Integrated prediction model before conservative management of placenta accreta spectrum : hospital based cohort study.

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Abstract

Introduction: The increase in the rate of caesarean sections has led to increase of potentially life threatening complications such as placenta accreta, low-lying placenta and rupture uterus, as well as, surgical morbidity. Placenta accrete spectrum is a condition of abnormal placental invasion on which the placenta invades beyond the decidua basalis. Morbidly adherent placenta represents a spectrum of disorders characterized by abnormal penetration of the placenta into the uterine wall.

Objectives: this hospital based cohort study was conducted at obstetrics and gynecology department at mansoura university hospitals from September 2022 to September 2023 aiming to formulate ascoring system to assess the degree of placenta accrete spectrum before decision of conservative management of placenta accrete spectrum.

Methods: Pregnant females in the third trimester of pregenancy with history of past cesarean section and diagnosed to have placenta accrete with 2D ultrasound and we intend to do conservative management, full history was taken, investigation, ultrasound and Doppler was done.

Results: Integrated score is highly sensitive for prediction of placenta accreta spectrum (71.9%) and specificity 64.9% and cut off level is 8.5 also positive predicitive value is 63.9% and negative predicitive value is 72.7% and accuracy of the score is 68.1% .

Conclusion: The study's implications for practice are profound. The integrated scoring system, by combining various parameters and ultrasound criteria, has the potential to aid clinicians in assessing PAS severity before choosing management strategies. This is particularly relevant when considering conservative approaches. The study's findings and the consistency of results with other related research enhance the credibility and applicability of the prediction model. In practice, the prediction model can assist healthcare professionals in identifying high-risk cases of PAS, allowing for informed decisions about conservative management options.

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Introduction

The incidence of the PAS has been elevating from a reported occurrence of one case in 30,000 deliveries in 1950 to one case in 2500 deliveries in 1997. This marked elevation has been due to the increase in caesarean section delivery rates allover the world . Recent studies showed marked increase in CS rate in Egypt (1). The association between cesarean section & placenta accreta may be due to malrepair of the endometrium (2). placenta accreta spectrum may occur after any procedure that causes some damage to the endometrium, including dilatation and curettage, manual removal of the placental tissue, uterine artery embolization, and also doing myomectomy.(3). Additional risk factors include maternal age, high parity , IVF techniques, and a diagnoses of placenta accrete spectrum in a previous pregnancy(4).

TVS has been done to evaluate the uterine scar site in non-pregnant women. The scar site can be detected in relation to the uterovesical junction (5). Antenatal diagnosis of PAS allows for multidisciplinary planning and delivery before the onset of labor and/or vaginal bleeding. This approach has decreased maternal morbidity rates, including less bleeding, fewer transfusion requirements and intraoperative bladder injuries as well as improve fetal outcome (6).

The depth of placental invasiveness is one of the most important factors that affect maternal outcome. Therefore, in order to decide the best strategies for the management of placenta accrete spectrum, acorrect assessment of the degree of the invasion at the time of delivery, stratification of women according to this, and correlation between prenatal imaging, intra-operative aspects and pathological aspects are of importance when comparing data from different studies (7).

Patients & Methods

Study design:

We conducted a cohort study

Place: Mansoura university hospitals, obstetric& gynecology deparement

Time: September 2022 to September 2023

Sample size: The calculated sample size of the study was 31 participants for each group at 5% level of significance and 80%, using the power of the study following formula (8).

$$n=\frac{Z^2*p*(1-P)}{d^2}$$

Where:

Z = 1.96 for 95% confidence level.

p = Expected total accuracy of placenta accrete index score in prediction of placenta accrete group was 98% based on (9)

d = precision (Margin of error) = 0.05

The sample size was elevated to **40 participants for each group** to compensate for insufficient data and to increase the power of the study.

