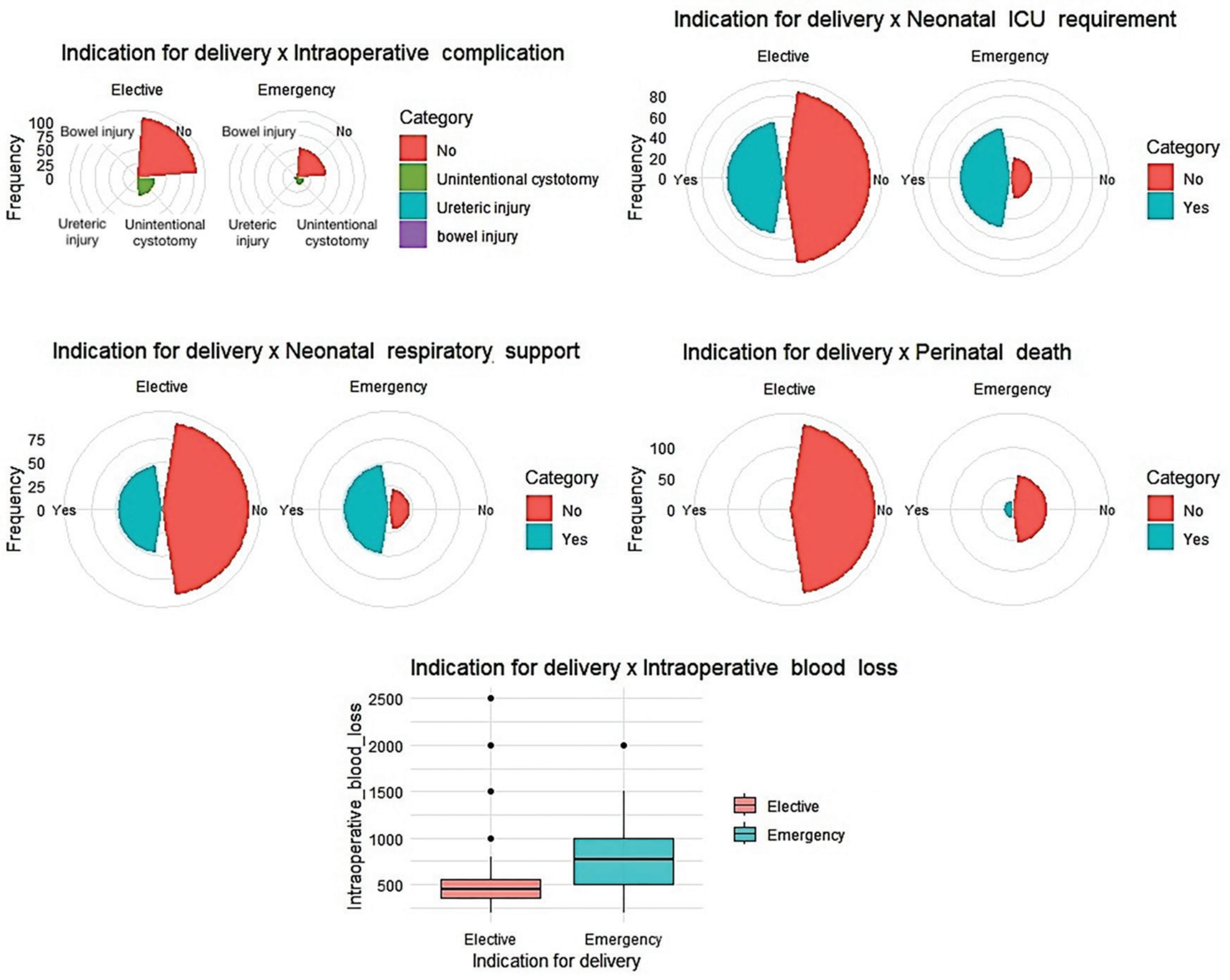


**Figure 1.** Distribution of maternal and neonatal outcomes by elective and emergency delivery indications

*ICU: Intensive care unit*

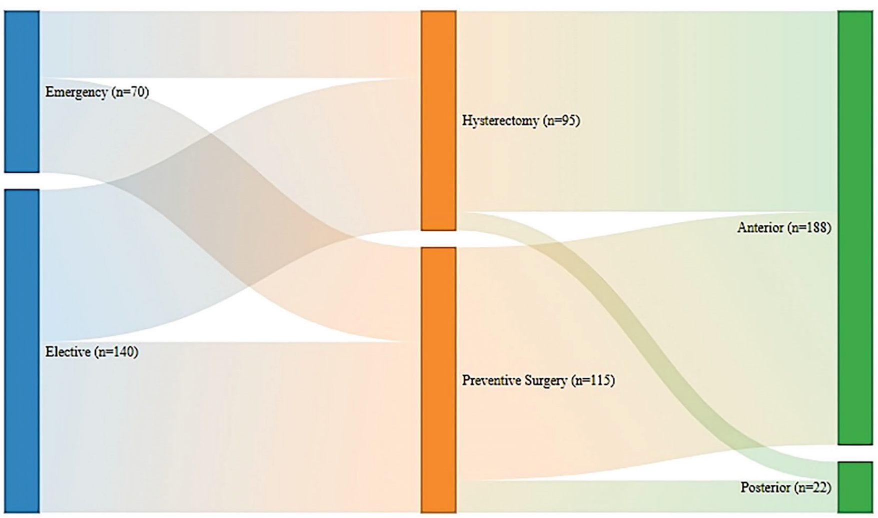


**Figure 2.** Sankey diagram illustrating the distribution of placenta accreta spectrum patients according to surgical timing (emergency vs. elective), surgical approach (hysterectomy vs. preventive surgery), and placental location (anterior vs. posterior)

**Table 2.** Comparison of maternal, obstetric, and neonatal characteristics according to elective and emergency indications for cesarean delivery

| Variable | Category | Indication for delivery | | p-value |
|---|---|---|---|---|
| | | Elective (n=140) | Emergency (n=70) | |
| | | Statistics | Statistics | |
| Age (year) | | 33.84±4.7; 34 (22-45) | 33.77±5.16; 34 (19-45) | 0.947 |
| Gravida | | 4.28±1.49; 4 (1-10) | 4.33±1.5; 4 (2-12) | 0.887 |
| Parity | | 2.83±1.22; 3 (0-6) | 2.83±1.23; 3 (0-8) | 0.902 |
| BMI ($kg/m^2$) | | 30.46±4.17; 30 (19-42) | 30.86±3.8; 30 (24-42) | 0.567 |
| Number of previous cesarean sections | | 2.06±0.99; 2 (0-5) | 2.16±0.94; 2 (0-5) | 0.559 |
| Gestational age at diagnosis (weeks) | | 26.78±5.7; 26 (17-39) | 25.56±5.41; 24 (20-38) | 0.126 |
| Gestational age at delivery (weeks) | | 36.01±1.86; 36 (22-39) | 32.13±4.57; 34 (20-38) | **<0.001** |
| Preoperative hemoglobin (g/L) | | 11.35±1.13; 11.3 (8.1-14) | 10.98±1.64; 11.05 (7.1-14.4) | 0.174 |
| Preoperative hematocrit (g/L) | | 34.59±3.18; 34.55 (25.6-44) | 33.45±4.31; 33.75 (23.5-46) | 0.077 |
| Intraoperative blood loss (cc) | | 511.43±311.49; 450 (200-2500) | 799.29±414.28; 775 (200-2000) | **<0.001** |
| Erythrocyte transfusion (units) | | 2.42±1.88; 2 (0-10) | 2.54±2.01; 3 (0-10) | 0.300 |
| Maternal ICU stay duration (days) | | 0.76±1.46; 0 (0-6) | 1.04±1.52; 0 (0-6) | 0.090 |
| Hospital stay duration (days) | | 5.36±2.92; 5 (1-21) | 5.84±3.32; 5 (2-20) | 0.198 |
| Postpartum hemoglobin (g/L) | | 9.21±1.33; 9.2 (4.3-12) | 8.96±1.72; 8.8 (4.6-12.9) | 0.224 |
| Postpartum hematocrit (g/L) | | 27.9±3.91; 28.4 (14.5-34.8) | 27.53±5.02; 28.1 (14.9-37.1) | 0.585 |
| Perioperative tranexamic acid use (vials) | | 0.4±1.2; 0 (0-4) | 0.11±0.67; 0 (0-4) | 0.067 |
| Neonatal birth weight (g) | | 2863.32±455.17; 2880 (450-4025) | 2147.91±858.94; 2425 (350-3390) | **<0.001** |
| 1-minute APGAR score | | 7.35±1.22; 8 (0-9) | 6.33±1.63; 6 (0-9) | **<0.001** |
| 5-minute APGAR score | | 9.11±1.36; 9 (0-10) | 8.01±1.94; 8 (0-10) | **<0.001** |
| Neonatal ICU stay duration | | 2.13±4.22; 0 (0-35) | 6.74±8.14; 3 (0-36) | **<0.001** |
| Neonatal respiratory distress syndrome | | 0.14±0.34; 0 (0-1) | 0.47±0.5; 0 (0-1) | **<0.001** |
| Smoking | No | 121 (86.4) | 59 (84.3) | 0.676 |
| | Yes | 19 (13.6) | 11 (15.7) | |
| IVF pregnancy | No | 137 (97.9) | 68 (97.1) | 0.749 |
| | Yes | 3 (2.1) | 2 (2.9) | |
| Diagnostic method | Ultrasound diagnosis | 30 (21.4) | 13 (18.5) | 0.820 |
| | Ultrasound + Doppler | 109 (77.9) | 57 (81.4) | |
| | Ultrasound, confirme by MRI | 1 (0.7) | 0 (0) | |

