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Original Research

Are Planned Caesarean Hysterectomies Performed Too Early in Placenta Accreta Spectrum Cases?

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Abstract

Background: Placenta accreta spectrum (PAS) is a condition associated with high maternal mortality and morbidity rates due to intraoperative massive bleeding. There is currently no consensus regarding the optimal gestational age at which elective surgery should be performed to reduce the potential complications of PAS. In PAS disorders, the optimal gestational week for intervention is carefully determined to improve neonatal survival and health outcomes while minimizing maternal mortality and the risk of complications associated with surgical treatment. The aim of this study was to evaluate the surgical outcomes of patients who underwent caesarean hysterectomy for PAS in our clinic, according to the timing of the procedure, to be able to predict potential complications and plan delivery time. **Methods**: Following a retrospective review of patients who underwent caesarean hysterectomy for PAS in our clinic, a total of 117 cases were included in the study. The patients included in the study were divided into five groups based on gestational age at the time of surgery: Group 1 (<34 weeks), Group 2 (≥34 weeks–35 weeks<), Group 3 (≥35 weeks–36 weeks<), Group 4 (≥36 weeks–37 weeks<), Group 5 (≥37 weeks). The groups were compared in terms of demographic data, hematological parameters, histopathological classification, surgical approach, early and late maternal complications, and neonatal outcomes. **Results**: No significant differences were observed among groups regarding demographics, intraoperative and postoperative blood transfusions, or maternal complication rates. Neonatal outcomes, excluding asphyxia, significantly improved with advancing gestational age, with the best results after 37 gestational weeks. However, maternal clinical complications increased beyond 37 gestational weeks. No significant association was found between histopathological classifications and transfusion requirements. Emergency surgeries were associated with longer intensive care unit (ICU) stays and higher transfusion needs. No significant differences in complication rates were found between the groups including between patients who underwent planned (elective) and unplanned (emergency) surgeries. **Conclusions**: This study demonstrated that PAS surgeries performed up to the 37th gestational week significantly improved neonatal outcomes without increasing maternal complication rates. Although neonatal outcomes were optimal after 37 weeks, a clinically significant rise in maternal complications was observed. Moreover, emergency surgeries were associated with longer ICU stays and higher blood transfusion requirements compared to elective procedures. These findings suggest that, in appropriately selected patients, postponing PAS surgery until 37 weeks of gestation, under close surveillance and multidisciplinary management, can enhance neonatal outcomes without increasing maternal morbidity.

Keywords: placenta accreta spectrum; placenta accreta; caesarean timing

1. Introduction

Placenta accreta spectrum (PAS) disorders represent a critical obstetric complication characterized by abnormal placental attachment and invasion into the uterine wall, often resulting in severe maternal morbidity and mortality [1,2]. Initially described by Irving and Hertig in 1937, PAS has witnessed a dramatic surge in incidence over recent decades, escalating from 1 in 30,000 births in the 1950s to 1 in 533 births today [3]. This rise is primarily attributed to increasing cesarean delivery rates, previous uterine surgeries, advanced maternal age, and multiparity [4,5]. Despite advancements in prenatal imaging and surgical techniques, PAS remains a formidable challenge in obstetrics, with significant variations in clinical management and unresolved debates regarding optimal timing of delivery [6,7].

The clinical spectrum of PAS is classified into three subtypes—placenta accreta, increta, and percreta—based on the depth of trophoblastic invasion into the uterine wall. Placenta accreta, the most common subtype (75–80% of cases), involves superficial adherence to the myometrium. In contrast, placenta increta (15–17%) penetrates more deeply into the myometrium, while placenta percreta (5–7%) extends through the uterine serosa and may invade into adjacent organs such as the bladder [1,8]. Prenatal diagnosis relies primarily on ultrasonography, with key features including placental lacunae, loss of the retroplacental clear zone, and aberrant vascularity [9,10]. Magnetic resonance imaging (MRI) serves as an adjunct, particularly in assessing extrauterine involvement. However, neither imaging modality is infallible, and diagnostic accuracy heavily depends on operator expertise [11]. Current management pri-

marily involves cesarean hysterectomy, though conservative approaches (e.g., uterine artery ligation, compression sutures) are explored in selected cases to preserve fertility [12]. Nevertheless, the absence of standardized protocols for delivery timing complicates clinical decision-making, as delayed intervention may improve neonatal outcomes at the cost of heightened maternal risks [13,14].

This study aims to evaluate the optimal gestational age for delivery in PAS cases by analyzing maternal and fetal outcomes following cesarean hysterectomy across different gestational weeks. By systematically assessing complications such as hemorrhage, adjacent organ injury, neonatal intensive care unit (NICU) admission, and perinatal mortality, we seek to establish evidence-based guidelines that balance fetal viability with maternal safety. Our findings intend to address a critical gap in PAS management, offering clinicians a structured framework to mitigate risks and improve patient outcomes in this high-risk obstetric condition.

