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Maternal and Neonatal Health Outcomes in Placenta Accreta: Short-Term Morbidity and Long-Term Neurodevelopmental Impacts

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ABSTRACT

Placenta accreta (PA) is a serious maternal complication defined by abnormal attachment of the placental trophoblastic tissue to the myometrial wall of the uterus. **Objectives:** To evaluate the effect of placenta accreta on maternal morbidity and neonatal health outcomes, with an emphasis on long-term neurodevelopmental effects. **Methods:** This retrospective study was conducted at Social Security Teaching Hospital, Lahore, from October 2022 to March 2023. A total of 231 patient data was gathered for the study, comprising 77 infants delivered after third-trimester bleeding due to placenta accreta and 154 gestational age-matched controls. The maternal outcomes assessed included rates of postpartum hemorrhage, cesarean section, and peripartum hysterectomy. Neonatal outcomes were evaluated by Apgar scores, the incidence of respiratory distress syndrome (RDS), intraventricular hemorrhage (IVH), and hypoglycemia. Long-term neurodevelopmental outcomes, including cerebral palsy (CP) and minor neurodevelopmental abnormalities, were followed up at 2 years. Statistical analyses were conducted using one-way ANOVA and Chi-square test using SPSS-26. **Results:** Infants born to mothers with PA had lower Apgar scores at 1 minute (24.7% vs. 5.2% in controls; adjusted OR-5.67), higher rates of RDS (40.3% vs. 7.8%; adjusted OR-7.42), and severe IVH (11.7% vs. 1.9%; adjusted OR-6.30). Hypoglycemia occurred in 18.2% of the PA group compared to 3.2% in controls (adjusted OR-6.41). At 24 months, 7.8% of infants with PA had cerebral palsy (adjusted OR-13.5) and 6.5% had severe developmental delays (adjusted OR-10.4). **Conclusions:** It was concluded that PA is a serious risk factor for maternal and neonatal morbidity and long-term neurodevelopmental impairment.

INTRODUCTION

The abnormally invasive placenta, often referred to as morbidly adherent placenta or placenta accreta (PA), is characterized by the invasion of trophoblast tissue into the myometrial tissue of the uterus. The rising incidence of PA is closely linked to the increased rate of cesarean births globally [1]. However, PA can also develop in the absence of prior uterine scars [2]. Massive intraoperative hemorrhages associated with placenta accreta can lead to hypovolemic shock, severe coagulopathy, and a significant rise in Intensive Care Unit (ICU) admissions following cesarean deliveries [3]. Consequently, managing morbidly adherent placenta presents ongoing challenges for obstetricians and gynecologists, resulting in increased maternal-fetal morbidity and mortality [4]. Proper management, involving multidisciplinary care teams and antenatal interventions, aims to improve maternal and neonatal outcomes, especially in low- and middle-income countries where healthcare resources may be limited [5]. Despite these efforts, PA is associated with several life-threatening complications. Pregnancy termination is frequently recommended in cases of unusual placental invasion up to the middle of the second trimester [6].

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Planned deliveries between 34 and 36 weeks of gestation have been linked to improved maternal outcomes following PA [7]. It is generally advised against extending pregnancies beyond 36 weeks due to the risk of emergency cesarean births arising from severe hemorrhage in approximately 50% of women with PA after this gestational age [6]. Notably, pregnancies complicated by PA are not associated with fetal growth restriction, as supported by various studies [5]. Furthermore, poor neonatal outcomes in emergency deliveries may result from a lack of corticosteroids for fetal lung maturation [8]. Recent findings by Del *et al.*, indicate that cesarean operations for PA are significantly associated with lower ≤5-min APGAR scores, reduced birth weights, and increased instances of preterm delivery compared to non-PA cesarean sections [9]. Given these complexities, it is crucial to diagnose PA before delivery. When deliveries occur at specialized hospitals with skilled obstetricians before the onset of labor, catastrophic hemorrhages and placental disruptions can be minimized, thereby maximizing maternal-fetal outcomes [10]. However, there was a notable gap in knowledge regarding the long-term neurodevelopmental outcomes of infants born to mothers with PA, despite evidence linking PA with immediate complications in high-risk pregnancies.

Although placenta accreta is well recognized for causing severe maternal complications and adverse immediate neonatal outcomes, limited local evidence exists regarding its long-term neurodevelopmental effects on surviving infants, particularly in resource-constrained healthcare settings. Previous studies have largely focused on short-term obstetric outcomes, leaving an important gap in understanding the extended developmental burden associated with placenta accreta. Therefore, this study aimed to evaluate both maternal morbidity and neonatal short-term complications, while also assessing the long-term neurodevelopmental outcomes of infants born to mothers with placenta accreta.

