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St. Paul's Hospital Millennium Medical College**

Prevalence, Risk factor, maternal and fetal outcome of placenta accreta spectrum managed at Saint Paul's hospital millennium medical college:
a 5 years retrospective study

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ADDIS ABABA, ETHIOPIA

Prevalence, Risk factor, maternal and fetal outcome of placenta accrete spectrum managed at Saint Paul's hospital millennium medical college: a 5 years retrospective study

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ADDIS ABABA, ETHIOPIA

Advisor's approval paper

DRPC FORM III: RESEARCH THESIS APPROVAL BY ADVISORS

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I, Dr. Robel Megabo, hereby declare that this research thesis entitled “ Prevalence, Risk factor, maternal and fetal outcome of placenta accrete spectrum managed at Saint Paul's hospital millennium medical college” in line with the requirement of graduate studies was fully undertaken by me under the guidance of my advisors and that I have, to the best of my knowledge and effort, avoided plagiarism or duplication of materials unless and otherwise cited and/or acknowledged and that it has not been so far submitted for any form of proposal application or consideration.

Investigator Dr. Robel Megabo _____

We hereby certify that we have read and evaluated this research thesis relating to“ Prevalence, Risk factor, maternal and fetal outcome of placenta accrete spectrum managed at Saint Paul's hospital millennium medical college ” under our guidance from its inception up to in its current format including ethical issues and that it can be submitted to the DRPC for further administrative processing & documentation of the proposal by the Department as part of the resident's research undertaking for his/ her partial fulfilment to the Degree of Specialty in Obstetrics and Gynaecology.

Advisors Dr. Yemeserach Mulugeta _____

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Acronyms

ACOG: American society of obstetrics and gynecology

ANC: antenatal care

CS: cesaerean section

CD: cesaerean delivery

GA: gestational age

ICU: intensive care unit

LNMP: last normal menstrual period

NICU: neonatal intensive care unit

NIH: national institute of health

NRFHR: normal regular fetal heart rate

VBAC: vaginal birth after cesarean section

VD: vaginal delivery

PAS: placenta accrete spectrum

Abstract

Background: Placenta accreta spectrum (PAS) disorders have become a significant life-threatening issue due to its increased incidence, morbidity and mortality. Several studies have tried to identify the risk factors for PAS disorders. The ideal management for PAS disorders is a matter of debate. there has not been studies conducted in SPHMMC.

Objectives: To assess the Prevalence, risk factor, maternal and fetal outcome of placenta accrete spectrum at Saint Paul's hospital millennium medical college.

Methods: This was a five-year (2020-2025) retrospective review on risk factors, maternal and perinatal outcome of PAS managed at St. Paul's Hospital Millennium Medical College. Data were collected retrospectively using electronic capture technique using open data kit (ODK). Data were analyzed using SPSS version 27 Simple descriptive statistics, Chi-Squared test, and multiple logistic regression analysis were performed as appropriate. Odds ration with 95% CI and P-value of <0.05 was used to present findings significance.

Result: - Among the study participants, 67.4% of women experienced poor composite maternal outcomes. The most common maternal complications were PPH (67.4%), Need for ICU admission (67.4%), Maternal infection (16.3%), Organ injury (25.6%), and relaparatomy(9.3%). Grade of adherence(AOR = 7.28, 95% CI: 1.85–28.65, $p=0.004$) , and mode of delivery (AOR = 5.83, 95% CI:1.15–29.5, $p=0.033$) were significant predictors of adverse maternal outcomes. Poor perinatal outcomes occurred in 44.2% of neonates, with prematurity, low birth weight, and NICU admission being most frequent. Type of CD(AOR=4.92,95% CI: 1.08–22.42, $p=0.039$) and Grade of adherence (AOR =3.61, 95% CI: 1.02–12.85, $p=0.046$) were independently associated with adverse perinatal outcomes. Cesarean Hysterectomy was the most common mode of delivery (51.2%), followed by Cesarean section(46.5%).

Conclusion: - The study revealed a high burden of adverse maternal and perinatal outcomes among the participants. Perinatal outcomes were also concerning, with 44.2% of neonates experiencing poor outcomes, predominantly prematurity, low birth weight, and NICU admission. Key factors associated with adverse perinatal outcomes were GA at delivery and birth weight.

Keywords; PAS, maternal outcome, perinatal outcome, St Paul's hospital millennium medical college

1. Introduction

1.1 Background of the study

Placenta accreta spectrum (PAS), first described in 1937, refers to the pathologic invasion of the placental trophoblasts to the myometrium and beyond, which was formerly known as morbidly adherent placenta with subtypes described as accreta (adheres to the myometrium), increta (invades deep to the myometrium) and percreta (the invasion reaches to the uterine serosa and beyond)¹.

Why the placenta gets infiltrated deep to the myometrium is not exactly known. Taking the strong association of PAS with uterine scar, defective decidualization at the endometrium–myometrium interface is usually attributed to its occurrence², but that does not exclusively explain the whole picture. Infrequently, PAS occurs in the first pregnancy. The rare variety of PAS is the growth of the significant part of the placenta in the utero-vesical pouch passing through the uterine window of caesarean section (CS) scar while the fetus and part of the placenta was on the inside wall of the placenta. Placenta percreta extending beyond the uterine surface is not uncommon.

The global incidence of PAS is not known because of the paucity of data from developing countries. In the United States of America (US), for instance, the incidence of PAS rose from 1 in 2510 to 1 in 4017 between 1970s and 1980s³ to 1 in 272 in 2016⁴, which is about 10-15-fold increment in the last three to four decades. Its incidence was much higher in women with placenta Previa and/or scarred uterus⁵.

The finding of anterior low lying or major placenta Previa with a previous CS scar was highly indicative of the possibility of PAS, which is still a reminder that such cases require thorough ultrasound screening by an expert in the field starting from 18 weeks' gestation⁴⁵.

The single biggest risk factor for PAS is prior cesarean delivery, with the risk increasing with each additional cesarean. In general, the increasing number of CS delivery across the world is highly incriminated for the progressively increasing incidence of placental adherence.

A meta-analysis of 11 case–control and 5 cohort studies showed about 2-fold increased risk of the PAS disorder after CS⁶. Women with three or more uterine CS scar were more than 10 times at higher risk of PAS than women with single uterine scar, which indicates the increased risk of PAS as the number of CS scar increases.

In agreement with this finding, a systematic review reported the incidence of PAS as 3.3%-4% in women with placenta previa with no CS scar and 50–67% in women with three or more CS scars⁷. About a decade back, another study reported that women presenting with placenta previa and prior CS, the incidence of PAS was 3%, 11%, 40%, 61% and 67% for one, two, three, four, and five or more CS deliveries, respectively.⁸

Other risk factors attributed to PAS are also related to surgical and infectious injuries, which potentially can cause scar to the uterine wall (previous history of PAS, current placenta previa, previous myomectomy, metroplasty, endometrial ablation, Asherman's syndrome, excised uterine polyp, repaired uterine perforation or rupture, endometrial curettage and previous endometritis)⁴.

The diagnosis of PAS is suspected antenatally via imaging, and confirmed clinically usually during CS, and occasionally with histopathologic examination of the hysterectomy or partially resected myometrial tissue. The antenatal diagnosis of PAS using imaging techniques is currently the gold standard and highly desirable to make a decision on the management plan and minimize the complications.

The rise in PAS incidence has significant implications for maternal and perinatal outcomes. PAS is associated with increased risks of massive obstetric hemorrhage, emergency hysterectomy, blood transfusion, admission to the intensive care unit, and maternal mortality. Perinatal complications include preterm birth, low birth weight, and increased neonatal intensive care unit admissions.

