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Abd Elmonem Mohamed Zakaria
Obstetrics and Gynecology, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

Mahmoud Abd El Latif Hashish
Clinical Pathology, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

Yasser Mohamed Said Diab
Obstetrics and Gynecology, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

Mahmoud Hamada Gharieb El Maadawy
Obstetrics and Gynecology, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt,
elmadawym128@gmail.com

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ORIGINAL ARTICLE

Role of Doppler Ultrasound and Creatine Kinase as Markers in Diagnosis of Placenta Accreta

Abd Elmonem M. Zakaria [a], Mahmoud A. Hashish [b], Yasser M. S. Diab [a], Mahmoud H. G. El Maadawy [a,*]

[a] Department of Obstetrics and Gynecology, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt
[b] Department of Clinical Pathology, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

Abstract

Background: ***The aberrant adhesion of placental villi to the underlying myometrium in the absence of decidua basalis is known as placenta accreta. Ignoring placenta accreta and not planning for the management of it can result in severe bleeding, potentially fatal, acute respiratory distress, widespread coagulopathy, renal failure, and emergent hysterectomy.***

Aim: ***To assess creatine kinase and Doppler ultrasound's potential as indicators for accurate diagnosis of placenta.***

Methods: ***Samples for this prospective observational study were gathered using a systematic random technique, and 100 patients were chosen from the obstetrics and gynecology outpatient clinic at Al-Azhar University Hospitals.***

Results: ***Compared to women without placenta accreta, individuals with placenta accreta tend to be older. There was no discernible difference when comparing the two groups' BMI, GA at delivery, and GA at assessment.***

Conclusion: ***The CK test is unreliable; an ultrasound would be helpful; a mix of the two is best; aid is needed in finding the best. Since this mixture failed the gas test, it's worth looking for further biochemical signs. Comparing radiological modalities will help us find more MAP cases, reducing maternal mortality and terrible outcomes. It will also reduce the anxiety of consenting to a hysterectomy before surgery. Previously, patients without placental attacks failed that venture.***

Keywords: Placenta accreta; Creatine Kinase; Doppler Ultrasound

1. Introduction

Cystotomy, ureteral damage, infection, venous thromboembolism, and extended hospital stays are examples of surgical complications. Planned birth at a tertiary care facility using a multidisciplinary approach can be arranged with an accurate prenatal diagnosis of placenta accrete, which has been demonstrated to reduce maternal morbidity considerably.[1]

Patients and doctors are increasingly faced with tough decisions, such as whether to schedule a planned hysterectomy or transfer care to a tertiary care institution, as the frequency of placenta accreta rises in tandem with an increased incidence of cesarean birth. This is not a decision that is made lightly because of the potential consequences for perioperative morbidity and future fertility.[2]

Considering sensitivities ranging from 77-97%, ultrasonography is typically thought to have good accuracy in predicting placenta accreta. However, due to the use of a single expert observer, suspicion of accreta, and awareness of risk factors, previous research on the precision of ultrasonography in predicting accreta may have been biased.[3]

Placenta accrete is associated with several sonographic abnormalities, including decreased myometrial thickness, premature placenta, placental lacunae, incorrect color Doppler pattern, loss of the retroplacental clear zone, and placenta percreta irregularities in the urinary bladder (UB) wall.4

This study aims to assess the use of creatine kinase and Doppler ultrasound as indicators in the diagnosis of placenta accreta.

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* Corresponding author at: Obstetrics and Gynecology, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt.
E-mail address: elmadawym128@gmail.com (M. H. G. El Maadawy).

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2. Patients and methods

In this prospective observational study, 100 patients will be randomly chosen from the obstetrics and gynecology outpatient clinic at Al-Azhar University El-Hussein Hospitals. Samples were gathered using a systematic random procedure between January 11, 2022, and September 30, 2023. The local ethics committee approves the study protocol, and informed consent forms are collected in writing.

Inclusion criteria: Age range of 20-35 years, BMI of less than 30, and pregnancy with a history of hysterotomy or cesarean section claims placenta Previa has an easier time covering the scar from previous cesarean sections. It can be used for singleton pregnancies and gestations lasting from 28 weeks to full term.