Patient

Inclusion criteria:

1. Pregnant females in third trimester of pregnancy (28 -40 week).
2. Pregnant females with history of at least one cesarean section .
3. Pregnant females diagnosed to have placenta previa accreta by 2D trans vaginal ultrasound assessment(placenta previa situated at anterior uterine wall about 2 cm from the internal os) .
4. Pregnant females undergo conservative management at delivery.

Exclusion criteria:

1. Pregnant females with no history of previous cesarean deliveries

2. Pregnant females under go cesarean section hysterectomy.
3. Pregnant females diagnosed to have posteriorly situated placenta previa.

Methods

» **Clinical assessment :**

In the form of full history taking(personal history &obstetric history , Number of past CS deliveries , Previous history of placenta previa, Past or current history of medical disorders (DM, heart disease, HTN, renal ,hepatic impairment).

» General examination was done and vital signs was assessed and recorded.

» An abdominal examination was performed and the fetal heart rate will be recorded.

» Routine investigations including CBC, urine analysis, liver function tests & kidney function tests.

» Ultrasound evaluation for PAS was done with grayscale and color

Doppler imaging using (GE Logiq P5, General Electric, USA) ultrasound device with a transabdominal array probe 3.5 MHZ. Scanning was performed with a moderately filled bladder. The diagnosis of placenta previa was confirmed if the placenta situated within 2 cm from the internal cervical os but did not cover it. Meanwhile, anterior placenta previa was diagnosed if any portion of the placenta was anterior and the placental tissue covering the internal cervical os.

» Detailed assessment looking for ultrasound signs of PAS was done which include:

A:loss of the retroplacental clear zone, the smallest myometrial thickness in sagittal plane.

B: presence of lacunar spaces

Its grading into_____ 0-3 and bridging vessels using color Doppler Lacunar spaces were graded as follows: grade (0) = not present, grade (1) =1-3 present and generally small, grade (2) = 4-6 present and tending to be larger and more irregular and grade (3) = many throughout the placenta and appearing large and bizarre.

C:bladder wall interruption

D:placental Wall bulge

E: exophytic focal mass mostly into urinary bladder

» Doppler assement including

A: vesicouterine hypervascularity

B: presence of sub placental hypervascularity

C: bridging vessels passing from placenta to myometrium or adjacent organs

D: lacunae feeder vessels

• Intraoperative assessment according to FIGO classification for placenta accreta spectrum

Grade 1: Abnormally adherent placenta (placenta creta)

At time of laparotomy

» No evidence of separation with giving synthetic ecobolics such as oxytocin and gentle controlled cord traction

» Attempts of manual removal of the placenta results in heavy bleeding from the placenta implantation site that require mechanical or surgical procedures

» Macroscopically, the uterus shows no distension at the placental bed ,no placental tissue is seen invading through the surface of the uterus, and there is no neovascularity or there is little neovascularity.

Grade 2: Abnormally invasive placenta (Increta)

At time of laparotomy

» Abnormal macroscopic findings at the placental implantation site: bluish/purple colouration, distension (placental “bulge”)

» Significant amounts of neovascularity (dense tangled bed of vessels running parallel

craniocaudially in the uterine serosa)

» Uterine serosa not invaded by placental tissues

» gentle cord traction results in the dimple sign , the uterus pulled inwards but without separation of the placenta.

Grade 3: Abnormal invasive placenta (Percreta)

Grade 3a: Limited to the uterine serosa

Clinical criteria

At laparotomy

» Abnormal macroscopic findings on the uterine serosa (as above) and serosa is invaded by the placental tissues.

» No invasion to any other organ, such as the back of the bladder (a clear surgical plane can be identified between the uterus and the bladder)

Grade 3b: With urinary bladder invasion

Clinical criteria

• At time of laparotomy

» Placental villi are invading into the bladder walls .

