

Original Research

To compare ultrasound and magnetic resonance imaging in placenta accreta spectrum disorder

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ABSTRACT

Background: The incidence of placenta accreta is increasing significantly since last several decades, main risk factor being placenta previa with or without scarred uterus. The present study was conducted to assess all high-risk pregnancies antenatally for placenta accreta spectrum and to compare ultrasound and magnetic resonance imaging in placenta accreta spectrum disorder.

Materials & Methods: A total of 42 placenta previa patients were taken. Ultrasonography and MRI of these women were done and their findings were compared with intraoperative findings.

Results: Sensitivity and specificity of ultrasound and MRI were compared. According to our study, the sensitivity and specificity of ultrasound was 89.47% and 69.6% respectively. Sensitivity and specificity of MRI was 84% and 91.3% respectively

Conclusion: Ultrasound and MRI findings were compared with the intraoperative findings. It was concluded that there is not much significant difference in the sensitivity of ultrasound and MRI though USG carries slightly higher sensitivity, easy accessibility, cost effective and fairly good sensitivity. Both USG and MRI had fairly good sensitivity. Specificity of MRI was better than ultrasound. Ultrasound should be used as a first line investigation because of its cost and accessibility. MRI should be reserved for those cases in which USG is inconclusive like posterior localization of placenta and involvement of pelvic organs.

Key words: placenta, Magnetic resonance imaging, ultrasound

Introduction

Abnormal implantation of the placenta into the uterine wall is called as Placenta accreta spectrum (PAS). The incidence of placenta accreta is increasing significantly since last several decades, main risk factor being placenta previa with or without scarred uterus. There are numerous risk factors for placenta accrete like multiparity, asherman syndrome, smoking, advanced maternal age, space occupying lesions, previous trophoblastic diseases, history of curettage and increased number of caesarean sections. PAS was formerly known as morbidly adherent placenta.¹ Failure to diagnose placenta accreta prenatally places mother at the risk of haemorrhage which can be life threatening and associated with serious complications like shock, renal failure, adult respiratory syndrome, DIC, pulmonary embolism and injury to bladder. It is a significant cause of maternal morbidity and mortality and presently the most common reason of emergency postpartum hysterectomy.² Accurate prenatal diagnosis is crucial for appropriate patient management based upon diagnosis. Magnetic resonance imaging is reserved for those in which ultrasound is inconclusive, posterior placenta accreta and invasion of adjacent organ. Magnetic resonance imaging findings in Placenta Accreta include dark intra-placental bands on T2-weighted imaging, abnormal bulging of placenta and uterus, disruption of zone between uterus and placenta and abnormal blood vessels, direct visualization of invasion of adjacent organs.³ Findings of placenta accreta can be seen on ultrasound from the first trimester. First trimester findings on grey scale ultrasound are gestational sac in lower segment, irregular vascular spaces in placental bed, implantation on caesarean section scar.⁴ Second and third trimester findings on grey scale ultrasound are multiple irregular shaped lacunae in placenta giving moth eaten appearance or Swiss cheese appearance, loss of hypoechoic placental myometrial differentiation i.e. retroplacental clear space, myometrial thinning (myometrial thickness <1mm), placental protrusion in urinary bladder.⁵ Placenta Accreta Index (PAI) is a standardized approach for prenatal diagnosis of PAS incorporating clinical risk and ultrasound findings suggestive of placental invasion. It includes number of previous caesarean deliveries, presence of lacunae, presence of bridging vessels. A score of >8 has 96% probability of invasion with a specificity of 100%.⁶ The present study was conducted to assess all high-risk pregnancies antenatally for placenta accreta spectrum and to compare ultrasound and magnetic resonance imaging in placenta accreta spectrum disorder.

Aims & Objectives

- To diagnose all high risk pregnancies antenatally for placenta accretaspectrum.
- To compare ultrasound and MRI in placenta accreta spectrum disorder
- To provide better health care facility to improve feto-maternal outcome in placenta accreta spectrum disorder

Materials & Methods

The present study was conducted at in department of Obstetrics and Gynaecology, Bebe Nanki Mother and Child Care Centre, Government Medical College , Amritsar in collaboration with Department of Radiodiagnosis and Imaging, Government Medical College, Amritsar from May 2020 to June 2021. A total of 42 patients were identified and included in the study on the basis of placenta previa with history of previous caesarean section, history of D & C, history of uterine surgery, space occupying lesion were recruited. A detailed history regarding age, gravidity, parity, number of caesarean sections, previous dilatation and curettage, and uterine surgery was recorded. All women underwent USG evaluation, transabdominal or transvaginal, using gray scale and colour Doppler on full bladder. USG was done using Philips clear view 350 machine using frequencies of 3.5 MHz. Gray- scale B mode USG was to screen the placental tissue, followed by colour Doppler MRI (without Gadolinium) was done on Seimens 1.5 T scanner and T1, T2, STIR Sequences were done in axial, saggital and coronal planes. The procedure was performed with partial filled bladder and holding of breath at the time of taking images. USG and MRI findings were compared with intraoperative findings. Sensitivity, specificity, PPV and NPV of both USG and MRI were calculated and compared. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant

