

Article

Management of Placenta Accreta Spectrum Disorders: A Prospective Single-Centre Experience of 236 Cases in Riyadh, Saudi Arabia (2018–2024)

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Abstract:

Objective: To evaluate maternal and neonatal outcomes of women with placenta accreta spectrum (PAS) disorders managed by a dedicated multidisciplinary team at a tertiary referral centre in Riyadh, Saudi Arabia. **Methods:** We conducted a prospective case series of all women with antenatally suspected and intraoperatively or histopathologically confirmed PAS managed at King Fahad Medical City between April 2018 and December 2024. Women with high suspicion of PAS were electively admitted at 31+6 weeks' gestation for optimisation when feasible and delivered by midline laparotomy and fundal or classical caesarean incision with the placenta left in situ. Definitive management consisted of hand-assisted retrograde caesarean hysterectomy or segmental uterine resection with reconstruction. Outcomes included operative time, quantified blood loss, transfusion requirements, intra- and postoperative complications, intensive care unit (ICU) admission, hospital stay, and neonatal morbidity. **Results:** A total of 236 women with confirmed PAS were managed. Median maternal age was 36 years and placenta previa coexisted in 86.9%. Elective caesarean delivery at 34+0–35+6 weeks occurred in 72.0%, whereas 28.0% required emergency delivery for haemorrhage or labour. Caesarean hysterectomy was performed in 85.2% and conservative segmental uterine resection in 14.8%. Median operative time was 135 minutes and median blood loss 4.3 L; the median transfusion requirement was six units of packed red blood cells. Intraoperative complications occurred in 27.1%, most commonly bladder injury (14.8%). One woman (0.4%) died intraoperatively from disseminated intravascular coagulation with intracardiac thrombosis. ICU admission was required in 66.0%. Neonatal intensive care unit admission occurred in 53.0%, mainly because of prematurity; there were no neonatal deaths. **Conclusion:** Centralised multidisciplinary management of PAS with planned delivery at 34–35 weeks, avoidance of placental removal, and use of retrograde hysterectomy or segmental resection can minimise haemorrhage and maternal mortality while maintaining acceptable neonatal outcomes in a high-volume referral centre.

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1. Introduction

Placenta accreta spectrum (PAS) encompasses placenta accreta, increta, and percreta and refers to abnormal adherence or invasion of placental villi into the myometrium due to defects at the endometrial–myometrial interface [1,2]. These disorders are strongly associated with previous caesarean delivery and placenta previa and have become a leading cause of severe postpartum haemorrhage, peripartum hysterectomy, and maternal morbidity and mortality [3–5]. Older series reported maternal mortality rates as high as 7% [2,6].

Rising global caesarean delivery rates have led to a marked increase in PAS incidence [4]. Prevalence estimates have shifted from approximately 1 in 2500–4000 pregnancies in the 1970s and 1980s to about 0.17% (around 1 in 588) in more recent pooled data [14]. Accurate population-based estimates remain challenging because definitions and coding have only recently been standardised [1,14].

Early antenatal diagnosis and referral to centres with multidisciplinary expertise are key determinants of outcome. The American College of Obstetricians and Gynecologists and the Society of Obstetricians and Gynaecologists of Canada recommend that women with suspected PAS be delivered in level III or IV maternal care facilities with access to massive transfusion protocols and subspecialist support [11,12]. Observational studies suggest that care in high-volume centres with standardised protocols reduces blood loss, transfusion, and maternal mortality [2,6–8].

Data from the Middle East remain limited. A recent retrospective study from Bahrain identified 20 PAS cases among 30 004 deliveries with an increasing annual trend [13]. There is a need for detailed contemporary reports from the region to inform practice and resource allocation.

We therefore sought to describe our prospective experience over seven years with multidisciplinary PAS management at King Fahad Medical City (KFMC), a tertiary referral centre in Riyadh, Saudi Arabia. The primary objective was to evaluate maternal outcomes, including haemorrhagic morbidity and complications. Secondary objectives were to assess neonatal outcomes and describe temporal trends in case numbers.