» Clear surgical plane cannot be identified between the bladder and uterus

Grade 3c: With invasion of other pelvic tissue/organs

Clinical criteria

At laparotomy

Placental villi invade into the broad ligament, vaginal walls, pelvic sidewalls or any other pelvic organs (with or without invasion of the bladder)

The gold standared for scoring was histopathological examination of a biopsy that was taken from placental bed& it was classified into (according to figo clacification of PAS 2019):

Grade 1: Abnormally adherent placenta (placenta adherenta or creta)

Histologic criteria

- Microscopic examination of the placental implantation site samples from hysterectomy specimen shows wide areas of absent decidua between villous tissue and myometrium with placental villi attached directly to the myometrium.
- The final diagnosis cannot be made only on just delivered placental tissue nor on random biopsies of the placental implantation sites.

Grade 2: Abnormally invasive placenta (Increta)

Histologic criteria

- Hysterectomy specimen or partial myometrial removal of the increta area shows placental villious tissue present inside the muscle fibers and sometimes inside the lumen of the deep uterine vessels (radial or arcuate arteries).

Grade 3: Abnormally invasive placenta (Percreta)

Grade 3a: Limited to the uterine serosa Histologic criteria

- Hysterectomy specimens showing that placental tissue inside or reaching the uterine serosa

Grade 3b: With urinary bladder invasion Histologic criteria

- Hysterectomy specimens showing placental tissues reaching the uterine serosa and invading the bladder wall tissue or urothelium.

Grade 3c: With invasion of other pelvic tissues/organs Histologic criteria

- Hysterectomy specimen showing placental tissues reaching the uterine serosa and invading pelvic tissues/organs (with or without invasion of the bladder)

Patients were divided into two groups:

1. Study group was 40 patients diagnosed to have placenta previa &placenta accreta spectrum.
2. Control group was 40 patients diagnosed placenta previa without placenta accreta spectrum.

scoring system:

The scoring system icluded five items each was given a score 1or score 2

Items	Score 1	Score 2
Number of cesarean sections:	If one cesarean delivery .	If > one cesarean delivery.
Number of lacunae:	Grade 0&1	Grade 2&3
Retroplacental Clear zone:	Present	Absent
Doppler assessment:	Hypervascularity of placental lacunae alone.	Hypervascularity between placenta and bladder with bridging vessels in between.
Intraoperative evaluation:	Intraoperative easy access to dissection plane between bladder and placenta.	Intraoperative difficult access to dissection plane between bladder and placenta.

Management plan was:

Preoperative management:

Counseling:

Cases with suspected placenta accreta was counseled about potential risks and complications.

Cases with placenta accreta are at increased risk for hemorrhage, massive blood transfusion, bladder, ureteric injury, infection, need for intubation, prolonged hospital stay, ICU admission, need for reoperation, thromboembolic complications and death. Considerations should involve comparative possibility for hysterectomy and subsequent infertility (10).

Timing of delivery:

According to our local protocol:

Time of delivery was at (34-36 week) if associated with history of reccurent bleeding.

Time of delivery was at 37 week if not associated with history of reccurent bleeding.

Anesthesia for delivery:

General anasthesia or regional anasthesia planned with anesthesia team.

Intraoperative management:

Patients was subjected to one of the conservative methods of PAS according to multi desplaniery team assessment.

Conservative management includes the following techniques:

1 ..|One-step conservative surgery approach for placenta accreta spectrum (PAS) disorders:

1. Upper uterine segment incision and delivery of the fetus.
2. Removal of all myometrial tissue which is invaded and the all placenta in one piece with previous local vascular control.
3. Surgical maneuvers fo ensuring r hemostasis.
2. Myometrial suturing in 2 planes.
3. Bladder wall repair if needed.

2 ..Stepwise surgical approach for (PAS) disorders:

1. Combined an early uterotonics intravenously just before fetus delivery
2. Transverse upper uterine incision at the superior border of the placenta without cutting through the placenta.
3. Delivery of the fetus
4. The uterus is exteriorized and compressed against the symphysis pubis by assistant (transient bilateral kink of uterine arteries).
5. Bilateral ligation of the anterior division of the internal iliac artery .