**Table 2.** Continued

| Variable | Category | Indication for delivery | | p-value |
|---|---|---|---|---|
| | | Elective (n=140) | Emergency (n=70) | |
| | | Statistics | Statistics | |
| Antenatal steroid use | No | 51 (36.4) | 19 (27.1) | **<0.001** |
| | Complete course | 55 (39.3) | 33 (47.1) | |
| | Incomplete course | 7 (5) | 17 (24.3) | |
| | Not indicated | 27 (19.2) | 1 (1.4) | |
| Intrapartum assessment | Planned hysterectomy | 67 (47.9) | 30 (42.9) | 0.099 |
| | Conservative procedure | 58 (41.4) | 29 (41.4) | |
| | Failed conservative procedure followed by immediate hysterectomy | 15 (10.7) | 8 (11.4) | |
| | Failed conservative management followed by delayed hysterectomy | 0 (0) | 3 (4.3) | |
| Conservative management | No | 66 (47.1) | 29 (41.4) | 0.432 |
| | Yes | 74 (52.9) | 41 (58.6) | |
| Compression suture types | No | 137 (97.9) | 70 (100) | 0.217 |
| | Yes | 3 (2.1) | 0 (0) | |
| Type of placental invasion | Accreta | 50 (35.7) | 18 (25.7) | 0.209 |
| | Increta | 34 (24.3) | 24 (34.3) | |
| | Percreta | 56 (40) | 28 (40) | |
| Placental location | Anterior low | 16 (11.4) | 9 (12.9) | 0.948 |
| | Posterior low | 15 (10.7) | 7 (10) | |
| | Central over the internal os | 109 (77.9) | 54 (77.1) | |
| Degree of placental invasion | Focal | 40 (28.6) | 18 (25.7) | 0.662 |
| | Complete | 100 (71.4) | 52 (74.3) | |
| Cesarean incision type | Low transverse | 31 (22.1) | 13 (18.6) | 0.566 |
| | High transverse | 55 (39.3) | 32 (45.7) | |
| | Classic | 41 (29.3) | 16 (22.9) | |
| | vertical | 13 (9.3) | 9 (12.9) | |
| Relation of incision to placenta | Incision through placenta | 3 (2.1) | 3 (4.3) | 0.380 |
| | Incision away from placenta | 137 (97.9) | 67 (95.7) | |

**Table 2.** Continued

| Variable | Category | Indication for delivery | | p-value |
|---|---|---|---|---|
| | | Elective (n=140) | Emergency (n=70) | |
| | | Statistics | Statistics | |
| Preoperative ultrasound | No | 7 (5) | 5 (7.1) | 0.528 |
| | Yes | 133 (95) | 65 (92.9) | |
| Organ invasion by placenta | No | 107 (76.4) | 45 (64.3) | 0.177 |
| | Bladder invasion | 30 (21.4) | 23 (32.9) | |
| | Parametrial invasion | 3 (2.1) | 2 (2.9) | |
| Intraoperative complications | No | 106 (75.7) | 53 (75.7) | **0.024** |
| | Unintentional cystotomy | 32 (22.9) | 13 (18.6) | |
| | Ureteric injury | 0 (0) | 4 (5.7) | |
| | Bowel injury | 2 (1.4) | 0 (0) | |
| Maternal ICU admission | No | 98 (70) | 41 (58.6) | 0.098 |
| | Yes | 42 (30) | 29 (41.4) | |
| Maternal mortality | No | 139 (99.3) | 70 (100) | 0.478 |
| | Yes | 1 (0.7) | 0 (0) | |
| Intrauterine fetal death | No | 138 (98.6) | 68 (97.1) | 0.475 |
| | Yes | 2 (1.4) | 2 (2.9) | |
| Perinatal death | No | 138 (98.6) | 56 (80) | **<0.001** |
| | Yes | 2 (1.4) | 14 (20) | |
| Neonatal ICU requirement | No | 85 (60.7) | 21 (30) | **<0.001** |
| | Yes | 55 (39.3) | 49 (70) | |
| Need for neonatal respiratory support | No | 93 (66.4) | 22 (31.4) | **<0.001** |
| | Yes | 47 (33.6) | 48 (68.6) | |
| Neonatal intracranial hemorrhage | No | 136 (97.1) | 57 (81.4) | **<0.001** |
| | Yes | 4 (2.9) | 13 (18.6) | |
| Neonatal hypoxic-ischemic encephalopathy | No | 137 (97.9) | 63 (90) | **0.012** |
| | Yes | 3 (2.1) | 7 (10) | |

BMI: Body mass index, IVF: In vitro fertilization, ICU: Intensive care unit. Statistically significant p values are indicated in bold

Anterior placental location was strongly associated with complete invasion and bladder involvement, whereas posterior placentas were mainly characterized by focal invasion and minimal organ involvement (Figure 3). The surgical approach varied significantly based on clinical presentation and intraoperative findings. Anterior placental location was observed in 188 patients (89.5%) and posterior location in 22 patients (10.5%). With respect to invasion type, 68 patients (32.4%) had placenta accreta, 58 (27.6%) had increta, and 84 (40.0%) had percreta. Complete invasion was more common (72.4%) than focal invasion (27.6%). Hysterectomy was performed in 95 cases (45.24%), while uterine-preserving techniques were attempted in 115 patients (54.76%). Among the conservative management group, 23 cases (20%) required conversion to hysterectomy intraoperatively due to uncontrolled hemorrhage, and 3 (2.6%) underwent delayed hysterectomy during the postoperative period. The hysterectomy group demonstrated higher rates of complete placental invasion (92.6% vs. 55.7%, $p<0.001$) and placenta percreta (60% vs. 23.5%, $p<0.001$). Surgical approach also differed significantly, with upper transverse incisions predominating in uterine-preserving cases (65.2%) versus classical incisions in hysterectomies

(56.8%, p<0.001) (Table 3). In addition, the number of previous cesarean sections and the rate of perinatal death were higher in the hysterectomy group (Figure 4).

When comparing planned and emergency deliveries, there was no significant difference in preoperative or postoperative hemoglobin and hematocrit levels or in transfusion requirements. However, intraoperative blood loss was significantly higher in the emergency group (799.3±414.3 mL vs. 511.4±311.5 mL; p<0.001).

**Neonatal Outcomes**

The neonatal consequences of PAS were particularly pronounced in emergency deliveries. Infants born under emergent conditions had significantly lower birth weights (2147.91±858.94 g vs. 2863.32±455.17 g, p<0.001), reflecting their earlier gestational age at delivery. Apgar scores were markedly reduced in the emergency group at both 1-minute (6.33±1.63 vs. 7.35±1.22, p<0.001) and 5-minute assessments (8.01±1.94 vs. 9.11±1.36, p<0.001). NICU admission duration was nearly three times longer for neonates delivered emergently (6.74±8.14 days vs. 2.13±4.22 days, p<0.001). The emergency group also demonstrated higher rates of respiratory distress syndrome (RDS) (47% vs. 14%, p<0.001), intracranial hemorrhage (18.6% vs. 2.9%, p<0.001), and hypoxic-ischemic encephalopathy (10% vs. 2.1%, p =0.012). Most alarmingly, perinatal mortality was fourteen times higher in emergency deliveries (20% vs. 1.4%, p<0.001).

**Table 3.** Comparison of maternal, obstetric, and neonatal characteristics between hysterectomy and conservative surgery

| Variables | Category | Conservative management | | p-value |
|---|---|---|---|---|
| | | Hysterectomy Statistics | Conservative surgery Statistics | |
| Age (year) | | 35.07±4.14; 35 (25-45) | 32.77±5.15; 33 (19-45) | **<0.001** |
| Gravida | | 4.59±1.65; 4 (2-12) | 4.05±1.31; 4 (1-9) | **0.024** |
| Parity | | 3.08±1.31; 3 (1-8) | 2.62±1.1; 3 (0-6) | **0.012** |
| BMI (kg/m$^2$) | | 30.9±4.14; 30 (22-42) | 30.35±3.98; 30 (19-39) | 0.37 |
| Number of previous cesarean sections | | 2.27±0.93; 2 (0-5) | 1.94±0.99; 2 (0-5) | **0.013** |
| Gestational age at diagnosis (weeks) | | 26.22±5.18; 24 (17-38) | 26.5±5.98; 24 (19-39) | 0.544 |
| Gestational age at delivery (weeks) | | 34.71±3; 36 (21-38) | 34.72±3.95; 36 (20-39) | 0.091 |
| Preoperative hemoglobin (g/L) | | 11.19±1.21; 11.2 (7.4-14.2) | 11.26±1.43; 11.4 (7.1-14.4) | 0.397 |
| Preoperative hematocrit (g/L) | | 34.14±3.28; 33.7 (25.4-46) | 34.26±3.9; 34.3 (23.5-44) | 0.406 |
| Intraoperative blood loss (cc) | | 561.05±333.52; 500 (200-2000) | 645.65±401.4; 500 (200-2500) | 0.055 |
| Erythrocyte transfusion (units) | | 2.47±1.74; 2 (0-10) | 2.45±2.07; 2 (0-10) | 0.869 |
| Maternal ICU stay duration (days) | | 0.74±1.45; 0 (0-6) | 0.96±1.5; 0 (0-6) | 0.168 |
| Hospital stay duration (days) | | 5.73±3.43; 5 (1-21) | 5.35±2.72; 5 (2-20) | 0.522 |
| Postpartum hemoglobin (g/L) | | 9.12±1.23; 9.1 (5.3-12) | 9.14±1.65; 9.2 (4.3-12.9) | 0.828 |
| Postpartum hematocrit (g/L) | | 27.76±3.83; 28.4 (14.5-36.1) | 27.78±4.68; 28.2 (14.9-37.1) | 0.856 |
| Perioperative tranexamic acid use (vials) | | 0.17±0.81; 0 (0-4) | 0.42±1.23; 0 (0-4) | 0.091 |
| Neonatal birth weight (g) | | 2633.93±624.71; 2780 (350-3890) | 2617.36±766; 2790 (480-4025) | 0.526 |
| 1-minute APGAR score | | 7.03±1.64; 8 (0-9) | 6.99±1.28; 7 (3-9) | 0.379 |
| 5-minute APGAR score | | 8.63±1.92; 9 (0-10) | 8.84±1.41; 9 (4-10) | 0.503 |
| Neonatal ICU stay duration | | 3.98±6.57; 0 (0-35) | 3.41±5.89; 0 (0-36) | 0.697 |
| Neonatal respiratory distress syndrome | | 0.25±0.44; 0 (0-1) | 0.24±0.43; 0 (0-1) | 0.878 |
| Smoking | No | 77 (81.1) | 103 (89.6) | 0.079 |
| | Yes | 18 (18.9) | 12 (10.4) | |

