# Feto-maternal outcomes of patients with placenta previa and accuracy of diagnosis of placenta accreta syndrome at Chris Hani Baragwanath Academic Hospital

**M N A Hammond,** MBChB, FCOG(SA), MMed (Obstet Gynaecol);
**J Jeebodh,** MBChB, FCOG(SA), MMed (Obstet Gynaecol), Cert (Maternal and Fetal Medicine);
**C Georgiou,** MBChB, FCOG (SA), MMed (Obstet Gynaecol), Cert (Maternal and Fetal Medicine);

*Department of Obstetrics and Gynaecology, School of Clinical Medicine, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa*

***Corresponding author:*** *MNA Hammond (niiamahammond@gmail.com)*

**Background.** The incidence of placenta praevia (PP) is 0.3 - 0.5% of pregnancies and it is a major risk factor for placenta accreta syndrome (PAS). PP and PAS cause immense feto-maternal morbidity and mortality and, as a result, place a huge burden on healthcare resources. Hence, accurate diagnosis prenatally of PP and associated PAS is essential as this allows adequate preparation for potential complications.
**Objective.** To ascertain the accuracy of prenatal diagnosis of PP and PAS, and the feto-maternal effects of these conditions in women diagnosed at Chris Hani Baragwanath Academic Hospital (CHBAH)
**Methods.** This was a retrospective, descriptive study that reviewed the medical files of 55 women diagnosed with PP at CHBAH in 2018.
**Results.** Complete data was obtained for 28 women. The incidence of PP was 0.3%. The mean age, gravity and parity of women with PP were 31.65 (6.0) years, 3.0 (1.3) and 1.7 (1.3), respectively. The mean birthweight was 2 244 (730) g. Eighteen (56.2%) of newborns had birth weight <2 500g. The incidence of adverse outcomes was increased in patients with suspected PAS on prenatal ultrasound compared with patients showing no prenatal ultrasound evidence of PAS. Ultrasound had a positive predictive value of 50% while MRI correctly identified PAS in 33.3% of patients.
**Conclusion.** PP and PAS increase the likelihood of maternal and neonatal morbidities. Ultrasound is a useful tool in evaluating placenta implantation and can assist in anticipating adverse feto-maternal outcomes in PP and PAS. MRI has limited clinical value in this setting Keywords. Placenta praevia (PP), Placenta accreta syndrome (PAS), Chris Hani Baragwanath Academic Hospital (CHBAH), Magnetic Resonance Imaging (MRI) currently, and should not be done routinely.

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Placenta previa (PP) is defined as a placenta that implants in the lower uterine segment and covers the internal cervical os partially or wholly. It occurs in approximately 0.3 - 1.9% of pregnancies and is an important contributor to maternal morbidity, mortality, prematurity and perinatal mortality owing to the possibility of maternal bleeding.[1] Placenta accreta syndrome (PAS), often associated with PP, is defined as the invasion of the chorionic villi into myometrial tissue.[2] Histopathologically, it is sub-classified into three types based on the depth of penetration into the myometrium: accreta, increta and percreta. Placenta accreta involves superficial myometrial attachment, placenta increta penetrates the myometrium and placenta percreta penetrates through the myometrium and other pelvic organs, usually the bladder.[2]

Feto-maternal morbidity and mortality from PP and PAS place a significant burden on healthcare resources. Hence, accurate prenatal diagnosis is essential as this allows both patients and obstetricians to adequately prepare for potential complications. The prenatal detection could in turn reduce maternal and fetal morbidity. However, even in specialised hospitals, up to a third of PAS cases remain undiagnosed during pregnancy.[3] This highlights the difficulty in diagnosing these conditions and the poor sensitivity of the present diagnostic techniques. Although ultrasound is still the primary modality in the assessment of placental implantation, there has been growing interest in magnetic resonance imaging (MRI) in recent years.[4]

The literature has shown conflicting reports regarding feto-maternal outcomes of PP. This study aims to assess the accuracy of prenatal diagnosis of PP and PAS and the feto-maternal outcomes of these conditions in women diagnosed at Chris Hani Baragwanath Academic Hospital (CHBAH), Johannesburg, South Africa (SA). The hospital introduced a new protocol for the management of PP and PAS in 2018. This protocol emphasises the use of a multi-disciplinary team (MDT) in the management of PP and PAS.