6. Placental tissue complete extraction (delayed after pelvic devascularization).

4. Proper identification of the lower uterine segment by the index and ring fingers after identification of internal cervical os by the middle finger of the left hand.

5. Repair of the uterine incision.

3combined approach.

*if un controlled bleeding occur cesarean hysterectomy will be done.

Outcome measures:

Primary outcome: was to formulate a cut off level score at which success rate developed to preserve the uterus in cases of PAS.

Secondary outcome :

Complication rate:

- bladder injury rate
- bleeding rate
- blood transfusion volume.
- Intestinal injury rate
- ICU admission rate
- hosipital stay length.
- Thromboembolic complications rate .
- Maternal Mortality rate.

Statistical analysis

The collected data were coded, processed and analyzed using SPSS program (Version 26) for windows. The appropriate statistical tests was used when needed. P values less than 0.05 (5%) was considered to be statically significant.

Ethical consideration:

- Study protocol was submitted for approval by IRB
- Approval of the mangers of the health care facilities in which the study were conducted
- Informed consent was obtained from each participant sharing in the study.

Confidentiality and personal privacy was respected in all levels of the study. Collected data were not used for any other purpose.

Results

Table (3): Demographic and baseline obstetric data among studied group

	Placenta accreta (n=32)	No placenta accreta (n=37)	Unsatisfactory (n=11)	P value
Age (Years) Mean ± SD	30.81± 5.73	30.11± 4.47	30.27± 6.88	P1=0.569
Age (Years) Min-Max	22-43	20-40	18-41	P2=0.799 P3=0.926
Gravidity Median(range)	**5 (2-7)**	**3 (2-8)**	**4 (2-9)**	P1=0.005* P2=0.852 P3=0.05*
Parity Median(range)	**3 (1-5)**	**2 (1-5)**	**3 (1-5)**	P1=0.003* P2=0.536 P3=0.214
Number of cesarean sections Median(range)	**3 (1-5)**	**2 (1-5)**	**3 (1-5)**	P1=0.003* P2=0.536 P3=0.198
Abortion Number(percent) Yes No	 12 (37.5%) 20 (62.5%)	 12 (32.4%) 25 (67.6%)	 4 (36.4%) 7 (63.6%)	P1=.659 P2=0.946 P3=0.808

Preterm Number(percent) Yes No	0 (0%) 32 (100%)	2 (5.4%) 35 (94.6%)	1 (9.1%) 10 (90.9%)	P1=0.495 P2=0.238 P3=1.0
Place of first section Number(percent) MUH Outside MUH	4 (12.5%) 28 (87.5%)	5 (13.5%) 32 (86.5%)	3 (27.3%) 8 (72.7%)	P1=1.0 P2=0.252 P3=0.361
Previous pregnancy complications Number(percent)				
PET CS scar ectopic Gestational diabetes Gestational diabetes & PET Pulmonary embolism Vesicular mole Rupture uterus IUFD No	1 (25.0%) 1 (25.0%) 1 (25.0%) 1 (25.0%) 0 (0%) 0 (0%) 0 (0%) 0 (0%) 28 (87.5%)	3 (42.9%) 0 (0%) 0 (0%) 0 (0%) 1 (14.3%) 1 (14.3%) 1 (14.3%) 1 (14.3%) 30(81.1)	0 (0%) 0 (0%) 0 (0%) 0 (0%) 0 (0%) 0 (0%) 0 (0%) 0 (0%) 11 (100%)	P1=0.623 P2=0.646 P3=0.838

MUH... Mansoura university hospitals.

PET...pre eclampsia.

IUFD...intrauterine fetal death.