Exclusion criteria: Age above 35 years, obese women (BMI more than 30), embolism, thrombosis, D. V. T, cardiac diseases, metabolic disorders, and endocrine diseases.

Sample size:

This research is based on work done by Cahill et al.,5 The following presumptions were considered when calculating the sample size using Epi Info STATCALC: - A two-sided confidence level of 95% with 80% power. The computed odds ratio, with a 5% error, is 1.115. 86 was the final maximum sample size that could be obtained from the Epi-Info output. In order to account for potential incidences of dropout during follow-up, the sample size was raised to 100 individuals.

Methods: Every patient will experience: Every patient will be asked for their informed consent once a thorough history is gathered. Vital signs (blood pressure, temperature, heart rate, respiratory rate), signs of pallor, cyanosis, jaundice, and lymph node enlargement, all of which are part of a comprehensive physical examination, as well as any complaints, obstetric history, menstrual history, past medical and surgical history, and family history.

Lab investigations include a complete Blood Picture (CBC), Rhesus element (RH), blood group, blood sugar, serum CK assessment, urine for protein, bacteriuria, kidney work tests, and liver capacities tests.

Ultrasonography: It is possible that the whole placenta was previously precisely imaged using 2D grayscale ultrasonography Model GE Voluson E6. Transabdominal sonography in grayscale B-mode may have been used to screen placenta tissue precisely. Most suspect districts' colored Doppler ultrasonography filters were used. ELISA quantitative CK test, agent information: Toweling, sterilizing, and catheterization Tolerable equality is necessary for the C-shaped entry point of the uterus, the longitudinal entry point, and the abdominal entry point. Preoperative assessment is more significant. Embryo's conveyance toward breech extraction or scooping. Waiting 15 minutes for the placenta to split spontaneously on the easily distinguished rapid end of the uterus for two layers. If not separated, perhaps preservationist care or a cesarean hysterectomy.

When the placenta is challenging to remove from the uterus and causes significant bleeding even with slight placental separation, the intraoperative diagnosis of PA will be made. Pathologists will send a sample for analysis. For PA to be diagnosed, there must be no decidua at the placental attachment site and significant myometrial invasion by the chorionic villi.

Figure 1. Shows the ultrasonography machine Model GE Voluson E6.

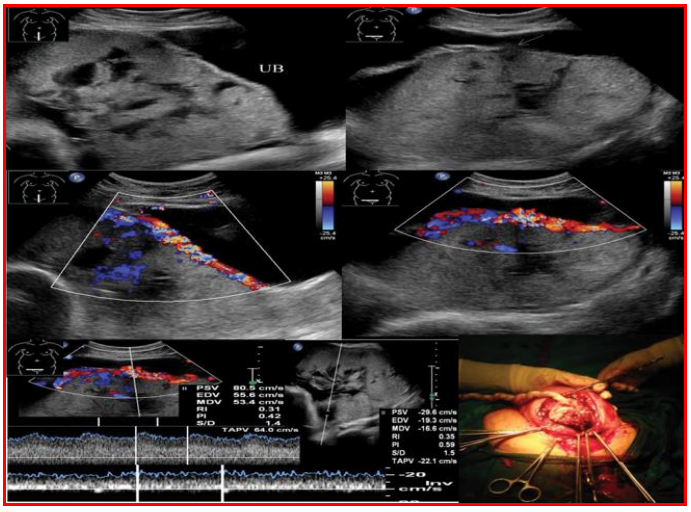

Figure 2. A patient with a history of two cesarean sections (CS) who was 28 years old appeared with antepartum hemorrhage (APH). The patient's transabdominal imaging reveals a central placenta previa. Grade 3 heterogeneous placenta characterized by scattered nonechogenic walls throughout the parenchyma and numerous big irregularly shaped lacunae. There is a loss of space, thin myometrium, and an arrow pointing to a break in the echogenic bladder line, all of which point to placental invasion into the UB and, by

extension, placenta percreta. Increased periuterine vascularity indicating low-resistance arterial flow is shown by color and spectral Doppler imaging. Angiomas reveal venous blood flow at a high velocity. The intraoperative picture reveals a thickly adherent placental tissue layer over a very thin and vascular Lower Uterine Segment (LUS). An acronym for "antepartum hemorrhage," "CS" stands for "cesarean section," and "UB" is for "urinary bladder.".