2. Material and Methods

Ethical approval for this retrospective study was obtained from the Local Ethics Committee. All procedures were conducted in accordance with institutional and/or national research committee ethical standards and the principles outlined in the 1964 Helsinki Declaration and its later amendments. The study included patients who underwent surgery for PAS at our clinic between January 01, 2015 and January 01, 2019. Relevant data from patients diagnosed with placenta accreta were retrieved and examined using patient files, the hospital's electronic medical record system, and automated hospital databases.

Inclusion criteria were as follows: singleton pregnancies; gestational age of 24 weeks or greater; confirmation of PAS diagnosis through postoperative histopathological examination of the placenta; maternal age over 18 years; and availability of documented gestational age.

Exclusion criteria were as follows: pregnancies with a gestational age below 24 weeks; intrauterine fetal demise before delivery; pregnancies with major fetal anomalies; cases without histopathological confirmation of PAS; multiple pregnancies; maternal age under 18 years; undocumented gestational age; patients who underwent uterus-preserving surgical interventions; patients who underwent cesarean hysterectomy for reasons other than PAS; placental pathologies other than PAS; maternal malignancies; molar pregnancies; a history of preterm birth; and cases with missing data for key study parameters.

For each patient, the following data was recorded: maternal age, body mass index (BMI), gravida, parity, gestational week, history of caesarean section (CS), histopathological classification of the placenta, type of surgery (emergency or elective), occurrence of re-laparotomy, performance of hypogastric artery ligation, presence of bleeding, need for intraoperative and postoperative blood and blood transfusions (including amounts), requirement and duration of maternal intensive care, early and late maternal complications (bleeding, infection, fistula), infant birthweight, the development of respiratory distress syndrome (RDS), 1- and 5-minute Apgar scores (Apgar score is a rapid assessment tool used to evaluate a newborn's condition at 1 and 5 minutes after birth. It includes five components: Appearance [skin color], Pulse [heart rate], Grimace [reflex response], Activity [muscle tone], and Respiration [breathing effort]. Each component is scored from 0 to 2, with a maximum total score of 10 points), development of asphyxia, and the need for neonatal intensive care.

The degree of PAS was also evaluated based on the histopathological examination of hysterectomy specimens.

The patients included in the study were evaluated in five groups: Group 1 (<34 weeks), Group 2 (≥34 weeks–35 weeks<), Group 3 (≥35 weeks–36 weeks<), Group 4 (≥36 weeks–37 weeks<, and Group 5 (≥37 weeks).

To minimize preterm birth-related complications, the preferred approach was to delay surgery for PAS until 37 weeks of gestation, when clinically feasible, rather than operating at earlier gestational ages.

Statistical Analysis

Descriptive statistics were presented as frequency, percentage, mean, standard deviation (SD), median, minimum, maximum, and interquartile range (IQR; 25th–75th percentiles, Q1–Q3). The assumption of normality was assessed using the Shapiro-Wilk test, complemented by visual inspection of histograms and Q–Q plots, as well as evaluation of skewness and kurtosis values. Since the numerical data between two groups did not follow a normal distribution, the Mann-Whitney U test was used for analysis. For comparisons of numerical variables across more than two groups, when the data did not meet the normality assumption, the Kruskal-Wallis H test was performed, and pairwise comparisons were conducted using the Bonferroni-Dunn procedure for significant results. To analyze relationships between categorical variables, Pearson's Chi-Square test was used when fewer than 20% of cells had an expected count less than 5; otherwise, Fisher's Exact test was applied. For multi-way contingency tables, the Fisher-Freeman-Halton test was used. A p-value of less than 0.05 was considered statistically significant. All analyses were conducted using the SPSS version 23.0 software (IBM Corp., Chicago, IL, USA).

3. Results

The patients included in our study were evaluated in five groups according to gestational age (<34 weeks, ≥34 weeks–35 weeks<, ≥35 weeks–36 weeks<, ≥36 weeks–37 weeks<, and ≥37 weeks).

When the demographic characteristics were compared across the five groups, no statistically significant differences were observed, except for the number of previous CS.

Table 1. Comparison of demographic characteristicsbetween groups.