The table (3) shows that median gravidity is 5(2-7)in placenta accreta more than placenta non accreta 3(2-8). P1=0.005 and median parity is 3(1-5) in Placenta accreta more than placenta non accrete 2(1-5) P1=0.003. Median number of cesarean sections is significant in Placenta accrete 3(1-5) than placenta non accrete 2 (1-5) P1=0.003.

Table (5): Ultrasound & doppler criteria among the studied groups:

	Placenta accreta (n=32)	No placenta accreta (n=37)	Unsatisfactory (n=11)	P value
Ultrasound criteria				
Clear zone ***Number(percent)*** Lost Present	29 (90.6%) 3 (9.4%)	30 (81.1%) 7 (18.9%)	11 (100%) 0 (0%)	P1=0.261 P2=0.558 P3=0.119
Lacunae grade ***Number (percent)*** Grade 1 Grade2 Grade3	3 (9.4%) 16 (50.0%) 13 (40.6%)	10 (27.0%) 21 (56.8%) 6 (16.2%)	4 (36.4%) 5 (45.5%) 2 (18.2%)	P1=0.036* P2=0.093 P3=0.896
Bladder wall interruption ***Number (percent)*** Yes NO	7 (21.9%) 25 (78.1%)	2 (5.4%) 35 (94.6%)	1 (9.1%) 10 (90.9%)	P1=0.043* P2=0.347 P3=1.0
Placental pulge ***Number (percent)*** Yes No	4 (12.5%) 28 (87.5%)	2 (5.4%) 35 (94.6%)	1 (9.1%) 10 (90.9%)	P1=.405 P2=1.0 P3=1.0

Focal exophytic mass ***Number (percent)*** Yes No	 1 (3.1%) 31 (96.9%)	 2 (5.4%) 35 (94.6%)	 0 (0%) 11 (100%)	P1=1.0 P2=1.0 P3=1.0
Doppler criteria				
Uterovesical hypervascularity ***Number (percent)*** Yes No	 27 (84.4%) 5 (15.6%)	 18 (48.6%) 19 (51.4%)	 7 (63.6%) 4 (36.4%)	P1=0.002* P2=0.145 P3=0.382
Subplacental hyprtvascularity ***Number (percent)*** Yes No	 30 (93.8%) 2 (6.2%)	 30 (81.1%) 7 (18.9%)	 9 (81.8%) 2 (18.2%)	P1=0.161 P2=0.558 P3=0.956
Bridging vessels ***Number (percent)*** Yes No	 19 (59.4%) 13 (40.6%)	 14 (37.8%) 23 (62.2%)	 6 (54.5%) 5 (45.5%)	P1=0.074 P2=0.779 P3=0.324
Lacunae feeder vessels ***Number (percent)*** Yes No	 26 (81.2%) 6 (18.8%)	 28 (75.7%) 9 (24.3%)	 11 (100%) 0 (0%)	P1=0.576 P2=0.122 P3=0.07

The table (5) shows that Lacunae grade 3 is more significant in Placenta accrete (40.6%) than placenta withour accreation (16.2%) than unsatisfactory group(18.2%) P1=0.036 and bladder wall interruption is more significant in Placenta accreta (21.9%) more than placenta without accreation (5.4%) P1=0.043 also uterovesical hypervascularity is more significant in Placenta accreta (84.4) than placenta without accreation

Table (6): Intraoperative intervention among the studied groups :

	Placenta accreta (n=32)	No placenta accreta (n=37)	Unsatisfactory (n=11)	P value
Surgical procedures				
Surgical technique ***Number (percent)*** *Resection of lower uterine segment & cervicoisthmic sutures	 15 (46.9%) 17 (53.1%)	 9 (24.3%) 28 (75.7%)	 8 (72.7%) 3 (27.3%)	P1=0.05* P2=0.138 P3=0.003*
Bilateral uterine artery ligation ***Number(percent)***	32 (100%)	37 (100%)	11 (100%)	-
Internal iliac artery ligation ***Number(percent)*** Yes	 12 (37.5%) 20 (62.5%)	 7 (18.9%) 30 (81.1%)	 4 (36.4%) 7 (63.6%)	P1=0.085 P2=0.946 P3=0.227
Intra operative complications				
Intra operative complications ***Number(percent)*** Intra operative complications Yes No	 **11 (34.4%)** 21 (65.6%)	 **7 (18.9%)** 30 (81.1%)	 **4 (36.4%)** 7 (63.6%)	P1=0.145 P2=1.0 P3=0.227

