Original Article

Diagnostic Accuracy of Doppler Ultrasound in Diagnosis of Morbidly Adherent Placenta (MAP) Keeping per Operative Diagnosis as Gold Standard

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ABSTRACT

Objective: To determine the accuracy of Obstetrical Doppler ultrasound as a diagnostic modality in detection of patients with morbidly adherent placenta (MAP) and keeping per operative diagnosis as gold standard.

Study Design: Cross sectional study

Place and Duration of Study: This study was conducted at the department of Radiology Nishtar Hospital Multan from March 2020 to March 2021 in one-year duration.

Materials and Methods: A total of one hundred and eighty patients were enrolled in study. Positive predictive value, negative predictive value, sensitivity, specificity and diagnostic accuracy were main variables of study. SPSS version 23 was used for data analysis. Tests of significance were applied and p value ≤0.05 was taken as significant.

Results: The estimated sensitivity was 87.0%. The estimated specificity was 85.1%. Positive predictive value was 66.7% and negative predictive value was 95.0%. The overall diagnostic accuracy was found as 40.6%.

Conclusion: Diagnostic accuracy of transabdominal Color Doppler ultrasound is much higher in detection of morbidly adherent placenta. It is safe, useful and easily available imaging technique for diagnosis of potentially harmful and life threatening obstetrical conditions.

Key Words: Doppler ultrasound, morbidly adherent placenta, diagnostic accuracy, sensitivity, specificity

INTRODUCTION

Morbidly adherent placenta (MAP) is a condition that covers different abnormalities of placenta like abnormal adherence of placenta to underlying wall of uterus [1]. In this condition placenta may be partially or fully abnormally attached to implantation site [2]. Extent of trophoblastic involvement or invasion via uterine serosa and myometrium are main determinant of MAP and its variants. Morbidly adherent placenta s variants include placenta accreta, increta and percreta.

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Frequency of MAP is increasing day by day because of increase in number of cesarean deliveries. It was noted about 8.7% increase in cesarean section deliveries every year [3].

In Pakistani population after uterine atony and rupture MAP is the 3rd most common cause of emergency obstetrical hysterectomy. It is a life threatening condition which can lead to many complications such as need for blood transfusion [4], maternal heamorrhage, damage to adjacent organs, peripartum hysterectomy, need of ventilator support, ICU admission, and morbidities[5].

Ultrasonography in antenatal period considered as main diagnostic tool for MAP and its complications. Myometrial invasion can easily be predicted with Doppler ultrasound when myometrium involved more than Imm with large placental lakes [6]. Prenatal diagnosis of MAP results in reduction of morbidities due to MAP because of planned treatment during pregnancy. In ultrasonography (USG); Color doppler ultrasound have capability of easy detection of abnormal placental attachment and myometrial involvement[7].

Diagnostic accuracy of color Doppler ultrasound was documented 97.1% in previous literature when used for antenatal diagnosis of invasive placentation in gravid females[8]. Preoperative diagnosis of MAP is the

ultimate diagnostic approach as it allows obstetricians to examine the degree of placental invasion in myometrium with naked eyes [9]. In a study, prevalence of morbidly adherent placenta was found to be 28.0% and sensitivity and specificity of ultrasonography in diagnosing morbidly adherent placenta as 85.7% and 83.3% respectively [10]. 1n another study, sensitivity and specificity of ultrasonography in diagnosing morbidly adherent placenta was found to be 50.8% and 86.4% respectively [11]. Prenatal diagnosis of morbidly adherent placenta is very important as this helps in timely management of complications by involving multidisciplinary team care i.e., obstetricians, pediatricians, surgeons, radiologists [12]. This reduces the maternal and perinatal mortality. Since there is variation in previous literature and also local study has shown variable results as compared to other available studies, so, there is a need of re-evaluation of its results in local population [13,14].

The rationale of this study is that results of our study will provide an accurate imaging modality for accurate prenatal identification of morbidly adherent placenta and will help clinicians for optimal obstetric management, because site of delivery, timing of delivery, availability of blood products and recruitment of a skilled surgical and anesthesia team can be organized in advance.