Observations

Table: I AGE WISE DISTRIBUTION OF PATIENTS

Age (years)	No. of Cases	Percentage
<25	4	9.52%
25-30	9	21.43%
31-35	9	21.43%
>35	20	47.62%
Total	42	100.00%

In the present study, out of 42 patients, 4(9.5%) patients were less than 25 year, 9 (21.43%) patients were between the age of 25 to 30 years, 9 (21.43%) were in age group 31 to 35 years and 20 (47.62%) patients were more than 35 years of age.

Table: II DISTRIBUTION OF PATIENTS ACCORDING TO PARITY

Multiparity	No. of cases	Percentage
Primigravida	6	14.3%
Multigravida	36	85.7%
Total	42	100.0%

In our study out of 42 patients, 6 (14.3%) patients had no living children and 36 (85.7%) patients were multiparous.

Table: III DISTRIBUTION OF PATIENTS ACCORDING TO HISTORY OF DILATATION AND CURETTAGE (D& C) DONE

Number of Curettage	No. of cases	Percentage
Nil	13	30.95%
History of 1 D&C	9	21.43%
History of 2 D& C	9	21.43%
History of 3 D&C	11	26.19%
Total	42	100.00%

In present study, out of 42 patients 13 (30.95%) had no history of uterine curettage, 9(21.43%) patients had history of one curettage, 9(21.43%) had history of two curettage, 11(26.19%) had history of three curettage.

Table: IV COMPARISON OF USG FINDING WITH INTRAOPERATIVE FINDING (ACCRETA)

Ultrasonography	Intraoperative finding (PAS)		Total	'p' value
	Absence of Accreta	Presence of Accreta		

		No. of cases	Percentage	No. of cases	Percentage	No. of cases	Percentage	
Myometrial Thinning	Absent	17	40.48%	8	19.05%	25	59.52%	0.03(S)
	Present	6	14.29%	11	26.19%	17	40.48%	
	Total	23	54.76%	19	45.24%	42	100.00%	
Lacunae with Turbulent Flow	Absent	18	42.86%	3	7.14%	21	50.00%	0.000(HS)
	Present	5	11.90%	16	38.10%	21	50.00%	
	Total	23	54.76%	19	45.24%	42	100.00%	
Loss of retroplacental space	Absent	21	50.00%	10	23.81%	31	73.81%	0.004(S)
	Present	2	4.76%	9	21.43%	11	26.19%	
	Total	23	54.76%	19	45.24%	42	100.00%	
Invasion of uterine serosa	Absent	20	47.62%	11	26.19%	31	73.81%	0.03(S)
	Present	3	7.14%	8	19.05%	11	26.19%	
	Total	23	54.76%	19	45.24%	42	100.00%	
Increased Vascularity	Absent	18	42.86%	6	14.29%	24	57.14%	0.002(S)
	Present	5	11.90%	13	30.95%	18	42.86%	
	Total	23	54.76%	19	45.24%	42	100.00%	

*p'=<0.001(Highly Significant); *p'<0.05 (Significant)

In our study, out of 42 patients, according to ultrasound findings, myometrial thinning was seen in 17 (40.48%) patients, lacunae with turbulent flow seen in 21 (50%) patients, loss of retroplacental space was seen in 11(26.19%) patients, invasion of uterine serosa was seen in 11 (19.05%) patients and increased vascularity was seen in 18 (42.86%). Out of 19 confirmed cases of accreta, 11(26.19%) patients had myometrial thinning on ultrasound with p value 0.03(S), lacunae with turbulent flow was seen in 16 patients with p value 0.000(HS), loss of retroplacental space was seen in 9 (21.43%) with p value 0.004(S), invasion of uterine serosa in 8 (19.05%) with p value 0.03(S) and increased vascularity was seen in 13(30.95%) patients with p value 0.002 (HS) which was statistically significant.

