

Validity of Ultrasound in diagnosis of Abnormal Placental Adherence at Third Trimester of Pregnancy

Case Report

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Abstract

Objective: To assess the value of ultrasound in diagnosis of abnormal adherent placenta in third trimester of pregnancy, which causes a life threatening maternal hemorrhage.

Methods: A retrospective cohort observational study of (68) patients in Ob/Gyn Department within five years, from the first of January 2009 to the last of December 2014 during their cesarean section found to be placenta accreta, increta, and percreta at 28 weeks and above, and to compare the finding with their finding of ultrasound antenatally, and the histopathology after surgery.

Results: The surgery findings revealed that 49(72.1%) of the women had adherent placenta, 58(85.3%) had abnormal placentation by ultrasound, whereas only 10(14.7%) normal. 36(52.9%) confirmed by histopathology exam (15 accreta, 15 accreta increta, and 6 accreta percreta). The ultrasound findings revealed an area under the curve (AUC) of 53.8%, sensitivity of 88.9%, and specificity of only 18.8% while gave unsatisfactory agreement (55.9%) with histopathology exam, ultrasound failed to detect normal findings in 26 cases.

Conclusion: The ultrasound examination is available, cheap, and easy to use, but it is not specifically reliable in diagnosis of abnormal adherent placenta in third trimester of pregnancy.

Keywords: Placenta Accrete; Increta; Percreta.

Introduction

Placenta accreta refers to an abnormality of placental implantation in which the anchoring placental villi attach to myometrium rather than decidua, resulting in a morbidly adherent placenta and massive hemorrhage. Placenta increta (chorionic villi penetrate into the myometrium) and placenta percreta (chorionic villi penetrate through the myometrium to the uterine serosa or adjacent organs). The pathogenesis is primarily attributed to defective decidualization of the implantation site [1-3]. The marked increase has been attributed due to increase the prevalence of cesarean delivery in recent years [4], or related to any previous uterine surgery, allows the placenta to attach directly to the myometrium [5, 6]. The frequency of placenta accreta increases with an increasing number of cesarean deliveries as follows [7, 8]: No previous cesarean birth 1- 5%, One cesarean birth 11- 25 %, Two previous cesarean births 35-47%, Three previous cesarean births 40%,

and Four or more previous cesarean births 50 - 67% [9]. Other risk factors include a history of uterine surgery: myomectomy, removal of intrauterine adhesions, cornual resection of ectopic pregnancy, curettage, and maternal age greater than 35 years [10, 11]. The most common diagnostic image used for evaluating the placental position is trans-abdominal, and trans-vaginal ultrasound [12-15]. In the second and third trimesters [16, 17]: A loss of placental homogeneity, suggestive of placenta accreta which is replaced by intraplacental sonolucent spaces, and loss or thinning of the normal hypoechoic area behind the placenta, and loss or disruption of the normally continuous white line representing the bladder wall-uterine serosa interface, bulging of the placenta into the posterior wall of the bladder [18].

In a 2014 review and meta-analysis of 18 studies totaling 1010 pregnancies at risk for placenta accreta, magnetic resonance imaging (MRI) had high diagnostic accuracy for detection of placenta

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accreta: sensitivity 94.4 percent (95% CI 86.0-97.9), specificity 84 percent (95% CI 76.0-89.8), positive likelihood ratio 5.91 (95% CI 3.73-9.39), and negative likelihood ratio 0.07 (95% CI 0.02-0.18) [19]. MRI can be more useful than ultrasound in two clinical scenarios: 1- Evaluation of a possible posterior placenta accreta because the bladder cannot be used to help clarify the placental-myometrium interface, and 2- Assessment of the depth of myometrium, and parametrium involvement, and bladder involvement [20, 21]. Our study will focus on the validity of ultrasound in diagnosis of adherent placenta in our department.