	Groups	n	Mean ± SD	Median (Q1–Q3)	Test	*p*-value
Age (years)	Group 1	31	34.90 ± 4.50	34.00 (32–36)	3.15	0.533
	Group 2	16	32.94 ± 4.06	34.00 (29–36)		
	Group 3	7	34.29 ± 3.30	34.00 (31–36)		
	Group 4	21	33.95 ± 5.19	34.00 (28–38)		
	Group 5	42	33.12 ± 3.49	33.00 (30–35)		
Gravida	Group 1	31	4.71 ± 1.01	5.00 (4–5)	6.46	0.167
	Group 2	16	4.63 ± 1.02	5.00 (4–5)		
	Group 3	7	3.71 ± 1.38	3.00 (3–5)		
	Group 4	21	4.29 ± 0.78	4.00 (4–5)		
	Group 5	42	4.48 ± 1.09	5.00 (4–5)		
Parity	Group 1	31	2.84 ± 0.90	3.00 (2–3)	1.19	0.880
	Group 2	16	3.06 ± 0.85	3.00 (2.50–3.50)		
	Group 3	7	2.86 ± 1.35	3.00 (2–4)		
	Group 4	21	2.86 ± 0.48	3.00 (3–3)		
	Group 5	42	2.76 ± 0.69	3.00 (3–3)		
Number of previous CS	Group 1	31	2.32 ± 1.22	2.00 (1–3)	9.98	0.041
	Group 2	16	2.50 ± 0.82	2.00 (2–3)		
	Group 3	7	2.57 ± 0.79	2.00 (2–3)		
	Group 4	21	2.95 ± 0.92	3.00 (2–4)[a]		
	Group 5	42	2.19 ± 1.02	2.00 (1–3)[b]		
BMI (kg/m^2)	Group 1	31	25.29 ± 4.55	24.00 (22–28)	3.88	0.422
	Group 2	16	26.44 ± 5.03	25.00 (22.50–30.50)		
	Group 3	7	25.00 ± 2.71	24.00 (23–28)		
	Group 4	21	25.57 ± 3.92	25.00 (24–28)		
	Group 5	42	26.90 ± 4.38	27.50 (24–30)		

The Kruskal-Wallis H test was reported using the H statistic.

SD, standard deviation; CS, caesarean section; BMI, body mass index; Q1–Q3, 25th–75th percentiles.

[a] and [b] indicate a statistically significant difference between the corresponding groups.

A significant difference was detected in the number of previous CS among the groups (Kruskal-Wallis H [4] = 9.98, $p = 0.041$). Post hoc analysis revealed that individuals in Group 4 had a significantly higher number of previous CS compared to those in Group 5 (Table 1).

No statistically significant differences were observed between the groups in terms of the presence or absence of complications. Similarly, when individual complications were evaluated separately, no significant differences were detected (Table 2).

No statistically significant differences were observed between the groups in terms of intraoperative and postoperative blood product transfusion (Table 3).

When the study groups were evaluated in terms of neonatal outcomes, statistically significant differences were observed regarding birth weight, 1st and 5th minute Apgar scores, RDS, fetal demise, and the need for NICU admission. As gestational age increased, an improvement in neonatal outcomes was observed, with the best outcomes recorded after 37 weeks of gestation. Only for asphyxia, no statistically significant differences were detected (Table 4).

When the degrees of placental invasion were evaluated in terms of intraoperative and postoperative blood product transfusion, no statistically significant differences were observed between the groups (Table 5).

When patients were compared based on emergency versus elective surgical intervention, no statistically significant differences were identified, except for the length of intensive care unit (ICU) stay. Although there was no statistically significant difference in ICU admission rates between the two groups, both exhibited a high requirement for ICU care. The median gestational age was approximately 36 weeks in both groups (Table 6).

A comparison of the emergency and elective groups regarding blood product transfusion revealed that both intraoperative and postoperative transfusion requirements were significantly higher in the emergency group. However, no statistically significant differences were observed between the two groups in terms of complication rates (Table 7).

Comparing patients based on the presence or absence of complications, no statistically significant differences were found regarding the type of surgery (emergency vs. elective). However, when assessing blood product transfusions, the amount of FFP transfused was significantly higher in the group that developed complications (Table 8).

Table 2. Comparison of complications between groups.