Table :V COMPARISON OF MRI FINDING WITH INTRAOPERATIVE FINDING (ACCRETA)

MRI		Intraoperative finding (PAS)				Total		'p' value
		Absence of accreta		Presence of accreta		No. of cases	%age	
		No. of cases	%age	No. of cases	%age			
Myometrial Thinning	Absent	21	50.00%	5	11.90%	26	61.90%	0.000 (HS)
	Present	2	4.76%	14	33.33%	16	38.10%	
	Total	23	54.76%	19	45.24%	42	100.00%	
Tenting of urinary bladder	Absent	22	52.38%	14	33.33%	36	85.71%	0.04 (S)
	Present	1	2.38%	5	11.90%	6	14.29%	
	Total	23	54.76%	19	45.24%	42	100.00%	
Loss of uterine serosal plane	Absent	22	52.38%	7	16.67%	29	69.05%	0.000 (HS)
	Present	1	2.38%	12	28.57%	13	30.95%	
	Total	23	54.76%	19	45.24%	42	100.00%	
Focal Bulge	Absent	21	50.00%	7	16.67%	28	66.67%	0.000 (HS)
	Present	2	4.76%	12	28.57%	14	33.33%	
	Total	23	54.76%	19	45.24%	42	100.00%	
Dark Intraplacental bands on T2 weighted images	Absent	22	52.38%	10	23.81%	32	76.19%	0.001 (S)
	Present	1	2.38%	9	21.43%	10	23.81%	
	Total	23	54.76%	19	45.24%	42	100.00%	

In our study, out of 42 patients on MRI, myometrial thinning was seen in 16 (38.10%) patients and tenting of urinary bladder was seen in 6 (14.29%) patients, loss of uterine serosal plane was seen in 13(30.95%) patients, focal bulge in 14 (33.33%) patient, and dark intraplacental bands on T2 weighted images in 10 (23.81%). Out of 19 confirmed cases of accreta on MRI myometrial thinning was seen in 19 (45.24%) patients with p value of 0.000(HS), tenting of urinary bladder seen in 5 (11.90%) patients with p value of 0.04 (S), loss of uterine serosal plane in 12 (28.57%) patients with p value of 0.000(HS), focal bulge in 12 (28.59%) with p value 0.000(HS)and dark intraplacental bands was seen in 19 (21.43%) patients with p value (0.001).

Table :VI SENSITIVITY AND SPECIFICITY OF USG IN (Placenta Accreta Syndrome) PAS

Ultrasound Findings Suggestive of Placenta Accreta	Intraoperative confirmation of Placenta Accreta		Total
	Present	Absent	
Present	17	7	24
Absent	2	16	18
Total	19	23	42

In our study sensitivity of ultrasound was 89.47% and specificity was 69.6%. Positive predictive value was 70.83% and negative predictive value was 84.2%. It was observed that 17/19 confirmed cases of placenta accreta were correctly identified on ultrasonography and 2 cases were missed. 7 (False Positive) cases had ultrasound findings suggestive of accreta but intraoperatively no evidence of accrete. 16 patients were true negative.

TABLE: VII SENSITIVITY AND SPECIFICITY OF MRI IN PAS

MRI Findings Suggestive of Accreta	Intraoperative Confirmation of Accreta		Total
	Present	Absent	
Present	16	2	18
Absent	3	21	24
Total	19	23	42

	True Positive	False Positive	False Negative	True Negative	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value
USG	17	7	2	16	89.47%	69.6%	70.83%	84.21%
MRI	16	2	3	21	84.00%	91.3%	84.21%	87.50%

In our study sensitivity of MRI was 84% and specificity was 91.3% and positive predictive value (PPV) was 84.21% and negative predictive value (NPV) was 87.5%. MRI correctly identifies 16 (True positive) patients, 3 (False negative) patients were missed. 2 patients had MRI findings suggestive of placenta accreta but intraoperatively there was no evidence of accreta and 21 patients were true negative.