**Table 3.** Continued

| Variables | Category | Conservative management<br>Hysterectomy<br>Statistics | Conservative surgery<br>Statistics | p-value |
|---|---|---|---|---|
| Indication for delivery | Elective | 66 (69.5) | 74 (64.3) | 0.433 |
| | Emergency | 29 (30.5) | 41 (35.7) | |
| Intrapartum assessment | Planned hysterectomy | 93 (97.9) | 4 (3.5) | **<0.001** |
| | Conservative procedure | 2 (2.1) | 85 (73.9) | |
| | Failed conservative procedure followed by immediate hysterectomy | 0 (0) | 23 (20) | |
| | Failed conservative management followed by delayed hysterectomy | 0 (0) | 3 (2.6) | |
| Compression suture types | No | 95 (100) | 112 (97.4) | 0.113 |
| | Yes | 0 (0) | 3 (2.6) | |
| Type of placental invasion | Accreta | 15 (15.8) | 53 (46.1) | **<0.001** |
| | Increta | 23 (24.2) | 35 (30.4) | |
| | Percreta | 57 (60) | 27 (23.5) | |
| Placental location | Anterior low | 13 (13.7) | 12 (10.4) | 0.559 |
| | Posterior low | 8 (8.4) | 14 (12.2) | |
| | Central over the internal os | 74 (77.9) | 89 (77.4) | |
| Degree of placental invasion | Focal | 7 (7.4) | 51 (44.3) | **<0.001** |
| | Complete | 88 (92.6) | 64 (55.7) | |
| Cesarean incision type | Low transverse | 10 (10.5) | 34 (29.6) | **<0.001** |
| | High transverse | 12 (12.6) | 75 (65.2) | |
| | Classic | 54 (56.8) | 3 (2.6) | |
| | Vertical | 19 (20) | 3 (2.6) | |
| Relation of incision to placenta | Incision through placenta | 4 (4.2) | 2 (1.7) | 0.285 |
| | Incision away from placenta | 91 (95.8) | 113 (98.3) | |
| Preoperative ultrasound | No | 3 (3.2) | 9 (7.8) | 0.147 |
| | Yes | 92 (96.8) | 106 (92.2) | |
| Organ invasion by placenta | No | 64 (67.4) | 88 (76.5) | 0.321 |
| | Bladder invasion | 28 (29.5) | 25 (21.7) | |
| | Parametrial invasion | 3 (3.2) | 2 (1.7) | |

**Table 3.** Continued

| Variables | Category | Conservative management Hysterectomy Statistics | Conservative surgery Statistics | p-value |
|---|---|---|---|---|
| Intraoperative complications | No | 65 (68.4) | 94 (81.7) | 0.068 |
| | Unintentional cystotomy | 28 (29.5) | 17 (14.8) | |
| | Ureteric injury | 1 (1.1) | 3 (2.6) | |
| | Bowel injury | 1 (1.1) | 1 (0.9) | |
| Maternal ICU admission | No | 66 (69.5) | 73 (63.5) | 0.361 |
| | Yes | 29 (30.5) | 42 (36.5) | |
| Maternal mortality | No | 94 (98.9) | 115 (100) | 0.27 |
| | Yes | 1 (1.1) | 0 (0) | |
| Intrauterine fetal death | No | 91 (95.8) | 115 (100) | **0.026** |
| | Yes | 4 (4.2) | 0 (0) | |
| Perinatal death | No | 92 (96.8) | 102 (88.7) | **0.027** |
| | Yes | 3 (3.2) | 13 (11.3) | |
| Neonatal ICU requirement | No | 48 (50.5) | 58 (50.4) | 0.989 |
| | Yes | 47 (49.5) | 57 (49.6) | |
| Need for neonatal respiratory support | No | 51 (53.7) | 64 (55.7) | 0.775 |
| | Yes | 44 (46.3) | 51 (44.3) | |
| Neonatal intracranial hemorrhage | No | 90 (94.7) | 103 (89.6) | 0.171 |
| | Yes | 5 (5.3) | 12 (10.4) | |
| Neonatal hypoxic-ischemic encephalopathy | No | 93 (97.9) | 107 (93) | 0.100 |
| | Yes | 2 (2.1) | 8 (7) | |

BMI: Body mass index, ICU: Intensive care unit. Statistically significant p values are indicated in bold

### Placental Characteristics and Associated Morbidity

The study provided a detailed analysis of placental morphology and its clinical implications. Anterior placental location predominated (89.52%), with these cases demonstrating higher rates of complete invasion (77.7% vs. 27.3% in posterior placentas, p<0.001) and bladder involvement (27.7% vs. 4.5%, p=0.038). Posterior placentas were more likely to show focal invasion (72.7%) and were found in patients with significantly lower BMI (28.95±3.81 vs. 30.79±4.04, p=0.015) (Table 4). Surgical complications varied by placental location, with ureteral injury occurring exclusively in emergency cases (5.7% vs. 0%, p=0.024), while bladder injuries were more common in planned deliveries (22.9% vs. 18.6%, p=0.024).

### Antenatal Management

Antenatal steroid administration showed significant variation between groups. Complete courses were more frequently administered in planned deliveries (39.3% vs. 24.3%, p<0.001), while incomplete dosing was more common in emergency cases (24.3% vs. 5%). This disparity in prenatal preparation likely contributed to the observed differences in neonatal outcomes.

### Predictive Modeling

In the univariate logistic regression analysis evaluating factors associated with the mode of delivery, variables including maternal age, gravida, parity, BMI, smoking status, and number of previous cesarean sections were not significantly associated with delivery type (p>0.05) (Table 5).

Conversely, lower preoperative hematocrit was identified as a significant predictor of emergency delivery (OR: 1.092; 95% CI: 1.007-1.185; p=0.034), while preoperative hemoglobin level showed a borderline association (OR: 1.234; 95% CI: 0.992-1.534; p=0.059). In the multivariable model, preoperative hematocrit remained an independent predictor of emergency delivery after adjustment for BMI, number of prior cesarean sections, and placental location, supporting its potential clinical value as an early marker of adverse delivery timing.

Furthermore, in a separate multivariable analysis adjusting for maternal diabetes, hypertension, parity, and gestational age, emergency delivery continued to be independently associated with increased risk of neonatal RDS (adjusted OR: 2.7, 95% CI: 1.4-5.2) and perinatal death (adjusted OR: 3.8, 95% CI: 1.1-8.6), confirming the robustness of the observed associations.

### Correlational Analysis

Table 6 summarizes the significant correlations observed in the emergency and elective cesarean section groups. In the emergency cesarean section group, maternal age was positively correlated with gravida (r=0.244; p=0.042), parity (r=0.321; p=0.007), and the number of previous cesarean deliveries (r=0.270; p=0.024).

