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# Evaluation of Placenta Accreta Index for Prenatal Diagnosis of Morbidly Adherent Placenta in Zagazig University Hospital

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## ABSTRACT

**Background:** Maternal and fetal mortality and morbidity from placenta previa and placenta accreta present a challenge to the obstetricians and were related with high demands on health resources. With the increase incidence of caesarean sections combined with the increasie of maternal age, the cases of placenta praevia with complications, will continue to increase. **Aim of the Work:** This study aimed to find out diagnostic value of Placenta Accreta Index Score (PAIS) in prenatal diagnosis of morbidly adherent placenta. **Patients and methods:** The study was carried at ultrasound unit of obstetrics and gynecology department in Zagazig university hospitals. The study involved 92 cases of placenta previa delivered at zagazig university hospitals. Study Design is Prospective descriptive study. Results: It was found that placenta accreta significantly increased, with increase No. of previous C.S , anterior placenta previa, increase grading of placental lacunae, presence of vascularity in placenta-bladder interface and with obliteration of uteroplacental demarcation, It was found that there is a significant impact of PAIS in diagnosis of placenta accrete. **Conclusion:** The application of the Placenta Accreta Index may be helpful in predicting individual patient risk for morbidly adherent placenta and significantly improved the antenatal detection of morbidly adherent placenta compared to prior standard interpretation.

## INTRODUCTION

Morbidly adherent placenta (MAP) defined as a group of conditions, including placenta accreta, increta and percreta, which are related significantly to maternal and fetal mortality and morbidity **(1)**.

Antenatal diagnosis of MAP and a multidisciplinary aspect to care have the potential to reduce maternal and fetal intrapartum complications, including loss of maternal blood, requirement for transfusion, hysterectomy, intraoperative urological and gastrointestinal injuries and even maternal death **(2).**

Recently, many studies showed that placenta accreta spectrum (PAS) disorders were undiagnosed before delivery in 50-67% of cases. A study of specialist diagnostic units in the USA, showed that 33% of cases of PAS disorders were not diagnosed during pregnancy. Maternal morbidity and mortality were reduced when women with PAS disorders, especially the invasive forms-placenta increta or percreta-deliver in an excellent center by a multidisciplinary care team with high experience in the management of surgical risks and perioperative challenges for these disorders. Transfer to an excellent center, depends on both recognition of the women at risk of PAS disorders and on accurate prenatal diagnosis **(3).**

Ultrasound evaluation, with grayscale and color Doppler imaging, is the first-line modality recommended for the diagnosis of MAP. Grayscale ultrasound features suggestive of placenta accreta include the myometrial interface loss or retroplacental clear space, decreased myometrial thickness and presence of intraplacental lacunae **(4)**.

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The next step in predicting placental invasion by ultrasound was to integrate some of the individual sonographic parameters related with MAP into a well-defined scoring system. Previous investigator have proposed a standardized evaluation of women at risk for MAP [(5)]. However, these results were based on small retrospective studies which recommended further study for validation of scoring model.

## AIM OF THE WORK

This study aimed to find out the diagnostic value of Placenta Accreta Index Score (PAIS) in prenatal diagnosis of morbidly adherent placenta.

## PATIENTS AND METHODS

This prospective cohort study was carried out in the ultrasound unit of obstetrics and gynecology department in Zagazige university hospitals during the period from January 2019 to July 2019. The study included 92 pregnant women undergoing evaluation of placenta accreta index for prenatal diagnosis of morbidly adherent placenta.

Written informed consent was obtained from all patients and the study was carried according to the research ethical committee of Faculty of Medicine, Zagazig University. The work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

**Inclusion criteria:**

- Age (20-45years).
- Sonographic confirmation of placenta previa or low lying anterior placenta in third trimester.
- Presence of uterine scar e.g. previous caesarean section, previous myomectomy or history of uterine perforation.

**Exclusion criteria:**

- Low lying placenta in first & second trimester.
- Patient with unstable vital signs or in attack of vaginal bleeding.
- Patient without previous uterine scar.

**PAIS calculation**

We used the reported PAI index that provides a score based on number of previous C.S, Number and maximum dimension of lacunae, obliteration of uteroplacental demarcation, location of placenta, and presence of hypervascularity in placenta-bladder interface

**II. Operational design:**

1. An informed written consent was taken from all patients.
2. A detailed history was taken at first visit including maternal age, parity, gestational age, Number of prior cesarean deliveries, Previous uterine surgeries.
3. General examination
4. Ultrasound examination: using two-dimensional (2D) grayscale imaging and color Doppler flow mapping.