Intra operative complications ***Number(percent)*** Blood loss Bladder injury Bladder injury & blood loss	 9 (81.8%) 1 (9.1%) 1 (9.1%)	 4 (57.1%) 3 (42.9%) 0 (0%)	 3 (75%) 1 (25%) 0 (0%)	P1=0.146 P2=1.0 P3=0.474
Bladder dissection ***Number(percent)*** Easy Difficult	 18 (56.2%) 14 (43.8%)	 32 (86.5%) 5 (13.5%)	 7 (63.6%) 4 (36.4%)	P1=0.005* P2=0.668 P3=0.088
Amount of blood loss Median (range)	1500 (400-5000)	1000 (300-4000)	2000 (800-6400)	P1=0.011* P2=0.539 P3=0.007*
Intraoperative blood transfusion Median (range)	2.5 (1-8)	2 (0-7)	3 (2-10)	P1=0.006* P2=0.178 P3=0.001*

The table(6)shows that Resection of lower uterine segment and cervicoisthmic sutures is more significant in Placenta accreta (46.9%) than placenta without accreation (24.3%) P1=0.05 and difficul bladder dissection is more significant in Placenta accreta (43.8%) than placenta without accreation (13.5%) P1=0.005 also amount of blood loss is more significant in Placenta accrete (median 1500 ml) than placenta without accreation (median 1000 ml) P1=0.011 and intraoperative blood transfusion is more significant in Placenta accrete median 2.5 (1-8) than placenta without accretion median2 (0-7) P1=0.006

Table (7) intraoperative evaluation of placenta accrete according to FIGO stages:

	Placenta accreta (n=32)	No placenta accreta (n=37)	Unsatisfactory (n=11)	P value
Grade 1	2 (6.2%)	13 (35.1%)	2 (18.2%)	P1=0.001*
Grade 2	14 (43.8%)	19 (51.4%) V	4 (36.4%)	P2=0.374
Grade 3a	13 (40.6%)	5 (13.5%)	3 (27.3%)	P3=0.057
Grade 3b	3 (9.4%)	0 (0%)	1 (9.1%)	
Grade 3c	0 (0%)	0 (0%)	1 (9.1%)	

The table (7)shows that intraoperative FIGO grade 3 a is more significant in Placenta accreta (40.6%)than placenta without accreation (3.5%)P1= 0.001.

Table (8): Pre and post -operative Hb &ICU & hospital stay among the studied groups

Placenta accreta (n=32)		No placenta accreta (n=37)	Unsatisfactory (n=11)	P value
Preoperative Hb Mean ± SD	10.63±1.08	10.77±1.04	11.04±1.23	P1=0.591 P2=0.298 P3=0.466
Postoperative Hb Mean ± SD	11.08±1.19	11.07±1.43	10.38±0.98	P1=0.994 P2=0.089 P3=0.140

Postoperative ICU admission number-percent) Yes No	2 (6.2%) 30 (93.8%)	1 (2.7%) 36 (97.3%)	1 (9.1%) 10 (90.9%)	P1=0.471 P2=1.0 P3=0.410
Hospital stay (Days) Median (range)	10.5 (4-26)	11 (4-40)	10.5 (8.5-12)	P1=0.842 P2=0.171 P3=0.289

Preoperative Hgb shows no significance by statistical analysis as in placenta accreta mean 10.63 and placenta without accreation 10.77 and unsatisfactory 11.04, also postoperative Hgb shows no significance by statistical analysis as in placenta accreta mean 11.08 and placenta without accreation 11.07 and nonsatsifactory 10.38.