The most common reason for maternal admission in cases of PAS is vaginal bleeding. The second-most common reason for admission is the antenatal diagnosis of PAS. There is no consensus for a single approach for the management of PAS disorders, and optimal management depends on local expertise⁹. PAS is associated with increased maternal and neonatal morbidity and mortality which can be reduced if these cases are managed by a multidisciplinary team with immediate access to blood products and ICU facilities⁵. These disorders are linked to severe maternal and neonatal morbidity and mortality, even in developed nations with easily available knowledge and cutting-edge resuscitative and supporting facilities¹⁰. Thus, prenatal diagnosis and management in a tertiary center are essential to ensure better outcomes. Caesarean hysterectomy after delivery of the baby with placenta in situ is the most widely acknowledged treatment for PAS as attempts at its removal are associated with a considerable risk of haemorrhage¹¹. It is linked with much lower morbidity - 36% vs. 67% - compared to those with attempted manual placental removal, therefore antenatal diagnosis is also crucial in these cases^{12,9}.

A balance between maternal and neonatal health has been considered for determination of the optimal timing of delivery. Thirty-four weeks of the gestation has been recommended as the optimal gestational age for delivery¹³. However, recent guidelines gave different

opinions for the optimal timing for delivery. For instance, the American College of Obstetricians and Gynecologists (ACOG) recommended termination between 34+0 and 35+6 and Royal College of Obstetricians and Gynaecologists (RCOG) 35+0 to 36+6 weeks of gestation¹⁴. Glucocorticoids should be administered for improving the fetal lung maturity and the delivery should be performed in a tertiary care center^{15, 16}.

The average volume of bleeding during surgery was reported to be ranging from 3000 to 5000 ml¹⁷. As massive bleeding may occur during the surgery, various blood products should be prepared in advance, also effective and easy maneuvers have been recently introduced to reduce maternal bleeding¹⁸. Literature suggests that caesarian section and hysterectomy in the same surgical time as the best option for management of this pathology¹⁹. After the surgery the tissues should be sent to pathology department for confirmation of the diagnosis by an expert pathologist. Due to difficulty of the operation and dangerousness of this pathology, the mother and newborn may have different complications and outcomes. Based on a systematic review of 34 studies, maternal need of transfusion and peripartum hysterectomy were among the most prevalent and significant adverse outcomes and preterm birth, low birth weight and low 5-min Apgar score were among the most common adverse outcomes of the neonates^{20, 21}.

1.2 Statement of the problem

The rising global cesarean delivery rate has led to a dramatic increase in the incidence of placenta accreta spectrum (PAS) disorders. According to the Ethiopian Demography and Health Survey (EDHS), CSR increased from 0.7% in 2000 to 1.9% in 2016 in the nation, with increment across all regions. Addis Ababa had the highest CSR (21.4%) in 2016 and the greatest increase since 2000. The overall prevalence of CD in selected hospitals in Addis Ababa was 38%. With increased rate of CD in Ethiopia especially in capital city - Addis Ababa, it is expected that the prevalence of PAS will be increased^{22, 23, 24}.

Screening all mothers with risk factors for PAS, planned delivery and multidisciplinary team (MDT) approach are found important in decreasing adverse perinatal outcome of mothers with PAS^{22, 25, 26}.

PAS is a severe obstetric complication characterized by the abnormal invasion of the placenta into the uterine wall. It is associated with life-threatening maternal complications, including massive postpartum hemorrhage, emergency hysterectomy, and increased risk of maternal mortality. Moreover, PAS can also lead to adverse perinatal outcomes, such as preterm birth, low birth weight, and increased neonatal intensive care unit admissions.

Early antenatal diagnosis of PAS through imaging techniques is crucial to guide appropriate management and minimize complications. However, the diagnostic capabilities and availability of multidisciplinary management teams may be limited in resource-constrained settings like Ethiopia. This can lead to delayed diagnosis and suboptimal management of PAS, ultimately contributing to the increased maternal and perinatal morbidity and mortality associated with this condition.

Total primary hysterectomy, delayed secondary hysterectomy and expectant management by leaving the placenta in situ are the main types of management for PAS and choosing which type depends on prenatal diagnosis, intraoperative or clinical finding, and experience of the surgeon, the facility and the local protocol if any^{25,27, 23}.

The immediate common complication of PAS is postpartum hemorrhage (PPH). Some call PAS the ‘nightmare’ of obstetricians (because of the massive hemorrhage encountered during an attempt of manual removal or during surgical excision of PAS involving extra uterine organs, and during caesarean hysterectomy)²⁸. The very severe complications (moribund hemorrhagic shock during delivery and uterine rupture before the onset of labor and usually early in pregnancy) are commonly encountered in women with placenta percreta²⁹. As a result, PAS is known to increase the relative risk of maternal death³⁰, but varies with the time of detection and subsequent interventions. PAS is also a common indication for peripartum hysterectomy. For instance, in the US and Australia, peripartum hysterectomy was the indication for 38% and 70% of peripartum hysterectomies, respectively^{31, 32}.

Given the rising burden of PAS in Ethiopia, particularly in the capital city of Addis Ababa, a comprehensive understanding of the risk factors, maternal outcomes, and perinatal outcomes of pregnancies complicated by PAS is essential. This research aims to investigate these important aspects of PAS in the Ethiopian context, which can inform clinical management strategies, guide preventive efforts, and ultimately improve maternal and neonatal health outcomes.

1.3 Significance of the study

This study holds significant importance in the context of Ethiopia, where the prevalence and outcomes of placenta accreta spectrum (PAS) disorders have not been thoroughly investigated and documented. The rising cesarean delivery rate in the country, particularly in the capital city of Addis Ababa, necessitates a comprehensive

understanding of the burden and management of PAS to improve maternal and perinatal health outcomes.

Firstly, this study fills a critical gap in the existing knowledge by determining the risk factors of PAS and its associated maternal and perinatal outcomes in the Ethiopian setting. As a tertiary referral hospital, St. Paul's Hospital Millennium Medical College (SPHMMC) is well-positioned to provide valuable insights into the current practice and management of PAS cases in the country.

Secondly, the findings of this study serve as a baseline for future prospective and national-level research on PAS in Ethiopia. By establishing the current landscape of PAS, this research inform the development of evidence-based clinical management strategies, resource allocation, and the implementation of multidisciplinary approaches to improve patient outcomes.

Moreover, this study holds significant practical implications for healthcare providers and policymakers in Ethiopia. By identifying the risk factors, maternal complications, and perinatal outcomes associated with PAS, the research can guide targeted prevention efforts, enhance antenatal screening, and improve the overall management of PAS cases. This, in turn, can contribute to reducing the burden of maternal and neonatal morbidity and mortality related to this serious obstetric complication.

Finally, the findings of this study serve as a valuable reference for other resource-constrained settings facing similar challenges in addressing the rising prevalence of PAS. The insights gained from this research can be leveraged to inform the development of contextually relevant strategies and interventions to manage PAS and improve maternal and perinatal health outcomes.

In summary, this research on the risk factors, maternal, and perinatal outcomes of pregnancies complicated by PAS in Ethiopia holds immense significance in filling a critical knowledge gap, informing clinical practice, and guiding future research and policymaking efforts in the country.

2. Literature review

2.1 risk factors

The global incidence of PAS is not known because of the paucity of data from developing countries. the increasing number of CS delivery across the world is highly incriminated for the progressively increasing incidence of placental adherence.