## Methods

The study was performed at CHBAH, which houses the largest maternity unit in SA. The unit serves as a referral centre for several community health centres and district hospitals, including centres outside the Gauteng province. A sub-specialist fetal medicine unit offers detailed ultrasound pregnancy scans.

This retrospective descriptive study was approved by the Human Research Ethics Committee of the University of the Witwatersrand (ref. no. M190568). Data were collected from 01 June 2019 to 31 July 2019. The inclusion criterion was a prenatal diagnosis of PP at the CHBAH Fetal Medicine Unit during the study period. Data for the included patients were obtained from Fetal Medicine Unit records, maternal records, operating theatre registers, Intensive care unit (ICU) registers, radiology reports, neonatal records and histopathology

reports. Each patient was assigned a data collection sheet, capturing demographic details, risk factors, clinical presentation, ultrasound and MRI findings, surgical findings, maternal and fetal outcomes and histopathology results. All ultrasound scans were performed by a maternal-fetal medicine specialist at the CHBAH Fetal Medicine Unit. Maternal outcomes assessed included intensive care or high care unit admission, acute kidney injury, coagulopathy, sepsis, postoperative ventilation, visceral injury at surgery, relook laparotomy, hysterectomy, blood transfusions and length of hospital stay. Fetal outcomes included 1-minute and 5-minute Apgar scores, newborns small for gestational age, intrauterine fetal death and neonatal intensive care unit (NICU) admission.

The data were entered into a Microsoft Excel spreadsheet and then imported into Stata 14.0 software (StataCorp, College Station, Texas, USA) for statistical analysis. Categorical variables were summarised by frequency and percentage and presented with bar charts. Continuous variables were summarised using means and standard deviations (SDs) or median and range, as applicable. Where appropriate, Fisher's exact test and Student's *t*-test were used to assess relationships. A $p$-value<0.05 was considered significant.

## Results

Fifty-five cases of PP were identified during the study period. With 18 728 births at CHBAH (Prof Yasmin Adam, personal communication), the hospital incidence of PP was 0.3%. Complete data were obtained for 28 patients, while the remaining 27 patients were included in the analysis where data were available. The mean age of women with PP was 31.65 (6.0) years, with a mean gravidity of 3.0 (1.3) and mean parity of 1.7 (1.3). Eighteen (32.7%) women were 35 years or older and 15 (27.3%) had a history of caesarean sections (CS). Additionally, 15 (27.3%) had experienced previous miscarriages. The median body mass index (BMI) was 32.5 kg/m$^2$. Tables 1 and 2 provide details on maternal demographics and risk factors, respectively.

Of the patients, 22 (64.7%) presented with vaginal bleeding, while 12 (35.3%) had incidental findings on ultrasound. The mean haemoglobin level at presentation was 11.95 (2.03) g/dL, with three (10.7%) patients requiring blood transfusions to optimise their haemoglobin levels before surgery. The mean gestational age at presentation was 30.85 (4.4) weeks. During the antenatal period, 13 (50%) patients had one episode of bleeding, six (23%) had more than one episode of bleeding and seven (27%) had no bleeding episodes.

All patients underwent CS, with 53.85% having scheduled delivery and 46.15% requiring emergency CS. The primary indications for emergency CS were antepartum haemorrhage in 6 (50%) cases, fetal distress in 4 (33.33%) cases, onset of labour in 1 (8.3%) case and intrauterine fetal death in 1 (8.3%) case.

Seventeen (58.6%) required ICU or high-care unit admissions, and seven (24.1%) patients required blood transfusion either during or after surgery. Five (17.2%) patients developed sepsis post-delivery, and four (12.12%) had hysterectomies. There was no maternal death reported in the study. The mean birth weight was 2 244 (730) g and the average gestational age at delivery was 33.84 (3.4) weeks (Fig. 1). Ten (30.12%) babies required admission to the NICU, and no neonatal death was reported in the first 24 hours.