2. Materials and Methods

Study Design and Setting We conducted a prospective case series of all women with antenatally suspected and intraoperatively or histopathologically confirmed PAS who were managed at KFMC between April 2018 and December 2024. KFMC is a tertiary referral centre for high-risk obstetrics serving a large catchment area within Saudi Arabia. All PAS cases are managed by a dedicated multidisciplinary team. **Patient Selection and Definitions** Women were eligible if they had antenatal imaging highly suggestive of PAS or intraoperative findings consistent with abnormal placental adherence or invasion confirmed by histopathology when hysterectomy or segmental resection was performed. Women with miscarriage or termination before 20 weeks, retained placenta without myometrial invasion, or incomplete records precluding outcome assessment were excluded.

PAS subtype (accreta, increta, percreta) was defined according to standardised terminology and histopathologic depth of invasion when tissue was available [1,11]. Placenta previa was diagnosed by ultrasound according to routine obstetric protocols. **Preoperative Evaluation and Optimisation** Women with risk factors such as placenta previa and previous caesarean delivery underwent detailed obstetric ultrasonography. Suspicious features included loss of the hypoechoic zone between placenta and myometrium, placental lacunae, turbulent subplacental blood flow, and placental extension beyond the uterine serosa [2,14]. Magnetic resonance imaging was requested when ultrasound findings were inconclusive.

Suspected cases were reviewed by a multidisciplinary PAS team comprising general obstetricians, maternal–fetal medicine specialists, gynaecologic oncologists, pelvic reconstructive surgeons, anaesthesiologists, critical care physicians, neonatologists, blood bank personnel, and specialised nurses. Women with high suspicion for PAS were electively admitted at 31+6 weeks' gestation for optimisation, including haemoglobin correction, counselling, and logistical planning. Surgical Management Protocol All operations were performed in the main operating suite under general anaesthesia with arterial and central venous access. Ten units each of packed red blood cells (RBCs), fresh frozen plasma, and platelets were cross-matched, with four to six units of RBCs immediately available. Prophylactic antibiotics were administered. Two experienced pelvic surgeons operated in all cases.

A midline laparotomy was used routinely. Adhesions were lysed, and a fundal classical or high transverse uterine incision was made to deliver the fetus, intentionally avoiding the placental bed. The placenta was left in situ, and manual removal was avoided unless placental adherence was uncertain; in such cases, a gentle trial of separation was allowed.

Definitive management followed one of two pathways: 1. Hand-assisted retrograde caesarean hysterectomy (modified total hysterectomy), including closure of the fundal hysterotomy; ligation of round and utero-ovarian ligaments with a vessel-sealing device; identification of ureters; bilateral internal iliac artery ligation; lateral bladder dissection; and hand-assisted retrograde dissection with en bloc removal of uterus and cervix with placenta in situ. When anterior bladder dissection was unsafe due to dense retrovesical placentation, a posterior colpotomy and “flip” technique were used. 2. Segmental uterine resection with reconstruction (conservative management), involving excision of the invaded uterine segment containing the placenta, haemostasis, and layered repair with preservation of the remainder of the uterus.

Quantitative blood loss was estimated by suction volume and weighing of surgical swabs. The institutional massive transfusion protocol (1:1:1 ratio of RBCs, plasma, and platelets) was activated early in cases of significant haemorrhage. All surgical specimens were submitted for histopathologic confirmation of PAS and invasion depth. Data Collection and Outcome Measures Demographic, obstetric, and clinical data were recorded prospectively in a dedicated database. Variables included maternal age, gravidity, parity, number of prior caesarean deliveries, presence of placenta previa, referral region, and comorbidities.

Operative variables included timing of delivery (elective vs emergency), gestational age at delivery, type of definitive surgery (hysterectomy vs segmental resection), operative time, quantified blood loss, and transfusion requirements. Intraoperative complications included bladder, ureteric, vascular, or bowel injury and disseminated intravascular coagulation (DIC).

Postoperative outcomes included ICU admission, length of ICU and total hospital stay, need for reoperation, postoperative transfusion, and maternal mortality. Neonatal outcomes included neonatal intensive care unit (NICU) admission and neonatal death.

The primary maternal outcome was severe morbidity reflected by high blood loss, transfusion, organ injury, need for reoperation, ICU admission, or death. Secondary outcomes included NICU admission and temporal trends in case numbers. Statistical Analysis Categorical variables are presented as frequencies and percentages; continuous variables as medians with interquartile ranges. Comparisons between groups were made using the chi-square or Fisher's exact test for categorical variables and the Mann–Whitney U test for continuous variables. A p-value <0.05 was considered statistically significant. Analyses were performed using SPSS version 17.0 (Chicago, IL). Ethics The study protocol was approved by the ethics committees of King Abdullah City for Science and Technology (approval 11-01-R-012) and the National Institutes of Health international review board (IRB00010471; Federalwide Assurance FWA00018774). All women provided written

informed consent. The study was conducted in accordance with the principles of the Declaration of Helsinki.