In a 5-year retrospective case-control study of documented cases of placenta accreta spectrum disorders in Ahvaz, southwest of Iran the PAS frequency was 3.7 per 1000 deliveries. Due to various designs and diagnoses in multiple studies, and the differences in the statistical populations, the reports of PAS incidence are dissimilar, all of which indicating an increase in the last two decades. The incidence has been reported to rise from 0.8 per 1000 births in the 1980s to 3 per 1000 births in the last decade. In this study, in 187 women with PAS the biggest risk factor associated with PAS was a history of previous cesarean section, with 97.3% of PAS mothers having a previous cesarean section (OR=89.1:95%CI:35.9- 220.5). the risk of PAS doubled after cesarean scarring and the higher the number of cesarean sections, the greater the likelihood of PAS. the risk of PAS in mothers with ≥ 3 cesarean sections was 2.5 times higher than that in mothers with a history of 1 or 2 cesarean sections. Another important risk factor associated with PAS is placenta previa. In this study, 59 (31.6%) women in the PAS group had placenta previa. Particularly, if placenta previa is associated with a previous cesarean section, the risk of PAS is significantly increased. out of 59 patients with placenta previa-acreta, 54 (91%) had a previous cesarean section. The risk of placenta accreta in women with placenta previa without cesarean scarring increases by 3.3%-4% and in those with more than 3 cesarean sections, it increases by 50-67%³³.

In a prospective study done in egypt The incidence of PAS disorders was 9 / 1000 maternities overall (0.91%), this incidence is comparable with published studies in the last decade (0.4–0.9%). The mean age of cases was 32.4 ± 4.2 years, 60% of them had a parity ≥ 3 and 82% of them had ≥ 2 previous CSs. Also, 1/3 of them had previous history of placenta previa³⁴.

In a retrospective study done in india, During the study period, there were 22,653 deliveries, of which 30 patients had morbidly adherent placenta, giving an incidence on 1.32 per 1000 pregnancies. Being a tertiary care institute, 53 % (16) patients were transferred from primary and secondary institutes. The maximum number of women (11, 36 %) in the study belonged to the age group 26–28 years and 47 % (14) of women were second gravida. Forty-three per cent (13) had undergone both Caesarean section and emergency curettage. In total, 90 % of the patients had undergone previous Caesarean section, of which 50 % (15) had 1 previous Caesarean section, 30 % (9) had previous 2 Caesarean sections and 10 % (3) had previous 3 Caesarean sections. Co-existing placenta praevia was diagnosed in 63 % (19) of the patients³⁵.

Also In an another retrospective study done in india A cohort of 32 women were identified with placenta accreta, increta, or percreta. The mean maternal age was 31 years. Around 50% of patients had risk factors for the abnormally invasive placenta, such as placenta praevia, and 75% had a history of previous caesarean sections. PAS was present in 11 patients who had a history of previous caesarean section along with a low-lying placenta in the present pregnancy⁹.

In a review article Placenta accreta occurs in approximately 1 : 1000 deliveries with a reported range from 0.04% rising up to 0.9% . The median maternal age is around 34 years and the median parity is 2.5. The risk of developing placenta accreta increases with the number of previous cesarean deliveries. These range from 2% among women with a placenta previa only to 39–60% among women with accompanied two or more prior cesarean deliveries. Up to 88% of the women have concomitant placenta previa . Risk factors other than a previous cesarean include submucous myoma, previous curettage, Asherman's syndrome, advanced maternal age, grandmultiparity, smoking, and chronic hypertension³⁶.

In a retrospective study done in Romania in 12 pregnancies with PAS the mean age was 34 ± 3.44 years. The analysis of the risk factors for placenta previa associated with PAS shows that the most important risk factor for PAS is the presence of a prior cesarean section (all cases). The risk for PAS is higher in the group of patients with multiple uterine surgical interventions (16.6% of cases) compared with those with only one prior cesarean section (83.3% of cases).³⁷

In a study done in tikur anbesa hospital The prevalence of PAS is 1 out of 994 deliveries. (25/24844). Risk factors identified in 92% (23 out of 25) of the mothers were either placenta previa or cesarean delivery; in 60% (15 out of 25) of the mothers both placenta previa and prior cesarean delivery. Six (24%) of the mothers had previous uterine surgery/procedure. Either PP or CD were present in 76% (19 out of 25) of the mothers with PAS.²³

2.2 Maternal outcome

Retrospective case series done in Melbourne Main outcome measures. Predefined maternal morbidities: blood loss, transfusion requirements, surgical complications, reoperation rate, duration in hospital. total of 27 were confirmed histologically after hysterectomy: 12 accreta, one increta, and 14 percreta. Median blood loss was 2 L. There was a 1.8-L reduction in mean blood loss with elective vs. emergency hysterectomy ($p = 0.04$). Nearly two thirds of women required four or more units of packed red-blood-cells. Half of the women suffered from surgical complications, mostly from bladder injury. The risk of returning to theater for further surgery was 20%. Women with placenta percreta were more likely to require additional blood products ($p = 0.03$), sustain renal tract injury ($p = 0.003$) and require intensive care admission ($p = 0.002$).³⁸

In a retrospective study done in India, from 30 women with PAS Fifty-three per cent of the women delivered between 35 and 38 weeks. Forty per cent (12) of the patients had no complaints, and they had planned deliveries by a multidisciplinary team (an obstetrician, a blood bank team, anesthetist, urologist, intensivist, an interventional radiologist and a neonatologist). Caesarean section was the most frequent mode of delivery (90 %, 20) with classical Caesarean section (57 %, 17) (in view of placenta Previa) being more frequent than lower segment Caesarean section (33 %, 10). The average intrapartum blood loss in patients with morbidly adherent placenta was 1500–2000 mL which was the case in 47 % (14) of the patients studied. More than half of the patients (64 %, 18) received 1–4 units of blood. Twenty-seven per cent of the patients (8) underwent prophylactic balloon placement in the internal iliac artery followed by classical Caesarean section and uterine artery embolization and methotrexate; this procedure was also associated with a blood loss of 1000–2000 mL. There were 20 % (6) of the patients who had disseminated intravascular coagulation (DIC) and 13 % (4) who required ICU admissions. The average hospital stays for a woman diagnosed with morbidly adherent placenta was 27 days.³⁵

In a case control study done in iran out of a total of 50037 deliveries, 187 cases (0.37%) had PAS problems, of whom 153 (81.8%) had placenta creta, 20 (10.6%) had placenta increta, and 14 (7.4%) had placenta percreta, Complications and morbidity associated with PAS included hysterectomy (60.4% vs. 0.7%, $p < 0.001$), cystostomy (24.1% vs. 0.2%, $p < 0.001$), the need for blood transfusion (73.7% vs. 1.4%, $p < 0.001$), intensive care unit admission of mother (42.8% vs. 0.2%, $p < 0.001$), duration of hospitalization (7.52 ± 6.34 vs. 1.97 ± 1.83 , $p < 0.001$). 3.7% of PAS women needed blood transfusion. The mean blood transfusion rate was 3 units. Among the maternal complications seen only in the PAS group, 3 cases of maternal disseminated intravascular coagulation (DIC) and 12 cases of postpartum hemorrhage (PPH) were observed.³³

In another study done in India on 40 pregnancies with PAS 25 out of 40 cases (62.5%) were done as elective caesarean sections, whereas 15 cases (37.5%) were done as emergency caesarean sections for antepartum hemorrhage. In this study, on evaluating the intraoperative complications, it was found that 13 patients (90%) had PPH, requiring massive blood transfusion. And six patients (22.2%) had organ injury; the organ involved was the bladder. On evaluating the post-operative complications in this study, it was noted that there was an unfortunate event of 1 maternal death (2.5%) We had 2 cases of postoperative intraperitoneal bleed that required relaparotomy. 20% of the patients had coagulopathy, 13% had surgical site infection, 3% had postpartum depression.³⁹

In a study done in black lion hospital in 25 pregnancies with PAS the estimated blood loss was <1500ml in 60%(15) & >1500ml in 40%(10) women, 6 transfused with <2unit, 7 transfused with 2-5unit, 4 transfused with more than 5 unit of blood. 60% has operation time between 1-2 hours. 56% of the mothers discharged after 5days of hospital stay, while 32% stayed between 5-7 days. Organ injury occurred in 8%, relaparotomy in 12%, and maternal infection occurred in 12% of the mothers.

