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ORIGINAL ARTICLE

Planned versus Emergency Management of Placenta Accreta Spectrum and Its Association with Maternal and Neonatal Outcomes: A Retrospective Cohort Study

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ABSTRACT

Objective: To compare maternal and neonatal outcomes between planned and emergency management of placenta accreta spectrum (PAS) in a tertiary care hospital.

Methodology: This retrospective cohort study was conducted at the Department of Obstetrics and Gynecology, Combined Military Hospital Kharian Cantt from January 2024 to December 2025. Data were retrospectively extracted from hospital medical records, including patient charts, operative and anaesthetic records, blood bank records, ICU records, and neonatal charts. In total 94 patients with confirmed PAS were included and divided equally into planned management (n=47) and emergency management (n=47) groups. Maternal intraoperative, postoperative, and neonatal outcomes were compared using chi-square test and independent t-test. Multivariate logistic regression was conducted to identify predictors of adverse maternal outcomes.

Results: Emergency management was associated with significantly higher estimated blood loss (3120 ± 980 mL vs 1850 ± 640 mL; p=0.001), massive transfusion (51.1% vs 17.0%; p=0.001), cesarean hysterectomy (70.2% vs 40.4%; p=0.004), and ICU admission (66.0% vs 25.5%; p=0.001) compared with planned management. Disseminated intravascular coagulation (31.9% vs 6.4%; p=0.002), ventilator requirement (38.3% vs 8.5%; p=0.001), and sepsis (21.3% vs 4.3%; p=0.014) were also significantly more frequent in emergency cases. Neonatal outcomes were worse in the emergency group, including higher NICU admission (61.7% vs 23.4%; p=0.001), RDS (44.7% vs 14.9%; p=0.002), and neonatal mortality (12.8% vs 2.1%; p=0.049). Emergency management independently predicted adverse maternal outcomes (AOR=4.82, 95% CI: 2.01–11.54; p=0.001).

Conclusion: Planned multidisciplinary management of PAS was associated with lower maternal and neonatal outcomes compared with emergency management. Early antenatal diagnosis and timely referral to specialized tertiary care centers may substantially reduce fetomaternal morbidity and mortality associated with PAS.

Keywords: Cesarean Section; Infant, Newborn; Intensive Care Units; Maternal Health; Placenta Accreta; Placenta Previa; Postpartum Hemorrhage; Pregnancy Complications.

Authors' Contribution:
[1,4]Conception; Literature research; manuscript design and drafting; [2,3]Critical analysis and manuscript review; [5,6]Data analysis; Manuscript Editing.

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Article info:
Received: August 11, 2026
Accepted: March 03, 2026

Cite this article. Shaheen M, Noor N, Nayyar S, Malik MN, Hussain M, Yasmeen. Planned versus Emergency Management of Placenta Accreta Spectrum and Its Association with Maternal and Neonatal Outcomes: A Retrospective Cohort Study. J Islamabad Med Dental Coll. 2026; 15(3): *335-342. DOI: https://doi.org/10.35787/jimdc.v15i3.1640*

Funding Source: Nil
Conflict of interest: Nil

Introduction

Placenta accreta spectrum (PAS) is a severe obstetric disorder characterized by abnormal placental attachment and invasion into the myometrium, including accreta, increta, and percreta forms.[1] PAS is a major cause of maternal morbidity and mortality

because of catastrophic obstetric haemorrhage, massive blood transfusion, caesarean hysterectomy, adjacent organ injury, ICU admission, and preterm birth.[2,3] Its incidence has increased substantially, paralleling rising caesarean delivery rates. Current estimates among high-risk populations range from 1 in 272 to 1 in 500 pregnancies, while the risk increases from approximately 0.3% after one previous caesarean delivery to 6.7% after five or more.[4]

Planned multidisciplinary management of PAS is associated with better maternal and neonatal outcomes.[2,5] Delivery planning at tertiary centers with adequate blood products, anaesthesia, neonatal services, and surgical support can minimize perioperative complications.[6,7] Conversely, emergency management is associated with uncontrolled haemorrhage, hemodynamic instability, disseminated intravascular coagulation, increased hysterectomy rates, and poorer fetal outcomes related to prematurity and fetal distress.[3,8]