METHODS

This retrospective study was conducted at Social Security Teaching Hospital, Lahore, over six months from October 2022 to March 2023. The study aimed to analyzed short-term maternal and neonatal morbidity (postpartum haemorrhage, caesarean section, peripartum hysterectomy, neonatal respiratory distress syndrome, intraventricular haemorrhage, and hypoglycaemia) and long-term neurodevelopmental outcomes (cerebral palsy and minor neurodevelopmental abnormalities assessed at 2 years of age) in infants born to mothers with placenta accreta compared to those without the condition. Ethical approval was obtained from the Institutional Review Board, Social Security Teaching Hospital, Lahore (Reference number: 15/2022). The sample size was calculated using Open Epi version 3.01, considering postpartum hemorrhage as the primary outcome variable, based on a reported incidence of 41% in placenta accreta cases versus 5% in controls by taking 95% confidence interval and 5% level of significance [11]. The calculated sample size was too small so to increase sample size to 231 pregnant female among which 77 cases of placenta accreta (PA group) and 154 gestational age-matched controls (control group). Medical records of 231 pregnant women aged 18 to 45 years, who delivered between May, 2020, and October, 2020, were reviewed. A written informed consent was taken from each participant. The retrospective design was chosen because the required data were already available in hospital records, facilitating the identification of cases and controls. The study included all available patients meeting the inclusion and exclusion criteria during the specified timeframe. Inclusion criteria included pregnant women with complete medical records, follow-up of infants for 24 months, and gestational ages of 32 weeks or more at the time of delivery. Exclusion criteria included multiple gestations, incomplete records, pre-existing maternal conditions (e.g., preeclampsia, uncontrolled diabetes), congenital anomalies in infants, preterm deliveries before 32 weeks, and lack of follow-up care at the hospital. The control group consisted of 154 gestational age-matched controls, selected based on having delivered in the same timeframe but without placenta accreta. Controls were selected from their medical records available to match cases by gestational age within two weeks and had no history of third-trimester bleeding or placenta accreta. Characteristics of the control group were similar to the PA group regarding maternal age, parity, and antenatal care, ensuring comparability for outcome analysis. Adequate antenatal care was defined as having received at least four scheduled antenatal visits during the pregnancy, with proper routine screenings, including blood pressure, hemoglobin and blood sugar level monitoring. The patients with missing or incomplete medical history were excluded. Maternal outcomes assessed included rates of postpartum hemorrhage, cesarean section, and peripartum hysterectomy. Neonatal outcomes included Apgar scores, the incidence of respiratory distress syndrome (RDS), intraventricular hemorrhage (IVH), and hypoglycemia. Long-term neurodevelopmental outcomes were assessed at 2 years, including cerebral palsy (CP) and minor neurodevelopmental abnormalities. Neurological assessments were performed at discharge and follow-up visits at 3, 6, 12, and 24 months. Cognitive development was measured using the Bayley Scales of Infant Development (Mental Development Index)[12]. The Bayley Scales assess cognitive, language, and motor development, with scores

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ranging from 49 to 155, where a score below 85 indicates developmental delay, 85–100 is considered low average, and above 100 is normal development. Statistical analyses were conducted using SPSS version 26.0. Descriptive statistics (mean ± SD for continuous variables and frequencies/percentages for categorical variables) were used to summarize baseline characteristics. Continuous variables were compared between groups using the independent t-test, while categorical variables were analyzed using the Chi-square test. Crude and adjusted odds ratios (ORs) with 95% confidence intervals (CIs) were calculated for maternal and neonatal outcomes using logistic regression models to control for potential confounders. A p-value <0.05 was considered statistically significant.

RESULTS

The study included 231 women, with 77 cases of placenta accreta (PA group) and 154 gestational age-matched controls (control group). The average age of the women in the PA group was 32.4 ± 4.8 years, compared to 31.9 ± 5.2 years in the control group. Most women in both groups had received adequate antenatal care. There were no significant differences in gestational age at delivery, which ranged from 32 to 40 weeks across both groups (Table 1).

Table 1: Basic Characteristics of Women in the Study

Characteristics	PA Group (n=77)	Control Group (n=154)
Age (years)	32.4 ± 4.8	31.9 ± 5.2
Gestational Age at Delivery (Weeks)	36.3 ± 1.8	36.7 ± 2.1
Adequate Antenatal Care	Yes	

Postpartum hemorrhage occurred in 58.4% of women in the PA group compared to just 14.3% in the control group. This suggests that women with placenta accreta are about 8 times more likely to experience severe bleeding after childbirth (OR-8.01), even after accounting for other factors (adjusted OR 7.65). A similar trend was seen in the case of Cesarean section rates and Peripartum hysterectomies (Table 2).