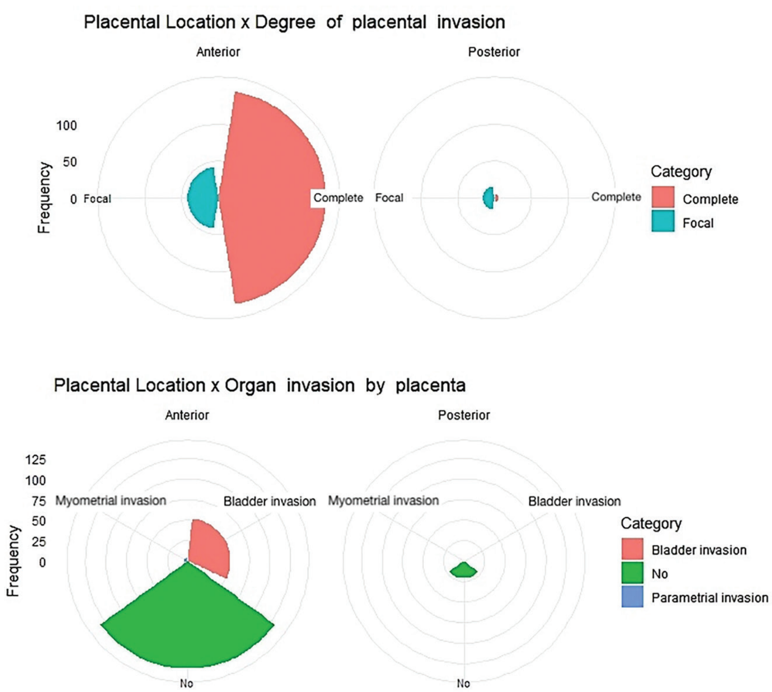


**Figure 3.** Placental invasion characteristics according to placental location (anterior vs. posterior)

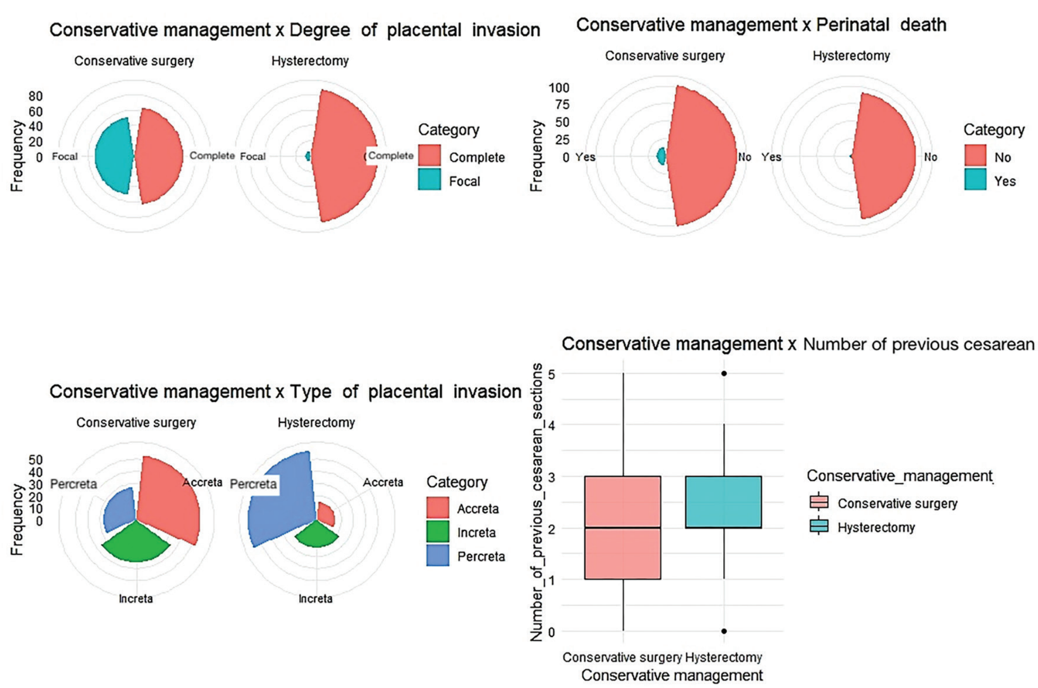


**Figure 4.** Clinical and obstetric characteristics according to management approach (conservative surgery vs. hysterectomy)

**Table 4.** Comparison of maternal, obstetric, and neonatal characteristics according to placental location (anterior vs. posterior)

| Variables | Category | Placental location | | p-value |
|---|---|---|---|---|
| | | Anterior | Posterior | |
| | | Statistics | Statistics | |
| Age (year) | | 33.7±4.81; 34 (19-45) | 34.82±5.22; 35 (26-43) | 0.345 |
| Gravida | | 4.35±1.5; 4 (1-12) | 3.86±1.42; 4 (2-7) | 0.113 |
| Parity | | 2.88±1.22; 3 (0-8) | 2.41±1.18; 2 (1-5) | 0.053 |
| BMI (kg/m$^2$) | | 30.79±4.04; 30 (19-42) | 28.95±3.81; 28 (24-41) | **0.015** |
| Number of previous cesarean sections | | 2.11±0.98; 2 (0-5) | 1.95±0.95; 2 (1-5) | 0.286 |
| Gestational age at diagnosis (weeks) | | 25.88±5.41; 24 (17-38) | 30.55±5.77; 31.5 (19-39) | **0.001** |
| Gestational age at delivery (weeks) | | 34.55±3.68; 36 (20-39) | 36.14±1.49; 36 (33-39) | **0.027** |
| Preoperative hemoglobin (g/L) | | 11.21±1.36; 11.2 (7.1-14.4) | 11.41±1.1; 11.4 (8.7-14) | 0.544 |
| Preoperative hematocrit (g/L) | | 34.09±3.64; 34.1 (23.5-46) | 35.18±3.44; 34.85 (30-44) | 0.324 |
| Intraoperative blood loss (cc) | | 612.77±385.56; 500 (200-2500) | 561.36±253.04; 500 (200-1100) | 0.947 |
| Erythrocyte transfusion (units) | | 2.44±1.88; 2 (0-10) | 2.68±2.3; 2 (0-10) | 0.827 |
| Maternal ICU stay duration (days) | | 0.82±1.45; 0 (0-6) | 1.14±1.75; 0 (0-6) | 0.543 |
| Hospital stay duration (days) | | 5.41±2.98; 5 (1-20) | 6.41±3.65; 5.5 (3-21) | **0.045** |
| Postpartum hemoglobin (g/L) | | 9.15±1.47; 9.2 (4.3-12.9) | 8.95±1.54; 8.75 (6.2-12) | 0.345 |
| Postpartum hematocrit (g/L) | | 27.84±4.31; 28.35 (14.5-37.1) | 27.24±4.32; 26.15 (20.4-36.1) | 0.354 |
| Perioperative tranexamic acid use (vials) | | 0.28±1.02; 0 (0-4) | 0.55±1.41; 0 (0-4) | 0.262 |
| Neonatal birth weight (g) | | 2591.51±710.08; 2780 (350-3600) | 2909.77±589.85; 2800 (1610-4025) | 0.182 |
| 1-minute APGAR score | | 6.97±1.5; 7 (0-9) | 7.32±0.89; 8 (5-8) | 0.449 |
| 5-minute APGAR score | | 8.68±1.72; 9 (0-10) | 9.36±0.73; 9.5 (8-10) | 0.072 |
| Neonatal ICU stay duration | | 3.66±6.29; 0.5 (0-36) | 3.73±5.53; 0 (0-19) | 0.992 |
| Neonatal respiratory distress syndrome | | 0.24±0.43; 0 (0-1) | 0.27±0.46; 0 (0-1) | 0.774 |
| Smoking | No | 159 (84.57%) | 21 (95.45%) | 0.168 |
| | Yes | 29 (15.43%) | 1 (4.55%) | |
| Diagnostic method | Ultrasound diagnosis | 36 (19.14%) | 7 (31.81%) | **<0.001** |
| | Ultrasound + Doppler | 152 (80.85%) | 14 (63.64%) | |
| | Ultrasound, confirme by MRI | 0 (0.00%) | 1 (4.55%) | |
| Indication for delivery | Elective | 125 (66.49%) | 15 (68.18%) | 0.873 |
| | Emergency | 63 (33.51%) | 7 (31.82%) | |

**Table 4.** Continued

| Variables | Category | Placental location | | p-value |
|---|---|---|---|---|
| | | Anterior | Posterior | |
| | | Statistics | Statistics | |
| Intrapartum assessment | Planned hysterectomy | 89 (47.34%) | 8 (36.36%) | 0.264 |
| | Conservative procedure | 78 (41.49%) | 9 (40.91%) | |
| | Failed conservative procedure followed by immediate hysterectomy | 18 (9.57%) | 5 (22.73%) | |
| | Failed conservative management followed by delayed hysterectomy | 3 (1.60%) | 0 (0.00%) | |
| Conservative management | Hysterectomy | 87 (46.28%) | 8 (36.36%) | 0.377 |
| | Conservative surgery | 101 (53.72%) | 14 (63.64%) | |
| Compression suture types | No | 187 (99.47%) | 20 (90.91%) | **0.001** |
| | Yes | 1 (0.53%) | 2 (9.09%) | |
| Degree of placental invasion | Focal | 42 (22.34%) | 16 (72.73%) | **<0.001** |
| | Complete | 146 (77.66%) | 6 (27.27%) | |
| Cesarean incision type | Low transverse | 29 (15.43%) | 15 (68.18%) | **<0.001** |
| | High transverse | 85 (45.21%) | 2 (9.09%) | |
| | Classic | 54 (28.72%) | 3 (13.64%) | |
| | Vertical | 20 (10.64%) | 2 (9.09%) | |
| Relation of incision to placenta | Incision through placenta | 5 (2.66%) | 1 (4.55%) | 0.615 |
| | Incision away from placenta | 183 (97.34%) | 21 (95.45%) | |
| Preoperative ultrasound | No | 8 (4.26%) | 4 (18.18%) | **0.008** |
| | Yes | 180 (95.74%) | 18 (81.82%) | |
| Organ invasion by placenta | No | 131 (69.68%) | 21 (95.45%) | **0.038** |
| | Bladder invasion | 52 (27.66%) | 1 (4.55%) | |
| | Parametrial invasion | 5 (2.66%) | 0 (0.00%) | |
| Intraoperative complications | No | 138 (73.40%) | 21 (95.45%) | 0.155 |
| | Unintentional cystotomy | 44 (23.40%) | 1 (4.55%) | |
| | Ureteric injury | 4 (2.13%) | 0 (0.00%) | |
| | Bowel injury | 2 (1.06%) | 0 (0.00%) | |