While maternal mortality is relatively low, it remains a concern in PAS cases. One study reported a single maternal death (2.5%) among 40 PAS cases. Prompt recognition of PAS, multidisciplinary management, and coordinated care are crucial to minimizing the risk of maternal mortality²³.

The available evidence highlights the significant maternal morbidity associated with PAS, including massive blood loss, transfusion requirements, surgical complications, and the need for intensive care. Continued research and optimization of management strategies are essential to improve maternal outcomes in this high-risk obstetric condition.

2.3 Fetal outcome

In a retrospective cohort study conducted at a single tertiary center, comparing women with PAS who underwent cesarean delivery (CD) to a matched control group of women without PAS who underwent CD. these adverse neonatal outcomes: umbilical artery pH < 7.0, umbilical artery base excess $\leq$ - 12, APGAR score < 7 at 5 min, neonatal intensive care unit (NICU) admission, mechanical ventilation, hypoxic ischemic encephalopathy, seizures and neonatal death. 265 women with PAS were included in the study group and were matched to 1382 controls. In the PAS group compared with controls, the rate of composite adverse neonatal outcomes was significantly higher (33.6% vs. 18.7%, respectively, $p < 0.001$). For women with PAS pregnancies, compared to women with non-PAS pregnancies, gestational age at delivery (36.1 vs. 36.0 weeks, respectively, $p=0.001$) was higher, birthweight (2660.0 g vs. 2625.0, respectively, $p = 0.006$) was lower. Umbilical artery pH (7.26 vs. 7.28, respectively, $p < 0.001$) was lower, while the incidence of APGAR score < 7 at 5 min (8.3% vs. 1.0%, respectively, $p < 0.001$), length of hospital stays (7.0 days vs. 6.0, respectively, $p < 0.001$), NICU admission (29.8% vs. 18.2%, respectively, $p < 0.001$), mechanical ventilation (9.8% vs. 3.8%, respectively, $p < 0.001$) and the neonatal composite score (33.6% vs. 18.7%, respectively, $p < 0.001$) were significantly higher. No other parameters differed significantly between the two groups. The following variables were independently associated with PAS: Apgar < 7 at 5 min [adjusted odds ratio (aOR) 95% confidence interval (CI) 2.21 (1.07–4.56), $p = 0.031$], NICU admission (aOR 95% CI 1.84 (1.05–3.24), $p = 0.033$) and composite adverse neonatal outcome (aOR 95% CI 2.38 (1.40–4.05), $p = 0.001$).⁴⁰

In a retrospective study done India in 32 women with PAS Most of the pregnancies terminated at a mean gestational age of 32 weeks. Fetal Apgar scores were good in the group of patients who had elective caesarean delivery and were unaffected by PAS risk factors. The patient who had an emergency caesarean section, on the other hand, had a lower fetal Apgar score. After delivery, 14 infants required admission to the neonatal ICU. The most frequent reason for newborn ICU admission was prematurity. There were four cases of neonatal deaths in the emergency caesarean section groups. The level of placental invasion did not significantly alter the fetal Apgar scores, although the gestational age at delivery did.⁹

PAS is a maternal condition that may require early termination, leading to poor neonatal outcomes with regard to prematurity, which may cause perinatal mortality. In A hospital-based prospective observational study from 40 cases of PAS the majority of the babies (76%) were preterm and delivered between 28 and 37 weeks of gestation with varying neonatal conditions as seen in their birth weight and 5-min APGAR score. Five babies were born before 28 weeks with a low 5-min APGAR score. The majority of the babies (57.1%) did not require NICU admission. There were 5 cases (12%) of neonatal death, all of them due to extreme prematurity.³⁹

In a case control study in Iran from 187 cases of PAS and 552 controls One of the most common neonatal complications associated with PAS is preterm birth which showed a significant difference between the two groups in this study (61.4% vs. 16.8%, $p<0.001$). The mean age of the infant in the PAS group and the control group was 33.84 and 36.98 weeks, respectively, with a mean difference of 3.14 ($p<0.001$). Birth weight was also different in the two groups (2686.1 vs. 2967.5, $p<0.001$), which may be due to lower gestational age at delivery in the PAS group. Prenatal mortality was almost three times higher in the PAS group compared with the control group (7.4% vs. 1.8%, $p<0.001$). The decision to terminate pregnancy depends on several factors, such as the mother's condition, the amount of bleeding throughout pregnancy, the degree and type of adhesion, the presence of placenta Previa, and the number of previous cesarean sections.³³

In a retrospective study done in India in 30 women with PAS Seventy-nine per cent of the patients had live births, 14 % had fresh stillbirths, and 7 % had macerated stillbirths. Fifty per cent of the babies were preterm (<37 weeks) and the maximum number of babies (30 %) had birth weight of 2300–2600 g. Twenty-seven per cent of the babies born required NICU admission for low birth weight, respiratory distress or neonatal jaundice. The neonatal death that occurred was due to respiratory distress in a preterm baby with low birth weight who was born with APGAR score of 3/10 and 5/10 at 1 and 5 min of life, respectively³⁵

In a total of 468 pregnant women with placenta accreta spectrum disorders (PASDs) met inclusion criteria, 65 cases underwent emergency cesarean section (CS) delivery, and 403 cases underwent planned delivery. Among them, 240 cases were greater than 34 weeks of gestation. Among 468 intraoperatively diagnosed PASD cases who underwent CS under general anesthesia, neonatal outcomes in the emergency CS ($n=65$) were significantly poorer than in planned delivery ($n=403$). Emergency CS increased the odds ratio (OR) for earlier gestational age, lower birthweight, lower APGAR score at 5 min, higher rate of neonatal intervention, NICU admission, and longer NICU LOS ≥ 7 days with OR, 95% confidence interval (CI) were 10.743 (5.675– 20.338), 3.823 (2.197–6.651), 5.215 (2.277–11.942), 2.256 (1.318–3.861), 2.177 (1.262–3.756), 3.613 (2.052–6.363), and 2.298 (1.140–4.630), respectively, $p<0.05$. Using the multivariable logistic regression, factors independently associated with the 5-min-APGAR score of less than 7 points were time duration from the skin incision to fetal delivery (min) and gestational age (week). One minute-decreased time duration from skin incision to fetal delivery contributed to reduce the risk of adverse neonatal outcome by 2.2% with adjusted OR, 95% CI: 0.978 (0.962– 0.993), $p=0.006$. Meanwhile, one week-decreased gestational age increased approximately two fold odds of the adverse neonatal outcome with adjusted OR, 95% CI: 1.983 (1.600–2.456), $p<0.0001$.⁴¹

In a study done in Poland A total of 30 live infants were delivered from 30 pregnancies with PAS. Mean birth weight was 2435 g (range 950–3450 g) and mean Apgar score at 1', 5' and 10' minutes was 6.8, 8 and 8.7 respectively. From this group 13 (43%) neonates required continuous positive airway pressure (CPAP) therapy for 12–24 hours after delivery. Additionally, in two (15%) infant exogenous surfactant therapy was implemented. All 13 infants were admitted to the neonatal ICU for observation. No further complications were observed. Eventually, all 30 infants and their mothers were discharged in good clinical condition. As far as neonatal complications are concerned, apart from large group of infants requiring continuous positive airway pressure (CPAP) therapy for 12–24 hours after delivery (14–43%, median gestation age — 32 weeks) no serious complications were observed.⁴²

The available evidence suggests that PAS is associated with earlier gestational age at delivery, lower birth weights, higher rates of NICU admission, and increased perinatal mortality, largely due to the high incidence of prematurity in these high-risk pregnancies. The degree of placental invasion does not appear to significantly impact fetal outcomes, but the emergent nature of some PAS deliveries may contribute to poorer neonatal endpoints.