Overall, 13 (23.6%) patients were suspected of having PAS based on prenatal ultrasound scanning. However, histopathological confirmation was obtained for only four patients, with PAS confirmed in three (75%) of them. In two other patients suspected of PAS on prenatal ultrasound, surgical separation of the placenta was successful without clinical evidence of adherence, resulting in a positive predictive value of 50% for ultrasound. One patient had PAS confirmed by histopathology, despite no evidence on prenatal ultrasound. Of the six patients who underwent MRI, two (33.3%) were correctly diagnosed with PAS. Table 3 presents ultrasound findings with surgery, histopathology and MRI results.

The incidence of adverse feto-maternal outcomes was higher in women with suspected PAS on prenatal ultrasound compared with women without prenatal ultrasound evidence of PAS. Statistically significant outcomes included increased mean blood loss, higher rates of hysterectomy, visceral injury during surgery, ventilator support postoperatively and lower 1-minute and 5-minute Apgar scores (Table 4).

## Discussion

The incidence of PP in the literature ranges from 0.3 - 1.9%, likely owing to varying risk profiles across different geographical locations. This study found an incidence of 0.3%, consistent with the literature.[1]

Advanced maternal age is associated with an increased risk of PP.[1] In this study, the prevalence of advanced maternal age was 32.7%, almost double that of the advanced maternal age in the South African pregnant population (17.5%).[5] The pathophysiology of how advanced maternal age affects normal placental migration is poorly understood.[6] A potential explanation is increased sclerotic changes in intramyometrial arteries, which may compromise placental blood supply.

In our study, 27.2% of patients with PP had a prior CS, a relatively high prevalence also observed in other studies.[7] Several studies from different global regions have shown a 2-fold increase in PP among women with prior CS.[8,9] Additionally, Faiz *et al.*[10] highlighted a dose-response pattern, with the risk of PP rising with the number of prior CS. This emphasises the importance of reducing primary CS and advocating for vaginal birth after previous CS, especially in women without contraindications to vaginal birth. Nearly a third (27.2%) of our patients had a prior miscarriage, this relatively higher incidence has been noted in other studies.[7]

PP was more common among multiparous women (83.6%), similar to findings from other studies.[1] The association of multigravida with PP may partially reflect the higher likelihood of multigravida women having had a previous miscarriage, CS or being of advanced maternal age. The larger proportion of multiparous patients simplifies the decision to proceed with a hysterectomy in case of uncontrolled bleeding during surgery.

Globally, the incidence of obesity is rising steadily, with a high prevalence among women of childbearing age.[11] More than half (55%) of our patients had a BMI of 30 kg/m$^2$ or higher. This can impact outcomes, as obesity is associated with increased maternal morbidity in PP.[12] This is because obese patients face greater surgical and anaesthetic challenges during CS, which contributes to these risks.

In over a third (35.29%) of our patients, PP was detected incidentally on ultrasound. We recommend routine assessment during the 20-week scan to allow for early diagnosis of PP and any associated PAS. This provides adequate time to prepare for potential complications, helping to reduce morbidity and mortality. A higher index of suspicion is particularly warranted in patients with a prior CS or previous miscarriage.

Unfortunately, most studies reporting the outcomes of PP did not clarify what proportion of deliveries were electively scheduled and therefore performed under controlled circumstances rather than by emergency CS. Emergency delivery can lead to increased maternal

