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Comparison between the Role of Transabdominal Ultrasound Versus Transvaginal Ultrasound in Evaluation of Placental Invasion in Cases of Placenta Previa Anterior Wall with Previous Uterine Scar

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ABSTRACT

Background: Maternal mortality from placenta accrete is estimated to be 6-7 % regardless of the type of the operation.

Aim of the work: To evaluate the influence of transabdominal versus transvaginal ultrasound in assessing placental invasion in situations of placenta previa anterior wall with a prior uterine scar using the unified ultrasonographic characteristics proposed by "EW-AIP," as well as to assess the sensitivity and accuracy of each characteristic by evaluatingthem to the pregnancy's end results.

Patients and methods: A sum of 100 pregnant female with persisting placenta previa (beyond 28 weeks of pregnancy) were included in this research. Transabdominal and transvaginal ultrasonography were conducted by two separate physicians who were unaware of each other's findings. TAS and TVS applied and analyzed unified descriptors on the placenta in order to determine its precise location.

Results: At the time of Cesarean delivery, 86 individuals had unusually invasive placentas and variations, which were subsequently validated by histological study. The reliability of diagnosis of the retroplacental clear zoneloss was 76 percent by TVS and 54 percent by TAS, while that of aberrant placental lacunae was 92 percent by TVS and 88 percent by TAS. The reliability of detecting myometrial thinning was 66 percent by TVS and 72 percent by TAS.

Conclusion: Transabdominal and transvaginal ultrasound have been proven to be complimentary to each other, with transvaginal ultrasound having the upper hand. The safety of TVS has also been established, and the unified descriptors have been proven to be dependable in correct diagnosis.

Keywords: *Abnormal invasion;Placenta;Transabdominal;Transvaginal; Ultrasound.*

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INTRODUCTION

By enabling us to pick the ideal time and location of delivery, prenatal identification of Morbidly Adherent Placenta (MAP) and its variations may help decrease fetus/maternal sickness and death. Early diagnosis of placental disease allows for multidisciplinary surgical intervention, newborn critical care, preventive hypogastric artery balloon closure, embolization of the uterus, and an appropriate amount of blood units in the operation theatre.[1]

The diagnosis of sonographic criteria for placenta accrete has been examined by many authors. Always evaluate the danger of undergoing a needless hysterectomy (false positive) or subsequent hemorrhage after attempted placental removal (false negative). The use of diagnostic criteria cannot be justified merely on the basis of sensitivity and specificity; PPV and NPV must be assessed in order to plan appropriate patient treatment and information.[2]

A study of the literature from the previous decade suggests that placenta accreta is becoming more common, owing to more common CSs. A prior uterine scar is nearly often the location of aberrant placental invasion. Greater maternal age, myometrial injury after a myomectomy with endometrial entry, extensive curettage with subsequent Ashermandisorder, and submucosal myoma are all risk factors that are less significantly linked to MAP.[1]

Women who have had a prior CS with a placenta previa atop the former uterine scars are at the biggest danger of an unusually invasive placenta.[3]

A variety of distinct ultrasonography criteria, some qualitative and others quantitative, are used to diagnose a morbidly adhered placenta. Several investigations have looked at the accuracy of several ultrasonography markers for placental attachment disorders (PAD). However, the efficacy of these markers varies a lot amongst investigations that use the same indicators. Limits on research population, retrospective methodology, and research requirements variation, as well as the eventual determination of AIP, have all been blamed for the differences.[4]

Moreover, like with other subjective diagnostic approaches, what defines a marker will influence whether or not each symptom is logged, according to the operator. This is especially crucial for practitioners who may not have much expertise with placental ultrasound or AIP diagnosis. Furthermore, there is no documented agreement on the characterization of the ultrasonography indicators that are typically used to diagnose AIP. Many indications have been recognized with several names, and in other instances, the same title has been used to many discoveries.[5]

The European Working Group on Unnaturally Invasive Placenta (EW-AIP) is a non-profit association with 29 members from 11 European countries, including obstetricians, gynecologists, pathologists, anesthesiologists, and basic science researchers. The group's mission is to enhance AIP diagnosis and treatment while also promoting research and understanding. The EW-AIP provides standardized definitions of the AIP imaging descriptors to enhance the comparability of future research, expand diagnostic capabilities, and promote international cooperation. All 23 papers in a recent systematic review of the prenatal sonographic detection of AIP were evaluated to establish these standardized criteria. [5]

