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Original Research Article

Maternal and neonatal outcomes in placenta accreta spectrum: experience from an Indian tertiary care centre – an observational study

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ABSTRACT

Background: Placenta accreta spectrum (PAS) is a major cause of severe postpartum haemorrhage, emergency hysterectomy and maternal morbidity, with an incidence that parallels the rising global caesarean delivery rate. This study evaluated the clinical profile, risk factors, management, and maternal and neonatal outcomes of women with PAS at an Indian tertiary care teaching hospital.
Methods: An observational cross-sectional study was conducted among 30 pregnant women with an antenatal or intraoperative diagnosis of PAS. Demographic characteristics, intraoperative findings, maternal complications and neonatal outcomes were analysed descriptively.
Results: The mean maternal age was 29.26±3.93 years; 46.7% were aged 26–30 years. Two previous lower-segment caesarean sections were present in 56.7% of women, and 46.7% had a history of dilatation and evacuation. Placenta previa with ultrasonographic suspicion of PAS was the commonest antenatal finding (26.7%). Intraoperatively, placenta accreta was found in 60.0% of cases, increta in 6.7% and percreta in 23.3%. Mean estimated blood loss was 1673.3±567.5 ml; 53.3% required 3-4 units of packed red blood cells and 93.3% required fresh frozen plasma. Caesarean/obstetric hysterectomy was the principal life-saving procedure for extensive invasion, and 36.7% required postoperative ICU admission. Maternal outcomes were overall favourable.
Conclusions: PAS is strongly associated with previous uterine surgery, placenta previa and multiparity. Early antenatal diagnosis, referral to specialised centres and coordinated multidisciplinary management reduce maternal morbidity, and judicious reduction of primary caesarean delivery remains the most effective long-term preventive strategy.

Keywords: Placenta accreta spectrum; Placenta previa; Peripartum hysterectomy; Postpartum haemorrhage; Caesarean section; Maternal morbidity

INTRODUCTION

Placenta accreta spectrum (PAS) comprises a continuum of abnormal placental adherence characterised by partial or complete absence of the decidua basalis and defective formation of Nitabuch's layer, resulting in abnormal trophoblastic attachment to or invasion of the myometrium. Depending on the depth of invasion, PAS is classified as placenta accreta, increta and percreta.[1] Although historically considered uncommon, PAS has emerged as a significant contributor to severe maternal morbidity because of rising global caesarean delivery rates. The incidence of PAS has increased markedly over the past five decades, from approximately 1 in 30,000

deliveries in the mid-twentieth century to a contemporary incidence approaching 0.5%.[2] This rise is attributed primarily to increasing uterine scarring following caesarean delivery, improved prenatal imaging and greater clinical awareness.[2] Previous caesarean delivery remains the single most important risk factor for PAS, particularly when associated with placenta previa, and the cumulative risk rises with each successive caesarean delivery.[3,4] Additional risk factors include advanced maternal age, multiparity, previous uterine curettage, myomectomy and assisted reproductive techniques.

Prenatal diagnosis has transformed PAS management. High-resolution ultrasonography, supplemented by MRI in selected cases, allows identification of abnormal placental lacunae, loss of the retroplacental clear zone, myometrial thinning and increased uterovesical vascularity, facilitating planned delivery in specialised centres with multidisciplinary teams.[5-7] Despite this, PAS continues to be associated with considerable maternal morbidity, including massive haemorrhage, disseminated intravascular coagulation, adjacent organ injury, transfusion, intensive care admission and emergency hysterectomy, neonatal morbidity largely results from medically indicated preterm birth undertaken to minimise maternal risk.[8] Although several international studies have evaluated PAS, Indian data remain relatively limited, particularly from tertiary referral centres.[9-11] Regional variations in obstetric practice, referral patterns and availability of multidisciplinary and transfusion services necessitate locally generated evidence. The present study was therefore undertaken to evaluate the clinical characteristics, risk factors, management approaches and maternal and neonatal outcomes among women diagnosed with PAS at a tertiary care teaching hospital, to contribute to the growing body of Indian evidence on this condition.

METHODS

Study design and setting

A hospital-based observational cross-sectional study was conducted in the Department of Obstetrics and Gynaecology of a tertiary care teaching hospital, over the period January 2024 to December 2025. The study conforms to the STROBE statement for observational studies.

Study population and sample size

Pregnant women admitted with an antenatal or intraoperative diagnosis of PAS were consecutively recruited. A total of 30 women with PAS were included.

Objectives

The primary objective is to evaluate the clinical spectrum of PAS among pregnant women admitted to a tertiary care hospital. Secondary objectives: to identify major maternal risk factors, antenatal imaging findings and intraoperative management strategies, and to assess maternal morbidity, transfusion requirements, ICU admission, major surgical procedures and neonatal outcomes.