3. objectives

3.1 General objective

To assess the risk factors, maternal and perinatal outcome of pregnancies complicated with PAS at saint Paul's hospital millennium medical college and identify predictors for these outcomes .

3.2 specific objective

- To identify the risk factors for PAS
- To assess the maternal outcome of PAS
- To assess the perinatal outcome of PAS

4. Methods and materials

4.1 study setting/area

The study was carried out in St. Paul's Hospital Millennium Medical College, Department of obstetrics and gynecology from sep30,2020 to sep30,2025 One of the few tertiary hospitals, SPHMMC is situated in the Ethiopian capital, Addis Ababa. This facility assists several individuals who are seeking care in various disciplines. The hospital, which treats over 200,000 patients each year, is the second largest public hospital in the nation. The obstetrics department is a progressively upgrading unit of the hospital that's improving in both quality of patient care as well as its capacity of treating an increasing number of patients. There are around 20 beds in the labor ward and more than 100 beds in the obstetrics and gynecology department including those for high risk patients kept and followed until their time of delivery. The labor ward also has an adjacent operation room for emergency and elective cases requiring caesarean section. It is also a place where undergraduate and postgraduate medical education takes place with concurrent researches that work on improving the hospital's and the country's health system specifically related to maternal and child health.

4.2 Study design and period

An institution-based retrospective chart review were conducted The study were conducted in Obstetrics and Gynecology Department of St. Paul's Hospital Millennium Medical College over a period of 5 years (setember 30 2020---september 30th 2025)

4.3 Population

4.3.1 Source population

All deliveries attended at SPHMMC during the study period.

4.3.2 Study population

All pregnant women who delivered in SPHMMC during the study period and diagnosed to have PAS that fulfill the inclusion criteria were the study population.

4.4 Sampling

4.4.1 Sample size

The sample size will be determined after counting all the registered deliveries in SPHMMC during the study period and the number of mothers who has PAS will be the sample size.

4.4.2 Sample technique

All women who have the diagnosis of PAS and managed at SPHMMC from sep30,2020 to sep30,2025 were included. The total number was 43.

4.5 Study Variables

Dependent variables

- PAS
- Maternal complication
- Neonatal complication

Independent variables

Maternal

- Age
- parity
- history of placenta previa
- current placenta previa
- gestational age at diagnosis
- gestational age at delivery
- history of curettage or myomectomy
- mode of delivery
- type of surgery(elective/emergency)
- type of PAS
- comorbid condition

4.6 Eligibility criteria

4.6.1 Inclusion criteria

All pregnant women diagnosed with PAS antenatal or intraoperative and managed at SPHMMC from sep30,2020 to sep30,2025 were included

4.6.2 Exclusion criteria

- Poorly registered cases

4.7 Operational definitions

- Maternal outcome included: obstetric hysterectomy, massive blood transfusion, bowel and bladder injury, infection, relaparotomy, maternal ICU admission, hospital stay and death
- Neonatal outcome included: prematurity, birth weight, APGAR score, NICU admission, need of mechanical ventilator and death
- Risk factors included: Exposure factors such as previous caesarean sections, previous uterine procedures, and presence of placenta previa
- Medical complication: any chronic medical illness or co morbidities that are present at the time of patient evaluation
- Obstetric complication: any medical complication that is directly related to the peripartum period at the time of patient evaluation
- Cesarean section: Delivery with transverse abdominal surgery.

4.8 Data collection tools, methods and procedures

The entire five-year patients' data was collected for all age categories. Data extraction format having the specified data variables were used to collect necessary data from HMIS register, patient folder, and HDU and ICU log books. The data extraction format was adapted from previous similar studies, and it primarily contains sections on sociodemographic characteristics, clinical profiles, and maternal and neonatal outcomes. Data collectors familiar with the study setting was recruited and briefly trained as data collectors while principal investigator supervises the data collection process. Data were first cleaned manually and data extraction format that did not fulfill minimum criteria for completeness was rejected from entry. A structured data extraction questionnaire was used.

4.9 Data analysis

Data was double entered in to Epi-Info version 7.3 to enter and clean data and then to export data to SPSS version 27 for analysis. Simple descriptive statistics was used to analyze the sociodemographic and obstetric characteristics. Chi-Squared test and multiple logistic regression analysis were performed to determine predictors of adverse maternal and perinatal outcomes of PAS. Odds ration with 95% CI and P-value of <0.05 was used to present findings significance.

4.9.1. Data quality control

An English version data extraction format was used to collect data. Brief training for the data collectors (two health professionals) about the process of data collection was given before the process of data collection. Close supervision was maintained during data collection by the principal investigator and the filled format was double-checked daily for consistency and completeness by data collectors and principal investigator before analysis.

4.10 Ethical consideration

The study was conducted after obtaining Ethical clearance from Ethical Review Board of St. Paul's Hospital Millennium Medical College right before the data collection process, the department of Obstetrics and Gynecology was briefed on the purpose and importance of the study. As the data used for this study is secondary in nature, no need to have written informed consent from the patients. After data collection, data was stored and used confidentially only for study purposes.

4.11 Plan for dissemination of the result

After completion of the study, data were examined, and key conclusions and recommendations were drawn. The research findings will be submitted to the gynecology and obstetrics department and will be presented at several scientific conferences and professional organization meetings, including the annual meetings of the Ethiopian Society of Obstetricians and Gynecologists, the Ethiopian Public Health Association, the Ethiopian Medical Association, and etc. The findings will be published in a peer-reviewed journal and will be made available online. The information will also be utilized as a starting point for future research and treatments.

5 RESULT

5.1 sociodemographic and obstetric characteristics of the participants

From a total of 42,980 deliveries a total of **43 women** with placenta accreta spectrum (PAS) were found making the prevalence of PAS 0.1%. From the 43 women the majority were **urban residents (67.4%)**, while **32.6% lived in rural areas**. Educational attainment was generally low: **60.5% had primary education, 27.9% secondary education, and 11.6% had no formal education**. Parity ranged from one to six, with **46.5% having two deliveries, 23.3% three deliveries**, and smaller proportions with one (11.6%), four (9.3%), five (4.7%), or six (4.7%) children. A striking **93% had a history of cesarean section**, and **76.7% presented with placenta previa**. Antenatal suspicion of PAS was high, with **93% suspected before delivery**, while **2.3% were not suspected** and **4.7% were incidental findings**. Regarding the grade of adherence, **62.8% were accreta**, and **37.2% were increta or percreta**.

Variables		Frequency	Proportions(%)
Maternal Age	<35years	28	65.1
	≥35years	15	34.9
Residence	Urban	29	67.4
	Rural	14	32.6
Educational Level	None	5	11.6
	Primary	26	60.5
	Secondary	12	27.9
Parity	Primiparous	5	11.6
	Multiparous	38	89.4
History of CD	Yes	40	93
	No	3	7
Presence of Placenta previa	Yes	33	76.7
	No	10	23.3

Table 1 sociodemographic characteristics

5.2 Management given by the characteristics of the participants

There was an antenatal suspicion of PAS in 88.8% (24 out of 27) of mothers with abnormally adherent placenta(grade 1) while in all (16 out of 16) of mothers with grade 2/3 of abnormally invasive placenta. Vaginal delivery was attended in 2.3% (1 out of 43) of mothers with abnormally adherent placenta. scheduled and emergency hysterectomy were performed in 22.2% (6 out of 27) and 3%(1 out of 27) of those with grade 1 PAS, respectively and emergency CD was done in 14.8%(4 out of 27) with grade 1 PAS. emergency and scheduled hysterectomy was done for 31.25%(5 out of 16) and 62.5%(10 out of 16)of those with grade 2/3 PAS, respectively . The gestational age at the time of delivery was ≥ 37 weeks in 34.9% (15 out of 43), and < 28 week in 14% (6 out of 43). *Histological* confirmation was made in 11 %(3 out of 27) of the mothers with abnormally adherent placenta (grade 1) and it was done for 6.25% (1 out of 16) with grade 2/3 PAS.