Six descriptions for 2D grayscale ultrasound, four for 2D color Doppler, and one for 3D power Doppler were created from the various wordings. The significance of describing each indication clearly was put on it, regardless of views about its predictive usefulness. [5]

The aim of this research is to evaluate the influence of transabdominal versus transvaginal ultrasound in assessing placental invasion in situations of placenta previa anterior wall with a prior uterine scar using the unified ultrasonographic characteristics proposed by "EW-AIP," as well as to assess the sensitivity and accuracy of each characteristic by evaluating them to the pregnancy's end results..

PATIENTS AND METHODS

This was a prospective Observational Cohort research with 100 pregnant women with persisting placenta previa (beyond 28 weeks' pregnancy) who attended Al-Hussien Hospital between April 2021 and the conclusion of the research adhering to the below inclusion and exclusion criteria:

Inclusion Criteria:Pregnant women identified with persisting placenta previa anterior wall following 28 weeks of pregnancy, and a histories of prior cesarean deliveryand/or additional uterine procedures (age group 18-45 years).

Exclusion Criteria:Unscarred uterus and placenta previa posterior wall

All the patients were submitted to the following steps:

Complete history, including:Personal history (name, age, file number).Obstetric history (number of C.S., abortion, prior gestation placenta previa, ectopic gestation history, medical disorder with pregnancy and number of living children).Present history (complain, gestational age, medical disorder in present pregnancy and history of ante partum hemorrhage), and past history (postpartum sepsis, postpartum hemorrhage & chronic diseases).

Two skilled operators performed transabdominal and transvaginal imaging utilizing all diagnostic procedures (gray-scale, color Doppler), followed by an offline analysis of the collected pictures and volumes.

Intraoperative information, such as placental site, spontaneous separation, and placental invasion of the bladder and other organs. Administration during pregnancy. Injury to the bladder, ureter, or bowel. Blood transfusions and blood loss to prevent a hysterectomy and the requirement for critical care unit hospitalization, conservative treatment is used.

Histopathological examination in cases of hysterectomy.

Sample size justification:

According to Sedek et al.[6], the overall accuracy of TVS identification was around 97.1 percent when using the EPI Info 7 software for sample size calculating. With a margin of error of 5% and a confidence level of 95 percent, a sample size of at least 100 women was required.

Statistical Analysis:

The statistical program for social sciences, version 23.0, was utilized to analyze the data (SPSS Inc., Chicago, Illinois, USA). The quantitative data was given in the form of a median, standard deviation, and range. The median and standard deviation were used to convey quantitative data (SD). Frequency and percentage were utilized to convey qualitative data. When comparing two averages, an independent-samples t-test of relevance was employed. To compare percentages between two qualitative factors, the Chi-square (X2) test of relevance was applied. For data correlation, Pearson's correlation coefficient (r) test was employed.Evaluation of Diagnostic Performance for histopathology and Transabdominal ultrasound & Transvaginal ultrasound. Sensitivity = (true +ve)/ [(true +ve) + (false –ve)]. Specificity = (true –ve) / [(true –ve) + (false +ve)]. PPV = (true +ve) / [(true

+ve) + (false +ve)]. NPV = (true –ve)/ [(true –ve) + (false –ve)]. Accuracy = (TP+TN)/[TP+FP+TN+FN]. McNemar's test was used to examine the relationship between two (paired) qualitative variables. The tolerable margin of error was set at 5%, while the confidence interval was set at 95%.A P value of less than 0.05 was deemed substantial.

RESULTS

Abnormal lacunea TAS		Histopathology Evaluation1		Total
		Abnormal	No abnormal	
Yes	Count	80	2	82
	% of TAS	97.6%	2.4%	100.0%
	% of Histopathology	93.0%	14.3%	82.0%
	% of Total	80.0%	2.0%	82.0%
No	Count	6	12	18
	% of TAS	33.3%	66.7%	100.0%
	% of Histopathology	7.0%	85.7%	18.0%
	% of Total	6.0%	12.0%	18.0%
Total	Count	86	14	100
	% of TAS	86.0%	14.0%	100.0%
	% of Histopathology	100.0%	100.0%	100.0%
	% of Total	86.0%	14.0%	100.0%

Table 1: Comparison between Histopathology Evaluation1 and TAS according abnormal lacunae.