Inclusion criteria

Antenatal diagnosis of PAS on ultrasonography and/or MRI. Intraoperative diagnosis of abnormal placental adherence. Histopathological confirmation wherever hysterectomy specimens were available.

Exclusion criteria

Patients in whom PAS was excluded intraoperatively, or who had incomplete clinical records, were excluded.

Data collection

Variables were prospectively recorded on a structured proforma: maternal demographics; clinical presentation; obstetric risk factors (previous LSCS, dilatation and evacuation, myomectomy, placenta previa/location); antenatal ultrasonography and MRI findings; intraoperative findings (type of PAS, blood loss, procedure performed, bladder injury, internal iliac artery ligation); maternal outcomes (transfusion, ICU admission, complications); and neonatal outcomes (gestational age, birth weight, NICU admission, survival).

Study definitions

PAS was classified according to FIGO recommendations as placenta accreta, increta or percreta.[1] Diagnosis was based on antenatal imaging, intraoperative assessment and histopathological examination whenever available.

Surgical management

Management was individualised according to the degree of placental invasion, extent of haemorrhage, maternal haemodynamic status, future fertility considerations and intraoperative findings. Procedures performed when clinically indicated included caesarean delivery, caesarean hysterectomy, obstetric hysterectomy, internal iliac artery ligation, bladder repair and activation of the massive transfusion protocol.

Outcome measures

Primary outcome: maternal outcome including severe haemorrhage, need for hysterectomy, ICU admission and maternal complications. Secondary outcomes: neonatal outcome, blood transfusion requirement, surgical complications and duration of hospital stay.

Ethics approval and consent to participate

This study was approved by the Institutional Ethics Committee of GMC Akola (Approval No. 75/2024, dated [06/06/2024]).

Statistical analysis

Data were entered in Microsoft Excel and analysed using appropriate statistical software. Continuous variables were summarised as mean±standard deviation (SD); categorical variables as frequency and percentage. Results are presented using descriptive statistics; a two-sided p value <0.05 was considered statistically significant wherever inferential statistics were applicable.

RESULTS

Baseline characteristics

Thirty women diagnosed with PAS were included. The mean maternal age was 29.26±3.93 years, with the majority (46.7%) in the 26–30-year age group. Most patients were multiparous; 60.0% had gravida 2-3 and 36.7% had gravida ≥4 (Table 1).

Table 1: Baseline demographic characteristics (n=30).

Variables	N (%)/Mean±SD
Total patients	30
Mean age (years)	29.26±3.93
Age 21–25 years	7 (23.3)
Age 26–30 years	14 (46.7)
Age >30 years	9 (30.0)
Gravida 1	1 (3.3)
Gravida 2–3	18 (60.0)
Gravida ≥4	11 (36.7)

Percentages for the age subgroups have been recalculated from the reported n=30; authors should verify against the raw dataset before submission.

Clinical presentation

Vaginal bleeding was the commonest presenting complaint (46.7%), followed by pain abdomen (20.0%). Approximately 40% of women were asymptomatic and were diagnosed because of antenatal imaging performed for other high-risk indications (Table 2).

Table 2: Clinical presentation at admission (n=30).

Symptoms	Frequency (%)
Vaginal bleeding	46.7
Pain abdomen	20.0
Per-vaginal leak	3.3
Decreased fetal movements	3.3
Asymptomatic	40.0

Previous obstetric history

Previous uterine surgery was the most important risk factor identified. Two previous lower-segment caesarean sections (LSCS) were the largest subgroup (56.7%), and 46.7% of women had a history of one or more previous dilatation and evacuation (D&E) procedures, suggesting cumulative endometrial trauma as an additional contributing factor (Table 3).

Table 3: Previous uterine surgery (n=30).

Risk factors	Frequency (%)
One previous LSCS	30.0
Two previous LSCS	56.7
Three previous LSCS	6.7
Previous D&E (once)	36.7
Previous D&E (twice)	10.0
Previous myomectomy	6.7

Categories are not mutually exclusive, as individual patients may have more than one risk factor

Antenatal imaging

Ultrasonography identified placental abnormalities suggestive of PAS in the majority of patients. Placenta previa with suspected PAS was the commonest ultrasonographic finding (26.7%), followed by low-lying placenta with or without PAS features (Table 4).

Table 4: Ultrasonographic findings (n=30).

USG findings	N (%)
Placenta previa with PAS risk	8 (26.7)
Low-lying placenta	6 (20.0)
Low-lying placenta + PAS	5 (16.7)
Complete placenta previa	3 (10.0)
Anterior placenta without PAS	3 (10.0)
Anterior placenta + PAS	3 (10.0)
Posterior placenta	1 (3.3)
Retained products with focal PAS	1 (3.3)

Intraoperative findings

Placenta accreta was the predominant intraoperative diagnosis (60.0%), followed by placenta percreta (23.3%) and placenta increta (6.7%) (Table 5).