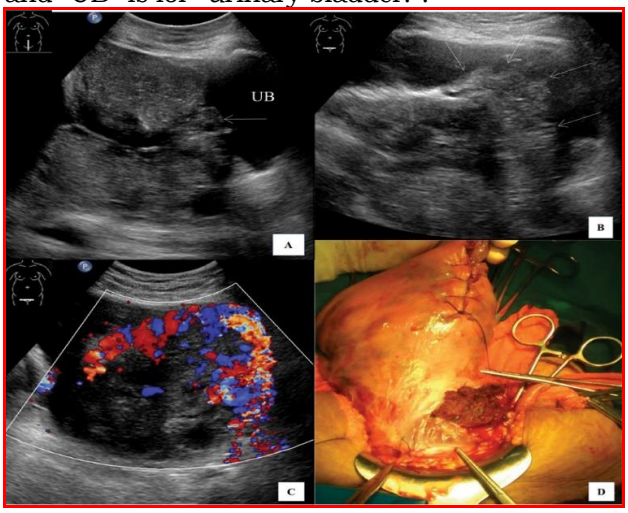

Figure 3. A 29-year-old woman who had two prior cesarean sections displayed signs of acute placental hemorrhage. (A) The trans abdominal sonography (TAS) image clearly shows an exophytic mass that is echogenic and has invaded the uterine base (UB) (arrow). The myometrium, uterine serosa, and bladder wall are not visible in this image. (B) The exact location of the invasion on the left side of the midline can be seen in the axial image at the same level. (C) The uterovesical interface displays significant hypervascularity in the color Doppler image of B. (D) This image was taken during the operation and shows the placenta as an exophytic mass that is sticking out from the front of the lower uterine segment and into the serosa. The acronyms "CS," "TAS," and "UB" stand for "urinary bladder" and "cesarean section," respectively.

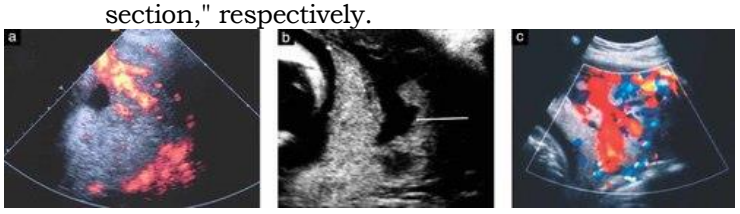

Figure 4. Placenta accreta sinuses. (A) Color Doppler picture of a sinus with a tornado form. (b) Grayscale picture of sinus formed like a tornado (arrow). (c) Color Doppler picture displaying many sinuses on the placenta accreta.

Analytical statistics: The noteworthiness advantage shifts at the 5% level (p-value). Those outcomes might have been considered. Significant if there is a 5% ($p<0.05$) likelihood of lapse. non-significant ($p>0.05$) if there is a greater than 5% chance of slipping. The moment at which the possibilities of a slide will be fewer than 0.1% ($p<0.001$) is quite significant.

3. Results

Table 1: Descriptive data of the studied population.

	Trans-septal suturing (N=30)
Age, years	
Mean±SD	29.91±3.05
Range	22-34
GA at assessment, weeks	
Mean±SD	35.31±2.68
Range	28-38
Placenta accreta	
Yes	60 (60%)
No	40 (40%)

Age ranged between 22-34 years with mean value of 29.91±3.05 years and their GA at assessment ranged between 28-39weeks with mean value of 35.31±2.68 weeks. Among our studied population 60 0f them (60%) have placenta accrete.

Table 2. Comparison of clinical data among the studied groups.

	Placenta accreta (N=60)		No placenta accreta (N=40)		Test of sig.	
	Mean	SD	Mean	SD	z/t	P value
Age, years	30.58	2.72	28.90	3.27	2.692	0.009
GA at assessment, weeks	35.75	2.48	34.65	2.87	1.981	0.051
BMI	30.92	2.24	31.95	2.85	-1.931	0.057
GA at delivery, weeks	36.67	1.67	36.35	2.47	0.710	0.480

SD: standard deviation z: Mann Whitney U test t: independent student t test

P-value>0.0: Non significant; P-value<0.0: Significant; P-value<0.00: Highly significant

Compared to women without placenta accreta, individuals with placenta accreta tend to be older. When comparing the two groups' BMI, GA at delivery, and GA at assessment, there was no discernible difference.

