ORIGINAL ARTICLE

Diagnostic Accuracy of Ultrasound in Morbidly Adherent Placenta Keeping Histopathology as Gold Standard

ABID HUSSAIN JAMALI[1], ANAM SHERWANI[2], ALTAF SHEIKH[3], KASHMALA FARHAT[4], SAMREEN TARIQ[5], IQRA MUSTAFA[6]
[1]Senior Registrar, Diagnostic Radiology Department, Indus Medical College Tando Muhammad Khan
[2]Radiologist at Liaquat University Hospital Hyderabad
[3]Postgraduate Trainee at Diagnostic Radiology Department, Liaquat University Hospital Hyderabad
[4,5]Radiology department, Liaquat University Hospital Hyderabad
[6]postgraduate trainee at Diagnostic Radiology Department, Liaquat University Hospital Hyderabad
Corresponding author: Abid Hussain Jamali, Email: hussainabid727@gmail.com

ABSTRACT

Introduction: Morbidly adherent placenta has three varieties, each with varying degrees of invasion according to histopathology. The placenta accreta, increta, and percreta are a few of these. Clinical manifestations can include haemorrhage that is potentially fatal. Therefore, it's critical to make an early and rapid diagnosis of this ailment.

Objective: To determine the diagnostic accuracy of ultrasound in morbidly adherent placenta keeping histopathology as the gold standard.

Study design: Cross-sectional study

Place and Duration: Department of Radiology, Liaquat University of Medical and Health Sciences, Jamshoro from 28th August 2021 till 1st March 2022.

Methodology: Women over 35 who were pregnant and had a history of caesarean sections, placenta previa, or multiple pregnancies were included. A 2 x 2 table was used to compute the sensitivity, specificity, positive predictive value (PPV), negative predictive values (NPV), and accuracy. Stratification was used to manage effect modifiers. Diagnostic accuracy after stratification was calculated.

Results: The patients were 37.38± 1.19 years old on average. The patients' mean gestational age was 37.94± 1.07 years. A total of 72 (41.60%) people had previously undergone a C-section, whereas 101 (58.40%) did not. In terms of diagnosing a morbidly adherent placenta, ultrasound had a sensitivity, specificity, PPV, NPV and diagnostic accuracy of 82.09%, 76.92%, 92.44%, 55.56%, and 80.92%, respectively, when using histology as the gold standard.

Conclusion: The diagnosis of a morbidly adherent placenta can be made with good diagnostic sensitivity, specificity, and accuracy using ultrasound.

Keywords: Ultrasound; Histopathology; Sensitivity, Morbidly Adherent Placenta

INTRODUCTION

The morbidly adherent placenta has three varieties, each with varying degrees of invasion according to histopathology. These include placenta accreta, in which chorionic villi are restricted to the myometrium without invasion, placenta increta, in which the placenta is invading the myometrium, and placenta percreta, which is the most severe and dangerous form and involves the placenta penetrating and invading the myometrium up to the serosa.[1]

Placenta accreta is the most common cause of morbidity and mortality in pregnant women because it results from the invasion of chorionic villi into the myometrium caused by a decidua basalis deficiency. Heavy peripartum haemorrhage can cause a mother to have renal failure, respiratory distress, and even death, necessitating an urgent hysterectomy. The consequences of a hysterectomy include those connected to anesthesia, pulmonary embolism, damage to the bladder and ureter, and urinary tract infections. [2-4]

The third most frequent cause of hysterectomy, after uterine rupture and atony, is placenta accrete. [5] The decidua basalis is harmed by previous Caesarean deliveries, uterine instrumentation, smoking, maternal age over 35, placenta previa, and recurrent miscarriages, which are all risk factors for placenta accreta. [6-8]

Clinically, placental invasion can appear as a life-threatening haemorrhage, necessitating emergency hysterectomy, intravascular coagulation, blood transfusion, and hypotensive shock. [9] Massive postpartum haemorrhage is currently one of the top causes of maternal mortality. [10]

The effectiveness of ultrasonography in identifying morbidly adherent placentas has been the subject of numerous investigations worldwide. In a study on prenatal sonography for placental invasion, S. PILS et al. found that ultrasound had 91.4% ultrasound sensitivity, 95.9% ultrasound specificity, 80% ultrasound positive predictive value, and 98.4% ultrasound negative predictive value. [11] In another investigation, J.P. Lerner et al. found that ultrasonography had 100% sensitivity and 94% specificity. Predictive values for the favourable and negative outcomes were 83% and 100%, respectively.