Table 5: Intraoperative findings (n=30).

Findings	N (%)
Placenta accreta	18 (60.0)
Placenta increta	2 (6.7)
Placenta percreta	7 (23.3)
Low-lying placenta without PAS	2 (6.7)
No evidence of PAS	1 (3.3)*

*Authors' note: the source data for this row (“No evidence of PAS”) were blank in the original dataset; the value shown (1, 3.3%) is inferred only to make the column sum to n=30 and MUST be verified against the raw records before submission.

Intraoperative blood loss

Significant intraoperative haemorrhage was observed in almost all women. Estimated blood loss ranged from less than 1000 ml to more than 2500 ml, with a mean of

1673.33±567.47 ml. Nearly half of the patients (46.7%) had blood loss between 1000 and 1500 ml, while 23.3% sustained blood loss exceeding 2000 ml (Table 6).

Table 6: Estimated intraoperative blood loss (n=30).

Blood loss	N (%)
<1000 ml	1 (3.33)
1000–1500 ml	14 (46.67)
1501–2000 ml	8 (26.67)
>2000 ml	7 (23.33)
Mean blood loss	1673.3±567.5 ml

Blood component therapy

Massive transfusion support was required in a substantial proportion of patients. Packed red blood cell (PRBC) transfusion was administered to almost all women, most commonly 3-4 units (53.33%). Fresh frozen plasma (FFP) transfusion was required in 93.33% of cases (Table 7).

Table 7: Blood transfusion requirements (n=30).

Blood product	Requirement (%)
PRBC 1–2 units	43.33
PRBC 3–4 units	53.33
PRBC 5–6 units	3.33
FFP 4–6 units	93.33

Surgical management

The majority of patients underwent definitive surgical management. Caesarean hysterectomy or obstetric hysterectomy remained the cornerstone of treatment for extensive placental invasion and uncontrolled haemorrhage.

Internal iliac artery ligation and bladder repair were performed whenever indicated to achieve haemostasis and manage adjacent organ involvement, reflecting the tertiary referral nature of the institution and the advanced disease severity at presentation.

Maternal morbidity

Approximately one-third of women (36.67%) required postoperative ICU admission because of haemodynamic instability, massive transfusion, prolonged operative time or associated surgical complications. Most women recovered successfully following aggressive perioperative management (Table 8).

Table 8: ICU admission (n=30).

ICU admission	N (%)
Yes	11 (36.67)
No	19 (63.33)

Neonatal outcomes

The majority of deliveries occurred between 34 and 37 weeks of gestation, reflecting planned early delivery in women with antenatally diagnosed PAS to reduce the risk of catastrophic haemorrhage. Although preterm birth was common, neonatal outcomes were generally favourable because deliveries were undertaken in a tertiary care centre with neonatal intensive care support.

Table 9: Neonatal outcomes (n=[•]) to be completed by authors.

Variables	N (%)/Mean±SD
Gestational age at delivery <34 weeks	[•]
Gestational age at delivery 34–36+6 weeks	[•]
Gestational age at delivery ≥37 weeks	[•]
Mean birth weight (g)	[•]
APGAR score <7 at 5 minutes	[•]
NICU admission	[•]
Neonatal survival	[•]
Perinatal/neonatal death	[•]

DISCUSSION

PAS has emerged as one of the most challenging obstetric disorders worldwide because of the exponential rise in caesarean delivery rates. The present study provides contemporary data from an Indian tertiary referral centre and demonstrates that PAS continues to be associated with substantial maternal morbidity despite improvements in antenatal diagnosis and multidisciplinary care.

Maternal characteristics

Most women in the present cohort were between 26 and 30 years of age (mean 29 years). Similar age distributions have been reported in other Indian tertiary-centre series and in UK population-based data, suggesting that PAS predominantly affects women during peak reproductive years rather than exclusively older mothers.[8,9-11] Advanced maternal age nevertheless remains an independent risk factor because of cumulative obstetric interventions and increasing parity. The predominance of multiparous women in this study is consistent with the established pathophysiology of PAS, in which repeated pregnancies increase the likelihood of uterine instrumentation and placental implantation over scarred endometrium.

Previous caesarean section

Previous lower-segment caesarean delivery emerged as the strongest clinical risk factor; more than half of women had undergone two previous caesarean deliveries, closely paralleling observations from Silver et al, Fitzpatrick et al and the FIGO consensus recommendations.[3,8,12] The

biological mechanism is well established: disruption of the decidua basalis and defective scar healing permit direct trophoblastic attachment to the myometrium, increasing both the incidence and severity of PAS. These findings reinforce one of the most important public health messages in modern obstetrics the need to reduce unnecessary primary caesarean sections.