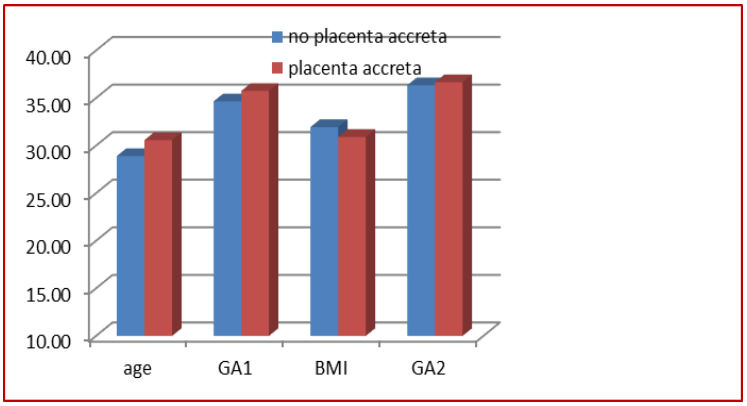

Figure 5. Clinical data among the studied groups.

Table 3. Comparison of parity among the studied groups.

	Placenta accreta (N=60)		No placenta accreta (N=40)		Test of sig.	
					X2	P value
Parity	N	%	N	%		
1	6	10.00%	10	25.00%	6.637	0.156
2	8	13.30%	8	20.00%		
3	19	31.70%	11	27.50%		
4	16	26.70%	8	20.00%		
5	11	18.30%	3	7.50%		

SD: standard deviation x2: chi square test P-value>0.05: Non significant;

P-value<0.05: Significant; P-value<0.001: Highly significant

No statistically significant difference between females with placenta accreta and those who did not develop placenta accreta regarding the parity (P>0.05).

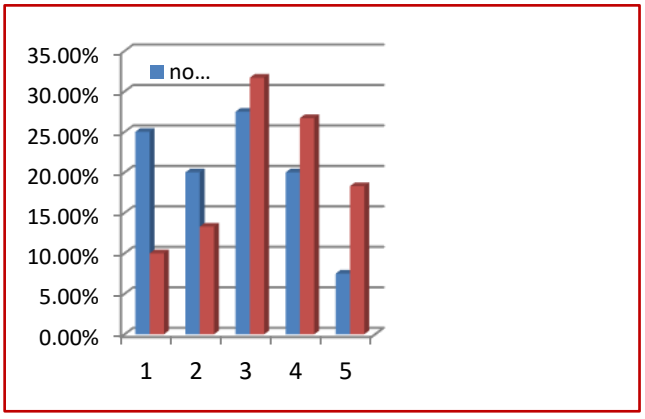

Figure 6. Parity among the studied groups.

Table 4. Comparison of obstetric data among the studied groups.

	Placenta accreta (N=60)		No placenta accreta (N=40)		Test of sig.	
					X2	P value
Previous abortion	N	%	N	%		
Yes	26	43.3%	12	30%	1.811	0.178
No	34	56.7%	28	70%		
Number of abortion	N	%	N	%		
1	11	42.3%	8	66.7%	3.341	0.188
2	10	38.5%	4	33.3%		
3	5	19.2%	0	0%		
Previous CS	N	%	N	%		
Yes	48	80%	15	37.5%	18.597	0.00001
No	12	20%	25	62.5%		
Number of CS	N	%	N	%		
1	17	35.4%	7	46.7%	0.750	0.687
2	17	35.4%	5	33.3%		
3	14	29.2%	3	20%		

SD: standard deviation x2: chi square test P-value>0.05: Non significant;

P-value<0.05: Significant; P-value<0.001: Highly significant

Statistically significant higher rate of previous CS (80% vs 37.5%) in females with placenta accreta than those who did not develop placenta accreta.

however no statistically significant difference between females with placenta accreta and those who did not develop placenta accreta regarding the previous abortion, the number of abortion and the number of previous CS (P>0.05).