MATERIALS AND METHODS

This study was conducted at radiology department of Nishtar hospital, Multan from March 2020 to March 2021 in one-year duration. The study was subjected to approval by the hospital ethical board. After approval, patient recruitment was started. Thorough history, examination and investigation were done by senior residence officer. Informed written consent was taken from the patients after detailed purpose and objective research. Sampling technique was based on non-probability consecutive sampling. Patients of age 20-45 yrs, gestational age more than 28 weeks, patients having previous vaginal or abdominal deliveries, with ultrasound finding of obliteration of space between uterus and placenta were included in the study. Patients maternal bleeding disorders, placenta abruption on ultrasound. Sensitivity of Doppler ultrasound was calculated as ability of identification true positive cases for diagnosis of morbidly adherent placenta also termed as true positive rate. Similarly, specificity of Doppler ultrasound is calculated as ability of identification of true negative cases for morbidly adherent placenta also labeled as true negative rate. Positive cases in Doppler ultrasound for intraoperative finding for MAP were labeled as True positive. Negative cases in Doppler ultrasound for intraoperative finding for MAP were labeled as True negative. Normal intraoperative findings for MAP and positive for Doppler ultrasound were labeled as false positive cases. Intraoperative positive findings for MAP and negative for Doppler ultrasound were labeled as false negative. Positive predictive value calculated as cases with Doppler ultrasound findings positive for morbidly adherent placenta should be true positive. Negative predictive value is calculated those cases with Doppler ultrasound findings negative for morbidly adherent placenta should be true negative.

Patients with presence or absence of abnormal placental invasion were investigated by Doppler ultrasound (done by a consultant sonologist with at least 3 years post-fellowship experience) and were followed till their surgery; whether elective or emergency by senior residence officer. Doppler ultrasound has findings in patients of morbidly adherent placenta as exophytic mass invading bladder, interruption of posterior uterine serosa-bladder interface, obliteration of space between uterus and placenta, morbidly adherent placental Variants. Per operative findings in patients with the diagnosis of morbidly adherent placenta as blood vessels invading myometrium, invasion of vessels into adjacent structures e.g bladder, placenta not separated. Surgery was planned after decision made jointly by patient and obstetrician. Details of medical and obstetric history and information on the intraoperative was recorded and analyzed.

SPSS version 23 was used for data entry and analysis. Mean value and standard deviation was calculated for quantitative variables like age, gestational age and number of previous cesarean sections and qualitative variables like parity, gravidity, history of previous C-section and presence/absence of morbidly adherent placenta on USG and operative findings were presented as frequency and percentages. Sensitivity, specificity, positive and negative predictive values were used for calculation of diagnostic accuracy of Doppler ultrasound and preoperative findings. Test of significance were applied and p value ≤ 0.05 was taken as significant.

RESULTS

One hundred and eighty patients were included in this study.The mean age, gestational age, mean number of previous caesarean sections and parity of the patients was 31.93±4.12 years, 31.48±1.47 weeks, 1.95±0.57 caesarean sections and 1.58±0.49 paras, respectively. Gravidity distribution of the patients was recorded as n=25 (13.9%) patients had 1 gravidity, n=61 (33.9%) had 2 gravidity and n=94 (52.2%) patients had 3 gravidities. History of previous caesarian section was recorded in n=55 (30.6%) patients. All the patients were subjected to color Doppler ultrasound. While, morbidly adherent placenta findings intra operatively was presented in n=46 (25.6%) patients. (Figure. I).

It was observed that 40 patients with morbidly adherent placenta findings intra operatively as well as on

Doppler ultrasound, known as true positive. Twenty patients were found with morbidly adherent placental findings intra operatively but absent on Doppler ultrasound known as false positive. Six patients had morbidly adherent placental findings intra operatively but absent on Doppler ultrasound, labeled as false negative. 114 patients had absent on morbidly adherent placenta findings intra operatively and also on Doppler ultrasound known as true negative. The difference was statistically significant (χ^2=79.95,d.f=1, odds ratio=38.0, p=0.000) (Table .I).

Therefore, the estimated sensitivity was 87.0%. The estimated specificity was 85.1%. Positive predictive value was 66.7% and negative predictive value was 95.0%. The overall diagnostic accuracy was found as 40.6%(Table. II).
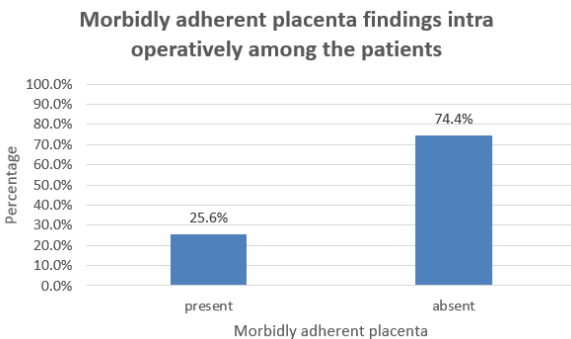