		Group 1		Group 2		Group 3		Group 4		Group 5		Test	*p*-value
		n	%	n	%	n	%	n	%	n	%		
Occurrence of complications	No	20	64.50%	11	68.80%	4	57.10%	12	57.10%	17	40.50%	5.97[a]	0.201
	Yes	11	35.50%	5	31.30%	3	42.90%	9	42.90%	25	59.50%		
Hypogastric artery ligation	No	29	93.50%	14	87.50%	6	85.70%	17	81.00%	33	78.60%	3.54[b]	0.457
	Yes	2	6.50%	2	12.50%	1	14.30%	4	19.00%	9	21.40%		
Bladder injury	No	22	71.00%	12	75.00%	6	85.70%	13	61.90%	32	76.20%	2.17[a]	0.704
	Yes	9	29.00%	4	25.00%	1	14.30%	8	38.10%	10	23.80%		
Maternal ureter injury	No	30	96.80%	15	93.80%	6	85.70%	21	100.00%	39	92.90%	3.29[b]	0.464
	Yes	1	3.20%	1	6.30%	1	14.30%	0	0.00%	3	7.10%		
Relaparotomy	No	31	100.00%	16	100.00%	7	100.00%	21	100.00%	40	95.20%	2.95[b]	0.678
	Yes	0	0.00%	0	0.00%	0	0.00%	0	0.00%	2	4.80%		
Hemorrhage	No	31	100.00%	16	100.00%	7	100.00%	21	100.00%	40	95.20%	2.95[b]	0.678
	Yes	0	0.00%	0	0.00%	0	0.00%	0	0.00%	2	4.80%		
DVT	No	31	100.00%	16	100.00%	7	100.00%	20	95.20%	40	95.20%	2.56[b]	0.637
	Yes	0	0.00%	0	0.00%	0	0.00%	1	4.80%	2	4.80%		
SSI	No	31	100.00%	15	93.80%	7	100.00%	21	100.00%	40	95.20%	3.11[b]	0.513
	Yes	0	0.00%	1	6.30%	0	0.00%	0	0.00%	2	4.80%		
Vesicovaginal fistula	No	31	100.00%	16	100.00%	7	100.00%	21	100.00%	41	97.60%	3.60[b]	0.999
	Yes	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1	2.40%		
Wound evisceration	No	31	100.00%	16	100.00%	7	100.00%	21	100.00%	41	97.60%	3.60[b]	0.999
	Yes	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1	2.40%		
Adult ICU requirement	No	5	16.10%	2	12.50%	0	0.00%	2	9.50%	5	11.90%	1.10[b]	0.919
	Yes	26	83.90%	14	87.50%	7	100.00%	19	90.50%	37	88.10%		
Maternal ICU stay (days)	Mean ± SD	31	3.23 ± 2.60	16	3.19 ± 2.88	7	1.71 ± 1.11	21	2.71 ± 2.69	42	3.40 ± 2.68	3.01[c]	0.555
	Median (Q1–Q3)		3.00 (1–5)		2 (1–3)		2 (0–5)		2.5 (0–5.5)		3.0 (2–5)		

[a], Pearson Chi-Square test with Chi-Square value; [b], Fisher-Freeman-Halton test with Chi-Square value; [c], Kruskal Wallis-H test with H value.

DVT, deep vein thrombosis; SSI, surgical site infection; ICU, intensive care unit.

Table 3. Comparison of blood product transfusion between groups.

	Groups	n	Mean ± SD	Median (Q1–Q3)	Test	*p*-value
Maternal intraoperative transfusion of PRBCs	Group 1	31	4.23 ± 1.80	4 (4–5)	2.74	0.602
	Group 2	16	4.44 ± 1.31	4 (4–5.50)		
	Group 3	7	3.57 ± 1.51	3 (3–5)		
	Group 4	21	4.62 ± 2.36	5 (5–5)		
	Group 5	42	4.29 ± 2.12	4 (4–5)		
Maternal intraoperative FFP transfusion	Group 1	31	2.45 ± 1.26	2 (2–3)	5.96	0.202
	Group 2	16	2.38 ± 0.72	2 (2–3)		
	Group 3	7	1.71 ± 0.76	2 (2–2)		
	Group 4	21	2.95 ± 1.66	3 (3–3)		
	Group 5	42	2.55 ± 1.63	2 (2–3)		
Maternal postoperative transfusion of PRBCs	Group 1	31	1.87 ± 0.92	2 (2–2)	4.67	0.322
	Group 2	16	1.94 ± 0.77	2 (2–2.50)		
	Group 3	7	1.29 ± 0.49	1 (1–2)		
	Group 4	21	1.67 ± 0.80	2 (2–2)		
	Group 5	42	1.81 ± 0.80	2 (2–2)		
Maternal postoperative FFP transfusion	Group 1	31	1.16 ± 0.37	1 (1–1)	3.29	0.510
	Group 2	16	1.25 ± 0.45	1 (1–1.50)		
	Group 3	7	1.00 ± 0.00	1 (1–1)		
	Group 4	21	1.10 ± 0.30	1 (1–1)		
	Group 5	42	1.14 ± 0.42	1 (1–1)		

The Kruskal-Wallis H test was reported using the H statistic value.

PRBCs, packed red blood cells; FFP, fresh frozen plasma.

When patients were grouped in two groups based on 37th week of gestation, the overall rate of complication development was found to be significantly higher after 37 weeks. However, when individual complications were analyzed separately, no statistically significant differences were observed between the two groups (Table 9).