Variables		Frequency(n)	Proportion(%)
Antenatal suspicion of PAS	Suspected	40	93
	Not suspected	1	2.3
	Incidental	2	4.7
Mode of delivery	VD followed by hysterectomy	1	2.3
	CD	20	46.5
	Hysterectomy	22	51.2
Type of CD	Emergency	10	23.3
	Elective	33	76.7
Grade of adherence	Grade 1	27	62.8
	Grade 2/3	16	37.2
GA at time of diagnosis	< 28 week	7	16.3
	28 to 34 week	15	34.9

	≥34weeks	21	48.8
GA at time of delivery	<28week	6	14
	28 to <34week	5	11.6
	34 to <37week	17	39.5
	≥37 week	15	34.9
Histologic confirmation	Yes	4	9.3
	No	39	90.7
Reason for admission	Planned surgery	5	11.6
	Bleeding	34	79.1
	Others	4	9.3

Table 2management given

5.4 maternal outcome

Maternal outcomes revealed significant morbidity. Postpartum hemorrhage (PPH) was diagnosed in 67.4% of cases, and the same proportion required ICU admission (67.4%). Blood transfusion was necessary in 72.1%, while 25.6% sustained intraoperative organ injury. Relaparotomy was performed in 9.3%, and maternal infection occurred in 16.3%. Continuous variables further highlighted the severity of cases. The mean maternal age was 31.7 years (range 21–40), with an average of 1.9 previous cesarean sections. The mean estimated blood loss was 1662.8 ml (range 500–3300), and the mean hospital stay was 5.3 days (range 3–12). Operations were lengthy, averaging 112.5 minutes (range 40–210). Inferential statistics demonstrated that women with increta/percreta had significantly worse outcomes compared to those with accreta. Mann-Whitney U tests showed higher blood loss ($p < 0.001$), longer operative times ($p < 0.001$), and greater transfusion requirements ($p = 0.003$) in increta/percreta cases. Chi-square analyses confirmed significant associations between grade of adherence and organ injury ($p < 0.001$), ICU admission ($p = 0.005$), and PPH diagnosis ($p = 0.005$).

Variables		Frequency(n)	Proportion(%)
Blood loss	<1500ml	18	41.9
	1500 to 2500ml	17	39.5
	≥2500ml	8	18.6
Operation time	≤ 1 hours	13	30.2
	>1 to 2 hours	11	25.6
	>2 to 3 hours	14	32.6
	>3hours	5	11.6
Organ injury	Yes	11	25.6
	No	32	74.4
ICU admission	Yes	29	67.4
	No	14	32.6
Hospital stay	<5days	19	44.2
	5 to 7 days	12	27.9
	≥7days	12	27.9
Relaparatomy	Yes	4	9.3
	No	39	90.7
Need for transfusion	Yes	31	67.4
	No	12	32.6
Number of units transfused	≤2 units	17	39.5
	2 to 5 units	20	46.5
	>5 units	6	14
Maternal infection	Yes	7	16.3
	No	36	83.7

Table 3maternal outcome

5.5 maternal outcome by grade of PAS and type of surgery

This study demonstrates that **the severity of placental adherence (Accreta vs. Increta/Percreta)** is the most influential determinant of maternal and neonatal outcomes in pregnancies complicated by PAS. Women with Increta/Percreta consistently showed significantly higher surgical and postoperative morbidity compared to those with Accreta. Surgical burden was markedly greater in the Increta/Percreta group, reflected by substantially higher estimated blood loss, longer operative durations, and an increased need for blood transfusion. These differences were strongly significant in the Mann–Whitney tests ($p < 0.01$ for all three parameters), confirming that deeper placental invasion is associated with more complex operative management.

The risk of major maternal complications was also disproportionately elevated in severe PAS cases. Organ injury, postpartum hemorrhage, and ICU admission all showed significant associations with grade of adherence, with Increta/Percreta patients carrying much higher risk. Severe Maternal Morbidity (SMM) occurred in nearly all patients with Increta/Percreta, compared to roughly half of those with Accreta. Logistic regression reinforced this pattern: **grade of adherence was the highest independent predictor of SMM**, with **AOR=9.45(95 % CI:2.15-33.2, P=0.002)**, indicating that women with Increta/Percreta were over nine times more likely to experience severe maternal morbidity than those with Accreta. Other maternal factors—age, parity, prior cesareans, and placenta previa—did not independently predict severe morbidity.

Another independent risk factor is the type of surgery (emergency vs elective) The analysis reveals that emergency surgeries were associated with a significantly greater surgical burden with AOR 5.83(95%CI:1.15-29.55, P=0.03) adjusted for maternal age, parity, number of cs, placenta previa, grade of adherence. Patients undergoing emergency procedures had statistically higher estimated blood loss ($p=0.012$), longer operative durations ($p=0.002$), and required a greater number of blood transfusions ($p=0.047$) compared to those who had elective surgery. This indicates that unplanned, urgent interventions for PAS are technically more challenging and resource-intensive. The findings demonstrate a clear and significant disadvantage for the emergency surgery group. These patients experienced markedly higher rates of major complications, including intraoperative organ injury (50.0% vs. 18.2%, $p=0.041$), postpartum hemorrhage (90.0% vs. 60.6%, $p=0.047$), and the need for ICU admission (90.0% vs. 60.6%, $p=0.047$). While not all outcomes reached statistical significance, the consistent trend across all measures confirms that emergency surgery is also a critical determinant of severe maternal morbidity.

Surgical Burden by Grade of Adherence

Variable	Accreta (Rank)	Increta/Percreta (Rank)	U	p-value
Estimated blood loss	16.70	30.94	73.0	<0.001
Duration of operation	16.06	32.03	55.5	<0.001
Units transfused	17.70	29.25	100.0	0.003

Table 4surgical burden by grade of PAS

Maternal Morbidity by Grade of Adherence

Outcome	Accreta	Increta/Percreta	Significance
Organ injury	7.4%	56.3%	p < 0.001
Postpartum hemorrhage	51.9%	93.8%	p = 0.005
ICU admission	51.9%	93.8%	p = 0.005
Severe maternal morbidity	55.6%	93.8%	p = 0.008

Table 5maternal morbidity by grade of PAS

Maternal morbidity by type of surgery

Variable	Elective (Rank)	Emergency (Rank)	U	p-value
Estimated blood loss	18.45	27.88	85.5	0.012
Duration of operation	17.82	29.25	72.0	0.002
Units transfused	18.95	26.75	102.5	0.047

Table 6maternal morbidity by type of surgery

Outcome	Elective (n=33)	Emergency (n=10)	Significance
Organ injury	18.2% (6)	50.0% (5)	p = 0.041
Postpartum hemorrhage	60.6% (20)	90.0% (9)	p = 0.047
ICU admission	60.6% (20)	90.0% (9)	p = 0.047

Blood transfusion	66.7% (22)	90.0% (9)	p = 0.121
Relaparatomy	6.1% (2)	20.0% (2)	p = 0.142
Maternal infection	12.1% (4)	30.0% (3)	p = 0.154