Methods

A retrospective cohort observational study of (68) patients in Ob/Gyn Department within five years, from the first of January

2009 to the last of December 2014 during their cesarean section found to be placenta accreta, increta, or percreta at 28 weeks and above, comparing the finding with their finding of ultrasound antenatally, and the histopathology after surgery.

Statistical Analysis

The data were analyzed using IBM SPSS software V22. The association between abnormal surgery findings, and women characteristics was assessed using the Chi-square/Fisher's Exact test for categorical variables. The test findings were categorized into normal and abnormal (moderate-to-severe). Reference to histopathology examinations, the accuracy measurements for ultrasound, and surgery findings were evaluated by area under the curve, sensitivity, specificity, positive predictive value, negative predictive

Table 1. Abnormal surgery findings and patients' characteristics.

Characteristics		Overall N=68		Abnormal 49(72.1%)		Normal 19(27.9%)		P
		n	%	n	%	n	%	
Gestational age	< 37	49	72.1	39	79.6	10	20.4	0.026*
	≥ 37	19	27.9	10	52.6	9	47.4	
Age	<35	26	38.2	19	73.1	7	26.9	0.883
	≥35	42	61.8	30	71.4	12	28.6	
No. Caesarean section	<3	27	39.7	22	81.5	5	18.5	0.16
	≥3	41	60.3	27	65.9	14	34.1	
Previous uterine surgery	Yes	25	36.8	17	68	8	32	0.57
	No	43	63.2	32	74.4	11	25.6	
Antenatal bleeding	Yes	36	52.9	29	80.6	7	19.4	0.098
	No	32	47.1	20	62.5	12	37.5	
Emergency Bleeding	Yes	31	45.6	26	83.9	5	16.1	0.047*
	No	37	54.4	23	62.2	14	37.8	
Elective	Yes	37	54.4	23	62.2	14	37.8	0.047*
	No	31	45.6	26	83.9	5	16.1	
Management of placenta	Yes	35	51.5	34	97.1	1	2.9	0.001*
	No	33	48.5	15	45.5	18	54.5	
Hysterectomy	Yes	29	42.6	28	96.6	1	3.4	0.001*
	No	39	57.4	21	53.8	18	46.2	
Bladder involvement	Yes	16	23.5	16	100	0	0	0.003*
	No	52	76.5	33	63.5	19	36.5	
In labor	Yes	30	44.1	25	83.3	5	16.7	0.066
	No	38	55.9	24	63.2	14	36.8	
PPH-BT	Yes	60	88.2	48	80	12	20	0.001*
	No	8	11.8	1	12.5	7	87.5	
ICU required	Yes	16	23.5	15	93.8	1	6.3	0.029*
	No	52	76.5	34	65.4	18	34.6	
uterine artery embolization	Yes	5	7.4	5	100	0	0	0.312
	No	63	92.6	44	69.8	19	30.2	
Internal iliac artery ligation	Yes	20	29.4	18	90	2	10	0.033*
	No	48	70.6	31	64.6	17	35.4	
Internal iliac artery ballooning	Yes	39	57.4	23	59	16	41	0.005*
	No	29	42.6	26	89.7	3	10.3	
Ultrasound findings	Abnormal	58	85.3	39	67.2	19	32.8	0.052
	Normal	10	14.7	10	100	0	0	
Histopathology findings	Abnormal	36	52.9	35	97.2	1	2.8	0.001*
	Normal	32	47.1	14	43.8	18	56.3	

* Chi-square test/ Fisher's exact test is significant at $\alpha=0.05$.

value, and agreement.

Results

A total of 68 women was our sample, the mean of age was 35.6 years (\pm SD 3.9), between 23 to 45 years fulfilled the study criteria. The mean gestational age was 34.8 weeks (\pm SD 2.6) with a range between 28 - 38 weeks. Of the sample, 61.8% were aged more than 35 years old, 72.1% had gestational age less than 37 weeks; 60.3% had three or more prior caesarean sections. Other characteristics are shown in Table 1.