PAS is increasingly prevalent in low- and middle-income countries, including Pakistan, where rising caesarean rates and limited access to specialized PAS facilities pose major challenges.[9] Local studies have reported substantial morbidity, including excessive blood loss, bladder injury, prolonged hospitalization, and ICU admission.[10-12] Delayed diagnosis and surgical intervention may further increase adverse fetomaternal outcomes.[11,13] However, regional studies have largely focused on surgical techniques or individual maternal outcomes, with limited comparison of planned versus emergency management.[10-14]

Although international evidence supports antenatal recognition and planned management, outcomes depend on healthcare infrastructure, resources, and multidisciplinary support.[5,6,15] Evidence directly comparing planned and emergency PAS management remains limited in Pakistan. Emergency presentation may restrict blood-product preparation, anaesthetic optimization, multidisciplinary coordination, and neonatal preparedness. Therefore, this study compared maternal and neonatal morbidity between planned and emergency PAS management in a tertiary Pakistani setting, including perioperative complications, blood transfusion requirements, ICU admissions, caesarean hysterectomy, and neonatal ICU admissions.

Methodology

This retrospective cohort study was conducted in the Obstetrics and Gynaecology Department of Combined Military Hospital (CMH), Kharian Cantt, Pakistan from January 2024 to December 2025. The study protocol and reporting process followed the STROBE recommendations for observational cohort research.

A total of 94 pregnant women diagnosed intraoperatively, radiologically, or histopathologically with PAS treated throughout the study duration underwent eligibility assessment. PAS was defined as varying degrees of placental invasion into the uterine wall, including accreta, increta, and percreta forms, confirmed through antenatal imaging findings, operative findings, and/or histopathological examination following caesarean hysterectomy.[16] For patients undergoing caesarean hysterectomy, PAS was histopathologically confirmed by microscopic examination of uterine and placental specimens. Accreta was defined by villous attachment to the superficial myometrium with absent or deficient decidua, increta by villous invasion into the myometrium, and percreta by extension through the myometrium to the serosa or adjacent pelvic structures. Assessment was performed by the institutional pathology department.

Patients were categorized into two groups: planned management and emergency management. Planned management referred to women with antenatal diagnosis of PAS who underwent scheduled delivery with multidisciplinary preparation, including

availability of blood products, anaesthesia, neonatology, and surgical teams. Emergency management referred to women requiring urgent surgical intervention because of active haemorrhage, labour onset, fetal distress, hemodynamic instability, or undiagnosed PAS identified during emergency caesarean delivery.[17]

Inclusion criteria:

- Women aged 18–45 years with confirmed PAS.
- Patients managed at the study centre between January 2024 and December 2025.
- Availability of complete maternal and neonatal outcome records.
- Singleton or multiple pregnancies.

Exclusion criteria:

- Incomplete or substantially missing medical records.
- Uncertain or unconfirmed diagnosis of PAS.
- Conservative management performed at another hospital before presentation to the study centre.
- Known coagulation disorders unrelated to obstetric haemorrhage.
- Major fetal congenital anomalies.
- Missing operative records or incomplete neonatal outcome data.

Sample estimation was performed through the WHO calculator by comparing two proportions. The calculation was based on the primary outcome of adverse maternal morbidity, for which previous evidence reported an event rate of 68.4% of emergency PAS cases compared with 38.2% in planned management cases.[18] Using 95% CI, statistical power of 80%, and a 1:1 comparison ratio, and anticipated proportion difference between groups, a total of 94 patients (47 patients per group) were enrolled for final evaluation. During the study period, all consecutive patients meeting the predefined eligibility criteria were included rather than selecting a subset based on clinical characteristics.

Data were retrospectively extracted from hospital medical records, including patient charts, operative reports, anaesthetic records, blood bank records, ICU records, and neonatal charts, using a standardized data extraction proforma. The collected information was independently verified by two reviewers to minimize data extraction errors and improve accuracy.