Table 1 shows statistically substantial diagnostic performance of Abnormal lacunae TAS it was sensitivity 93%, specificity 85.7%, positive predictive value 14.3% and negative predictive value 7% and accuracy 92%.

TAS		TVS		Total
		Correct	Incorrect	
Correct	Count	52	2	54
	% within TAS	96.3%	3.7%	100.0%
	% within TVS	68.4%	8.3%	54.0%
Incorrect	Count	24	22	46
	% within TAS	52.2%	47.8%	100.0%
	% within TVS	31.6%	91.7%	46.0%
Total	Count	76	24	100
	% within TAS	76.0%	24.0%	100.0%
	% within TVS	100.0%	100.0%	100.0%
McNemar Test: p-value			<0.001	

Table 2: A comparison of TAS and TVS accuracyaccording to loss clear zone.

Table 2 reveal highly statistically substantialvariation between TAS and TVS according to loss clear zone, with p-value (<0.001).

TAS		TVS		Total
		Correct	Incorrect	
Correct	Count	86	6	92
	% within TAS	93.5%	6.5%	100.0%
	% within TVS	97.7%	50.0%	92.0%
Incorrect	Count	2	6	8
	% within TAS	25.0%	75.0%	100.0%
	% within TVS	2.3%	50.0%	8.0%
Total	Count	88	12	100
	% within TAS	88.0%	12.0%	100.0%
	% within TVS	100.0%	100.0%	100.0%
McNemar Test: p-value			0.289	

Table 3: A comparison of TAS and TVS accuracyaccording to abnormal lacunae.

Table 3 shows no statistically substantial variation of TAS and TVS regarding abnormal lacunae, with p-value (>0.05 non-substantial).

TAS		TVS		Total
		Correct	Incorrect	
Correct	Count	58	8	66
	% within TAS	87.9%	12.1%	100.0%
	% within TVS	80.6%	28.6%	66.0%
Incorrect	Count	14	20	34
	% within TAS	41.2%	58.8%	100.0%
	% within TVS	19.4%	71.4%	34.0%
Total	Count	72	28	100
	% within TAS	72.0%	28.0%	100.0%
	% within TVS	100.0%	100.0%	100.0%
McNemar Test: p-value			0.286	

Table 4: A comparison of TAS and TVS accuracyaccording to myometrial thining.

Table 4 shows no statistically substantial variation between TAS and TVS regarding myometrial thining, with p-value (>0.05 non-substantial).

TAS		TVS		Total
		Correct	Incorrect	
Correct	Count	82	2	84
	% within TAS	97.6%	2.4%	100.0%
	% within TVS	93.2%	16.7%	84.0%
Incorrect	Count	6	10	16
	% within TAS	37.5%	62.5%	100.0%
	% within TVS	6.8%	83.3%	16.0%
Total	Count	88	12	100
	% within TAS	88.0%	12.0%	100.0%
	% within TVS	100.0%	100.0%	100.0%
McNemar Test: p-value			0.289	

Table 5: Comparison of the accuracy of TAS and TVS regarding uterovesical hypervascularity.

Table 5 shows no statistically substantial variation between TAS and TVS regarding uterovesical hypervascularity, with p-value (>0.05 non-substantial).

TAS		TVS		Total
		Correct	Incorrect	
Correct	Count	26	4	30
	% within TAS	86.7%	13.3%	100.0%
	% within TVS	76.5%	6.1%	30.0%
Incorrect	Count	8	62	70
	% within TAS	11.4%	88.6%	100.0%
	% within TVS	23.5%	93.9%	70.0%
Total	Count	34	66	100
	% within TAS	34.0%	66.0%	100.0%
	% within TVS	100.0%	100.0%	100.0%
McNemar Test: p-value			0.388	

Table 6: Comparison of the accuracy of TAS and TVS according to subplacental hypervascularity.

Table 6 shows no statistically substantial variation between TAS and TVS regarding subplacental hypervascularity, with p-value (>0.05 non-substantial).