4. Discussion

In the PAS cases included in our study, the timing of cesarean hysterectomy (early vs. late gestational age) showed no significant differences in maternal intraoperative and postoperative complications. However, neonatal outcomes improved significantly with advancing gestational age.

The increasing of CS compared to vaginal births over the past 3–4 decades there has led to a dramatic increase in the incidence of PAS [5,15]. PAS is associated with severe intraoperative bleeding, which causes significant morbidity and high mortality rates, and thus PAS has become one of the most complex and challenging conditions faced by obstetricians [6].

The incidence of PAS has shown a great increase especially in the last 15–20 years. Although several underlying causes have been reported in the literature, a history of CS and widespread presence of placenta previa are accepted as independent risk factors for PAS [4,16]. In a retrospective study by Wu *et al*. [3], factors playing a role in PAS etiology were evaluated, and CS was identified as the most significant risk factor. The study further reported that the risk of PAS increases logarithmically with the number of CS, specifically that women with a history of 3 or more CS had a 50–67% higher risk of PAS in subsequent pregnancies compared to women with only one previous CS [3]. In a 2012 case-controlled study by Fitzpatrick *et al*. [17], the risk was reported to be 14-fold higher in women with a history of CS. However, in some studies this rate has been reported as lower. Silver *et al*. [18] reported that in the absence of placenta previa, the risk of placenta accreta was approximately 0.03% after the first CS, 1% after the fifth CS and 4.7% after 6 or more CS.

The ideal gestational age for CS in PAS cases remains controversial, with no established international consensus. The American College of Obstetricians and Gynecologists (ACOG) and the Eunice Kennedy Shriver National Institute for Children's Health and Development (NICHD) recommend planned delivery at 34 weeks–36 weeks<, while the Royal College of Obstetricians and Gynaecologists (RCOG) do not recommend birth before the 36–37th week for asymptomatic women [19,20].

Although clinicians often prefer to plan surgery in earlier gestational weeks to prevent emergency operations and reduce maternal morbidity associated with hemorrhage in PAS patients, this can cause considerable neonatal morbidity and mortality rates [8]. However, the increasingly widespread use of uterus-sparing procedures, commonly used in placenta accreta patients, which constitute the vast majority of the PAS, together with the reporting of promising results, has led to many researchers to advocate for a more personalized treatment [11].

Table 4. Comparison of neonatal outcomes across groups.

		Group 1			Group 2			Group 3			Group 4			Group 5			Test	*p*-value
		n	% Mean ± SD	Median (Q1–Q3)	n	% Mean ± SD	Median (Q1–Q3)	n	% Mean ± SD	Median (Q1–Q3)	n	% Mean ± SD	Median (Q1–Q3)	n	% Mean ± SD	Median (Q1–Q3)		
Birth weight (g)		31	1064 ± 503	940 (600–1300)	16	2319 ± 293	2300 (2075–2450)	7	2500 ± 220	2510 (2340–2660)	21	2912 ± 334	2820 (2650–3000)	42	3313 ± 323	3295 (3010–3480)	97.76[a]	<0.001
1st minute Apgar score		31	4.74 ± 0.93	5 (4–5)	16	5.94 ± 0.57	6 (6–6)	7	6.43 ± 0.79	6 (6–7)	21	6.95 ± 0.67	7 (7–7)	42	7.38 ± 0.66	7 (7–8)	79.83[a]	<0.001
5th minute Apgar score		31	6.23 ± 1.26	6 (5–7)	16	7.94 ± 0.57	8 (8–8)	7	8.14 ± 0.38	8 (8–8)	21	8.71 ± 0.85	9 (8–9)	42	9.07 ± 0.81	9 (9–10)	72.21[a]	<0.001
Asphyxia	No	27	87.10%		16	100.00%		7	100.00%		21	100.00%		42	100.00%		7.04[b]	0.051
	Yes	4	12.90%		0	0.00%		0	0.00%		0	0.00%		0	0.00%			
RDS	No	17	54.80%		16	100.00%		7	100.00%		21	100.00%		42	100.00%		34.02[b]	<0.001
	Yes	14	45.20%		0	0.00%		0	0.00%		0	0.00%		0	0.00%			
Stillbirth	No	25	80.60%		16	100.00%		7	100.00%		21	100.00%		42	100.00%		11.27[b]	0.005
	Yes	6	19.40%		0	0.00%		0	0.00%		0	0.00%		0	0.00%			
NICU admission requirement	No	5	16.10%		9	56.30%		4	57.10%		18	85.70%		40	95.20%		57.04[b]	<0.001
	Yes	26	83.90%		7	43.80%		3	42.90%		3	14.30%		2	4.80%			

[a], Kruskal Wallis-H Test with H value; [b], Fisher-Freeman-Halton Test with Chi-Square value.