**Table 4.** Continued

| Variables | Category | Placental location | | p-value |
|---|---|---|---|---|
| | | Anterior | Posterior | |
| | | Statistics | Statistics | |
| Maternal ICU admission | No | 124 (65.96%) | 15 (68.18%) | 0.835 |
| | Yes | 64 (34.04%) | 7 (31.82%) | |
| Maternal mortality | No | 187 (99.47%) | 22 (100.00%) | 0.732 |
| | Yes | 1 (0.53%) | 0 (0.00%) | |
| Intrauterine fetal death | No | 184 (97.87%) | 22 (100.00%) | 0.490 |
| | Yes | 4 (2.13%) | 0 (0.00%) | |
| Perinatal death | No | 172 (91.49%) | 22 (100.00%) | 0.155 |
| | Yes | 16 (8.51%) | 0 (0.00%) | |
| Neonatal ICU requirement | No | 94 (50.00%) | 12 (54.55%) | 0.687 |
| | Yes | 94 (50.00%) | 10 (45.45%) | |
| Need for neonatal respiratory support | No | 103 (54.79%) | 12 (54.55%) | 0.983 |
| | Yes | 85 (45.21%) | 10 (45.45%) | |
| Neonatal intracranial hemorrhage | No | 172 (91.49%) | 21 (95.45%) | 0.519 |
| | Yes | 16 (8.51%) | 1 (4.55%) | |
| Neonatal hypoxic-ischemic encephalopathy | No | 179 (95.21%) | 21 (95.45%) | 0.960 |
| | Yes | 9 (4.79%) | 1 (4.55%) | |

BMI: Body mass index, ICU: Intensive care unit. Statistically significant p values are indicated in bold

**Table 5.** Univariate logistic regression analysis for predictors of elective versus emergency cesarean section

| Variables | Odds ratio | p-value | 95% CI for EXP(B) | |
|---|---|---|---|---|
| | | | Lower | Upper |
| Age | 1.003 | 0.928 | 0.945 | 1.064 |
| Constant | 1.823 | 0.561 | | |
| Gravida | 0.978 | 0.819 | 0.807 | 1.184 |
| Constant | 2.202 | 0.077 | | |
| Parity | 1.000 | 1.000 | 0.790 | 1.265 |
| Constant | 2.000 | 0.061 | | |
| BMI | 0.976 | 0.505 | 0.909 | 1.048 |
| Constant | 4.189 | 0.202 | | |
| Smoking | 0.842 | 0.676 | 0.376 | 1.884 |
| Constant | 1.882 | **0.002** | | |
| Number of previous cesarean sections | 0.900 | 0.484 | 0.671 | 1.208 |
| Constant | 2.496 | **0.009** | | |
| Gestational age at delivery (weeks) | 1.662 | **<0.001** | 1.372 | 2.013 |
| Constant | 0.000 | **<0.001** | | |
| Preoperative hemoglobin (g/L) | 1.234 | **0.059** | 0.992 | 1.534 |
| Constant | 0.191 | 0.183 | | |
| Preoperative hematocrit (g/L) | 1.092 | **0.034** | 1.007 | 1.185 |
| Constant | 0.099 | 0.103 | | |
| Intraoperative blood loss (cc) | 0.998 | **<0.001** | 0.997 | 0.999 |
| Constant | 8.571 | **<0.001** | | |
| Erythrocyte transfusion (units) | 0.968 | 0.666 | 0.835 | 1.122 |
| Constant | 2.169 | **0.001** | | |
| Maternal ICU stay duration (days) | 0.884 | 0.201 | 0.733 | 1.067 |
| Constant | 2.233 | <0.001 | | |
| Hospital stay duration (days) | 0.951 | 0.282 | 0.868 | 1.042 |
| Constant | 2.644 | **0.001** | | |
| Neonatal ICU stay duration (days) | 0.874 | **<0.001** | 0.823 | 0.928 |
| Constant | 3.344 | **<0.001** | | |
| Neonatal respiratory distress syndrome | 0.176 | **<0.001** | 0.090 | 0.345 |
| Constant | 3.270 | **<0.001** | | |

BMI: Body mass index, CI: Confidence interval, ICU: Intensive care unit. Statistically significant p values are indicated in bold

**Table 6.** Pearson correlation coefficients and p-values between clinical and neonatal variables in emergency and elective cesarean groups

| | | | Gravida | Parity | BMI | Number of previous cesarean sections | Gestational age at delivery | Intraoperative blood loss | Erythrocyte transfusion | Maternal ICU stay duration | Hospital stay duration | Neonatal ICU stay duration | Neonatal respiratory distress syndrome |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Emergency | Age | Pearson correlation | 0.244 | 0.321 | 0.221 | 0.270 | 0.140 | -0.056 | -0.206 | -0.043 | -0.098 | -0.043 | -0.120 |
| | | p-value | **0.042** | **0.007** | 0.066 | **0.024** | 0.247 | 0.643 | 0.088 | 0.723 | 0.421 | 0.723 | 0.323 |
| | Gravida | Pearson correlation | | 0.881 | 0.262 | 0.516 | -0.068 | -0.145 | -0.113 | -0.146 | -0.164 | 0.130 | 0.157 |
| | | p-value | | **<0.001** | **0.029** | **<0.001** | 0.578 | 0.230 | 0.353 | 0.227 | 0.175 | 0.282 | 0.195 |
| | Parite | Pearson correlation | | | 0.302 | 0.700 | -0.045 | -0.123 | -0.097 | -0.159 | -0.188 | 0.070 | 0.062 |
| | | p-value | | | **0.011** | **<0.001** | 0.711 | 0.311 | 0.426 | 0.187 | 0.119 | 0.567 | 0.608 |
| | BMI | Pearson correlation | | | | 0.039 | -0.009 | -0.028 | -0.035 | -0.145 | -0.064 | 0.010 | 0.210 |
| | | p-value | | | | 0.746 | 0.940 | 0.821 | 0.777 | 0.231 | 0.596 | 0.936 | 0.081 |
| | Number of previous cesarean sections | Pearson correlation | | | | | -0.106 | 0.127 | 0.153 | 0.026 | 0.013 | 0.157 | 0.055 |
| | | p-value | | | | | 0.384 | 0.297 | 0.206 | 0.833 | 0.917 | 0.196 | 0.648 |
| | Gestational age at delivery | Pearson correlation | | | | | | -0.039 | -0.134 | -0.151 | -0.017 | -0.385 | -0.582 |
| | | p-value | | | | | | 0.746 | 0.269 | 0.211 | 0.890 | **0.001** | **<0.001** |
| | Intraoperative blood loss | Pearson correlation | | | | | | | 0.880 | 0.692 | 0.405 | 0.142 | 0.141 |
| | | p-value | | | | | | | **<0.001** | **<0.001** | **<0.001** | 0.242 | 0.245 |
| | Erythrocyte transfusion | Pearson correlation | | | | | | | | 0.723 | 0.486 | 0.116 | 0.202 |
| | | p-value | | | | | | | | **<0.001** | **<0.001** | 0.340 | 0.094 |
| | Maternal ICU stay duration | Pearson correlation | | | | | | | | | 0.618 | 0.080 | 0.201 |
| | | p-value | | | | | | | | | **<0.001** | 0.513 | 0.095 |
| | Hospital stay duration | Pearson correlation | | | | | | | | | | 0.041 | 0.097 |
| | | p-value | | | | | | | | | | 0.737 | 0.423 |
| | Neonatal ICU stay duration | Pearson correlation | | | | | | | | | | | 0.547 |
| | | p-value | | | | | | | | | | | **<0.001** |

**Table 6.** Continued

| | | | Gravida | Parity | BMI | Number of previous cesarean sections | Gestational age at delivery | Intraoperative blood loss | Erythrocyte transfusion | Maternal ICU stay duration | Hospital stay duration | Neonatal ICU stay duration | Neonatal respiratory distress syndrome |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Elective | Age | Pearson correlation | 0.215 | 0.206 | 0.261 | 0.196 | -0.065 | -0.006 | 0.205 | 0.137 | 0.180 | 0.086 | 0.098 |
| | | p-value | **0.011** | **0.014** | **0.002** | **0.020** | 0.448 | 0.943 | **0.015** | 0.106 | **0.034** | 0.313 | 0.247 |
| | Gravida | Pearson correlation | | 0.830 | 0.176 | 0.551 | 0.033 | -0.096 | -0.088 | -0.112 | -0.016 | 0.167 | 0.108 |
| | | p-value | | **<0.001** | **0.037** | **<0.001** | 0.700 | 0.260 | 0.300 | 0.189 | 0.848 | **0.049** | 0.204 |
| | Parity | Pearson correlation | | | 0.224 | 0.676 | 0.051 | -0.084 | -0.065 | -0.132 | -0.083 | 0.041 | 0.039 |
| | | p-value | | | **0.008** | **<0.001** | 0.549 | 0.326 | 0.443 | 0.121 | 0.327 | 0.634 | 0.650 |
| | BMI | Pearson correlation | | | | 0.167 | 0.099 | -0.176 | -0.056 | -0.063 | -0.012 | -0.126 | -0.089 |
| | | p-value | | | | **0.049** | 0.243 | **0.037** | 0.509 | 0.456 | 0.889 | 0.138 | 0.294 |
| | Number of previous cesarean sections | Pearson correlation | | | | | 0.004 | -0.033 | 0.106 | 0.014 | -0.039 | -0.087 | 0.040 |
| | | p-value | | | | | 0.966 | 0.695 | 0.212 | 0.867 | 0.645 | 0.304 | 0.637 |
| | Gestational age at delivery | Pearson correlation | | | | | | -0.103 | 0.016 | 0.027 | -0.063 | -0.149 | -0.170 |
| | | p-value | | | | | | 0.226 | 0.855 | 0.751 | 0.463 | 0.078 | **0.045** |
| | Intraoperative blood loss | Pearson correlation | | | | | | | 0.591 | 0.360 | 0.230 | 0.067 | 0.093 |
| | | p-value | | | | | | | **<0.001** | **<0.001** | **0.006** | 0.429 | 0.275 |
| | Erythrocyte transfusion | Pearson correlation | | | | | | | | 0.640 | 0.525 | 0.039 | 0.167 |
| | | p-value | | | | | | | | **<0.001** | **<0.001** | 0.644 | **0.049** |
| | Maternal ICU stay duration | Pearson correlation | | | | | | | | | 0.613 | 0.124 | 0.308 |
| | | p-value | | | | | | | | | **<0.001** | 0.143 | **<0.001** |
| | Hospital stay duration | Pearson correlation | | | | | | | | | | 0.336 | 0.439 |
| | | p-value | | | | | | | | | | **<0.001** | **<0.001** |
| | Neonatal ICU stay duration | Pearson correlation | | | | | | | | | | | 0.628 |
| | | p-value | | | | | | | | | | | **<0.001** |