Ultrasound examinations was performed with either a 2–5 MHz curvilinear transabdominal transducer or a 5–9 MHz transvaginal probe. Reports of ultrasound images was used in the clinical management of every patient were recorded electronically in a picture archive and communication system during the study period. Therefore every patient had a hard copy and an electronic archived file of images.

**i. Routine ultrasound examination**: fetal biometry, amniotic fluid and placental location.

**ii. Score system (placenta accreta index):** for diagnosis of MAP, which include:

- Previous Cesarean deliveries
- Placental location(placenta previa, anterior)
- size and number of placental lacunae (an irregular area of low echogenicity larger than 1×1cm in the placental parenchyma)
- Obliteration of the demarcation between the uterus and the placenta.

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- Color Doppler assessment of flow in the placental lacunae and placenta–bladder and/or utero-placental interface hyper vascularity.

**Follow up:**

The patient selected under the inclusion criteria was followed by ultrasound and Doppler ultrasound, complete investigations, any attack of bleeding (nature, amount, duration, frequency, recurrency, hemodynamic stability).

This follow up was regular every three weeks till time of delivery whatever elective or emergency delivery.

**Statistical analysis**

Data were assessed, entered and analyzed using SPSS version 20. P<0.05 was considered to be the level of statistical significance.

## RESULTS

**Table (1): Socio-demographic characteristics of the studied group**

| Variable | The studied group(92) mean ± SD (Range) | |
|---|---|---|
| **Age (years)** | 30.1±6 (20-41) | |
| **Variable** | **NO (92)** | **%** |
| **Age group** | | |
| 20-25 years | 21 | 22.8% |
| 25-30 years | 32 | 34.8% |
| 30-35 years | 17 | 18.5% |
| >35 years | 22 | 23.9% |

Table (1), showed that the age of the study group was (30.1±6) years ranged from (20-41) years, (34.8%) of them were between (25-30) years.

**Table (2): Comparing age and obstetric history between placenta previa and accreta patients**

| Variable | Placenta previa Not accreta mean ± SD (Range) | | Placenta previa accreta mean ± SD (Range) | | t-test | p-value |
|---|---|---|---|---|---|---|
| **Age** | 28.4±3.9 (21-36) | | 30.8±6.6 (20-41) | | 1.7 | 0.08 |
| **Gravidity** | 3.1±0.8 (2-4) | | 4.9±1.4 (3-8) | | 6.3 | **0.001**** |
| **Parity** | 1.9±0.7 (1-3) | | 3.3±1.1 (1-5) | | 6 | **0.001**** |
| **Gestational age (weeks)** | 37±0.78 (36-38) | | 37.9±0.5 (36-38) | | 0.2 | 0.8 |
| **Variable** | **Placenta previa** | | **Placenta accreta** | | **$\chi^2$** | **p-value** |
| | **No(27)** | **%** | **No(65)** | **%** | | |
| **Abortion No** | 23 | 85.2% | 46 | 70.8% | 5.1 | 0.2 |

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| | | | | | | |
|---|---|---|---|---|---|---|
| **Once** | 4 | 14.8% | 8 | 12.3% | | |
| **Twice** | 0.0 | 0.00% | 7 | 10.8% | | |
| **Three times** | 0.0 | 0.00% | 4 | 6.2% | | |
| **No. of previous C.S** | | | | | | |
| **1** | 17 | 63.0% | 17 | 26.2% | 11.1 | **0.001**** |
| **≥ 2** | 10 | 37.0% | 48 | 73.8% | | |

**** Statistically highly significant difference (P ≤ 0.001)**

Table (2), showed that there was statistical significant difference between placenta previa and accreta patients regarding gravidity, parity number of previous C.S. But regarding maternal age and abortion, there was no statistical significant difference between the studied patients.