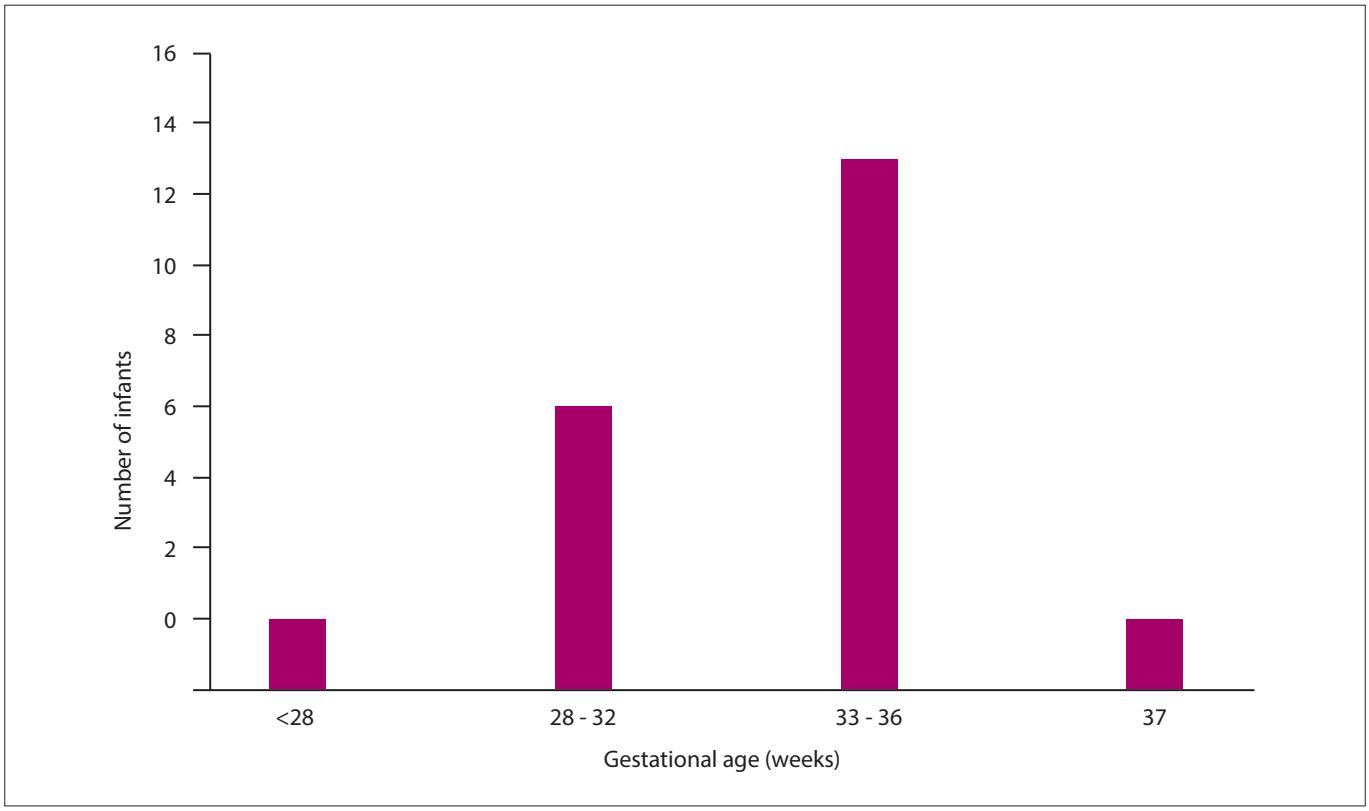


*Fig. 1. Gestational age at delivery.*

**Table 1. Maternal demographic information**

| Variables | Numbers | Percentage |
|---|---|---|
| Age (years) | | |
| <18 | 1 | 1.8 |
| 19 - 34 | 36 | 65.5 |
| >35 | 18 | 32.7 |
| Parity | | |
| 0 | 9 | 16.4 |
| 1 | 17 | 30.9 |
| 2 | 15 | 27.3 |
| 3 | 7 | 12.7 |
| 4 | 5 | 9.1 |
| 5 | 2 | 3.6 |
| Gravidity | | |
| 1 | 7 | 12.7 |
| 2 | 11 | 20.0 |
| 3 | 17 | 30.9 |
| 4 | 13 | 23.6 |
| 5 | 4 | 7.3 |
| 6 | 3 | 5.5 |
| BMI | | |
| <18.5 | 0 | 0 |
| 18.5 - 30 | 9 | 45.0 |
| >30 | 12 | 55.0 |

BMI = body mass index.