Baseline demographic and obstetric characteristics included maternal age, parity, gravidity, gestational age at delivery, previous caesarean sections history, placenta previa, antenatal diagnosis of PAS, and maternal comorbidities including hypertension, diabetes mellitus, and anaemia. Antenatal diagnosis of PAS was established using obstetric ultrasonography and/or magnetic resonance imaging (MRI) based on internationally accepted diagnostic criteria, including placental lacunae, bridging vessels, loss of retroplacental clear zone, uterovesical hypervascularity, and bladder wall disruption.[17,19]

Primary outcomes included maternal and neonatal morbidity associated with planned versus emergency PAS management. Maternal intraoperative outcomes included estimated blood loss, blood transfusion requirement, massive transfusion, caesarean hysterectomy, bladder injury, ureteric injury, and surgical duration. Estimated blood loss was defined as the total intraoperative blood loss documented in anaesthesia and operative records. Massive transfusion referred to administration of at least four packed red cell units within one hour or ten or more units over a 24-hour period.[20] Operative duration was measured from the initial skin incision until final surgical closure. Postoperative maternal outcomes included ICU admission, ventilator requirement, disseminated intravascular coagulation (DIC), sepsis, maternal mortality, and length of hospital stay. DIC was diagnosed using laboratory and clinical criteria documented in patient records.[21]

Evaluated neonatal parameters included gestational age at birth, neonatal weight, APGAR assessment at 1 and 5 minutes, NICU requirement, respiratory distress syndrome (RDS), and neonatal mortality.

The diagnosis of RDS was established by attending neonatologists based on clinical and radiological findings. Neonatal mortality referred to death occurring during the first 28 postnatal days.[2]

Data were collected by performing retrospective review within hospital medical records, operative reports, anaesthetic records, blood bank records, ICU records and neonatal charts through a standardized data extraction proforma for collecting data for the study. All the collected data were independently verified for accuracy by two independent reviewers to reduce potential errors of bias and increase accuracy of the data.

Statistical analysis was carried out using SPSS version 26. Normality assessment for continuous variables was performed using the Shapiro–Wilk test and summarized as mean ± SD. Qualitative variables were summarized as frequencies and percentages. Between-group comparisons used the independent t-test for continuous variables and chi-square test for categorical variables. Multivariable logistic regression was performed to identify independent predictors of adverse maternal outcomes, with covariates selected a priori based on clinical relevance and potential confounding, including maternal age, ≥2 prior caesarean deliveries, placenta previa, PAS type/severity, placental location, antenatal PAS diagnosis, gestational age <34 weeks, multiple pregnancy, and emergency referral status. Effect estimates were reported with 95% CIs alongside p-values; ORs were used for categorical outcomes and mean differences for continuous outcomes, with AORs reported for multivariable analyses. Patients with incomplete maternal and/or neonatal outcome records were excluded, and no imputation was performed.

The requirement for informed consent was waived by the institutional ethics committee (Ref. No. A/25/73, Dated: 18/12/2025) because of the retrospective nature of the study and the use of routinely collected clinical data without direct contact with patients.

Results

During the study period, 100 patients with suspected or confirmed PAS were assessed for eligibility. Six patients were excluded because of incomplete maternal and neonatal outcome data. The remaining 94 patients were included in the final analysis, with 47 patients in each management group.

Table I: Baseline maternal and obstetric profile of patients with PAS (n=94)

Variable	Planned management (n=47)	Emergency management (n=47)	Effect size (95% CI)	p-value
Maternal age (years)	31.8 ± 4.6	32.5 ± 5.1	MD: 0.70 (-1.27 to 2.67)	0.481
Gravidity	4.1 ± 1.5	4.4 ± 1.7	MD: 0.30 (-0.35 to 0.95)	0.362
Parity	3.2 ± 1.3	3.5 ± 1.5	MD: 0.30 (-0.27 to 0.87)	0.298
≥2 previous caesarean sections	28 (59.6%)	37 (78.7%)	OR: 2.51 (1.02–6.15)	0.041
Placenta previa	35 (74.5%)	41 (87.2%)	OR: 2.34 (0.80–6.88)	0.118
Multiple pregnancy	2 (4.3%)	4 (8.5%)	OR: 2.09 (0.36–12.06	0.678
Transferred / Referred acutely from secondary facility	5 (10.6%)	32 (68.1%)	OR: 17.92 (5.73–56.02)	0.001
Placental Location				
— Anterior / Low-lying	37 (78.7%)	41 (87.2%)	OR: 1.84 (0.61–5.58)	0.278
— Posterior / Other	10 (21.3%)	6 (12.8%)	Ref	—
PAS Classification / Severity				
— Placenta accreta	24 (51.1%)	19 (40.4%)	Ref	—
— Placenta increta	15 (31.9%)	18 (38.3%)	OR: 1.52 (0.60–3.84)	0.381
— Placenta percreta	8 (17.0%)	10 (21.3%)	OR: 1.58 (0.50–4.98)	0.435
Antenatal diagnosis of PAS	42 (89.4%)	16 (34.0%)	OR: 0.06 (0.02–0.21)	0.001
Gestational age at delivery (weeks)	36.1 ± 1.4	33.9 ± 2.2	MD: -2.20 (-2.95 to -1.45)	0.001
Maternal comorbidities	15 (31.9%)	18 (38.3%)	OR: 1.32 (0.57–3.10)	0.512