RDS, respiratory distress syndrome; NICU, neonatal intensive care unit.

Table 5. Comparison of blood product requirements by degree of placental invasion.

	Groups	n	Mean ± SD	Median (Q1–Q3)	Test	*p*-value
Maternal intraoperative transfusion of PRBCs (units)	Accreta	14	4.79 ± 2.01	4.00 (4–5)		
	Increta	19	3.95 ± 1.78	4.00 (3–4)	1.729	0.421
	Percreta	84	4.31 ± 1.98	4.00 (3–5)		
Maternal intraoperative FFP transfusion (units)	Accreta	14	2.93 ± 1.73	2.50 (2–3)		
	Increta	19	2.37 ± 1.34	2.00 (2–3)	1.487	0.475
	Percreta	84	2.49 ± 1.38	2.00 (2–3)		
Maternal postoperative transfusion of PRBCs (units)	Accreta	14	1.93 ± 0.62	2.00 (2–2)		
	Increta	19	1.63 ± 0.83	1.00 (1–2)	2.221	0.329
	Percreta	84	1.80 ± 0.85	2.00 (1–2)		
Maternal postoperative FFP transfusion (units)	Accreta	14	1.14 ± 0.36	1.00 (1–1)		
	Increta	19	1.11 ± 0.32	1.00 (1–1)	0.200	0.905
	Percreta	84	1.15 ± 0.40	1.00 (1–1)		

The Kruskal-Wallis H test was reported using the H statistic value.

Table 6. Comparative analysis of emergency and elective surgical groups.

		Elective			Emergency			Test	*p*-value
		n	Mean ± SD	Median (Q1–Q3)	n	Mean ± SD	Median (Q1–Q3)		
Age (years)		105	33.88 ± 4.23	34.00 (31–36)	12	33.00 ± 3.84	33.50 (30.50–35.50)	–0.49[a]	0.620
Gravida		105	4.50 ± 1.06	5.00 (4–5)	12	4.33 ± 0.89	5.00 (3.50–5.00)	–0.61[a]	0.538
Parity		105	2.87 ± 0.81	3.00 (2–3)	12	2.67 ± 0.49	3.00 (2.00–3.00)	–0.94[a]	0.347
BMI (kg/m^2)		105	26.07 ± 4.37	25.00 (23–29)	12	26.00 ± 4.45	25.50 (22.50–29.00)	–0.10[a]	0.921
Gestational week		105	34.34 ± 4.06	36.29 (33–37)	12	34.35 ± 4.71	36.43 (31.79–37.57)	–0.38[a]	0.702
Adult ICU requirement	No	14	13.30%		0	0.00%			0.356[b]
	Yes	91	86.70%		12	100.00%			
Maternal ICU stay (days)		105	2.61 ± 2.26	2.00 (0–4)	12	7.42 ± 1.24	7.50 (6.00–8.50)	–5.21[a]	<0.001

[a], Mann Whitney-U Test Z value; [b], Fisher's Exact Test.

Table 7. Comparative analysis of blood product use and complications between emergency and elective surgical groups.

		Elective			Emergency			Test	*p*-value
		n	% Mean ± SD	Median (Q1–Q3)	n	% Mean ± SD	Median (Q1–Q3)		
Maternal intraoperative transfusion of PRBCs		105	3.91 ± 1.58	4 (3–5)	12	7.75 ± 1.42	7.50 (6.50–9.00)	–5.33[a]	<0.001
Maternal intraoperative FFP transfusion		105	2.23 ± 1.05	2 (2–3)	12	5.08 ± 1.62	5.50 (3.50–6.50)	–5.25[a]	<0.001
Maternal postoperative transfusion of PRBCs		105	1.64 ± 0.68	2 (1–2)	12	3.08 ± 0.79	3.00 (2.50–4.00)	–4.92[a]	<0.001
Maternal postoperative FFP transfusion		105	1.06 ± 0.23	1 (1–1)	12	1.92 ± 0.51	2.00 (2.00–2.00)	–7.42[a]	<0.001
Presence of complications	0	60	57.10%		4	33.30%		2.46[b]	0.116
	1	45	42.90%		8	66.70%			
Hypogastric artery ligation	0	89	84.80%		10	83.30%			0.999[c]
	1	16	15.20%		2	16.70%			
Bladder injury	0	79	75.20%		6	50.00%			0.086[c]
	1	26	24.80%		6	50.00%			
Maternal ureter injury	0	100	95.20%		11	91.70%			0.485[c]
	1	5	4.80%		1	8.30%			
Relaparotomy	0	103	98.10%		12	100.00%			0.999[c]
	1	2	1.90%		0	0.00%			
Hemorrhage	0	104	99.00%		11	91.70%			0.195[c]
	1	1	1.00%		1	8.30%			
DVT	0	102	97.10%		12	100.00%			0.999[c]
	1	3	2.90%		0	0.00%			
SSI	0	103	98.10%		11	91.70%			0.279[c]
	1	2	1.90%		1	8.30%			
Vesicovaginal fistula	0	104	99.00%		12	100.00%			0.999[c]
	1	1	1.00%		0	0.00%			
Wound evisceration	0	104	99.00%		12	100.00%			0.999[c]
	1	1	1.00%		0	0.00%			