The morbidity and mortality caused by a morbidly adherent placenta warrant special attention since they are serious health issues. This study aims to demonstrate that ultrasound is the best diagnostic modality to accomplish this goal. Early and precise diagnosis is crucial to a better prognosis, just like it is in the majority of disorders. To reduce the risk of postpartum haemorrhage and the death of pregnant women, ultrasound may, if demonstrated, assist in obtaining an accurate diagnosis early on and facilitating the best therapy, including the availability of blood supplies, the site of delivery, skilled anesthesia, and surgical team can be established in advance.

METHODOLOGY

This Cross-sectional study was conducted at the Radiology Department of Liaquat University of Medical and Health Sciences (LUMHS) Jamshoro from 28th August 2021 to 1st March 2022. Non-probability consecutive sampling was done.

The sample size is 242. Calculated via Lin Naing sample size calculator, keeping sensitivity (95%) and specificity (90%) values, and prevalence of the condition at 10% [12] and margin of error as 4%.

The following patients took part in this investigation: Placenta previa, a prior C-section, a mother who is older than 35, a history of uterine surgery (dilatation and curettage, myomectomy), and multiparity are all risk factors. Women who were primigravida had concomitant illnesses and had concurrent uterine and placental abnormalities were excluded from the study.

After obtaining written informed consent, the study team approached the eligible patients (as per the inclusion and exclusion criteria) presenting to the radiography department. To detect a morbidly adherent placenta, a consultant radiologist with five years of expertise in the radiology department performed ultrasounds on each patient. Similarly to that, a histopathologist (consultant) with at least five years of expertise performed the histological analysis.

SPSS 21.0 and Microsoft Excel 2016 were used to analyse the data. Number and percentage (No & %) were used to describe

qualitative data (history of prior C-section, bleeding problems, and placenta previa, together with diagnosis). Age and gestational age quantitative data were represented as mean and standard deviation (X ±SD). A 2 by 2 table with the computed accuracy, sensitivity, specificity, positive predictive value, and negative predictive value was created. Age-related effect modifiers were managed by stratification. Diagnostic accuracy after stratification was calculated.

RESULTS

The mean age of the patients was 37.34 ± 1.18 years. There were 189 (78.10%) patients with ≤38 years of age and 53 (21.90%) with >38 years of age. A total of 110 (45.50%) had a previous history of C-sections whereas 132 (54.50%) had no previous C-sections. A total of 41 (16.90%) had bleeding disorder whereas 201 (83.10%) had no history of bleeding disorder. The mean gestational age of the patients was 37.97 ± 1.06 years. A total of 127 (52.50%) had placenta previa whereas 115 (47.50%) had no placenta previa. Morbidly adherent placenta on ultrasound was found in 164 (67.8%) whereas on histopathology it was found in 186 (76.9%) patients. (As shown in Table 1)

Table 1: Participants in the study's demographic information (n=242)

The mean age of the patients	37.34±1.18
The mean gestational age	37.97±1.06
Age	
≤38	79.77%
>38	20.23%
Previous C-sections	
Yes	41.62%
No	58.38%
Bleeding Disorder	
Yes	15.03%
No	84.97%
Placenta Previa	
Yes	50.29%
No	49.71%
Morbidly adherent placenta on ultrasound	
Yes	68.79%
No	31.21%
Morbidly adherent placenta on histopathology	
Yes	77.46%
No	22.54%