*Values are expressed as mean ± SD or n (%). MD = Mean Difference; OR = Odds Ratio.

Baseline maternal and obstetric characteristics are presented in Table 1. The emergency group had a

higher frequency of ≥2 previous caesarean sections (OR: 2.51) and a substantially lower frequency of antenatal PAS diagnosis (OR: 0.06). Gestational age at delivery was also lower in the emergency group (MD: −2.20 weeks). Other baseline characteristics, including maternal age, gravidity, parity, placenta previa, placental location, PAS classification/severity, maternal comorbidities, and multiple pregnancy, did not differ significantly between groups. Acute transfer/referral from a secondary facility was more frequent in the emergency group (OR: 17.92).

Maternal intraoperative outcomes are summarized in Table 2. Emergency management was associated with greater estimated blood loss (MD: 1270.0 mL), blood transfusion requirement (OR: 5.52), massive transfusion (OR: 5.09), caesarean hysterectomy (OR: 3.51), and bladder injury (OR: 3.56). Surgical duration was also longer in the emergency group (MD: 46.0 minutes), whereas ureteric injury did not differ significantly between groups (OR: 4.28).

Table II: Maternal intraoperative outcomes (n=94)

Variable	Planned management (n=47)	Emergency management (n=47)	Effect size (95% CI)	p-value
Estimated blood loss (mL)	1850 ± 640	3120 ± 980	MD: 1270.0 (932.3–1607.7)	0.001
Blood transfusion required	26 (55.3%)	41 (87.2%)	OR: 5.52 (1.98–15.41)	0.001
Massive transfusion	8 (17.0%)	24 (51.1%)	OR: 5.09 (1.97–13.12)	0.001
Caesarean hysterectomy	19 (40.4%)	33 (70.2%)	OR: 3.51 (1.48–8.34)	0.004
Bladder injury	5 (10.6%)	14 (29.8%)	OR: 3.56 (1.16–10.96)	0.021
Ureteric injury	1 (2.1%)	4 (8.5%)	OR: 4.28 (0.46–39.81)	0.168
Surgical duration (min.)	118 ± 28	164 ± 42	MD: 46.0 (31.4–60.6)	0.001

*Values are expressed as mean ± SD or n (%). MD = Mean Difference; OR = Odds Ratio.

Postoperative maternal outcomes are shown in Table 3. Emergency management was associated with higher rates of ICU admission (OR: 5.66), ventilator requirement (OR: 6.67), DIC (OR: 6.88), and sepsis (OR: 6.08). Hospital stay was longer among emergency cases (MD: 4.60 days). Maternal mortality occurred only in the emergency group, although the between-group difference was not statistically significant (p=0.079).

Table III: Postoperative maternal outcomes (n=94)

Variable	Planned management (n=47)	Emergency management (n=47)	Effect size (95% CI)	p-value
ICU admission	12 (25.5%)	31 (66.0%)	OR: 5.66 (2.31–13.88)	0.001
Ventilator requirement	4 (8.5%)	18 (38.3%)	OR: 6.67 (2.05–21.73)	0.001
DIC	3 (6.4%)	15 (31.9%)	OR: 6.88 (1.83–25.79)	0.002
Sepsis	2 (4.3%)	10 (21.3%)	OR: 6.08 (1.25–29.62)	0.014
Maternal mortality	0 (0%)	3 (6.4%)	Undefined / Peto OR: 7.39	0.079
Length of hospital stay (days)	6.2 ± 2.1	10.8 ± 4.5	MD: 4.60 (3.17–6.03)	0.001

*Values are expressed as mean ± SD or n (%). MD = Mean Difference; OR = Odds Ratio.