[a], Mann Whitney-U Test Z value; [b], Pearson Chi-Square Test with Chi-Square value; [c], Fisher's Exact Test.

Table 8. Comparison of parameters according to the presence of complications.

	Complication (No)			Complication (Yes)			Test	*p*-value
	n	% Mean ± SD	Median (Q1–Q3)	n	% Mean ± SD	Median (Q1–Q3)		
Surgery elective	60	93.80%		45	84.90%		2.46[a]	0.116
Emergency	4	6.30%		8	15.10%			
Maternal intraoperative transfusion of PRBCs	64	3.98 ± 1.66	4 (3–5)	53	4.70 ± 2.20	4 (3–6)	–1.75[b]	0.079
Maternal intraoperative FFP transfusion	64	2.33 ± 1.24	2 (2–3)	53	2.75 ± 1.58	2 (2–3)	–1.45[b]	0.145
Maternal postoperative transfusion of PRBCs	64	1.62 ± 0.63	2 (1–2)	53	1.98 ± 0.97	2 (1–2)	–1.79[b]	0.073
Maternal postoperative FFP transfusion	64	1.09 ± 0.34	1 (1–1)	53	1.21 ± 0.41	1 (1–1)	–1.96[b]	0.049

[a], Pearson Chi-Square Test with Chi-Square value; [b], Mann Whitney-U Test Z value.

In other words, in selected patients with suspected PAS who do not have ultrasonographic findings suggestive of percreta or increta (e.g., high placental localization and absence of hypervascularity on ultrasonography) and who are not at high risk for preterm birth, delaying surgical intervention may result in better neonatal outcomes with no negative effect on maternal outcomes [7].

The most noteworthy of the studies conducted on this subject was a retrospective study by Perlman *et al.* [21] in 2017 which covered a 17-year period. The 84 patients in that study were evaluated based on the procedures performed at 34, 35, and 36+ weeks of gestation. It was emphasized that surgeries conducted at ≥36 weeks were associated with improved fetal outcomes without a corresponding increase in maternal morbidity [21]. However, in another study by Reale and Farber [14], the authors highlighted the need for definitive criteria to identify patients suitable for delayed intervention, and this was seen to be a serious deficiency in the literature on this subject. Due to the difficulties of homogenization and conducting prospective studies of these patients, the determination of these criteria is extremely difficult. In this study, patients were evaluated across five groups.

Consistent with previous studies, evaluation of this study's results regarding early and late complications revealed no significant effect of gestational week at the time of surgery on complication rates. However, as the 37th gestational week was used as the reference point in our study, an increased likelihood of developing at least one complication was observed after this week. Although this increase was not statistically significant when patients were evaluated across the five groups, it was considered clinically relevant. When assessing neonatal birth weight and fetal outcomes, the results-particularly birth weight-significantly improved with advancing gestational age at the time of surgery.

The increasing availability of advanced imaging modalities and perioperative technologies, alongside the evolving demographic profile characterized by higher cesarean rates and advanced maternal age, have significantly influenced the management strategies of PAS [10]. These developments allow for earlier diagnosis, safer elective planning, and better neonatal and maternal outcomes, making the timing of delivery an even more crucial component of clinical decision-making.

The findings of this study suggest that, in carefully selected and closely monitored PAS patients, delaying surgery until the 37th gestational week can significantly improve neonatal outcomes without increasing maternal complication outcomes. However, optimal management of PAS extends beyond surgical timing, requiring a well-structured perioperative strategy to ensure the best maternal and neonatal outcomes.

To enhance the clinical applicability and provide practical guidance, the following perioperative recommendations are proposed:

• Preoperative Preparation: Patients should undergo evaluation by a multidisciplinary team (including obstetrics, anesthesiology, urology, intensive care, and neonatology). Blood products should be prepared in advance, with a massive transfusion protocol and emergency response plan in place. The extent of placental invasion should be clarified using pelvic MRI or detailed ultrasound.

• Intraoperative Management: Surgery should be performed by experienced teams in facilities with 24/7 access to the operating room and NICU. Hemorrhage-reduction strategies, such as balloon occlusion catheters or hypogastric artery ligation may be considered. In appropriate cases, uterus-sparing surgical approaches may be explored.