BMI: Body mass index, ICU: Intensive care unit. Statistically significant p values are indicated in bold

Increasing gestational age at delivery was negatively correlated with NICU stay duration (r=-0.385; p=0.001) and the presence of neonatal RDS (r=-0.582; p<0.001). Intraoperative blood loss was strongly correlated with erythrocyte transfusion requirement (r=0.880; p<0.001) and maternal ICU stay duration (r=0.692; p<0.001). In the elective cesarean section group, maternal age showed significant positive correlations with gravida (r=0.215; p=0.011), parity (r=0.206; p=0.014), BMI (r=0.261; p=0.002), and the number of previous cesarean deliveries (r=0.196; p=0.020). Intraoperative blood loss was positively correlated with erythrocyte transfusion (r=0.591; p<0.001) and maternal ICU stay duration (r=0.360; p<0.001).

On the other hand, in the hysterectomy group, maternal age showed a positive correlation with gravida (r=0.285, p=0.005), parity (r=0.232, p=0.024), and the number of previous cesarean sections (r=0.300, p=0.003). Parity was positively associated with gestational age at delivery (r=0.515, p<0.001), but negatively correlated with intraoperative blood loss (r=-0.240, p=0.019) and maternal ICU stay (r=-0.245, p=0.017). Gestational age was inversely correlated with neonatal ICU stay (r=-0.381, p<0.001) and neonatal RDS (r=-0.405, p<0.001). Intraoperative blood loss showed strong positive correlations with erythrocyte transfusion (r=0.575, p<0.001) and maternal ICU stay (r=0.369, p<0.001). Erythrocyte transfusion was positively associated with maternal ICU stay (r=0.606, p<0.001) and hospital stay (r=0.481, p<0.001). In the uterus-preserving surgery group, maternal age was positively correlated with gravida (r=0.202, p=0.030) and parity (r=0.198, p=0.034). Gestational age showed negative correlations with neonatal ICU stay (r=-0.482, p<0.001) and neonatal RDS (r=-0.609, p<0.001). Intraoperative blood loss was positively associated with erythrocyte transfusion (r=0.730, p<0.001), maternal ICU stay (r=0.563, p<0.001), hospital stay (r=0.436, p<0.001), and neonatal ICU stay (r=0.299, p=0.001). Erythrocyte transfusion was positively correlated with maternal ICU stay (r=0.718, p<0.001) and hospital stay (r=0.557, p<0.001) (Table 7).

Table 8 presents the correlation analysis of maternal and neonatal outcomes between the anterior and posterior placenta groups. In the anterior placenta group, maternal age was positively correlated with gravida (r=0.227, p=0.002), parity (r=0.264, p<0.001), BMI (r=0.253, p<0.001), and the number of previous cesarean sections (r=0.210, p=0.004). The number of previous cesarean sections correlated positively with erythrocyte transfusion (r=0.172, p=0.018). Gestational age at delivery was negatively correlated with intraoperative blood loss (r=-0.239, p=0.001), NICU stay (r=-0.437, p<0.001), and neonatal RDS (r=-0.557, p<0.001). Intraoperative blood loss correlated positively with erythrocyte transfusion (r=0.717, p<0.001), maternal ICU stay (r=0.529, p<0.001), hospital stay (r=0.348, p<0.001), NICU stay (r=0.225, p=0.002), and neonatal RDS (r=0.261, p<0.001). Erythrocyte transfusion was significantly associated with maternal ICU stay (r=0.652, p<0.001) and hospital stay duration (r=0.483, p<0.001). In the posterior placenta group, gravida was strongly correlated with parity (r=0.884, p<0.001), BMI (r=0.490, p=0.021), and the number of previous cesarean sections (r=0.699, p<0.001). Parity was also associated with BMI (r=0.427, p=0.047) and the number of previous cesarean sections (r=0.781, p<0.001). BMI showed a significant positive correlation with the number of previous cesarean sections (r=0.512, p=0.015). Gestational age at delivery was negatively correlated with NICU stay (r=-0.568, p=0.006). Erythrocyte transfusion was positively correlated with maternal ICU stay duration (r=0.768, p<0.001) and hospital stay duration (r=0.670, p=0.001).

## Discussion

In this retrospective analysis of 210 patients diagnosed with PAS, we investigated the impact of antenatal risk factors, clinical presentation, and management strategies on maternal and neonatal outcomes. Our findings demonstrate that planned surgical intervention was associated with reduced intraoperative blood loss, higher gestational age at delivery, and improved neonatal outcomes compared to emergency interventions. These results reinforce the critical role of antenatal diagnosis and timely delivery planning in optimizing outcomes for both the mother and the neonate.

The observed predominance of anterior placental location in our cohort (89.5%) aligns with prior studies reporting anterior implantation as a significant risk factor for severe placental invasion, particularly in patients with multiple prior cesarean sections[12]. Our data further indicate that anterior location was associated with higher rates of complete invasion and bladder involvement. These findings are consistent with earlier reports suggesting that anterior PAS may have a more aggressive clinical course and higher surgical complexity[13,14]. This underlines the importance of detailed prenatal imaging and multidisciplinary surgical preparation, especially in anteriorly located PAS cases.

Surgical management in our cohort favored hysterectomy in 58.6% of cases, with conservative uterus-preserving approaches used in 41.4% of cases, particularly in accreta and increta cases. This is comparable to previous large series, which reported hysterectomy rates ranging from 50% to 80% depending on disease severity and institutional protocols[15,16]. Moreover, accumulating evidence from recent high-quality studies strongly supports the clinical value of selective uterus-preserving surgical techniques in appropriately selected PAS patients[17-19]. These techniques, including localized resection of the invaded myometrium, partial myometrial excision with uterine reconstruction, stepwise devascularization, and the placenta left *in situ* approach, have emerged as rational alternatives to routine peripartum hysterectomy, particularly in cases of focal or limited invasion and hemodynamic stability. Multiple observational series and meta-analyses have demonstrated that such uterus-preserving interventions are associated with significantly reduced operative time, lower intraoperative blood loss, and decreased transfusion requirements compared to hysterectomy, without compromising maternal survival[20].

**Table 7.** Pearson correlation coefficients between clinical and neonatal variables in the hysterectomy and conservative surgery groups

| | | | Gravida | Parity | BMI | Number of previous cesarean sections | Gestational age at delivery | Intraoperative blood loss | Erythrocyte transfusion | Maternal ICU stay duration | Hospital stay duration | Neonatal ICU stay duration | Neonatal respiratory distress syndrome |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hysterectomy | Age | Pearson correlation | 0.285 | 0.232 | 0.300 | 0.205 | 0.057 | -0.044 | 0.051 | 0.083 | 0.085 | 0.093 | 0.125 |
| | | p-value | **0.005** | **0.024** | **0.003** | **0.046** | 0.586 | 0.669 | 0.622 | 0.425 | 0.411 | 0.368 | 0.228 |
| | Gravida | Pearson correlation | | 0.864 | 0.269 | 0.332 | 0.167 | -0.239 | -0.255 | -0.175 | -0.103 | 0.237 | 0.131 |
| | | p-value | | **<0.001** | **0.008** | **0.001** | 0.106 | **0.020** | **0.013** | 0.091 | 0.321 | **0.021** | 0.206 |
| | Parity | Pearson correlation | | | 0.321 | 0.515 | 0.209 | -0.240 | -0.237 | -0.245 | -0.203 | 0.090 | 0.037 |
| | | p-value | | | **0.002** | **<0.001** | **0.042** | **0.019** | **0.021** | **0.017** | **0.048** | 0.383 | 0.723 |
| | BMI | Pearson correlation | | | | 0.188 | 0.169 | -0.076 | 0.002 | 0.005 | 0.063 | -0.079 | 0.061 |
| | | p-value | | | | 0.068 | 0.101 | 0.462 | 0.985 | 0.958 | 0.544 | 0.449 | 0.555 |
| | Number of previous cesarean sections | Pearson correlation | | | | | 0.060 | -0.068 | -0.009 | -0.135 | -0.227 | -0.016 | -0.094 |
| | | p-value | | | | | 0.564 | 0.511 | 0.933 | 0.191 | **0.027** | 0.874 | 0.367 |
| | Gestational age at delivery | Pearson correlation | | | | | | -0.364 | -0.065 | -0.194 | -0.113 | -0.381 | -0.405 |
| | | p-value | | | | | | **<0.001** | 0.533 | 0.060 | 0.274 | **<0.001** | **<0.001** |
| | Intraoperative blood loss | Pearson correlation | | | | | | | 0.575 | 0.369 | 0.199 | 0.142 | 0.236 |
| | | p-value | | | | | | | **<0.001** | **<0.001** | 0.054 | 0.170 | 0.021 |
| | Erythrocyte transfusion | Pearson correlation | | | | | | | | 0.606 | 0.481 | -0.068 | 0.051 |
| | | p-value | | | | | | | | **<0.001** | **<0.001** | 0.512 | 0.624 |
| | Maternal ICU stay duration | Pearson correlation | | | | | | | | | 0.607 | 0.054 | 0.273 |
| | | p-value | | | | | | | | | **<0.001** | 0.603 | 0.007 |
| | Hospital stay duration | Pearson correlation | | | | | | | | | | 0.170 | 0.267 |
| | | p-value | | | | | | | | | | **0.099** | **0.009** |
| | Neonatal ICU stay duration | Pearson correlation | | | | | | | | | | | 0.710 |
| | | p-value | | | | | | | | | | | **<0.001** |