TAS		TVS		Total
		Correct	Incorrect	
Correct	Count	70	4	74
	% within TAS	94.6%	5.4%	100.0%
	% within TVS	92.1%	16.7%	74.0%
Incorrect	Count	6	20	26
	% within TAS	23.1%	76.9%	100.0%
	% within TVS	7.9%	83.3%	26.0%
Total	Count	76	24	100
	% within TAS	76.0%	24.0%	100.0%
	% within TVS	100.0%	100.0%	100.0%
McNemar Test: p-value			0.754	

Table 7: Comparison of the accuracy of TAS and TVS regarding bridge vessels.

Table 7 shows no statistically substantial variation between TAS and TVS regarding bridge vessels, with p-value (>0.05 non-substantial).

TAS		TVS		Total
		Correct	Incorrect	
Correct	Count	40	12	52
	% within TAS	76.9%	23.1%	100.0%
	% within TVS	76.9%	25.0%	52.0%
Incorrect	Count	12	36	48
	% within TAS	25.0%	75.0%	100.0%
	% within TVS	23.1%	75.0%	48.0%
Total	Count	52	48	100
	% within TAS	52.0%	48.0%	100.0%
	% within TVS	100.0%	100.0%	100.0%
McNemar Test: p-value			1.000	

Table 8: Comparison of the accuracy of TAS and TVS regarding placental lacunea feeder vessels.

Table 8 shows no statistically substantial variation of TAS and TVS regarding placental lacunae feeder vessels, with p-value (>0.05 non-substantial).

	Transabdominal ultrasound	**Transvaginal ultrasound**
Sensitivity	94.2%	98.1%
Specificity	85.0%	93.8%

Positive predictive value	92.0%	97.0%
Negative predictive value	65.2%	89.1%
Accuracy	91.5%	97.5%
Validity (out of 86 patients)	Detected 74	Detected 84

Table 9: Comparison of the accuracy of TAS and TVS according to overall finding.

Table 9 shows statistically significant diagnostic performance of overall, as for the transabdominal ultrasound it was sensitivity 94.2%, specificity 85%, positive predictive value 92% and negative predictive value 65.2% and accuracy 91.5%, while transvaginal ultrasound it was sensitivity 98.1%, specificity 93.8%, positive predictive value 97% and negative predictive value 89.1% and accuracy 97.5%, this indicates that the transvaginal ultrasound the most diagnosis for placental invasion.

DISCUSSION

The results showed that regarding the presence of abnormal placental lacunae, they showed Sensitivity 93.0%, specificity 66.7%, PPV 97.6%, NPV 85.7%, accuracy 90% by transabdominal ulrasonography (TAS) and Sensitivity 88.4%, specificity 85.7%, PPV 97.4%, NPV 85.7%, accuracy 88.0% by transvaginal ultrasonography (TVS).

Lacunae's PPV varies more across authors than other indicators; they've been described as sensitive and specific in some investigations but not in others.

This result corresponds with Comstock et al.[3], who found them to be 93 percent sensitive in women at 20 weeks and beyond with a 93 percent PPV, whereas Cali et al.[1] discovered the existence of aberrant lacune exhibited sensitivity 73.0 percent and specificity 86.7 percent. The total pooled sensitivity and specificity from 13 investigations of lacunar spaces detecting MAP were 77 percent and 95 percent, respectively, in a recent systematic review, with a total diagnostic accuracy of 88 percent.[4]

Regarding loss of the retroplacental clear zone

This research revealedthat TAS had a sensitivity of 51.2 percent, specificity of 71.4 percent, PPV 91.7 percent, NPV 19.2 percent, and accuracy of 54.0 percent, but TVS had a sensitivity of 74.4 percent, specificity of 85.7 percent, PPV 97.0 percent, NPV 35.3 percent, and accuracy of 76.0 percent. Unlike Cali et al.[1]revealed that Sensitivity was 90%, specificity was 80%, PPV was 57%, and NPV was 97% when the retropalcental clear zone was lost.However, Finberg and Williams[7]stated that the most of false positive findings are caused by the disappearance of the retroplacental clear zone, and the criteria should not be employed alone to determine the diagnosis.

Wong et al.[8]The lack of the clear area was discovered in 37 (65%) of women without placenta accreta and 100 percent of those with it. As a result, it is perceptive but not specific. Because of its significant negative predictive value, the clear space seems to be used primarily to efficiently exclude placenta accreta (NPV).