**Table 2. Maternal risk factors**

| Risk factors | Numbers | Percentage |
|---|---|---|
| Previous CS | | |
| 0 | 40 | 72.7 |
| X1 | 7 | 12.7 |
| X2 | 7 | 12.7 |
| X>2 | 1 | 1.8 |
| Uterine fibroid | | |
| Yes | 1 | 1.8 |
| No | 54 | 98.4 |
| Previous PP | | |
| Yes | 2 | 3.6 |
| No | 53 | 96.4 |
| Previous miscarriage | | |
| Yes | 15 | 27.2 |
| No | 45 | 81.8 |
| Smoking | | |
| Yes | 3 | 5.5 |
| No | 52 | 95.5 |

CS = caesarean section.

and neonatal morbidities because of delays in mobilising necessary resources. Fortunately, in our study, the majority of patients (53.85%) had scheduled deliveries, compared with 46.15% who underwent emergency deliveries. Further research is warranted to evaluate the extent to which complications are increased in emergency deliveries v. scheduled ones.

Significant maternal morbidity was noted in this study, including sepsis, increased intensive care unit admissions, hysterectomies and massive haemorrhage. However, no maternal death was recorded. This could be attributed to the small sample size in this study. Another reason may be the MDT approach in the management of these patients, which has been shown in the literature to significantly reduce maternal morbidity and mortality.[13] At CHBAH, the team includes a senior surgeon who is the most experienced in the department. Although consultants perform all procedures, the senior surgeon is always available to assist if complications arise. When placenta adherence is suspected, the senior surgeon handles the case

**Table 3. Comparisons of ultrasound, surgical, histopathology, and MRI findings among patients**

| Case number | Ultrasound | MRI | Surgical | Histopathology | Final report |
|---|---|---|---|---|---|
| 1 | Present | Placenta Increta | Present | Placenta Increta | Placenta Increta |
| 2 | Present | Placenta Accreta | Not present | Not Applicable | Negative |
| 3 | Present | Negative | Present | Placenta Accreta | Placenta Accreta |
| 4 | Present | Negative | Not present | Not Applicable | Negative |
| 5 | Present | Placenta Increta | Present | Placenta Accreta | Placenta Accreta |
| 6 | Present | Negative | Not present | Placenta Accreta | Placenta Accreta |
| 7 | Not Present | Not Applicable | Present | Placenta Accreta | Placenta Accreta |

MRI = magnetic resonance imaging.

**Table 4. Comparison of feto-maternal outcomes in patients with suspicion of PAS and prenatal ultrasound scanning v. those without during prenatal scanning**

| Variable | Without PAS | With PAS | Significance test | *p*-value |
|---|---|---|---|---|
| Blood loss (mL), mean (SD) | 648 (59) | 1 537 (582) | t=2.7413 | 0.0098 |
| Hysterectomy, *n* (%) | | | | |
| Yes | 0 (0) | 4 (44.44) | Fisher's exact test | 0.0031 |
| No | 24 (100) | 5 (55.56) | | |
| Organ injury, *n* (%) | | | | |
| Yes | (0.0) | 3 (42.86) | Fisher's exact test | 0.0096 |
| No | 22 (100) | 4 (57.14) | | |
| Ventilator support, *n* (%) | | | | |
| Yes | 0 (0.0) | 2 (33.33) | Fisher's exact test | 0.005 |
| No | 22 (100) | 4 (66.67) | | |
| 1-minute Apgar score, mean (SD) | 7.2 (0.4) | 4.7 (1.5) | t=2.2252 | 0.0337 |
| 5-minute Apgar score, mean (SD) | 9.0 (0.3) | 6.6 (1.9) | t=2.3285 | 0.0271 |

PAS = Placenta accreta syndrome; SD = standard deviation.

to avoid wasting valuable surgical time in the event of complications. This approach is used in both elective and emergency cases. Also, preoperative haemoglobin levels are optimised to at least 12 g/dL to improve the perioperative outcomes, as blood loss in these patients can be rapid and catastrophic. All patients are counselled and consented to possible blood transfusion, with blood products readily available in the theatre and arrangements in place for urgent replenishment if needed. It is therefore recommended that CS for PP and PAS should be performed only in institutions with blood bank facilities

Four (12.12%) patients underwent hysterectomies. According to Wu *et al.*,[14] PAS has become the number one reason for emergency postpartum hysterectomy due to the high risk of bleeding in these patients. Consequently, we always obtain consent for life-saving hysterectomies before surgery. When PAS is suspected, consent is also obtained for bladder repair and bowel resection with stoma if necessary.