Figure No.1

Table No.1: Comparison of morbidly adherent placenta Doppler ultrasound and morbidly adherent placenta findings intra operatively

Doppler ultrasound	Morbidly adherent placenta findings intra operatively		Total	P-value
	Positive	**Negative**		
Positive	True positive 40	False positive 20	60	0.000
Negative	False Negative 6	True negative 114	120	
Total	46	134	180	

Table No.2: Diagnostic Accuracy

Diagnostic Measures	Value
Sensitivity	87.0%
Specificity	85.1%
Positive Predictive Value (PPV)	66.7%
Negative Predictive Value (PPV)	95.0%
Diagnostic accuracy	40.6%

DISCUSSION

Doppler ultrasonography during antenatal period is a main diagnostic tool that helps obstetricians for early detection and management of morbidly adherent placenta (MAP)[15].

On other hand ultrasound is a safe and cost effective radiological modality which is a complete alternative replacement of high cost diagnostic tools like magnetic resonance imaging (MRI) specifically in low cost or under developed countries. In under developed countries poverty, low education rate and lack of awareness about family planning increase the number of pregnancies that can cause placenta previa, uterine surgeries and abnormal attachment of placenta[16].

In our study diagnostic accuracy of Doppler ultrasound was found 40.6% when per operative findings were taken as gold standard. A study was conducted by Thai et al[17] in 2007 and reported diagnostic accuracy of color Doppler ultrasound is 97.10% in diagnosis of morbidly adherent placenta during antenatal period. Another similar study was conducted by Khalid et al[18] and reported higher diagnostic accuracy of Doppler ultrasound than our study. Mean age of patients in this study was 27.78+2.65 years while in our study mean age of patients was 31.93±4.12 years.

Our study reveals sensitivity 87.0% and specificity 85.1%. In 2006 Warshak et al[19] conducted a study on use of Doppler ultrasound in detection of placenta previa and reported sensitivity 0.77% and specificity 0.96% and low lying anterior position is most common. But location of placenta previa was not our variable. Calìet al[20] reported similar finding that Doppler ultrasound is main diagnostic tool for placenta previa, not only diagnosis but also useful in pointing the type of placental abnormality either placenta accrete or placenta percreta.

D'Antonio et al[21] conducted a review analysis on comparison of ultrasound and MRI and reported sensitivity and specificity of MRI as 94.4% and 84% respectively and sensitivity and specificity of Doppler ultrasound was 90.75 and 96.9% respectively. Similarly, Menget al[22] reported sensitivity of ultrasound 83% and diagnostic odds ratio was 63.41. These findings were compared with MRI which is detected with 82% sensitivity and diagnostic accuracy 22.9%. Both these studies reported good accuracy of ultrasound and MRI in diagnosis of placental invasion.

Color Doppler USG is widely used diagnostic tool of radiology during antenatal period for screening of placental adherence and localization, in parallel it is safe, cost effective easily available[23]. Doppler ultrasound can easily predict placenta accrete or abnormal adherence of placenta to myometrium. A variable diagnostic accuracy of Doppler ultrasound was found in literature like sensitivity varies from 85-100% and specificity from 35-96%[24].

Another study was conducted by Asghar S et al[25] and concluded that Doppler ultrasound is highly effective tool in diagnosis of MAP, its accuracy was calculated 87.6% with sensitivity 86.5 and specificity 90.24%.

CONCLUSION

Results of our study reveal that diagnostic accuracy of transabdominal Color Doppler ultrasound is much higher in detection of morbidly adherent placenta. It is safe, useful and easily available imaging technique for diagnosis of potentially harmful and life threatening obstetrical conditions.

Limitations: Most of patients in our study belongs to tribal areas of South Punjab, because of low literacy rate and some religious believes they did not allow them for participation in study, that's why study was conducted on small sample size.

Author's Contribution:

Concept & Design of Study:	Maham Munir Awan
Drafting:	Uzma Shaheen, Afshan Noreen
Data Analysis:	Farah Kalsoom, Neelam Malik, Irum Aslam
Revisiting Critically:	Maham Munir Awan, Uzma Shaheen
Final Approval of version:	Maham Munir Awan

Conflict of Interest: The study has no conflict of interest to declare by any author.

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