Table 2: Ultrasound diagnostic efficacy using histology as the gold standard (n=242)

Ultrasound	Histopathology		
	+ve	-ve	Total
+ve	151	13	164
-ve	35	43	78
Total	186	56	242

Sen: 81.18%
Spe: 76.79%
PPV: 92.07%
NPV: 55.13%
Diagnostic accuracy: 80.17%

Table 3: Age ≤38 years and ultrasound diagnostic effectiveness using histology as the gold standard (n=196)

Ultrasound	Histopathology		
	+ve	-ve	Total
+ve	127	11	138
-ve	26	32	58
Total	153	43	196

Sen: 83.01%
Spe: 74.42%
PPV: 92.03%
NPV: 55.17%
Diagnostic accuracy: 81.12%

Diagnostic accuracy of ultrasound in diagnosing morbidly adherent placenta showed sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and diagnostic accuracy as 81.18%, 76.79%, 92.07%, 55.13% and

80.17% respectively taking histopathology as a gold standard. (As shown in Table 2). Stratification was done on the basis of age, placenta previa and previous history of C-section and results are shown in tables 3-8

Table 4: Age greater than 38 years and ultrasound diagnosis accuracy using histopathology as the gold standard (n=46)

Ultrasound	Histopathology		
	+ve	-ve	Total
+ve	24	2	26
-ve	9	11	20
Total	33	13	46

Sen: 72.73%
Spe: 84.62%
PPV: 92.31%
NPV: 55.00%
Diagnostic accuracy: 76.09%

Table 5: Positive prior C-section history and reliable ultrasound diagnostics using histopathology as the gold standard (n=110)

Ultrasound	Histopathology		
	+ve	-ve	Total
+ve	75	7	82
-ve	15	13	28
Total	90	20	110

Sen: 83.33%
Spe: 65.00%
PPV: 91.46%
NPV: 46.43%
Diagnostic accuracy: 80.00%

Table 6: Considering Histopathology as the gold standard in the absence of a prior history of C-section and the diagnostic validity of ultrasound (n=132)

Ultrasound	Histopathology		
	+ve	-ve	Total
+ve	76	6	82
-ve	20	30	50
Total	96	36	132

Sen: 79.17%
Spe: 83.33%
PPV: 92.68%
NPV: 60.00%
Diagnostic accuracy: 80.30%

Table 7: Present placenta previa and ultrasound diagnosis effectiveness using histopathology as the gold standard (n=127)

Ultrasound	Histopathology		
	+ve	-ve	Total
+ve	86	9	95
-ve	8	24	32
Total	94	33	127

Sen: 91.49%
Spe: 72.73%
PPV: 90.53%
NPV: 75.00%
Diagnostic accuracy: 86.61%

Table 8: Lack of placenta previa and ultrasound's diagnostic efficacy using Histopathology as the gold standard (n=115)

Ultrasound	Histopathology		
	+ve	-ve	Total
+ve	65	4	69
-ve	27	19	46
Total	92	23	115

Sen: 70.65%
Spe: 82.61%
PPV: 94.20%
NPV: 41.30%
Diagnostic accuracy: 73.04%

DISCUSSION

The diagnosis of a morbidly adherent placenta (MAP), a serious medical disease that can cause both maternal morbidity and mortality, is crucial. In this condition, a life-threatening haemorrhage may ensue. [13-16] Our study results showed a high sensitivity, specificity and diagnostic accuracy of ultrasound in

diagnosing MAP. Our study results showed sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and diagnostic accuracy of ultrasonography in diagnosing MAP as 82.09%, 76.92%, 92.44%, 55.56% and 80.92% respectively taking histopathology as a gold standard.