Table 2: Effect of Placenta Accreta on Maternal Morbidity

Maternal Outcome	PA Group (n=77)	Control Group (n=154)	Crude OR (95% CI)	p-value (Crude OR)	Adjusted OR (95% CI)	p-value (Adjusted OR)
Postpartum Hemorrhage	45 (58.4%)	22 (14.3%)	8.01 (4.4–14.6)*	<0.001	7.65 (4.2–13.9)*	<0.001
Caesarean Section	66 (85.7%)	79 (51.3%)	5.28 (2.8–10.0)*	<0.001	5.10 (2.7–9.8)*	<0.001
Peripartum Hysterectomy	12 (15.6%)	2 (1.3%)	14.7 (3.2–67.4)*	<0.001	13.9 (3.1–63.8)*	<0.001

All crude and adjusted odds ratios presented above are statistically significant at p<0.05. *means that the results are statistically significant

Apgar scores at 1 minute were significantly lower in the PA group, with 24.7% of infants having a score of less than 7, compared to just 5.2% in the control group. Hypoglycemia was also associated with PA, it was observed in 18.2% of infants in the PA group, in contrast to only 3.2% in the control group. Infants born to mothers with placenta accreta were about 6 times more likely to develop hypoglycemia (adjusted OR 6.41), which can lead to serious complications if not managed. This means that infants born to mothers with placenta accreta are about 6 times more likely to have lower Apgar scores at birth (adjusted OR 5.67), indicating poor initial health status. RDS and IVH were much more common in the PA group when compared with the control group (Table 3).

Table 3: Effect of Placenta Accreta on Neonatal Outcomes

Neonatal Outcome	PA Group (n=77)	Control Group (n=154)	Crude OR (95% CI)	p-value (Crude OR)	Adjusted OR (95% CI)	p-value (Adjusted OR)
Apgar Score <7 at 1 Minute	19 (24.7%)	8 (5.2%)	5.89 (2.5–13.9)*	<0.001	5.67 (2.4–13.5)*	<0.001
Respiratory Distress Syndrome (RDS)	31 (40.3%)	12 (7.8%)	7.83 (3.8–16.2)*	<0.001	7.42 (3.6–15.5)*	<0.001
Intraventricular Hemorrhage (IVH)	9 (11.7%)	3 (1.9%)	6.86 (1.8–26.5)*	0.005	6.30 (1.6–24.4)*	0.008
Hypoglycemia	14 (18.2%)	5 (3.2%)	6.85 (2.4–19.1)*	0.002	6.41 (2.2–18.4)*	0.003

All crude and adjusted odds ratios presented above are statistically significant at p<0.05. *means that the results are statistically significant

At 24 months of age, Cerebral palsy (CP) was diagnosed in 7.8% of infants in the PA group, in comparison to just 0.6% in control having adjusted OR (CI) as 5.67 (2.4–13.5). For the Bayley Mental Index, which measures cognitive development, 6.5% of infants in the PA group had a score below 71, indicating severe developmental delay. In contrast, only 0.6% of infants in the control group showed this level of delay. Additionally, 11.7% of infants in the PA group had borderline cognitive development, with Bayley Mental Index scores between 71 and 84, compared to just 1.3% in the control group (Table 4).

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Table 4: Effect of Placenta Accreta on Long-Term Neurodevelopmental Outcomes

Neurodevelopmental Outcome	PA Group (n=77)	Control Group (n=154)	Crude OR (95% CI)	p-value (Crude OR)	Adjusted OR (95% CI)	p-value (Adjusted OR)
Cerebral Palsy (CP)	6 (7.8%)	1 (0.6%)	14.1 (1.7–116.0)*	0.012	13.5 (1.6–110.3)*	0.015
Bayley Mental Index < 71 (severe delay)	5 (6.5%)	1 (0.6%)	11.1 (1.3–91.3)*	0.018	10.4 (1.2–87.5)*	0.021
Bayley Mental Index 71–84 (borderline)	9 (11.7%)	2 (1.3%)	10.3 (2.2–48.1)*	<0.001	9.87 (2.1–45.7)*	<0.001

All crude and adjusted odds ratios above are statistically significant at p<0.05. *means that the results are statistically significant