Table IV: Neonatal outcomes (n=94)

Variable	Planned management (n=47)	Emergency management (n=47)	Effect size (95% CI)	p-value
Gestational age at delivery (weeks)	36.1 ± 1.4	33.9 ± 2.2	MD: -2.20 (-2.95 to -1.45)	0.001
Birth weight (kg)	2.82 ± 0.42	2.31 ± 0.51	MD: -0.51 (-0.70 to -0.32)	0.001
APGAR score at 1 minute	7.3 ± 1.1	5.8 ± 1.5	MD: -1.50 (-2.04 to -0.96)	0.001
APGAR score at 5 minutes	8.5 ± 0.9	7.1 ± 1.3	MD: -1.40 (-1.86 to -0.94)	0.001
NICU admission	11 (23.4%)	29 (61.7%)	OR: 5.27 (2.15–12.92)	0.001
RDS	7 (14.9%)	21 (44.7%)	OR: 4.62 (1.73–12.30)	0.002
Neonatal mortality	1 (2.1%)	6 (12.8%)	OR: 6.73 (0.78–58.28)	0.103

*Values are expressed as mean ± SD or n (%). MD = Mean Difference; OR = Odds Ratio.

Table V: Multivariable regression evaluating determinants of adverse maternal outcomes

Variable	Adjusted odds ratio (AOR)	95% CI	p-value
Emergency management	4.82	2.01–11.54	0.001
≥2 previous caesarean sections	2.67	1.18–6.04	0.019
Placenta previa	2.14	1.01–4.89	0.046
Absence of antenatal PAS diagnosis	5.31	2.20–12.79	0.001
Gestational age <34 weeks	2.89	1.27–6.58	0.011

Neonatal outcomes are presented in Table 4. Emergency management was associated with lower gestational age at delivery (MD: −2.20 weeks), birth

weight (MD: −0.51 kg), and APGAR scores at 1 minute (MD: −1.50) and 5 minutes (MD: −1.40). NICU admission (OR: 5.27) and RDS (OR: 4.62) were also more frequent in the emergency group. Neonatal mortality was higher in the emergency group but did not reach statistical significance (OR: 6.73, p=0.103).

In multivariable analysis, baseline differences were observed for antenatal diagnosis, gestational age, previous caesarean history, and acute referral status. After adjustment for prespecified potential confounders, emergency management remained independently associated with adverse maternal outcomes (AOR: 4.82) (Table 5). Absence of antenatal PAS diagnosis (AOR: 5.31), ≥2 previous caesarean sections (AOR: 2.67), placenta previa (AOR: 2.14), and gestational age <34 weeks (AOR: 2.89) were also independently associated with adverse maternal outcomes.

Discussion

The present study demonstrated that planned multidisciplinary management of PAS was associated with significantly lower maternal and neonatal morbidity than emergency management. Emergency intervention resulted in greater blood loss (3120 ± 980 vs 1850 ± 640 mL), massive transfusion (51.1% vs 17.0%), caesarean hysterectomy (70.2% vs 40.4%), and ICU admissions (66.0% vs 25.5%). Neonatal outcomes were also worse, with lower birth weight, higher NICU admissions (61.7% vs 23.4%), and higher neonatal mortality (12.8% vs 2.1%). Multivariate analysis identified emergency management and absence of antenatal PAS diagnosis as independent correlates of adverse maternal outcomes. These findings represent associations rather than direct causal evidence.

These findings are consistent with international evidence supporting antenatal diagnosis and planned multidisciplinary management.[1,22,23] Shamshirsaz et al reported reduced severe maternal morbidity and transfusion requirements with planned PAS management (61% vs 36%).[18] Collins et al reported that antenatal recognition and scheduled delivery at tertiary hospitals reduce catastrophic haemorrhage and improve maternal survival.[20] Jauniaux et al reported mean blood loss >3000 mL for unplanned PAS surgeries compared with approximately 1800–2200 mL for planned cases.[16]

The high rates of massive transfusion and caesarean hysterectomy among emergency cases reflect severe haemorrhage associated with undiagnosed or unstable PAS. FIGO guidelines emphasize the greater surgical complexity of emergency PAS because of limited preparation and availability of experienced surgical teams.[17] Cali et al reported that planned multidisciplinary management reduced hysterectomy-related complications and urinary tract injuries by nearly 40%.[19] Bladder injury was higher in emergency cases (29.8% vs 10.6%), supporting preoperative planning and multidisciplinary care.