The surgery findings revealed that 49(72.1%) of the women had abnormal placentation. Most women 58(85.3%) had confirmed ultrasound results, whereas only 10(14.7%) had normal ultrasound results. 36(52.9%) of the women were classified as having abnormal results by histopathology examinations. Of the 36 abnormal findings, histopathology examinations revealed 15 acreta, 15 acreta increta, and 6 acreta precreta.

Subgroup analyses were performed using Chi-square/Fisher's Exact test Table 1. Percentage of abnormal placentation in surgery finding was higher in women with gestational age less than 37 weeks than women with gestational age 37 weeks or more (79.6% vs 52.6%, $P=0.026$). Percentage of abnormal placentation in surgery finding significantly increased with bleeding emergency (83.9% vs 62.2%, $P=0.047$). Extra management required to remove the placenta with the group of abnormal placentation in surgery (97.1% vs 45.5%, $P=0.001$). Hysterectomy was required in the group of abnormal placentation (96.6% vs 53.8%, $P=0.001$). Internal iliac artery ballooning performed in 39 cases ($P= 0.005$), and internal iliac artery ligation in 20 cases ($P=0.033$), whereas

uterine artery embolization were performed in 5 cases only.

Bladder involvement in the group of abnormal placentation in surgery, was observed in (100%) compared to (63.5%) in normal group ($P=0.003$). Postpartum hemorrhage, and blood transfusion were observed in the group of abnormal placentation in surgery, compared with normal (80% vs 12.5%, $P=0.001$). ICU admission required in the group of abnormal placentation in surgery (93.8% vs 65.4% in normal, $P=0.029$).

Discussion

The area under the curve, sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and the agreement for ultrasound, and surgery findings reference to histopathology examinations are shown in Table 2. The ultrasound findings revealed an area under the curve (AUC) of 53.8%, sensitivity of 88.9%, and specificity of only 18.8% while gave unsatisfactory agreement (55.9%) with histopathology examination.

The surgery findings tend to have better discriminative ability than ultrasound findings with an area under the curve (AUC) of 76.7%, sensitivity 97.22%, and specificity 56.25% while gave satisfactory agreement (78%) with histopathology examination. Furthermore, the ultrasound and surgery findings were assessed by the receiver-operating characteristic (ROC) curve in Figure 1. revealed the surgery was better than ultrasound in detecting abnormal placentation.

In Table3 : The ultrasound reference to surgery findings, revealed an area under the curve (AUC) of 60.2%, sensitivity of 79.6%, and specificity of only 0.0%, positive predictive value (PPV)

Table 2. Accuracy measurements for ultrasound and surgery findings reference to Histopathology Findings.

	Ultrasound findings	Surgery findings
Accuracy		
AUC (95%CI)	53.8%(40.0%- 67.7%)	76.7%(64.8% - 88.6%)
Sensitivity (95%CI)	88.9%(73.9%- 96.9%)	97.22%(85.5% - 99.9%)
Specificity (95%CI)	18.8% (7.2% - 36.4%)	56.25% (37.7% -73.6%)
PPV (95%CI)	55.2% (41.5% - 68.3%)	71.43% (56.7% - 83.4%)
NPV (95%CI)	60.0 % (26.2% - 87.8%)	94.74% (74.0% - 99.9%)
Agreement		
Overall agreement %	55.90%	78.0%
Kappa (P-value)	0.09 (P-value=0.375)	0.55 (P-value=0.001)

AUC =Area Under the Curve; PPV= Positive Predictive Value; NPV Negative Predictive Value

Table 3. Accuracy measurements for ultrasound reference to surgery findings.