Postoperative ICU admission shows no significance in placenta accreta 2(6.2%) and placenta without accreation (2.7%) also days of hospital stay show no significance in placenta accreta median 10.5 and placenta without accreation median 11.

Table (9): Proportion of placenta accreta and no accreta cases according to histopatholpgy

	The studied group (n=80)	
	No	**%**
Placenta accrete(number -percent) **• Grade 1** **• Grade 2** **• Grade 3**	**32** 16 13 3	**40.0** 50.0 40.6 9.4
No placenta accrete (number-percent)	**37**	**46.2**
Unsatisfactory cases(number-percent)	**11**	**13.8**

Proportion of placenta accreta in studied groups according to histopathology is 30 case (40%) ... placenta figo grade 1 ===16 case & placenta figo grade 2 ==13 case & figo grade 3==3 cases .

Placenta non accrete number 37 case (46.2%),also unsatisfactory 11 case (13.8%).

Integrated score is more significant in Placenta accrete median 9 (5-10) than placenta without accreation median 8 (6-9) than unsatisfactory median 8 (7-10) P1<0.001

Table (10): Integrated score among the studied groups

Integrated score	**Placenta accreta (n=32)**	**No placenta accreta (n=37)**	**Unsatisfactory (n=11)**	**P value**
Mean ± SD	8.97± 1.06	7.92±0.98	8.54±0 .93	P1<0.001*
Median	9.0	8.0	8.0	P2=0.248
Range	5-10	6-9	7-10	P3=0.067

Table (11): Receiver operating characteristics curve (ROC) for prediction of placenta accrete by integrated score.

AUC	**95% CI**	**Cutoff**	**Sensitivity**	**Specificity**	**PPV**	**NPV**	**Accuracy**
0.778	0.67 0.89	8.5	71.9%	64.9%	63.9%	72.7%	68.1%

AUC: Area under the curve, CI: Confidence interval, PPV: positive predictive value, NPV: negative predictive value.

Integrated score is highly sensitive for prediction of placenta accreta spectrum (71.9%) and specificity 64.9% and cut off level is 8.5 also positive predicitive value is 63.9% and negative predicitive value is 72.7% and accuracy of the score is 68.1% .

Discussion

The current study assesses the diagnostic accuracy of its integrated scoring system through Receiver Operating Characteristics (ROC) curve analysis. The findings demonstrate a considerable sensitivity (71.9%) in predicting the presence of placenta accreta spectrum while preserving a specificity of 64.9%. The calculated cut-off level of 8.5 on the integrated score served as a threshold for distinguishing between different levels of risk. Further its positive predictive value, correctly predicts the presence of placenta accreta, was 63.9%, while the negative predictive value, was 72.7%. The overall accuracy of the integrated score was estimated at 68.1%, further affirming its potential to provide a reliable assessment of placenta accrete. Furthermore, the Area under the Curve (AUC) value of 0.778 in the ROC analysis signifies the integrated score's ability to discriminate between placenta accreta and non-accreta cases.

Similar analyses are conducted in some studies. They also use ROC curve analysis to evaluate their scoring systems' performance in predicting PAS. Our integrated scoring system's sensitivity (71.9%) is relatively lower than the sensitivities reported in some other studies (e.g., Mahboobeh fard: 83.3%, Yisu GAO: 91.84%, Abd El-Gaber Ali: 92.3%). This suggests that your system may have a higher likelihood of false negatives, meaning it might miss some cases of PAS (11). The specificity of your integrated scoring system (64.9%) is also less than the specificities in other studies (e.g., Yisu Gao: 87.27%, Abd El-Gaber Ali: 94.1%). Moreover, the accuracy of your integrated scoring system (68.1%) is within the range reported by other studies (e.g., Mahboobeh fard: 82.6%, Vajiheh Marsoosi: 86.54%)(12). Another research has validated the Placenta Accreta Index (PAI) as a reliable predictor of placenta accreta syndrome (PAS). The PAI's sensitivity (87%) and specificity (77%) are significant factors in assessing the efficacy of predictive models(13). The effectiveness of the PAI in predicting PAS supports the utilization of a scoring system like ours for accurate prediction. Furthermore, other studies underscore the importance of incorporating ultrasound features in predicting PAS(14).