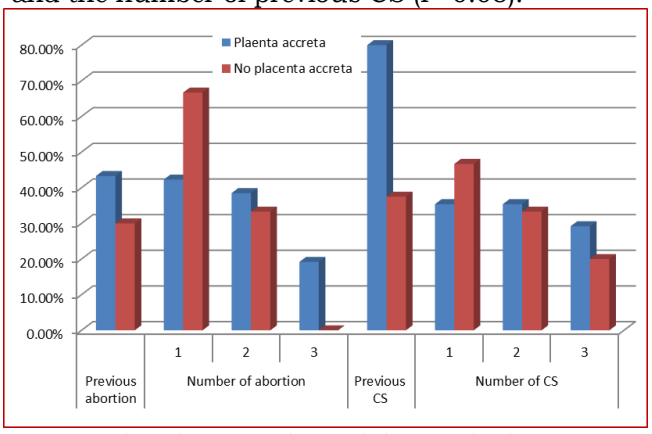

Figure 7. Obstetric data of the studied groups.

Table 5. Comparison of Placental invasion by 2D grayscale US with color Doppler among the studied groups.

	Placenta accreta (N=60)		No placenta accreta (N=40)		Test of sig.	
					X2	P value
Placental invasion by 2D grayscale US	N	%	N	%		
Yes	56	93.3%	6	15%	62.507	<0.0001
No	4	6.7%	34	85%		

SD: standard deviation x2: chi square test P-value > 0.05: Non significant;

P-value<0.05: Significant; P-value<0.001: Highly significant

Placental invasion was found to be statistically significant in females with placenta accreta compared to those whose did not develop placenta accreta, as determined by 2D grayscale ultrasound with color Doppler (P<0.05).

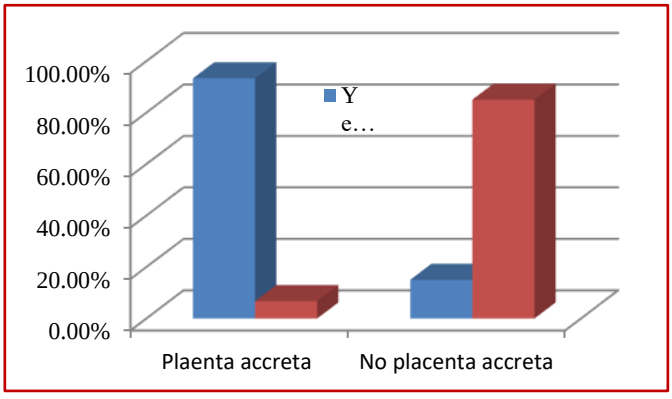

Figure 8. Placental invasion by 2D grayscale US with color Doppler among the studied groups.

Table 6. Comparison of CK level among the studied groups.

	Placenta accreta (N=60)		No placenta accreta (N=40)		Test of sig.	
					z/X2	P value
CK level U/L						
Mean±SD	38.88±25.74		85.28±48.69		-	<0.0001
Range	30-187		22-180		6.197	
Elevated CK>160 U/L	N	%	N	%		
Yes	11	18.3%	1	2.5%	5.698	0.017
No	49	81.7%	39	97.5%		

SD: standard deviation x2: chi square test z: Mann Whitney U test

P-value>0.05: Non significant; P-value<0.05: Significant; P-value<0.001: Highly significant

statistically significant elevated quantitative CK measurements and higher number of elevated CK in females with placenta accreta than those who did not develop placenta accreta (P<0.05). (P<0.05).

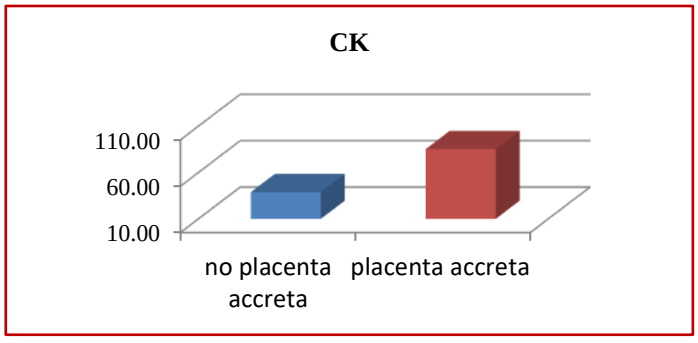

Figure 9. CK level among the studied groups.