	Ultrasound findings
Accuracy	
AUC (95%CI)	60.2%(46.3%- 74.1%)
Sensitivity (95%CI)	79.6%(65.7%- 89.8%)
Specificity (95%CI)	0%(0.0% - 17.7%)
PPV (95%CI)	67.2% (53.7% - 79.0%)
NPV (95%CI)	0.0 % (0.0% - 30.9%)
Agreement	
Overall agreement %	57.40%
Kappa (P-value)	-0.2 (P-value=0.033)

AUC =Area Under the Curve; PPV= Positive Predictive Value; NPV Negative Predictive Value

67.2%, and negative predictive value (NPV) 0.0%, with unsatisfactory agreement 57.4%. So the ultrasound is not a specific medical image reliable for diagnosis of abnormal placental adherence at third trimester of pregnancy, could be because of over diagnosis report of positive finding. In Table 4: Ultrasound findings vs Surgery findings Cross-tabulation, revealed 39 cases reported by ultrasound as abnormal and confirmed by surgery (True positive), while 19 cases counted as abnormal by ultrasound and found to be normal during surgery (False positive), 10 cases reported as normal by ultrasound found to be abnormal during surgery (False negative), none of the cases found to be normal during surgery (True negative).

In Table 5: Ultrasound findings vs Histopathology findings Cross-tabulation. Of 32 normal cases, ultrasound failed to detect normal findings in 26 cases. In Table 6: Surgery findings vs Histopathology findings Cross-tabulation, 14 normal cases from 32 normal cases were counted as abnormal during surgery, could be due to difficulty during removal of placenta.

Conclusion

The ultrasound examination is available, cheap, and easy to use, but it is not specifically reliable in diagnosis of abnormal adherent placenta in third trimester of pregnancy.

Figure 1. Receiver-operating characteristic (ROC) curve for ultrasound and surgery findings.

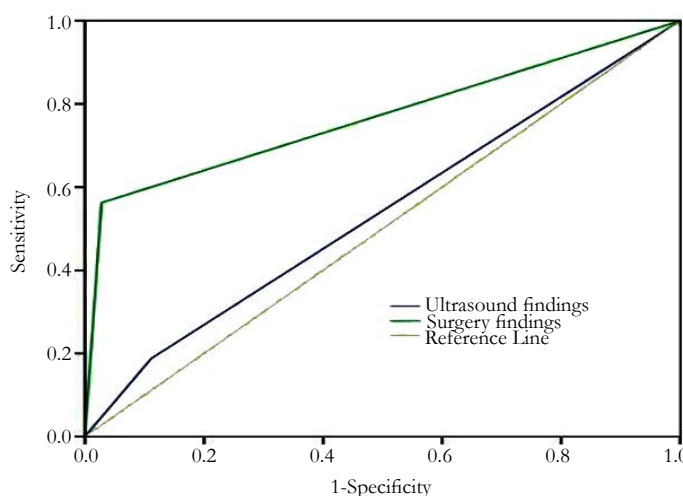


Table 4. Ultrasound findings * Surgery findings Cross-tabulation.

			Surgery findings		Total
			Abnormal	Normal	
Ultrasound findings	Abnormal	Count % within Surgery findings	TP=39 79.6%	FP=19 100.0%	58 85.3%
	Normal	Count % within Surgery findings	FN=10 20.4%	TN=0 0.0%	10 14.7%
Total	Count		49	19	68
	% within Surgery findings		100.0%	100.0%	100.0%

Table 5. Ultrasound findings * Histopathology findings Cross-tabulation.

			Histopathology findings		Total
			Abnormal	Normal	
Ultrasound findings	Abnormal	Count % within Histopathology findings	32 88.90%	26 81.30%	58 85.30%
	Normal	Count % within Histopathology findings	4 11.10%	6 18.80%	10 14.70%
Total	Count		36	32	68
	% within Histopathology findings		100.00%	100.00%	100.00%

Table 6. Surgery findings * Histopathology findings Cross-tabulation.

			Histopathology findings		Total
			Abnormal	Normal	
Surgery findings	Abnormal	Count % within Histopathology findings	35 97.20%	14 43.80%	49 72.10%
	Normal	Count % within Histopathology findings	1 2.80%	18 56.30%	19 27.90%
Total	Count		36	32	68
	% within Histopathology findings		100.00%	100.00%	100.00%

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