Table 7maternal morbidity by type of surgery B

5.6 neonatal outcomes

Neonatal outcomes were also concerning. Prematurity was common, with 51.2% born preterm (28–37 weeks) and 14% extremely preterm (<28 weeks), while only 34.9% were term deliveries. NICU admission was required in 30.2%, and 14% needed mechanical ventilation. The neonatal mortality rate was 20.9%, with nine deaths recorded. Neonatal birth weights averaged 2097.7 g (range 500–3200). The mean APGAR score at 1 minute was 6.7, rising to 7.5 at 5 minutes. Neonatal outcomes were primarily driven by prematurity, which itself was more common in severe PAS cases. Birthweight and APGAR scores at both 1 and 5 minutes decreased progressively with increasing prematurity, and infants born extremely preterm (<28 weeks) had uniformly poor outcomes. Notably, all extremely preterm infants required NICU admission, and neonatal mortality reached 100% in this group. Emergency cesarean delivery was also significantly associated with worse neonatal measures, including lower birthweight and higher rates of NICU admission and neonatal death. neonates delivered during emergency surgeries faced significantly worse outcomes AOR 4.92(95%CI:1.08-22.42, P=0.039) adjusted for GA at delivery, birth weight, grade of adherence. This group had a higher incidence of extreme prematurity (<28 weeks, 30.0% vs. 9.1%), lower birth weights (p=0.025), and required NICU admission more frequently (50.0% vs. 24.2%, p=0.047). Most critically, the neonatal mortality rate was significantly higher in the emergency group (40.0% vs. 15.2%, p=0.042), underscoring the profound perinatal risks associated with unplanned delivery for PAS.

Variables		Frequency(n)	Proportion(%)
Prematurity	Term(≥ 37 week)	15	34.9
	Preterm(28- 37 week)	22	51.2
	Extreme preterm(<28week)	6	14

Birth weight	<1000 gm.	6	14
	1000-1499 gm.	4	9.3
	1500-2499 gm.	17	39.5
	≥ 2500 gm.	16	37.2
NICU Admission	Yes	13	30.2
	No	30	69.8
Mechanical ventilator	Yes	6	14
	No	37	86
Neonatal death	Yes	9	20.9
	No	34	79.1

Table 8 neonatal outcome

Neonatal Outcomes by Prematurity

Outcome	Term	Preterm	Extreme Preterm	Significance
Birthweight (mean rank)	35.9	17.6	3.5	p < 0.001
1-minute APGAR	29.9	21.6	3.5	p < 0.001
5-minute APGAR	30.5	21.3	3.5	p < 0.001
NICU admission	0%	59%	100%	p < 0.001
Neonatal death	0%	14%	100%	p < 0.001

Table 9 neonatal outcome by prematurity

Neonatal Outcomes by type of surgery

Variable	Elective (n=33)	Emergency (n=10)	Significance
Prematurity			p = 0.038
- Term (≥37 weeks)	42.4% (14)	10.0% (1)	
- Preterm (28-37 weeks)	48.5% (16)	60.0% (6)	
- Extreme preterm (<28 weeks)	9.1% (3)	30.0% (3)	
Birth weight			p = 0.025
- <1000g	9.1% (3)	30.0% (3)	
- 1000-1499g	6.1% (2)	20.0% (2)	

- 1500-2499g	39.4% (13)	40.0% (4)	
- ≥2500g	45.5% (15)	10.0% (1)	
NICU admission	24.2% (8)	50.0% (5)	p = 0.047
Mechanical ventilation	9.1% (3)	30.0% (3)	p = 0.077
Neonatal death	15.2% (5)	40.0% (4)	p = 0.042

Table 10 neonatal outcome by type of surgery

Collectively, these findings illustrate a clear and escalating pattern of risk tied to the depth of placental invasion. As adherence progresses from Accreta to Increta/Percreta, maternal surgical complexity increases sharply, major complications become more frequent, and the probability of severe morbidity rises dramatically. The neonatal consequences parallel this trajectory, since severe PAS often necessitates earlier delivery, leading to a cascade of prematurity-related complications.

6. Discussion

This five-year retrospective study at St. Paul's Hospital Millennium Medical College (SPHMMC) provides critical insights into the prevalence, risk factors, and outcomes of Placenta Accreta Spectrum (PAS) disorders in a tertiary Ethiopian hospital. The findings underscore the severe burden of this condition on both maternal and perinatal health and highlight areas for targeted intervention.

The prevalence of PAS in our study was found to be 0.1% (1 in 1,000 deliveries), which aligns with the global incidence reported in the literature, often cited as approximately 1 in 1,000 pregnancies (36). This figure is significant, confirming that PAS is not a rare occurrence in the Ethiopian context, particularly at a tertiary referral center like SPHMMC. The rising cesarean section (CS) rate in Ethiopia, especially in Addis Ababa (24), is a likely contributing factor to this observed prevalence, reinforcing the well-established link between surgical uterine scarring and abnormal placentation (4, 6).

Our findings strongly corroborate existing evidence on the risk factors for PAS. A striking 93% of the women in our cohort had a history of previous cesarean section, and 76.7% presented with placenta previa. This synergy between prior CS and placenta previa is the cornerstone of PAS pathogenesis, as defective decidualization at the site of a

uterine scar facilitates abnormal trophoblastic invasion (2, 5). The risk escalates with the number of prior CSs; our data, showing a mean of 1.9 previous CS per patient, is consistent with studies that report a risk of PAS increasing from 3% with one prior CS to over 60% with three or more in the setting of placenta previa (8). This reinforces the urgent need for prudent primary cesarean section practices and the vigilant screening of all women with this risk profile.

The maternal outcomes observed in this study were grave, reflecting the life-threatening nature of PAS. A majority of women (67.4%) experienced postpartum hemorrhage (PPH) and required admission to the ICU. This high rate of PPH and critical care need is a common theme in PAS literature, often described as an obstetrician's "nightmare" due to the torrential hemorrhage encountered during surgery (28). The mean estimated blood loss of 1662.8 ml and the high transfusion rate (72.1% of patients) are comparable to figures from studies in Iran and India, which reported average blood losses of 1500-2000 ml and transfusion rates of 64-73.7% (33, 35). Organ injury, primarily to the bladder, occurred in 25.6% of cases, a complication particularly associated with the more invasive PAS forms (38).

Crucially, our analysis identified that the grade of adherence was the most significant determinant of maternal morbidity. Women with placenta increta/percreta had dramatically higher blood loss, longer operative times, greater transfusion needs, and significantly increased rates of organ injury, ICU admission, and PPH compared to those with accreta alone. This finding is consistent with a study from Melbourne which found that women with percreta were more likely to require additional blood products and sustain renal tract injury (38). Multivariable analysis in our study confirmed that the grade of adherence was the strongest independent predictor of adverse maternal morbidity, with an adjusted odds ratio (AOR) of 7.28 with the risk increasing to 9.42 fold for severe maternal morbidity. This underscores that the depth of placental invasion is a primary driver of surgical complexity and maternal risk, more so than other factors like maternal age or parity.

Regarding management, cesarean hysterectomy was the most common mode of delivery (51.2%), which is in line with international guidelines that recommend it as the standard of care for diagnosed PAS to minimize hemorrhage from attempted placental removal (11, 19). The high rate of antenatal suspicion (93%) is commendable and reflects improved diagnostic capabilities, which is vital for planning delivery in a multidisciplinary setting and arranging for adequate blood products and ICU backup (5, 16).