Table 7. Comparison of complication rate among the studied groups.

	Placenta accreta (N=60)		No placenta accreta (N=40)		Test of sig.	
					X2	P value
Need for bl. transfusion	N	%	N	%		
Yes	12	20%	0	0%	9.091	0.003
No	48	80%	40	100%		
UB injury	N	%	N	%		
Yes	3	5%	0	0%	2.062	0.151
No	57	95%	40	100%		
Ligation of UA or IIA	N	%	N	%		
Yes	10	16.7%	0	0%	7.407	0.006
No	50	83.3%	40	100%		
Hysterectomy	N	%	N	%		
Yes	46	76.7%	0	0%	56.790	<0.0001
No	14	23.3%	40	100%		

SD: standard deviation x2: chi square test P-value>0.05: Non significant;

P-value<0.05: Significant; P-value<0.001: Highly significant

Inpatients with placenta accreta, 76.7% need hysterectomy, 20% need blood transfusion, 16.7% need ligation of UA or IIA and 5% develop UB injury.

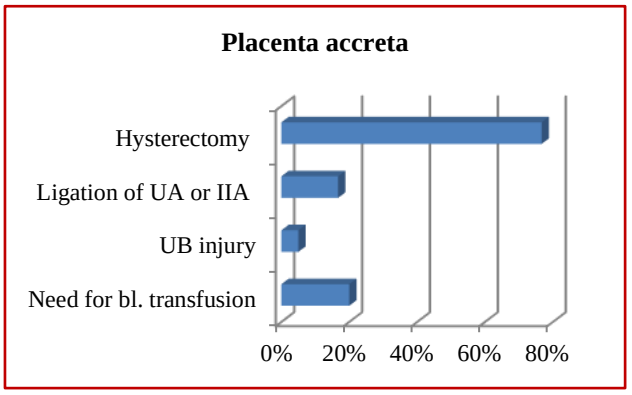

Figure 10. complication rate among the studied groups.

	Plaenta accreta (N=60)		No placenta accreta (N=40)		Test of sig.	
					z/t	P value
	Mean	SD	Mean	SD		
Delivery gestational age, weeks	36.67	1.67	36.35	2.47	0.710	0.480
Birthweight, grams						
<2500	25 (41.6%)		7 (17.5%)		6.7	0.03
2500-3999	33 (55%)		30 (75%)			
>4000	2 (3.33%)		3 (7.5%)			
1 min APGAR score	13 (21.67%)		7 (17.5%)		0.26	0.6
5 min APGAR score	3 (5%)		1 (2.5%)		0.39	0.53
Perinatal mortality	6 (10%)		0 (0%)		4.25	0.03

SD: standard deviation z: Mann Whitney U test t: independent student t test P-value>0.05: Non significant; P-value<0.05: Significant; P-value<0.001: Highly significant

Table 8. Comparison of Neonatal outcomes among the studied groups.

There was no significant difference between both groups as regard Delivery gestational age (weeks), 1 min APGAR score and 5 min APGAR score and There was significant difference as regard Birthweight, grams and Perinatal mortality.

4. Discussion

Like Fayed et al.[6] the objective was to compare creatine kinase as a biological marker with ultrasonography and Doppler data for the prenatal diagnosis of morbid placentation in the anterior placenta on the scar of a previous cesarean section. Their study involved 50 women, in whom the 2D ultrasound examination revealed evidence of significant placenta previa in each case. Significant differences were seen between the investigated groups regarding age and parity.

Also, our results disagree with Cai et al.[7] Their investigation encompassed 60 cases. Thirty pregnant women were diagnosed with placenta

abnormalities (PA), and thirty had normal placentas. A significant difference was seen among the studied groups regarding age and parity. There was no statistically significant difference in BMI between these groups.

We found that there was a statistically significant higher rate of previous CS (80% vs 37.5%) in females with placenta accreta than those who did not develop placenta accreta; however, no statistically.

Fayed et al.[6] supports our results. The individual who provided the report commented that there had been a notable difference among the groups under study regarding prior cesarean sections.

The findings of our study revealed that there was no statistically significant differentiation between females who experienced placenta accreta and those who did not, regarding their history of abortion, the number of abortions, and the number of prior cesarean sections (P>0.05).