The current study highlights the significance of ultrasound and Doppler criteria in predicting PAS severity. Parameters such as lacunae grade, bladder wall interruption, and uterovesical hypervascularity were found to be significantly more pronounced in the placenta accreta group, implying their potential as markers for identifying PAS. Other study reinforces this notion, indicating that several ultrasound criteria, including absence of retroplacental clear zone, abnormal placental lacunae, and hypervascularity, can accurately diagnose placenta accreta and its variants(15). Keita Hasegawa's findings align with this by showcasing that PAI > 2 is a useful cut-off point for predicting PAS. Notably, the presence of severe placental lacunae and thin myometrial thickness further supports the role of these ultrasound criteria in identifying PAS(16). These findings align with the current study's results, which highlight the significance of similar ultrasound and Doppler criteria in differentiating between PAS and non-accreta cases. Others have placed considerable emphasis on the predictive capacity of ultrasound and Doppler markers in identifying placenta accreta spectrum (PAS) and predicting outcomes in their researches. Their study delved into the value of ultrasound markers in prognosticating major intraoperative blood loss in PAS cases. The parameters they identified, including the quantity of lacunae, subplacental hypervascularity, and tortuous vascularity with chaotic branching, as well as the presence of bridging vessels(17), align with the Doppler assessment parameter in the predictive model of the present study.

The current study introduces an integrated scoring system comprising five parameters

to predict PAS severity. These parameters include cesarean sections, lacunae grade, retroplacental clear zone, Doppler assessment, and intraoperative evaluation. Several other studies, also integrate multiple ultrasound parameters to predict PAS outcomes. These parameters include abnormal lacunae, bladder wall interruption, myometrial thickness, placental location, bridging vessels, and more (18). The association of these parameters across studies suggests a consensus on the significance of specific ultrasound markers in predicting PAS severity. The current study's scoring system reflects this consensus by incorporating similar parameters. Moreover, some studies focus on incorporating specific ultrasound features like lacunae, bladder wall interruption, uterine-bladder serous interface disruption, placental bulge, placental location, and hypervascularity into their scoring systems(19). These shared ultrasound features confirm the significance of such markers in predicting PAS and support the consistency of findings across studies.

Conclusions and implications for practice

In conclusion, the present study's findings serve to underscore the strong association between multiple previous cesarean sections and the presence of PAS thereby increasing the risk of this condition. Additionally, the predictive model is supported by gravidity, parity, and cesarean count, which are significant predictors. Furthermore, the identification of ultrasound and Doppler criteria as crucial indicators for predicting PAS severity is noteworthy. The significant differences observed between the placenta accreta and non-accreta groups in parameters such as lacunae grade, bladder wall interruption, and uterovesical hypervascularity highlight the potential of these markers in identifying cases of PAS and emphasize the importance of ultrasound evaluations in predicting severity.

The present study's introduction of an integrated scoring system evinces its effectiveness in the stratification of placenta accrete cases, while also demonstrating its potential to augment clinical decision-making. The scoring system's capacity to distinguish between PAS and non-accreta cases, as well as its sensitivity and specificity values, corroborate its usefulness. Furthermore, the established risk stratification cut-off level and Area AUC value serve to further underscore the scoring system's discriminative efficacy and clinical applicability.

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