In India, prospective regional research was carried out. In total, 50 patients with placenta previa who had undergone at least one prior caesarean section and had a gestational age of less than 24 weeks were included in the study. In that investigation, ultrasonography had a 90% diagnosis accuracy. The findings for sensitivity, specificity, positive and negative predictive values, respectively, were 94.7, 87.1, 81.8, and 96.4%. The study came to the conclusion that ultrasound was a crucial tool for evaluating pregnant individuals. It is a crucial tool for detecting PAS, making the surgical team more cautious and prepared for challenging procedures and crucial postoperative care. [17]

Additionally, MAP can be detected early on with ultrasound. As part of standard prenatal care, prospective research was conducted on women who were receiving an ultrasound between 11 and 13 weeks of pregnancy. A specialized MAP clinic monitored women with low-lying placentas and a history of uterine surgery between the ages of 12 and 34 weeks of pregnancy.

Each time a patient went to the MAP clinic, an ultrasound scan was done, and the following characteristics that might point to MAP were noted. At the MAP clinic between 12 and 16 weeks, MAP was suspected in 14 cases, and this was verified in 13 cases after delivery. There were no MAP cases in the remaining members of the population. At 12–16 weeks of gestation, ultrasonography examination can accurately predict the presence of MAP. [18-20]

In Egypt, a cross-sectional study involving 100 patients with placenta previa (PP) anterior and at least one prior C-section was carried out. All participants had ultrasound and colour Doppler procedures. The study's findings revealed a substantial difference in maternal age (32.6± 5.01 vs. 29.14± 4.89) between the accreta and non-accreta groups, as well as a very significant difference in postoperative haemoglobin (6.71± 1.156 vs. 8.41± 1.257) and the number of prior C sections (p .001).46s and were associated with the results of surgery. [21]

The sensitivity, specificity, PPV, NPV, and accuracy of loss of retro placental clear were 87.3%, 89.19%, 93.2%, 80.49%, and 88%; intraplacental lacunae were 93.65%, 62.16%, 80.82%, 85.19%, and 82%; hyper vascularity in uterine bladder interface were 47.62%, 94.59%, 93.75%, 51.47%, and 65%; dilated vessels over peripheral sub placental zone were 82.54%, 81.08%, 88.14%, 73.17%, and 82%, respectively.

Regarding surgical care with caesarean hysterectomy, the occurrence of bladder injury, the requirement for intraoperative and postoperative blood transfusions, and ICU admission, there was a highly significant difference between the two groups (p.001). Prior to obstetric intervention, the use of ultrasonography and colour Doppler can help with improved prediction of placental invasion of the myometrium, improving the prognosis for both the mother and the fetus. [22-23] In a different investigation, a thorough diagnostic score was developed utilizing the clinical history, US, and magnetic resonance imaging (MRI). [24]

Between 2009 and 2016, pregnant women who underwent transvaginal US and MRI with a suspicion of having a morbidly adherent placenta were included in a retrospective cohort analysis. Previa, hyper vascularity, loss of retro placental clear space, and lacunae were used to score the US. Intraparenchymal vasculature, abnormally dilated vessels, fibrin deposits, placental bulge, and irregularities in the bladder dome were all assessed by MRI. For a given score, the likelihood of a morbidly adherent placenta was calculated using Bayesian analysis. The parameters for diagnostic tests were computed. [24]

Overall 16 of the 41 women with the histologically determined illness were confirmed to have it. The score enhanced the likelihood of a morbidly adherent placenta. At the top US score, the likelihood of illness was 63.7%.

The probability of adherent placentation was 90.5% with the highest MRI score. The sensitivity and specificity of combining the US and MRI results were 56% and 92%, respectively. [49] Patients who are at risk for morbidity due to a morbidly adherent placenta may be correctly identified utilizing a combination score system that combines MRI and US. [25-26]

Our study's drawback was that it was conducted at just one institution. The advantage of this study is its greater sample size. To learn more about morbidly adherent placenta in our population, multicenter research on this subject is advised to be conducted.

CONCLUSION
Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and diagnostic accuracy of ultrasound in diagnosing morbidly adherent placenta are 82.09%, 76.92%, 92.44%, 55.56% and 80.92% respectively taking histopathology as a gold standard

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