The results we obtained corroborated Fayed et al.[6] who reported that there was a significance between the studied groups regarding previous abortion.

The results of our study demonstrated a statistically significant occurrence of placental invasion in females with placenta accreta, as detected by 2D grayscale ultrasound with color Doppler, compared to those who did not develop placenta accreta (P<0.05).

The results we obtained corroborated Fayed et al.[6] who reported a statistically significant difference between the study groups in terms of 2D grayscale ultrasound with color Doppler.

Our current study showed statistically significant elevated quantitative CK measurements and a higher number of elevated CK in females with placenta accreta than in those who did not develop placenta accreta (P<0.05).

Our findings showed that in patients with placenta accreta, 76.7% need a hysterectomy, 20% need a blood transfusion, 16.7% need UA or IIA ligation, and 5% develop UB injury.

Fayed et al.[6] Who made the report? A crucial connection exists between identifying 2D-GS ultrasonography findings and the challenging condition of placental separation during childbirth. This connection necessitates the inclusion of intraoperative measures and justifies the need for a cesarean hysterectomy. The bladder damage has an accuracy of 80%, sensitivity of 90%, specificity of 60%, positive predictive value (PPV) of 80%, and negative predictive value (NPV) of 70%. This means that a 2 d GS may result in many undiagnosed patients despite the high level of confidence regarding identifying legitimate negative examples.

Saad et al.[8] According to their report, 65% of patients did not require any intervention or manipulation. 15% of the cases necessitated a cesarean hysterectomy. The incidence of bladder injury was approximately 8.3%. Chilling verification, the post-partum discharge rate was approximately 5%. The data suggests a significantly greater blood transfusion rate in the studied group, with a p-value of less than 0.001. It was shown that the hemoglobin level was significantly lower in the accreta group compared to the control group (p-value < 0.001).

Our results indicate that at a cutoff point of 72U/L, the CK level has a sensitivity of 55% and a specificity of 91.5% in predicting placenta accreta in females with placenta previa.

Fayed et al.[6] Who provided the report on examining creatine kinase? Just like an absolute marker in the past, CK identified 10 out of 31 individuals with placenta accreta and 18 out of 19 patients without placental invasion, resulting in false negative cases in patients with a scar from a previous placenta. For a person aged 21, the question test has a precision of 60% for detecting actual cases, a sensitivity of 30%, a specificity of 95%, a positive predictive value (PPV) of 90%, and a negative predictive value (NPV) of 45%. However, the area under the curve (AUC) is only 0.65, indicating that the test may be unreliable. To improve accuracy, we selected the best cutoff value under the receiver operating characteristic (ROC) curve, which is 60. With this cutoff, the test has a sensitivity of 52.5%, a specificity of 81%, and a PPV of 82.5%. Similarly, the NPV is halved.

Cai et al.[7] The individual who concluded that utilizing CK using 3D ultrasound flowing imaging examination might enhance the diagnostic effectiveness of prenatal diagnosis of PA, aid in determining the type of PA, and offer significant guidance to clinical diagnosis and therapy. The combination detection of serum and ultrasound markers is advised since it can offer a more comprehensive and dependable reference for predicting the PA rate in clinical settings.

4. Conclusion

The CK test alone is not dependable. It would be beneficial to conduct an ultrasonography examination, as it yields more accurate results. However, the combination of both tests would provide the best outcome. Nevertheless, we are actively seeking the optimal solution. However, the current mixture is not a perfect gas test, so additional biochemical markers are worth considering. Alternatively, alternative radiological modalities should be evaluated in order to achieve more precise detection of cases with MAP to reduce maternal morbidity. In addition, death rates are also reduced by eliminating the fears associated with obtaining preoperative consent for

hysterectomy in patients who have not experienced a placental attack and do not have a high risk for such an event. The current study suggests that 2D grayscale ultrasound has a high screening proficiency for predicting adverse outcomes related to poor placental attachment, specifically difficult placental delivery, significant intraoperative blood loss, the need for cesarean hysterectomy, and bladder injury in women with placenta previa and a history of previous cesarean section. This is due to its high sensitivity, negative predictive value, and low false negative rates. Additionally, these symptoms are very indicative and can be used to make accurate predictions..

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article

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Conflicts of interest

There are no conflicts of interest.

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