Discussion

Placenta accreta spectrum is a condition in which there is direct contact of chorionic villi with the myometrium without an intervening decidua basalis. It includes placenta accreta, placenta increta and placenta percreta.⁷ Placenta accreta spectrum is classified on the basis of depth of myometrial invasion of chorionic villi. In placenta accreta, chorionic villi are attached to the myometrium but do not invade the muscle. In placenta increta, villi partially invade the myometrium. The most severe type of PAS is placenta percreta, in which villi penetrate through whole myometrial thickness or beyond the serosa or may invade surrounding structures.⁸ The aim of this study was to compare the utility of ultrasound and MRI in diagnosis of placenta accreta spectrum disorders. The patients were analysed on the basis of different parameters like age, multiparity, grade of placenta previa, previous history of LSCS, history of curettage, previous history of uterine surgery and any space occupying lesion in the uterus, ultrasonography MRI findings and intraoperative findings. Ultrasound and MRI findings were compared with the intraoperative findings. In our study, out of 42 patients, 4 (9.5%) patients were less than 25 year, 9 (21.43%) patients were between the age of 25 to 30 years, 9 (21.43%) were in age group 31 to 35 years and 20 (47.62%) patients were more than 35 years of age. 6 (14.3%) patients had no living children and 36 (85.7%) patients were multiparous. In our study, we observed that out of 42 patients 13 (30.95%) had no history of uterine curettage, 9 (21.43%) patients had history of one curettage, 9 (21.43%) had history of two curettage, 11 (26.19%) had history of three curettage. Javed K et al⁹ determined the utility of ultrasound and magnetic resonance imaging in prenatal diagnosis of placenta accreta. Only 10 patients with placenta accreta were positive on USG while other 9 patients were found to be negative; and 3 patients were misdiagnosed to have placenta accreta on USG. Only 15 patients with placenta accreta were positive on MRI while other 4 patients were found to be negative; and 2 patients were misdiagnosed to have placenta accreta on USG. On ultrasound the sensitivity and specificity was 52.6% and 72.7% and on MRI was 78.9% and 81.8% respectively.⁴² In our study, according to ultrasound findings, myometrial thinning was seen in 17 (40.48%) patients, lacunae with turbulent flow seen in 21 (50%) patients, loss of retroplacental space was seen in 11 (26.19%) patients, invasion of uterine serosa was seen in 11 (19.05%) patients and increased vascularity was seen in 18 (42.86%). Out of 19 confirmed cases of accreta, 11 (26.19%) patients had myometrial thinning on ultrasound with p value 0.03(S), lacunae with turbulent flow was seen in 16 patients with p value 0.000 (HS), loss of retroplacental space was seen in 9 (21.43%) with p value 0.004 (S), invasion of uterine serosa in 8 (19.05%) with p value 0.03 (S) and increased vascularity was seen in 13 (30.95%) patients with p value 0.002 (HS) which was statistically significant. Romeo V et al¹⁰ detected placental adhesion spectrum (PAS) in patients with placenta previa. He found, loss of retroplacental clear

space, myometrial thinning and placenta lacunar spaces on US; intraplacental dark bands, focal interruption of myometrial border and abnormal vascularity on MRI were statistically significant ($p < 0.01$). Three diagnostic methods for PAS were then developed for both Ultrasound and MRI. MRI showed a significantly ($p < 0.05$) higher accuracy (91%) compared to the other methods. When MRI was used in combination with ultrasound the probability of PAS increased from 75 to 90% (sensitivity) and from 80% to 91% (specificity) respectively.⁴³ In our study, out of 42 patients on MRI, myometrial thinning was seen in 16 (38.10%) patients and tenting of urinary bladder was seen in 6 (14.29%) patients, loss of uterine serosal plane was seen in 13 (30.95%) patients, focal bulge in 14 (33.33%) patient, and dark intraplacental bands on T2 weighted images in 10 (23.81%). Out of 19 confirmed cases of accreta on MRI myometrial thinning was seen in 19 (45.24%) patients with p value of 0.000 (HS), tenting of urinary bladder seen in 5 (11.90%) patients with p value of 0.04 (S), loss of uterine serosal plane in 12 (28.57%) patients with p value of 0.000 (HS), focal bulge in 12 (28.59%) with p value 0.000 (HS) and dark intraplacental bands was seen in 19 (21.43%) patients with p value (0.001). In our study, sensitivity of ultrasound was 89.47% and specificity was 69.6%. Positive predictive value was 70.83% and negative predictive value was 84.2%. It was observed that 17/19 confirmed cases of placenta accreta were correctly identified on ultrasonography and 2 cases were missed. 7 (False Positive) cases had ultrasound findings suggestive of accreta but intraoperatively no evidence of accrete was found. 16 patients were true negative. In our study, sensitivity of MRI was 84% and specificity was 91.3% and positive predictive value (PPV) was 84.21% and negative predictive value (NPV) was 87.5%. MRI correctly identified 16 (True positive) patients, 3 (False negative) patients were missed. 2 patients had MRI findings suggestive of placenta accreta but intraoperatively there was no evidence of accreta and 21 patients were true negative. Thiravit S et al¹¹ included 62 pregnant women with clinically suspected PAS who underwent both ultrasound and MRI. A total of 58.1% (36/62) of patients had severe PAS. On ultrasound, the finding with the highest accuracy for severe PAS was placental bulge (85.5%), which had a sensitivity of 91.7% and specificity of 76.9%. On MRI, the finding with highest accuracy was also placental bulge (90.3%), which had a sensitivity of 94.4% and specificity of 84.6%. In the multivariable regression analysis, placental bulge was an independent predictor of severe PAS on US.

Conclusion

In our study, ultrasound and MRI findings were compared with the intraoperative findings. It was concluded that sensitivity of ultrasound is better than MRI but there is no significant difference. Both USG and MRI had fairly good sensitivity. Specificity of MRI was better than ultrasound. Ultrasound should be used as a first line investigation because of its cost and accessibility. MRI should be reserved for those cases in which USG is inconclusive like posterior localization of placenta and involvement of pelvic organs.

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