The mean gestational age at delivery was 33.84 weeks. According to CHBAH protocol, patients with suspected PAS should undergo elective delivery between 32 and 34 weeks, while those with PP but no suspicion of PAS are delivered at 36 weeks. Although preterm infants are at risk for various complications, maternal health is prioritised, leading to iatrogenic preterm delivery in many cases. This resulted in about a third (30.12%) of our babies requiring NICU admission. We recommend managing and delivering patients with PP and PAS in institutions with NICU facilities. Additionally, these patients should be counselled by the neonatologist about the risks associated with prematurity.

No neonatal deaths were reported in this study, although most studies on neonatal outcomes in PP and PAS have demonstrated significant perinatal morbidity.[15] This observation should however be interpreted with caution as neonatal outcomes were only studied for the first 24 hours of life, and deaths occurring beyond this period were not captured. Kalimba *et al.*[16] looked at the survival rate of preterm infants at Charlotte Maxeke Johannesburg Academic Hospital, which serves a similar patient population as CHBAH. They found that 79% of neonatal deaths in preterm infants happen by the end of the first week of life, suggesting that 24 hours is too short to accurately determine the incidence. Moreover, the sample size was small, limiting the conclusions. Further studies with larger numbers and longer follow-ups are needed to better understand the true incidence and long-term outcomes for these infants.

Although our study found low accuracy in diagnosing PAS with MRI, others have demonstrated very high accuracies.[17] A 2015 systemic review analysing MRI overall performance for prenatal PAS diagnosis found sensitivity levels ranging from 75 - 100%.[17] The high accuracy reported in these studies is likely attributed to the expertise of the institutions in performing and interpreting MRI images. The lower accuracy of MRI in our study may reflect a lack of expertise in

interpreting the images rather than a limitation of the MRI modality itself. However, technological advancements now allow images to be sent to centres of excellence for expert second opinions.

On the other hand, ultrasound is widely recognised as the primary diagnostic tool for PP. Most importantly, the utility of ultrasound in diagnosing PAS and predicting outcomes has been demonstrated in this study. Half of the cases suspected of PAS on ultrasound were eventually confirmed, with only one case of PAS not detected prenatally by ultrasound. Ebrahim *et al.*[18] discovered that ultrasound features, such as retroplacental hypervascularity, absence of clear zone and the presence of lacunae—suggestive of PAS—were associated with increased severity of intrapartum haemorrhage. Maternal haemorrhage, an important factor contributing to maternal and perinatal morbidity, may explain the more severe adverse outcomes in patients with prenatal suspicion of PAS on ultrasound. Other studies have demonstrated that ultrasound can detect severe PAS cases as effectively as MRI.[19] Dwyer *et al.*[20] further demonstrated that the diagnostic ability of MRI or ultrasound for PAS is not affected by placental location, contrary to suggestions by other authors.

The strengths of this study are that the protocol remained the same throughout the study period and the same person performed all ultrasound scans. The limitations include the small number of patients, the retrospective nature of the study and different doctors interpreting the MRI images.

## Conclusion

Patients with risk factors, such as advanced maternal age, previous CS and previous miscarriages, should have the placenta routinely assessed by ultrasound in the second trimester. PP and PAS increase the likelihood of maternal and neonatal morbidity. Management of these patients must involve an experienced MDT with access to blood bank, NICU and ICU facilities. Ultrasound is useful for evaluating placental implantation and can assist in anticipating severe feto-maternal outcomes in PP and PAS. Currently, MRI has a limited clinical value in this setting, is expensive and should not be used routinely. Further research on diagnosis and outcomes in PP and PAS, with higher numbers, is warranted.

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**Data availability statement.** The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request.

**Conflicts of interest.** None.

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