**Table (3): Comparing PAIS domains between placenta previa and accreta patients**

| Variables | Placenta previa | | Placenta accrete | | $\chi^2$ | p-value |
|---|---|---|---|---|---|---|
| | No(27) | % | No(65) | % | | |
| **Lacunae maximum dimension** | | | | | | |
| No | 16 | 59.3% | 11 | 16.9% | 20.1 | **0.001**** |
| ≤ 2 cm | 7 | 25.9% | 15 | 23.1% | | |
| >2 cm | 4 | 14.8% | 39 | 60.0% | | |
| **Number of Lacunae** | | | | | | |
| No | 16 | 59.3% | 11 | 16.9% | 21.9 | **0.001**** |
| ≤ 2 | 4 | 14.8% | 9 | 13.8% | | |
| >2 | 7 | 25.9% | 45 | 69.2% | | |
| **No. of previous C.S** | | | | | | |
| **1** | 17 | 63.0% | 17 | 26.2% | 11.1 | **0.001**** |
| **≥ 2** | 10 | 37.0% | 48 | 73.8% | | |
| **Obliteration of utero-placental demarcation** | | | | | | |
| Yes | 10 | 37.0% | 63 | 96.9% | 19.4 | **0.001**** |
| **No** | 17 | 63.0% | 2 | 3.1% | | |
| **Doppler assessment** | | | | | | |
| Blood flow in placental Lacunae | 6 | 22.2% | 4 | 6.2% | 9.4 | **0.008*** |
| Hyper-vascularity of placental bladder | 21 | 77.8% | 61 | 93.8% | | |

*** Statistically significant difference (P ≤ 0.05)**
**** Statistically highly significant difference (P ≤ 0.001)**

Table (3), showed that there was statistical significant difference between placenta previa and accreta patients regarding all PAIS domains including Lacunae maximum dimension and numbers, number of previous C.S, obliteration of utero-placental demarcation and Doppler assessment.

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**Table (4): Comparing total PAIS and its classification between placenta previa and accreta patients**

| Variable | Placenta previa mean ± SD (Range) | | Placenta accreta mean ± SD (Range) | | t-test | p-value |
|---|---|---|---|---|---|---|
| **Total PAIS** | 6±1.5 (3-8) | | 10.6±1.6 (6-12) | | 9.8 | **0.001**** |
| **Variable** | **Placenta previa** | | **Placenta accreta** | | $\chi^2$ | **p-value** |
| | **No (27)** | **%** | **No (65)** | **%** | | |
| **PAIS classification** | | | | | | |
| **Low** | 10 | 37.0% | 5 | 7.7% | 20.2 | **0.001**** |
| **Moderate** | 10 | 37.0% | 12 | 18.2% | | |
| **High** | 7 | 25.9% | 48 | 73.8% | | |

**** Statistically highly significant difference (P ≤ 0.001)**

Table (4), showed that there was statistical significant difference between placenta previa and accreta patients regarding total PAIS and its classification with (73.8%) of placenta accreta patients had high total PAIS.

**Table (5): Correlation between total PAIS with clinical data in the study group**

| Variable | Total PAIS | | |
|---|---|---|---|
| | **r^** | **P** | **SIG** |
| **Age (years)** | 0.2 | >0.05 | NS |
| **Gravidity** | **0.44** | **0.001**** | **HS** |
| **Parity** | **0.49** | **0.001**** | **HS** |
| **Gestational age (weeks)** | 0.2 | >0.05 | NS |
| **Abortion** | 0.14 | >0.05 | NS |
| **No. of previous C.S** | **0.41** | **0.001**** | **HS** |
| **Blood transfusion** | **0.33** | **0.001**** | **HS** |

*** Statistically significant difference (P ≤ 0.05), r^= correlation coefficient, NS; Non significant, HS; highly significant.**

Table (5), showed that there was statistically significant positive correlation between total PAIS with gravidity, parity, No. of previous C.S and blood transfusion. But regarding gestational age and abortion, there was no statistically significant correlation with total PAIS in the studied group.

**Table (6): Comparison between placenta previa and accreta patients regarding blood transfusion and need for ICU**

| Variables | Placenta previa | | Placenta accreta | | $\chi^2$ | p-value |
|---|---|---|---|---|---|---|
| | **No (27)** | **%** | **No (65)** | **%** | | |
| **ICU** Yes | 6 | 22.2% | 58 | 89.2% | 40.4 | **0.001**** |

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| | | | | | | |
|---|---|---|---|---|---|---|
| No | 21 | 77.8% | 7 | 10.8% | | |
| **Blood transfusion** | | | | | | |
| No | 4 | 14.8% | 5 | 7.7% | | |
| 1-2 units | 12 | 44.4% | 10 | 15.4% | 14.6 | **0.002*** |
| 3-4 units | 9 | 33.3% | 24 | 36.9% | | |
| ≥ 5 units | 2 | 7.4% | 26 | 40.0% | | |

*** Statistically significant difference (P ≤ 0.05)**
**** Statistically highly significant difference (P ≤ 0.001)**

Table (6), showed that there was statistically significant difference between placenta previa and accreta patients regarding need for ICU and blood transfusion with high need in placenta accreta patients (89.2% and 40.0% respectively).