3. Results

Patient Characteristics

During the study period, 236 women with confirmed PAS were managed. Median maternal age was 36 years (interquartile range 33–39), and median gravidity was 5. Placenta previa coexisted in 205 women (86.9%). The median number of prior caesarean deliveries was 4, and 51.6% had at least four previous caesareans. Most referrals originated from the central region of Saudi Arabia. Operative Management Elective caesarean delivery between 34+0 and 35+6 weeks occurred in 170 women (72.0%), while 66 women (28.0%) required emergency delivery for antepartum haemorrhage, preterm labour, or rupture of membranes. Caesarean hysterectomy with placenta left in situ was performed in 201 women (85.2%). Conservative management with segmental uterine resection and reconstruction was attempted in 35 women (14.8%) with focal invasion and a desire for uterine preservation.

Median operative time was 135 minutes (interquartile range 120–180). Quantitative blood loss averaged 4.3 L (interquartile range 3–5 L), and the median transfusion requirement was six units of packed RBCs. Intraoperative and Postoperative Complications Intraoperative complications occurred in 64 women (27.1%). Bladder injury was the most common complication, affecting 35 women (14.8%). DIC occurred in 14 women (5.9%), and ureteric or major vascular injury in 9 women (3.8%) each. One woman (0.4%) died intraoperatively from DIC with intracardiac thrombosis despite aggressive resuscitation.

Postoperative ICU admission was required in 156 women (66.0%) for a median of 1.3 days. The remaining 80 women (33.9%) were managed in standard post-anaesthesia care before transfer to the postpartum ward. Ten women (4.2%) required reoperation: two for removal of abdomino-pelvic packing, two for secondary hysterectomy after initial conservative management, two for ureteric reimplantation, and four for fascial dehiscence or deep surgical-site infection. Median total hospital stay was 6.4 days. Postoperative transfusion was required in 30 women (12.7%), with a median of three RBC units. Neonatal Outcomes NICU admission occurred in 125 neonates (53.0%), largely due to complications of prematurity. There were no neonatal deaths during the study period. Temporal Trends in Case Numbers The annual number of PAS cases managed at KFMC varied over time. The programme cared for 50 women in 2018, 52 in 2019, and 49 in 2020. After 2020, absolute numbers per year were lower but showed a gradual increase: 13 cases in 2021, 28 in 2022, 20 in 2023, and 24 in 2024. The rise observed from 2022 onward likely reflects improved antenatal detection and referral rather than changes in data collection and is consistent with global trends in PAS incidence [13,14].

4. Discussion

Main Findings This large prospective single-centre series from the Middle East demonstrates that centralised, multidisciplinary management of PAS can achieve excellent maternal outcomes despite substantial haemorrhagic risk. Elective delivery at 34–35 weeks with planned hysterotomy away from the placenta, avoidance of placental removal, and use of hand-assisted retrograde hysterectomy or segmental resection was associated with a low maternal mortality of 0.4% and acceptable morbidity in 236 women. **Interpretation in the Context of the Literature** Our findings align with observational studies showing that PAS outcomes are improved in specialised centres using standardised protocols [2,6–8]. Wright and colleagues reported mean blood loss of 3 L and transfusion of five RBC units, with blood loss ≥ 5 L in 41.7% of cases undergoing

hysterectomy [6]. Our quantified blood loss and transfusion data are similar, despite a high proportion of women with multiple previous caesareans and placenta previa.

The observed maternal mortality (0.4%) compares favourably with historical rates of up to 7% [2]. This improvement likely reflects adherence to recommendations from ACOG and the SOGC that women with suspected PAS deliver in level III or IV centres with access to massive transfusion protocols and multidisciplinary expertise [11,12]. Our results support timing of delivery at 34–35 weeks and avoidance of attempted placental separation, as both strategies reduce haemorrhage and emergent operative interventions [2,11].