This study revealed that interruption of the bladder wall had sensitivity 4.7 percent, specificity 100.0 percent, PPV 100.0 percent, NPV 14.6 percent, accuracy 18.0 percent by TAS, and sensitivity 9.3 percent, specificity 100 percent, PPV 100 percent, NPV 15.2 percent, accuracy 22.0 percent by TVS, which agrees with Comstock et al.[3], where this result had Sensitivity 20 percent, PPV 75 percent, and Wong et al[8], sensitivity 11%, specificity 100%. Unlike Cali et al.[1], who found that these criteria had a Sensitivity of 70%, Specificity of 100%, PPV of 100%, and NPV of 100%.

The poor sensitivity observed by Comstock et al.[3] and Wong et al.[8] might be due to the fact that not all women received transvaginal ultrasonography under the very strict settings employed by Cali et al.[1]. The authors of that huge research first found that 300 ml in the bladder gave the greatest view of uterine–bladder contact, and then instilled that quantity into each woman's bladder.

Regarding the uterovesical hypervascualrity using color doppler flow

This study shows Sensitivity 86.0%, specificity 71.4%, PPV 94.9%, NPV 45.5%, accuracy 84.0% by TAS and Sensitivity 93.0%, specificity 57.1%, PPV 93.0%, NPV 57.1%, accuracy 88.0% by TVS the sensitivity of this descriptor significantly increased using TVS. Also, this agrees with Cali et al.[1] where is revealed Sensitivity 95.0%, specificity 100%, PPV 100%, NPV 97%.

Regarding the occurrence of aberrant arteries connecting the placenta to the bladder wall

This study showed sensitivity 69.8 percent, specificity 100 percent, PPV 100 percent, NPV 35.0 percent, and accuracy 74.0 percent according to TAS, and sensitivity 71.2 percent, specificity 100 percent, PPV 100 percent, NPV 36.8 percent, and accuracy 76.0 percent according to TVS., which also confirms with Cali et al.[1].

Although there have been no research showing the diagnostic performance of transabdominal vs. transvaginal ultrasound in the setting of presumed placental invasion, transvaginal ultrasound allows for a more thorough examination of the lower uterine segment and is the commonly prescribed quality of care.[9]

This research employed the criteria of the "EW-AIP" to examine the function of transabdominal ultrasonography vs. transvaginal ultrasound in assessing placental invasion in instances with placenta previa anterior wall with preexisting uterine scar.[9]

Throughout the period of this study, every patient who was enrolled has undergone both Transabdominal sonography and transvaginal

sosngraphy and every one of the unified descriptors was assessed via both modalities, the accuracy of both modalities was calculated regarding their ability to evaluate each one of the unified descriptors as follows

The accuracy of TVS and TAS in detecting the disappearance of the retroplacental clear zone was 76 percent and 54 percent, respectively. TAS reported 92 percent of aberrant placental lacunae while TVS reported 88 percent. TAS had a detecting accuracy of 66% and TVS had a detecting accuracy of 72% for myometrial thinning. The accuracy of identification of uterovesical hypervascularity was 84 percent by TAS and 88 percent by TVS, according to the Doppler evaluation. TAS detected 76 percent of bridging vessels, whereas TVS detected 75 percent.

From this we conclude the accuracy of detection of the unified descriptors is quite close regarding TVS and TAS, however TVS was found to be more accurate in the exact placental localization putting in mind as well that The TVS was conducted by an extremely skilled operator, but the TAS was performed by less skilled operators. The total accuracy of identification for TAS was 91 percent, whereas the TVS was at 97.1 percent.

By enabling multidisciplinary counseling and delivery planning and scheduling, assigning a score in clinical practice may be beneficial in the prenatal identification of MAP and appear to be a crucial component in minimizing mother and fetus illness and death.

Other studies suggested different scoring systems based on different criteria that would eventually enhance the ability of ultrasonogropahy to predict abnormal placental invasion and thus enhance the offered approach.

CONCLUSION

This study suggests that both transabdominal and transvaginal ultrasonographic modalities are complementary to each other, putting in mind that TVS had a slightly higher overall accuracy and was done by a seasoned professional.

Also the unified descriptors suggested by the EW-AIP were found to be of dependable accuracy as well an important point to be considered is that all the patients who were enrolled in this study and were exposed to transvaginal ultrasound, none of them experienced any attack of bleeding during the procedure which proves the profound safety of this modality confirming many previous studies.

Conflict of interest : none

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