**Table 7.** Continued

| | | | Gravida | Parity | BMI | Number of previous cesarean sections | Gestational age at delivery | Intraoperative blood loss | Erythrocyte transfusion | Maternal ICU stay duration | Hospital stay duration | Neonatal ICU stay duration | Neonatal respiratory distress syndrome |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conservative Surgery | Age | Pearson correlation | 0.121 | 0.202 | 0.198 | 0.177 | 0.042 | 0.023 | 0.055 | 0.097 | 0.042 | -0.061 | -0.090 |
| | | p-value | 0.196 | **0.030** | **0.034** | 0.058 | 0.658 | 0.805 | 0.560 | 0.300 | 0.656 | 0.521 | 0.341 |
| | Gravida | Pearson correlation | | 0.814 | 0.116 | 0.723 | -0.179 | 0.049 | 0.033 | -0.048 | -0.052 | 0.011 | 0.117 |
| | | p-value | | **<0.001** | 0.217 | **<0.001** | 0.056 | 0.604 | 0.724 | 0.611 | 0.582 | 0.908 | 0.213 |
| | Parity | Pearson correlation | | | 0.158 | 0.825 | -0.157 | 0.062 | 0.049 | -0.021 | -0.052 | -0.013 | 0.050 |
| | | p-value | | | 0.092 | **<0.001** | 0.093 | 0.507 | 0.600 | 0.826 | 0.584 | 0.886 | 0.596 |
| | BMI | Pearson correlation | | | | 0.068 | -0.096 | -0.094 | -0.085 | -0.151 | -0.131 | -0.007 | 0.027 |
| | | p-value | | | | 0.473 | 0.308 | 0.315 | 0.369 | 0.106 | 0.161 | 0.941 | 0.772 |
| | Number of previous cesarean sections | Pearson correlation | | | | | -0.143 | 0.149 | 0.210 | 0.163 | 0.164 | 0.079 | 0.178 |
| | | p-value | | | | | 0.128 | 0.112 | **0.025** | 0.082 | 0.081 | 0.400 | 0.057 |
| | Gestational age at delivery | Pearson correlation | | | | | | -0.174 | -0.072 | -0.049 | -0.035 | -0.482 | -0.609 |
| | | p-value | | | | | | 0.063 | 0.442 | 0.600 | 0.711 | **<0.001** | **<0.001** |
| | Intraoperative blood loss | Pearson correlation | | | | | | | 0.730 | 0.563 | 0.436 | 0.299 | 0.239 |
| | | p-value | | | | | | | **<0.001** | **<0.001** | **<0.001** | **0.001** | **0.010** |
| | Erythrocyte transfusion | Pearson correlation | | | | | | | | 0.718 | 0.557 | 0.196 | 0.269 |
| | | p-value | | | | | | | | **<0.001** | **<0.001** | **0.036** | **0.004** |
| | Maternal ICU stay duration | Pearson correlation | | | | | | | | | 0.652 | 0.190 | 0.274 |
| | | p-value | | | | | | | | | **<0.001** | **0.041** | **0.003** |
| | Hospital stay duration | Pearson correlation | | | | | | | | | | 0.210 | 0.316 |
| | | p-value | | | | | | | | | | **0.024** | **0.001** |
| | Neonatal ICU stay duration | Pearson correlation | | | | | | | | | | | 0.558 |
| | | p-value | | | | | | | | | | | **<0.001** |

BMI: Body mass index, ICU: Intensive care unit. Statistically significant p values are indicated in bold

**Table 8.** Correlation analysis of maternal and neonatal outcomes in anterior and posterior placenta groups

| | | | Gravida | Parity | BMI | Number of previous cesarean sections | Gestational age at delivery | Intraoperative blood loss | Erythrocyte transfusion | Maternal ICU stay duration | Hospital stay duration | Neonatal ICU stay duration | Neonatal respiratory distress syndrome |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Anterior | Age | Pearson correlation | 0.227 | 0.264 | 0.253 | 0.210 | 0.019 | -0.003 | 0.060 | 0.092 | 0.049 | 0.008 | -0.031 |
| | | p-value | **0.002** | **<0.001** | **<0.001** | **0.004** | 0.794 | 0.965 | 0.415 | 0.208 | 0.506 | 0.918 | 0.672 |
| | Gravida | Pearson correlation | | 0.841 | 0.162 | 0.521 | -0.005 | -0.108 | -0.071 | -0.088 | -0.054 | 0.145 | 0.142 |
| | | p-value | | **<0.001** | **0.026** | **<0.001** | 0.941 | 0.139 | 0.333 | 0.230 | 0.462 | **0.047** | 0.052 |
| | Parite | Pearson correlation | | | 0.216 | 0.673 | 0.028 | -0.098 | -0.049 | -0.103 | -0.113 | 0.056 | 0.057 |
| | | p-value | | | **0.003** | **<0.001** | 0.701 | 0.179 | 0.505 | 0.159 | 0.124 | 0.446 | 0.435 |
| | BMI | Pearson correlation | | | | 0.086 | 0.031 | -0.103 | 0.004 | -0.045 | 0.029 | -0.029 | 0.070 |
| | | p-value | | | | 0.243 | 0.675 | 0.158 | 0.956 | 0.541 | 0.689 | 0.695 | 0.341 |
| | Number of previous cesarean sections | Pearson correlation | | | | | -0.061 | 0.059 | 0.172 | 0.055 | -0.019 | 0.046 | 0.052 |
| | | p-value | | | | | 0.408 | 0.424 | **0.018** | 0.456 | 0.797 | 0.533 | 0.479 |
| | Gestational age at delivery | Pearson correlation | | | | | | -0.239 | -0.097 | -0.133 | -0.087 | -0.437 | -0.557 |
| | | p-value | | | | | | **0.001** | 0.183 | 0.070 | 0.234 | **<0.001** | **<0.001** |
| | Intraoperative blood loss | Pearson correlation | | | | | | | 0.717 | 0.529 | 0.348 | 0.225 | 0.261 |
| | | p-value | | | | | | | **<0.001** | **<0.001** | **<0.001** | **0.002** | **<0.001** |
| | Erythrocyte transfusion | Pearson correlation | | | | | | | | 0.652 | 0.483 | 0.090 | 0.178 |
| | | p-value | | | | | | | | **<0.001** | **<0.001** | 0.219 | **0.015** |
| | Maternal ICU stay duration | Pearson correlation | | | | | | | | | 0.623 | 0.141 | 0.292 |
| | | p-value | | | | | | | | | **<0.001** | 0.054 | **<0.001** |
| | Hospital stay duration | Pearson correlation | | | | | | | | | | 0.191 | 0.287 |
| | | p-value | | | | | | | | | | **0.009** | **<0.001** |
| | Neonatal ICU stay duration | Pearson correlation | | | | | | | | | | | 0.629 |
| | | p-value | | | | | | | | | | | **<0.001** |

**Table 8.** Continued

| | | | Gravida | Parity | BMI | Number of previous cesarean sections | Gestational age at delivery | Intraoperative blood loss | Erythrocyte transfusion | Maternal ICU stay duration | Hospital stay duration | Neonatal ICU stay duration | Neonatal respiratory distress syndrome |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Posterior | Age | Pearson correlation | 0.298 | 0.206 | 0.321 | 0.344 | 0.383 | -0.294 | -0.009 | -0.106 | 0.184 | 0.089 | 0.222 |
| | | p-value | 0.178 | 0.358 | 0.146 | 0.117 | 0.078 | 0.184 | 0.968 | 0.637 | 0.412 | 0.694 | 0.320 |
| | Gravida | Pearson correlation | | 0.884 | 0.490 | 0.699 | -0.170 | -0.075 | -0.261 | -0.335 | -0.099 | 0.074 | -0.013 |
| | | p-value | | **<0.001** | **0.021** | **<0.001** | 0.448 | 0.741 | 0.240 | 0.127 | 0.662 | 0.745 | 0.953 |
| | Parite | Pearson correlation | | | 0.427 | 0.781 | -0.277 | -0.088 | -0.248 | -0.373 | -0.096 | -0.019 | -0.040 |
| | | p-value | | | **0.047** | **<0.001** | 0.213 | 0.697 | 0.266 | 0.087 | 0.671 | 0.935 | 0.859 |
| | BMI | Pearson correlation | | | | 0.512 | -0.024 | -0.061 | -0.404 | -0.327 | -0.334 | -0.143 | -0.157 |
| | | p-value | | | | **0.015** | 0.915 | 0.787 | 0.062 | 0.138 | 0.128 | 0.526 | 0.485 |
| | Number of previous cesarean sections | Pearson correlation | | | | | -0.096 | -0.196 | -0.225 | -0.196 | 0.033 | 0.007 | 0.140 |
| | | p-value | | | | | 0.670 | 0.382 | 0.314 | 0.382 | 0.884 | 0.977 | 0.535 |
| | Gestational age at delivery | Pearson correlation | | | | | | -0.067 | 0.264 | 0.175 | -0.046 | -0.568 | -0.268 |
| | | p-value | | | | | | 0.765 | 0.235 | 0.436 | 0.840 | **0.006** | 0.228 |
| | Intraoperative blood loss | Pearson correlation | | | | | | | 0.285 | 0.179 | 0.021 | 0.179 | -0.069 |
| | | p-value | | | | | | | 0.198 | 0.426 | 0.928 | 0.425 | 0.759 |
| | Erythrocyte transfusion | Pearson correlation | | | | | | | | 0.768 | 0.670 | 0.004 | 0.178 |
| | | p-value | | | | | | | | **<0.001** | **0.001** | 0.986 | 0.429 |
| | Maternal ICU stay duration | Pearson correlation | | | | | | | | | 0.564 | -0.030 | 0.130 |
| | | p-value | | | | | | | | | **0.006** | 0.893 | 0.564 |
| | Hospital stay duration | Pearson correlation | | | | | | | | | | 0.202 | 0.302 |
| | | p-value | | | | | | | | | | 0.368 | 0.172 |
| | Neonatal ICU stay duration | Pearson correlation | | | | | | | | | | | 0.654 |
| | | p-value | | | | | | | | | | | **0.001** |