Perinatal outcomes were also concerning, with 44.2% of neonates experiencing a poor composite outcome. Preterm birth was a major issue, affecting 65.1% of neonates, with 14% being extremely preterm (<28 weeks). This high rate of iatrogenic prematurity is a

direct consequence of the need for early delivery to mitigate maternal risks, such as catastrophic hemorrhage (33, 39). Consequently, low birth weight was common, with a mean of 2097.7g, and 30.2% of newborns required NICU admission, predominantly for complications of prematurity. The neonatal mortality rate was 20.9%, with all deaths occurring in the extremely preterm group and after exclusion of the extreme preterm the neonatal mortality rate was 8.1% . These findings are consistent with other studies that report significantly higher rates of NICU admission, lower birth weights, and increased perinatal mortality in PAS pregnancies compared to controls (40, 41). As demonstrated in other research, the emergent nature of delivery further exacerbates adverse neonatal outcomes, highlighting the importance of planned, multidisciplinary management whenever possible. The fact that emergency surgery worsened neonatal outcomes in this cohort is consistent with large studies showing a 2–5-fold increase in NICU admission and neonatal mortality when PAS cases are delivered outside a controlled, scheduled, multidisciplinary setting (41).

A key strength of this study is its focus on a high-risk obstetric condition in an under-researched setting, providing baseline data that is crucial for clinical practice and health policy in Ethiopia. However, the study's limitations must be acknowledged. Its retrospective design is susceptible to missing data and selection bias, as it only includes cases managed at a single tertiary center, which may not represent the national picture. The small sample size, while expected for a condition of this prevalence, limits the statistical power for some subgroup analyses. Furthermore, the low rate of histologic confirmation (9.3%) means that some diagnoses were based on clinical and intraoperative findings alone.

7. Conclusion

This study conclusively demonstrates that Placenta Accreta Spectrum disorders represent a significant cause of severe maternal and perinatal morbidity at SPHMMC. The prevalence of 0.1% confirms it as a relevant public health issue. The overwhelming risk factors are a history of cesarean section and concomitant placenta previa.

The maternal outcomes are severe, characterized by life-threatening hemorrhage, high rates of surgical intervention like hysterectomy, and significant utilization of critical care resources. The single most critical factor predicting the severity of these outcomes is the depth of placental invasion (accreta vs. increta/percreta). Perinatal outcomes are predominantly overshadowed by iatrogenic prematurity, leading to high rates of NICU admission and neonatal mortality.

Overall, the findings support global recommendations that early antenatal diagnosis and planned delivery in a tertiary center with a multidisciplinary team are essential to reduce morbidity.

8. Recommendation

Based on these findings, we recommend the following:

1. **Enhanced Antenatal Screening and Diagnosis:** Implement a protocol for mandatory, detailed second-trimester ultrasound screening for all women with a prior cesarean section, especially those with current placenta previa. This will maximize antenatal detection, allowing for optimal planning.
2. **Centralized, Multidisciplinary Care:** All cases of suspected PAS should be managed in a tertiary care center like SPHMMC with a pre-established, dedicated multidisciplinary team (MDT) involving obstetricians, gynecologic oncologists, urologists, interventional radiologists, anesthesiologists, hematologists, and neonatologists.
3. **Individualized Delivery Planning:** For antenatally diagnosed cases, planned delivery between 34 and 36 weeks of gestation after corticosteroid administration for fetal lung maturation should be the goal to balance maternal and neonatal risks (13, 14, 15). Emergency deliveries should be minimized through close monitoring and timely intervention.
4. **Resource Preparedness:** Hospitals managing PAS must ensure the ready availability of adequate blood and blood products, a fully equipped ICU, and a trained surgical team to manage massive hemorrhage and its complications.
5. **Primary Prevention:** Efforts to reduce the primary cesarean section rate through the promotion of evidence-based labor management and the cautious use of cesarean delivery for non-medical indications are paramount to curbing the rising incidence of PAS in the long term.
6. **Future Research:** Larger, prospective, multi-center studies are needed across Ethiopia to better understand the national epidemiology of PAS. Research should also focus on evaluating the cost-effectiveness and outcomes of implementing standardized MDT protocols in resource-limited settings.

In conclusion, while PAS poses a formidable challenge, its adverse outcomes can be mitigated through a strategy centered on prevention, early and accurate diagnosis, and planned, coordinated care in a well-resourced tertiary setting.

9. Limitations

1. Small sample size, which may limit statistical power and the precision of some estimates.
2. Single-center study, which may reduce generalizability to broader populations or different healthcare systems.
3. Lack of long-term maternal and neonatal follow-up, limiting understanding of extended postoperative outcomes or developmental impacts.
4. PAS severity classification relied on imaging and intraoperative assessment without external validation.

Potential selection bias, as more severe cases may be referred to tertiary centers, affecting prevalence estimates.

10. Implication for practice

The findings highlight the urgent need for health systems to prioritize early identification and risk stratification of PAS. Establishing strong antenatal screening mechanisms, improving diagnostic capacity (particularly ultrasound expertise), and ensuring clear referral pathways to tertiary centers are crucial. Structured multidisciplinary care should be the standard for confirmed PAS cases, with surgical, anesthetic, and neonatal teams prepared for massive transfusion and complex operative scenarios. Ultimately, optimizing outcomes for both mother and newborn requires a coordinated, well-prepared, and well-equipped system that anticipates the challenges associated with PAS rather than reacting to them in emergency situations. Ethiopia must anticipate rising PAS incidence as cesarean rates increase and respond by building expertise, increasing screening capacity, and developing MDT-ready centers. Strengthening these systems can significantly reduce hemorrhage-related maternal mortality — one of Ethiopia's top causes of maternal death.

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12. Annex

Data abstraction form Part one: socio demographic factors

Variable			
Maternal age _____ years			
Address 1. Rural 2. Urban			
Educational level 1. No formal education 2. Primary school 3. Secondary school 4. College and above			
Marital status 1. married 2. others			

Table 11 data abstraction form 1

Checklist -socio demographic factors

Part two: obstetric factors

Variables			
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Risk factors 1. parity 2. history of cs 3. number of cs 4. history of uterine surgery 5. presence of placenta Previa 6. others			
Antenatal suspicion 1. Yes 2. No			
GA at time of diagnosis 1. <20weeks 2. ≥20weeks			
Reason for admission 1. Labor pain 2. Placenta previa 3. Elective 4. Others			
Mode of delivery 1. SVD 2. CD			
Type of CD 1. Scheduled CD 2. Emergency CD 3. Scheduled hysterectomy 4. Emergency hysterectomy			
Gestational age at time of delivery 1. <28 week 2. 28-34week 3. 34-37week 4. >37week			

Grade of adherence 1. Grade1(accrета) 2. Grade 2/3(incrета/percrета)			
Histology confirmation 1. Yes 2. No			

Table 12 data abstraction form 2

Checklist - obstetric factors

Part three: maternal outcome

Variables			
PPH diagnosed 1. Yes 2. no			
Estimated blood loss 1. <1500ml 2. ≥1500ml			
Need for ICU admission 1. Yes 2. No			
Blood transfusion 1. Yes 2. no			
Number of units transfused 1. <2units 2. 2-5units 3. >5units			
Hospital stay			

1. <5days 2. 5-7days 3. >5days			
Duration of operation 1. <1hour 2. 1-2hour 3. >2hour			
Organ injury 1. Bladder injury 2. DIC 3. others			
Relaparotomy 1. no 2. yes			
If yes, why? 1. Bleeding 2. Others			
Maternal infection 1. Yes 2. no			

Table 13 data abstraction form 3

Checklist - Obstetric outcomes

Variable			
Prematurity 1. extreme preterm(<28week) 2. preterm(28-37week) 3. term(>37week)			
Birth weight 1. <1.5kg 2. 1.5-2.5kg 3. ≥1.5kg			

1 st min APGAR 1. <7 2. ≥7			
5th min APGAR 1. <7 2. ≥7			
NICU admission 1. Yes 2. No			
Need for mechanical ventilator 1. Yes 2. No			
Neonatal death 1. No 2. Yes			

Table 14 data abstraction form 4

Checklist – neonatal outcomes