DISCUSSION

The abnormal adhesion of the trophoblastic tissue to the myometrial wall is the hallmark of placenta accreta (PA), a serious maternal complication [13]. Despite PA prevalence historically being less than 1%, national data from 2015 to 2017 showed that PA increased by about 2% every three months in women with prior cesarean deliveries. By 2025, the incidence is expected to reach 1 in every 200 women undergoing cesarean deliveries [2, 14]. Early detection and management are crucial since PA increases the risk of severe complications such as catastrophic bleeding, hysterectomy, organ damage, coagulopathy, and even maternal death [15, 16]. Current study confirms that PA is associated with significant maternal morbidity. Women with PA experienced markedly higher rates of postpartum hemorrhage (58.4%) compared to controls (14.3%) (OR 7.65). This finding aligns with prior studies that identify PA as a major risk factor for hemorrhage, given the abnormal placental attachment and difficulty separating the placenta after delivery [17]. Additionally, cesarean section rates (85.7% in the PA group vs. 51.3% in controls) and peripartum hysterectomy (15.6% vs. 1.3%) were significantly elevated in the PA group. These results are consistent with Aryananda *et al.*, findings of increased blood loss and complications in PA patients undergoing cesarean hysterectomy [18]. Similarly, Nieto-Calvache *et al.*, reported prolonged operating times and higher blood transfusion rates in PA patients requiring hysterectomy [19]. Neonatal outcomes were also significantly impacted by PA, with lower 1-minute Apgar scores (24.7% of PA infants scoring below 7 compared to 5.2% in controls; adjusted OR 5.67). The PA group had higher rates of respiratory distress syndrome (RDS) (40.3% vs. 7.8%) and intraventricular hemorrhage (IVH) (11.7% vs. 1.9%). These findings align with prior studies reporting increased neonatal complications in PA pregnancies, particularly in relation to preterm deliveries and lower birthweights [20]. The odds of RDS (adjusted OR 7.42) and IVH (adjusted OR 6.30) were significantly elevated in the PA group, highlighting the association between PA and poor neonatal outcomes [21, 22]. Hypoglycemia rates were also higher in the PA group (18.2% vs. 3.2%, adjusted OR 6.41). Long-term neurodevelopmental outcomes were notably worse in infants born to mothers with PA. By 24 months, 7.8% of PA-exposed infants were diagnosed with cerebral palsy (CP) compared to 0.6% in the control group (adjusted OR 13.5). Moreover, 6.5% of infants in the PA group had severe cognitive delays (Bayley Mental Index scores <71) compared to 0.6% of controls (adjusted OR 10.4). Similar findings were reported by Moeini *et al.*, linking lower gestational ages and increased NICU admissions to higher morbidity rates in neonates exposed to PA [23]. Additionally, 11.7% of PA-exposed infants showed borderline cognitive development (scores 71–84), compared to 1.3% in controls (adjusted OR 9.87), further emphasizing the long-term developmental impact of PA [24, 25]. Clinical recommendations for PA management include antenatal diagnosis via imaging and planned cesarean delivery at 34–36 weeks in specialized centers to minimize risks for both mother and infant. While cesarean hysterectomy remains the standard for managing PA, uterine-sparing procedures may be considered in select cases to preserve fertility and reduce morbidity. Multidisciplinary care teams involving obstetricians, anesthesiologists, and neonatologists are critical for optimal outcomes [26].This study's retrospective design may introduce biases, especially concerning data completeness. Additionally, the study population was drawn from a specific demographic, limiting generalizability to other populations. Future prospective studies are needed to validate these findings and improve PA management strategies.

This study was limited by its retrospective single-center design, which may introduce selection bias, incomplete record dependency, and reduced generalizability to broader populations. The relatively small sample size and follow-up restricted to 24 months may also underestimate later developmental impairments. Future multicenter prospective studies with larger cohorts and longer neurodevelopmental follow-up are recommended to validate these findings, improve risk stratification, and develop standardized multidisciplinary management protocols for placenta accreta.

CONCLUSIONS

It was concluded that placenta accreta is associated with serious maternal morbidity, increasing hemorrhage, rate of cesareans, and hysterectomies. It also causes poor short-term neonatal outcomes in terms of having RDS, IVR hypoglycemia, and long-term neurodegenerative disorders from minor cognitive defects to major problems like CP.

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Authors' Contribution

Conceptualization: ZEH
Methodology: ZEH, UZ, AS[1]
Formal analysis: AS[2]
Writing and Drafting: SN, AA
Review and Editing: SN, AA, ZEH, UZ, AS[1]

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflicts of Interest

All the authors declare no conflict of interest.

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