BMI: Body mass index, ICU: Intensive care unit. Statistically significant p values are indicated in bold

In addition, uterus-preserving surgery confers important long-term advantages, including preservation of menstrual function and the potential for future pregnancy. From a healthcare systems perspective, these strategies have also been linked to reduced resource utilization—notably shorter ICU stays, fewer secondary surgical procedures, and lower overall hospital costs—when performed in tertiary referral centers with multidisciplinary PAS teams and standardized management protocols. Our present findings align closely with this growing body of evidence, reaffirming that the selective use of uterus-preserving techniques in appropriately selected patients, tailored to the extent of placental invasion, placental location, and maternal clinical condition, is pivotal for optimizing outcomes. Integrating precise antenatal imaging with multidisciplinary intraoperative coordination allows for balancing maternal safety with fertility preservation, thereby reflecting the contemporary paradigm shift from radical to selective management in PAS care.

A key statistical finding of our study was the strong and consistent negative correlation between intraoperative blood loss and postoperative hemoglobin/hematocrit levels across all subgroups, including anterior vs. posterior location, hysterectomy vs. uterus-preserving surgery, and emergency vs. planned deliveries. The magnitude of these correlations (Spearman r ranging from -0.45 to -0.68, all $p<0.001$) confirms the predictable hematologic impact of blood loss in PAS surgery. Moreover, multivariate logistic regression identified lower preoperative hematocrit as an independent predictor of emergency delivery (OR: 1.092; 95% CI: 1.007-1.185; $p=0.034$), suggesting that antenatal hematologic optimization may reduce the likelihood of urgent intervention. These findings are in agreement with previous reports that emphasize the importance of preoperative hemoglobin status in reducing intraoperative transfusion needs and improving hemodynamic stability[21,22]. These results also highlight the importance of meticulous surgical planning, early vascular control, and the availability of massive transfusion protocols.

Emergency delivery was required in one-third of patients, most commonly due to PAS-related hemorrhage. Current guidelines emphasize rapid intervention in cases with impending or active hemorrhage, which aligns with our findings, as emergency deliveries were associated with markedly higher intraoperative blood loss, lower neonatal birth weight, and increased NICU admissions compared with planned procedures[23]. These results support previous studies reporting that unplanned surgery compromises maternal hemodynamic stability and worsens perinatal outcomes[24-26]. Moreover, the strong association between reduced preoperative hematocrit and the need for emergency delivery observed in our multivariate analysis suggests that antenatal optimization of maternal hematologic status may represent a modifiable risk factor for reducing the likelihood of unplanned intervention.

Neonatal outcomes in our cohort reflected the gestational age at delivery, with lower Apgar scores and higher respiratory distress rates in the emergency delivery group. This underscores the dual benefit of planned intervention: not only is maternal morbidity reduced, but neonatal maturity and stability at birth are improved. Our findings are in line with international guidelines recommending delivery at a gestational age balancing fetal maturity and maternal safety, often between 34 and 36 weeks in PAS cases[27-29].

Regarding long-term outcomes, several recent investigations have shown that uterus-preserving management may enable successful subsequent pregnancies in carefully selected patients, provided that rigorous follow-up and structured surveillance protocols are implemented[30]. However, subsequent pregnancies carry a measurable risk of recurrent abnormal placentation—most commonly placenta previa or recurrent PAS—highlighting the need for preconception counseling and delivery planning in tertiary centers with PAS expertise[31]. From a maternal health perspective, conservative strategies have been associated not only with preservation of reproductive potential but also with improved psychological, and quality-of-life outcomes, particularly among women desiring future fertility[32]. Long-term gynecologic sequelae, such as intrauterine adhesions or secondary infertility, appear uncommon when uterine repair is meticulous and postoperative infections are prevented through careful perioperative management. Moreover, structured and multidisciplinary care pathways that emphasize antenatal diagnosis, planned delivery, and optimized surgical coordination are consistently linked to lower blood transfusion requirements, shorter ICU stays, and reduced overall hospitalization time, translating into measurable cost savings for health systems. Economic analyses from recent multicenter studies indicate that planned conservative management, when applied in appropriate cases, can reduce total healthcare expenditure by up to 25-30% compared with emergency hysterectomy performed without prior antenatal diagnosis[33].

### Study Limitations

A major strength of our study is the relatively large sample size of patients with histopathologically confirmed PAS, allowing for meaningful subgroup analyses by placental location, surgical approach, and timing of delivery. The inclusion of detailed maternal, surgical, and neonatal outcomes, combined with correlation and regression analyses, provides a comprehensive assessment of the clinical course of PAS in a real-world tertiary care setting. Additionally, our focus on the predictive value of preoperative hematocrit for emergency delivery offers a potentially actionable clinical parameter for antenatal risk stratification.

However, several limitations should be acknowledged. The retrospective design inherently carries the risk of selection and information bias, particularly in the completeness of medical records. The study was conducted in a single tertiary referral center, which may limit the generalizability of the results to lower-resource or non-specialized settings. Furthermore, although surgical decision-making was standardized to an extent, variations in surgeon experience and intraoperative judgment could have influenced outcomes. In our center, although all procedures were performed by obstetric surgeons with expertise in high-risk obstetrics and PAS management, subtle differences in surgical judgment—such as the decision to proceed with uterus-preserving management versus radical management, the threshold for hysterectomy, or the intraoperative use of hemostatic and reconstructive techniques—may have impacted both maternal and neonatal outcomes. This inherent heterogeneity in operator experience is a well-recognized limitation in PAS research and contributes to interstudy variability reported in the literature. Differences in team composition, intraoperative resource availability, and surgeon familiarity with advanced uterus-preserving procedures may also act as confounding factors, particularly in retrospective analyses where allocation to a specific surgical approach cannot be fully randomized or blinded. Furthermore, emergent situations often necessitate rapid decision-making under suboptimal conditions, amplifying the effect of individual expertise on surgical outcomes. Although the use of institutional management protocols and multidisciplinary coordination minimizes this variability to some extent, the absence of a fully standardized decision-making algorithm across all surgeons remains an important source of potential bias. Finally, neonatal outcomes were influenced by multiple factors beyond the scope of PAS, including comorbidities and antenatal events, which could not be fully controlled in the analysis.

## Conclusion

This study demonstrates that early diagnosis and planned delivery in cases of PAS are critical for optimizing both maternal and neonatal outcomes. Emergency deliveries were associated with lower gestational age at birth, increased intraoperative blood loss, and higher rates of adverse neonatal outcomes, including low birth weight, reduced Apgar scores, prolonged NICU stay, and increased risk of RDS and other serious complications. Surgical management strategies varied according to the type and extent of placental invasion, with uterus-preserving approaches more frequently adopted in focal PAS and hysterectomy preferred in complete invasion or percreta cases. The choice of uterine incision was also influenced by placental location and invasion type, underscoring the importance of individualized surgical planning.

These findings highlight the necessity of multidisciplinary collaboration and careful preoperative planning to reduce maternal morbidity and improve neonatal prognosis. Incorporating detailed antenatal imaging, risk stratification, and timely delivery planning into routine care pathways can significantly mitigate the risks associated with PAS. Future prospective, multicenter studies are warranted to validate these findings and refine management guidelines.

**Ethics**

**Ethics Committee Approval:** This retrospective cohort study was conducted at the Department of Obstetrics and Gynecology, İnönü University Faculty of Medicine, after obtaining approval from the Institutional Non-Interventional Clinical Research Ethics Committee (approval date: 02.04.2024; approval number: 2024/5875).

**Informed Consent:** Retrospective study.

**Footnotes**

**Authorship Contributions**

Concept: L.O., R.M., Design: L.O., R.M., E.Y., Data Collection or Processing: L.O., R.M., H.Ö., Analysis or Interpretation: Ş.Y., Literature Search: R.M., Writing: R.M., E.Y., H.Ö., Ş.Y.

**Conflict of Interest:** Ercan Yılmaz MD is editor-in-chief in Turkish Journal of Obstetrics and Gynecology. He had no involvement in the peer-review of this article and had no access to information regarding its peer-review.

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