• Postoperative Care: Intensive care monitoring is crucial, with frequent assessment of hemoglobin, vital signs, and infection markers. Clinicians should remain vigilant for complications such as sepsis, disseminated intravascular coagulation (DIC), and thromboembolism. Psychological support and fertility counseling should be provided as needed.

Table 9. Comparative analysis of term and preterm deliveries.

		<37 weeks		≥37 weeks		Test	*p*-value
		n	%	n	%		
Surgery	Elective	68	90.7%	37	88.1%		0.754[a]
	Emergency	7	9.3%	5	11.9%		
Pathology	Accreta	9	12.0%	5	11.9%	4.100	0.128[b]
	Increta	16	21.3%	3	7.1%		
	Percreta	50	66.7%	34	81.0%		
Occurrence of complications	No	47	62.7%	17	40.5%	5.350	0.021[b]
	Yes	28	37.3%	25	59.5%		
Hypogastric artery ligation	No	66	88.0%	33	78.6%	1.840	0.175[b]
	Yes	9	12.0%	9	21.4%		
Bladder injury	No	53	70.7%	32	76.2%	0.413	0.520[b]
	Yes	22	29.3%	10	23.8%		
Maternal ureter injury	No	72	96.0%	39	92.9%		0.665[a]
	Yes	3	4.0%	3	7.1%		
Relaparotomy	No	75	100.0%	40	95.2%		0.127[a]
	Yes	0	0.0%	2	4.8%		
Hemorrhage	No	75	100.0%	40	95.2%		0.127[a]
	Yes	0	0.0%	2	4.8%		
DVT	No	74	98.7%	40	95.2%		0.292[a]
	Yes	1	1.3%	2	4.8%		
SSI	No	74	98.7%	40	95.2%		0.292[a]
	Yes	1	1.3%	2	4.8%		
Vesicovaginal fistula	No	75	100.0%	41	97.6%		0.359[a]
	Yes	0	0.0%	1	2.4%		
Wound evisceration	No	75	100.0%	41	97.6%		0.359[a]
	Yes	0	0.0%	1	2.4%		

[a], Fisher's Exact Test; [b], Pearson Chi-Square Test with Chi-Square value.

These recommendations emphasize that the safe and effective management of PAS requires not only optimal surgical timing but also a comprehensive, multidisciplinary perioperative approach.

This study aims to address a critical gap in the current literature concerning the optimal timing of delivery in the management of PAS disorders. Although international guidelines vary and a clear consensus remains elusive, clinical decisions are often guided by institutional practices and the experience of individual clinicians. This research provides robust and clinically meaningful evidence, suggesting that postponing cesarean hysterectomy to later gestational ages can significantly improve neonatal outcomes without increasing the risk of maternal complications.

What distinguishes this study from others is not only its analytical rigor but also its intentional design to directly inform and guide clinical decision-making. Patients were categorized into well-defined, homogeneous groups based on standardized protocols, and outcomes were meticulously analyzed by gestational age. Early and late maternal complications were thoroughly assessed, enabling nuanced interpretation. In this respect, the study goes beyond offering observational insights and contributes actionable, evidence-based recommendations that have the potential to enhance real-world clinical practice. The main study limitations are the retrospective nature, which limited access to some clinical variables, as well as single-center data collection (restricting generalizability). This study has several notable strengths. First, the strict adherence to predefined standardized protocols for data collection, which ensured high data quality and reliability. Second, the inclusion of a large number of participants, enhancing the generalizability of our findings. Most importantly, the results offer practical insights that can directly inform clinical decision-making.

5. Conclusions

The results of the current study showed that elective surgical intervention at the ≥34th week of gestation improved fetal outcomes without increasing maternal complications or morbidity. Therefore, in carefully selected patients under close monitoring, delaying surgery until the 37th gestational week may be considered a safe option. Patients selected for expectant management until 37 weeks of gestation must be carefully triaged and monitored to mitigate potential risks.

Availability of Data and Materials

The data used in this study are available from the corresponding author upon reasonable request.

Author Contributions

AU and SK conceptualized the study, curated the data, and performed the formal analysis. Methodology and visualization were also carried out by both authors. The original draft was written by AU and SK, and both authors contributed significantly to the review and editing of the manuscript. Both authors read and approved the final manuscript and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

The study was carried out in accordance with the guidelines of the Declaration of Helsinki and approved by the Clinical Research Ethics Committee of Kahramanmaraş Sütçü İmam University School of Medicine (decision no: 04, session number: 2019/06). Informed consent was waived by the ethics committee due to the retrospective nature of the study.

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Conflict of Interest

The authors declare no conflict of interest.

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