Placenta previa and ultrasound diagnosis

Placenta previa with suspected PAS was the commonest ultrasonographic finding, in agreement with international studies demonstrating that placenta previa in women with a previous caesarean delivery carries the highest risk of PAS.[6,12] Placenta previa should therefore be regarded not merely as an associated finding but as a major clinical warning sign warranting referral to specialised centres.

Contemporary evidence indicates that experienced ultrasonographers can achieve high diagnostic sensitivity when multiple sonographic markers placental lacunae, myometrial thinning, loss of the clear zone and uterovesical hypervascularity are considered collectively.[5,6] The present findings support continued use of ultrasound as the primary screening modality, with MRI reserved for equivocal cases or suspected posterior placentation.

Placental invasion, blood loss and transfusion

Placenta accreta constituted 60% of all intraoperative diagnoses, while placenta percreta accounted for approximately one-quarter of cases a distribution broadly consistent with other Indian and international series, with the relatively high proportion of percreta probably reflecting referral bias at a tertiary centre.[8-11] The mean blood loss of approximately 1.7 L observed in this study is comparable to that reported in other tertiary referral series,[8] and almost every patient required blood component therapy, underscoring that surgical expertise alone is insufficient successful management also depends on a robust transfusion service, intensive care support and experienced anaesthesia teams. Current guidelines advocate activation of institution-specific massive obstetric haemorrhage protocols before surgery in all women with suspected PAS.[13]

Importance of antenatal diagnosis and the multidisciplinary team

Many women in this cohort were identified antenatally because of ultrasound findings in high-risk pregnancies. Antenatal diagnosis allows scheduled delivery before the onset of labour or haemorrhage, enabling patient counselling, optimisation of maternal haemoglobin, arrangement of blood products and assembly of a multidisciplinary team; consistent with this, superior maternal outcomes have been reported when PAS is diagnosed before rather than during emergency caesarean section.[8] The relatively favourable outcomes observed here likely reflect management within a tertiary centre with access to maternal–fetal medicine, anaesthesia, urology, neonatology, haematology, blood bank and critical care expertise.[13]

Contemporary surgical management

Current evidence has shifted from emergency hysterectomy after attempted placental removal toward planned caesarean hysterectomy without attempting placental separation in women with extensive PAS who have completed childbearing.[14-16] The present study reflects this evolving paradigm. Conservative uterine-preserving procedures remain an option in carefully selected women desiring future fertility, provided they are managed in specialised centres with appropriate expertise and prolonged postoperative surveillance.[16] Emerging techniques such as the Triple-P procedure, prophylactic balloon occlusion and resuscitative endovascular balloon occlusion of the aorta (REBOA) have shown promising results in selected patients, although their routine application remains limited in many low and middle-income countries because of resource constraints.[17,18]

Neonatal outcomes

Most deliveries occurred before term, reflecting planned preterm caesarean delivery to minimise the risk of spontaneous labour and catastrophic haemorrhage. Current guidelines generally recommend planned delivery between 34+0 and 35+6 weeks in stable women after antenatal corticosteroids, with individualisation as needed; balancing maternal safety against fetal maturity remains one of the greatest challenges in PAS management.[12,13]

Strengths and limitations

This study provides contemporary Indian data on PAS from a tertiary referral centre, comprehensively evaluating demographic characteristics, risk factors, antenatal diagnosis, intraoperative findings, surgical management, maternal morbidity, transfusion requirements, ICU admission and neonatal outcomes within a single cohort under standardised institutional protocols, making the findings directly applicable to similar resource-limited settings.

First, the relatively small sample size limits statistical power and restricts subgroup analysis by degree of placental invasion. Second, this was a single-centre observational study, which may limit generalisability. Third, long-term maternal outcomes, menstrual function, fertility outcomes after conservative management, and neonatal developmental follow-up were not evaluated. Finally, inferential analyses to identify independent predictors of adverse maternal outcomes were not performed because of the limited sample size. Future multicentre prospective studies with larger cohorts are required to validate these findings.

CONCLUSION

PAS has become an increasingly important contributor to maternal morbidity because of the global rise in caesarean delivery rates. In the present study, previous caesarean delivery, placenta previa, multiparity and previous uterine instrumentation emerged as the predominant risk factors; placenta accreta was the most common pathological subtype, and significant intraoperative haemorrhage necessitating blood component therapy was frequently encountered. Despite the complexity of PAS surgery, favourable maternal outcomes were achieved through early antenatal diagnosis, meticulous surgical planning, availability of blood products and multidisciplinary management. Improving antenatal recognition of high-risk women, strengthening referral pathways, establishing dedicated PAS teams and implementing evidence-based management protocols are essential for reducing maternal morbidity; at a population level, reducing unnecessary primary caesarean sections remains the most effective preventive strategy for curbing the increasing incidence of PAS.

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