Bladder injury was the most frequent complication, underscoring the technical difficulty of bladder dissection in the presence of placenta percreta [7,9,10]. Early ureteric identification and internal iliac artery ligation were integral components of our approach to minimise vascular injury and facilitate safe retrograde hysterectomy. Conservative management with segmental uterine resection allowed uterine preservation in a carefully selected minority (14.8%) and appears feasible when performed by surgeons experienced in radical pelvic surgery [10,12].

Our data contribute region-specific evidence to the growing global literature on PAS, complementing recent reports from Bahrain and other settings [7,10,13,14]. The temporal increase in referred cases from 2022 onward likely reflects improved antenatal detection and awareness among referring centres rather than a true decrease followed by a rise in incidence. Strengths and Limitations Strengths of this study include its prospective design, large sample size, and uniform application of a standardised management protocol in a high-volume centre. Detailed intraoperative and postoperative data were collected, allowing comprehensive assessment of complications and resource utilisation.

Limitations include the single-centre design and absence of a contemporaneous control group managed in non-specialised settings. Long-term reproductive outcomes after segmental uterine resection were not systematically captured, precluding firm conclusions about fertility preservation. In addition, our findings may not be directly generalisable to centres with different resources or surgical expertise. Clinical Implications and Future Directions Our experience reinforces key elements of PAS management: early risk stratification, antenatal diagnosis, centralised care in high-volume centres, planned delivery at 34–35 weeks, avoidance of placental removal, and use of hand-assisted retrograde hysterectomy or segmental resection when appropriate. Health systems should prioritise regional referral pathways and capacity building for PAS care.

Future research should evaluate long-term maternal and reproductive outcomes after conservative surgery, assess the cost-effectiveness of centralised PAS programmes, and explore predictors of successful uterine preservation. Multicentre collaborations will be essential to refine patient selection for conservative approaches and to validate outcome benchmarks.

5. Conclusions

Centralised multidisciplinary management of PAS at a high-volume tertiary centre, with planned delivery at 34–35 weeks, avoidance of placental removal, and use of hand-assisted retrograde hysterectomy or segmental resection, can substantially reduce maternal mortality and achieve acceptable maternal and neonatal outcomes. Our findings support current recommendations that women with suspected PAS be delivered in level III or IV maternal care facilities with specialist expertise and access to comprehensive blood bank support.

Author Contributions

All authors meet the ICMJE criteria for authorship.

Khalid Al Wadi: conception and design of the study; development of the PAS protocol; supervision of clinical care; operative management; data interpretation; drafting and critical revision of the manuscript. Ashraf Dawood: operative management; data acquisition; contribution to methods and results sections; manuscript review. Amani Alshaya: operative management; perioperative care; maternal outcomes analysis; manuscript review. Mohammed Alsayed: operative management; data collection and curation; statistical analysis; drafting of methods and results; critical revision for important intellectual content. Eman Al Sanie: imaging assessment; operative management; contribution to diagnostic methodology; data interpretation; manuscript review. Faisal Al Turki: anaesthesia and ICU care; operative management; input on perioperative management sections; manuscript review. Yasser Butt: neonatal management; operative management at delivery; analysis of neonatal outcomes; manuscript review. Hasan Arnos: operative management; complications analysis; manuscript review. Manal Al Bakri: perioperative and postoperative care; operative management; data collection; manuscript review. Ahmed Khatab: methodological support; statistical advice; operative management oversight; critical revision of the manuscript. Ibrahim A. Albahlol: academic oversight; operative management; interpretation of findings in the context of regional data; manuscript review.

All authors approved the final manuscript and agree to be accountable for all aspects of the work.

Declarations

Ethics approval and consent to participate The study was approved by the ethics committees of King Abdullah City for Science and Technology (approval 11-01-R-012) and the National Institutes of Health international review board (IRB00010471; Federalwide Assurance FWA00018774). Written informed consent was obtained from all participants. Consent for publication Not applicable (no identifiable individual patient data are presented). **Competing interests** The authors declare no competing interests. **Funding** No external funding was obtained for this study. **Acknowledgements** The authors thank the obstetric, anaesthesiology, critical care, neonatal, and blood bank teams at King Fahad Medical City for their dedication to the care of women with PAS.

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Data Availability Statement

Data sharing is not applicable to this article as no publicly archived datasets were generated. Data may be available from the corresponding author on reasonable request, subject to institutional approval.

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Conflicts of Interest

The authors declare no competing interests.

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