**Table (7): Operation duration in the studied group**

| Variable | NO (92) | % |
|---|---|---|
| **1.5-2 hour** | 84 | 91.3% |
| **>2 hours** | 8 | 8.7% |

Table (7), showed that operation duration ranged from (1.5 -2 hours) in (91.3%) of the studied group and more than 2 hours in (8.7%).

**Table (8): Total PAIS and its classification in the studied group**

| Variable | The studied group(92) mean ± SD (Range) | |
|---|---|---|
| **Total PAIS** | 5.4±1.5<br>(3-12)<br>5 | |
| **PAIS classification** | **NO(92)** | **%** |
| **Low** | 15 | 16.3% |
| **Moderate** | 22 | 23.9% |
| **Severe** | 55 | 59.8% |

**(PAIS) placenta accreta index score**

Table (8), showed that the total PAIS of the studied group was (5.4±1.5) (59.8%) of them were severe class, (23.9%) were moderate and (16.3%) were low class.

**Table (9): Accuracy of total PAIS in detection of morbidly adherent placenta**

| Variable | Sensitivity | Specificity | PVP | PVN | Accuracy |
|---|---|---|---|---|---|
| **Total PAIS** | 98.0% | 54.0% | 68.0% | 96.0% | 76.0% |

**PVP: Predictive value positive**
**PVN: Predictive value negative**

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Table (9), showed that the ability of total PAIS to detect morbidly adherent placenta among the studied group was 98.0% while the ability to exclude negative cases was 54.0% with 76.0% accuracy.

## DISCUSSION

In our study it was found that the risk of accreta was 26%, 73.8% in women with 1, ≥2 prior cesarean deliveries, respectively, which were in agreement with the study of **Silver et al., [6]** found that in the cases of placenta previa, the risk of accreta was 11%, 40%, and >60% in women with 1, 2, and 3 prior cesarean deliveries, respectively. The present study showed that there was positive association between morbidly adherent placenta and the following variables : placental location, smallest myometrial thickness, and hypervascularity in placenta-bladder interface. Which in agreement withy the results of **Comstock [7] and Finberg and Williams [8]** as well as meta-analyses and systematic reviews of **D'Antonio et al., [4],** who showed that there was high sensitivity for these parameters.

The present study confirmed the predictive value of combining patient characteristics with ultrasound variables associated with placental invasion, and it also reported the interaction between the different variables which contribute to individual risk. Which in agreement with the results of **Weiniger et al. [9],** found that the combination of placenta previa, number of prior cesarean deliveries, and ultrasound suspicion of invasion were predictive more than ultrasound variables only, with an area under the receiver operator characteristic curve of 0.85.

In the present study showed that there was statistical significant difference between placenta previa and accreta patients regarding total PAIS and its classification with (73.8%) of placenta accreta patients had high total PAIS. which in agreement with the study of **Abbas et al. [10]** who found that PAIS is highly predictive of morbidly adherent placenta in patients at risk.

The present study showed that there was statistically significant difference between placenta previa and accreta patients regarding need for ICU and blood transfusion with high need in placenta accreta patients, which coincide with the results of **El Gelany et al. [11]** and **Kandil et al. [12]** studies.

The present study showed that the diagnostic value of PAIS with histopathological findings in placenta previa patient had a sensitivity 98%, a specificity 54%, positive predictive value (PPV) 68%, and negative predictive value (NPV) 96%, which nearly agreement with the study of **Sefty et al. [13], who reported that the d**iagnostic value of PAIS with histopathological findings in placenta previa patient had a sensitivity 70%, a specificity 81,8%, positive predictive value (PPV) 77.8%, and negative predictive value (NPV) 75%

**Rac [14]** study design was retrospective study from 1997 till 2011, where our study was prospective study from January 2019 till July 2019. In their study, of 184 gravidas who met inclusion criteria, 54 (29%) had invasion confirmed on hysterectomy specimen. All sonographic parameters were associated with placental invasion (P < .001), where our study involved 92 cases 65 of them were placenta previa accreta, the other 27 were placenta previa without invasion.

The present study showed that there was statistical significant difference between placenta previa and accreta patients regarding number of previous C.S, which in agreement with the study of **Chattopadhyay et al. [15]**, who reported a higher incidence of placenta accreta in patients with two or more previous CS (59.2%) compared with patients with one previous CS (10%) of their patients.

As regarding, duration of operation there was significant difference in duration of operation which is longer in placenta accreta cases.

**Conclusion:** The application of the Placenta Accreta Index may be helpful in predicting individual patient risk for morbidly adherent placenta and significantly improved the antenatal detection of morbidly adherent placenta compared to prior standard interpretation

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