Antenatal diagnosis was one of the strongest protective factors against maternal morbidity. Almost 90% of planned cases had an antenatal diagnosis compared with 34% of emergency cases. This supports ACOG recommendations for early ultrasound-based identification of PAS in high-risk pregnancies, particularly with prior caesarean and/or placenta previa.[4] Antenatal diagnosis permits optimization of delivery timing, blood products, anaesthesia, and specialist involvement.[2,20]

Neonatal outcomes also aligned with current literature. Emergency management was associated with lower gestational age and birth weight, poorer APGAR scores, increased RDS, and NICU admissions. Although neonatal deaths were higher in the emergency group (n=6 vs n=1), this was not statistically significant (p=0.103), likely reflecting the small sample and low event frequency. Einerson et al reported NICU admission rates of approximately 58% in emergency PAS deliveries versus 25% in planned deliveries, comparable with our findings.[2]

Neonatal mortality has also been linked to severe prematurity and fetal compromise secondary to acute maternal haemorrhage and hemodynamic instability.[16,17] These findings are particularly important in Pakistan, where rising caesarean rates may increase PAS incidence. Chohan et al reported hysterectomy rates exceeding 60% and ICU admission above 50% in severe PAS managed emergently.[10] Rao et al demonstrated increased blood loss and postoperative complications with delayed PAS diagnosis.[11] Brohi et al identified emergency surgery and lack of prenatal diagnosis as major determinants of adverse fetomaternal outcomes.[13] These findings highlight the need for improved antenatal screening and referral pathways. The superior outcomes with planned management likely reflect preoperative optimization, adequate blood products, experienced pelvic surgeons, and advanced anaesthesia and critical care support. Controlled timing also reduces haemorrhagic shock and facilitates coordinated neonatal management.[21-23] In contrast, emergency PAS is complicated by abrupt bleeding, hemodynamic collapse, limited blood availability, inadequate exposure, and delayed specialist involvement. These differences should be interpreted as associations rather than proof of causality. The present findings support FIGO and ACOG recommendations advocating antenatal PAS diagnosis and planned delivery at specialized tertiary centers with multidisciplinary expertise.[16,23] Standardized PAS protocols, referral systems, and dedicated multidisciplinary teams may reduce maternal and neonatal complications, particularly in low- and middle-income countries.

Conclusion

Planned multidisciplinary management of PAS was associated significantly lower maternal and neonatal morbidity compared with emergency management. However, emergency presentation is strongly influenced by acute hemorrhage, labor onset, non-reassuring fetal status, absence of antenatal diagnosis, earlier gestational age, greater anatomical disease severity, and emergency referral circumstances. Consequently, while antenatal recognition and timely, coordinated referral to specialized tertiary centers are strongly associated with improved fetomaternal outcomes, these observational findings reflect clinical associations rather than a definitive causal effect, and the potential for residual confounding remains.

Limitations*:* A number of study limitations must be considered while evaluating these results. Its single-center retrospective design and relatively small sample may limit generalizability and statistical power, particularly for rare outcomes such as maternal and neonatal mortality. Reliance on hospital records may have introduced information bias, incomplete documentation, and variability in clinical reporting. PAS classification was not uniformly histopathologically confirmed, as some diagnoses were based on operative findings. Variations in surgeon experience, anaesthetic management, and blood product availability may also have influenced outcomes, particularly during emergency surgery. Long-term maternal reproductive and neonatal developmental outcomes were not assessed. Although multivariable regression adjusted for important baseline factors, including antenatal diagnosis, gestational age, prior caesarean history, PAS type/severity, placental location, multiple pregnancy, and referral timing, residual confounding inherent to retrospective observational studies cannot be excluded. Nevertheless, the study provides relevant real-world evidence on the potential benefits of planned multidisciplinary management of PAS in a tertiary care setting.

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