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MRI assessment of placental variants to abnormal implantations

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ABSTRACT:

Background:Placenta is responsible for nutritive,respiratory and excretory functions of fetus. Placentais often overlooked in the routine evaluation of a normal gestation unless when anabnormality is detected.Although uncommon,abnormalities of the placenta are important to recognizeantenatally. Placental abnormalities mainly include variants like succenturiateplacenta, abnormal implantation, locationand adherence disorders etc. Although ultrasound is the primary imaging modalityfor evaluation of placenta in the antepartum period,there has been increasing use of MRIfor the diagnosis and characterization of placental adhesion disorders and the cases whichare equivocal in ultrasound.

Materials and Methods: This is a cross sectional observational study over a period of 1 years in the department of Radio diagnosis, NRI Medical College, Chinakakani. MRI pelvis was done with 1.5 Tesla Signa Explorer system. (General Electrical medical systems) with a phased array abdomen coil) for the patients referred to the department of Radio diagnosis from the department of obstretics and gynecology with placental abnormality in the antenatal ultrasound. 50 patients were included in the study. The data obtained was tabulated and analysed.

Results: In our study, the mean gestational age is 34.2 weeks, 14% had succenturiate placenta and 8% had bilobed placenta. 68% of patients had placenta previa out of which complete placenta previa is more common followed by grade-II and grade-III placenta previa. Placental invasion features are seen in 28 subjects out of which Placenta accreta is seen in 33.3%, increta is seen in 38% and percreta is seen in 28.5%.

Key Word: Placental variants; placenta previa; succenturiate placenta; Placental invasion.

I. INTRODUCTION

The Placenta attaches to the uterine wall and allows for the metabolic exchange of various nutrients and gases between the fetus and the mother. It has both embryonic and maternal components. The embryonic portion develops from the outermost embryonic membrane. The maternal portion develops from the decidua basalis of uterus. The placental membrane separates the embryonic blood from maternal blood. It is very thin to allow diffusion and nutrition transport and waste products. The placenta is round or oval in shape and around 22 cm in diameter and weighs around half a pound.

USG is the main imaging modality used for fetal imaging during pregnancy, as it can identify fetal and placental abnormalities, without any ionizing radiation. It has widespread availability and can be repeated with reduced risk to the patient and foetus[1]. Grayscale sonography was found to have a sensitivity of 77% to 87% and specificity of 96% to 98% for placenta accreta[2]. Magnetic resonance imaging (MRI) offers various advantages over USG, including better soft tissue contrast resolution and the wider field of view.

Ultrasonography (USG) characteristics that indicate placenta accrete spectrum include loss of retroplacental sonolucent zone, myometrial thinning, vascular lacunae, and discontinuity in the bladder line[3]. Recently imaging of the placenta is gaining focus due to its impact on fetal and maternal clinical outcomes. MRI plays a vital role in determining inconclusive cases by USG[4]. It enables reliable mapping of placental abnormalities for appropriate multidisciplinary planning and management. Hence the current study was conducted for the evaluation of placental abnormalities using MRI.

II. MATERIAL AND METHODS

This cross-sectional observational study was carried at the department of radiodiagnosis,

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NRI medical college, and general hospital with abnormal antenatal ultrasound from November 2021 to November 2022.

Study Design: Cross-sectional observational study.
Study Location: This was a tertiary care teaching hospital-based study done in the Department of Radio diagnosis, at NRI medical college and general Hospital, Chinnakakni, Guntur, Andhra Pradesh.
Study Duration: November 2021 to November 2022.
Sample size: 50 patients.
Sample size calculation: Convenience Sampling.
As per CE Aiken, the incidence of most common placental abnormality- abruptio placenta is 0.5%of pregnancies. $N=Z^2PQ/E^2$
N-sample size
P=0.5%
Q=1-P
E-Error: 2%,
Z-Constant number: 1.96 for 95% confidence limits
N=48 48 is the minimum sample size. So, we included 50 patients in the current study.

Subjects & selection method: The study population was drawn from gravid women who are referred from the department of obstetrics and gynecology with a placental abnormality on an antenatal ultrasound scan.

Inclusion criteria:
1. Gravid women with placental abnormalities detected in antenatal ultrasound.
2. Women aged above 18 years.
3. Women who provided informed consent to the present study.

Exclusion criteria:
1. Women are having history of claustrophobia.
2. Women with cardiac pacemakers, prosthetic cardiac valves, cochlear implants or any metallic implants.

Procedure methodology:

After written informed consent was obtained, all the subjects have undergone the MRI pelvis using 1.5 Tesla Signa Explorer system. (General Electrical medical systems) with a phased array abdomen coil)

MRI safety:

Exclusive MRI screening was done, that is all the patients were screened with a metal detector before the procedure to avoid complications due to any implants. Possible contraindications were checked. Metallic jewels were removed before the MRI examination. All the patients were informed that an increase in body temperature, blood pressure, or heart rate could occur.

Patient preparation:
- Patients were asked to change to the hospital gown and written consent was obtained.
- Mandatory safety precautions during MRI examinations were followed.
- Patients were informed about the procedure, the length of the scan, and any potential side effects prior to the examination to alleviate their fears.
- The patients were asked to practice the breath controlling exercises.

PATIENT POSITIONING
Position: Supine, Foot first.
Coil: Abdomen coil

SELECTION OF PROTOCOL:
MRI pelvis protocol for imaging the placenta was selected from the protocol library.

IMAGING SEQUENCES
- Localiser
- T2 W coronal, axial, sagittal
- FIESTA- coronal, axial, sagittal
- T2FSE-sagittal
- T1 fat sat - axial
- Diffusion-axial, sagittal

T2 weighted pulse sequence- fast spin eco sequence in axial, sagittal and coronal planes with TE of 90 ms, TR of 5000 ms done with slice thickness of 5mm done for anatomic details, placental position, attachment and depth of invasion.

Fast imaging employing steady state acquisition sequence (FIESTA) in axial, coronal and sagittal planes with TE 1 ms, TR 4 ms and slice thickness of 5mm was done to assess the placental vascularity.
T1 weighted sequence fast spin echo sequence in axial planes with TE 4ms, TR 15, slice thickness of 5mm done for assessing the subplacentalhaemorrhage.

Axial and sagittal diffusion weighted images with B value of 1000sec/ mm3 done for assessing the placental and myometrial interface

Statistical analysis:

Data was analyzed using SPSS version 20 (SPSS Inc., Chicago, IL). Student's t-test was used to ascertain the significance of differences between mean values of two continuous variables and

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confirmed by nonparametric Mann-Whitney test. In addition, paired t-test was used to determine the difference between baseline and 2 years after regarding biochemistry parameters, and this was confirmed by the Wilcoxon test which wasa nonparametric test that compares two paired groups. Chi-square and Fisher exact tests were performed to test for differences in proportions of categorical variables between two or more groups. The level P < 0.05 was considered as the cutoff value or significance.

III. RESULTS

Age distribution: Age ranged from 19 – 38 years. 84% of patients were aged 21 to 30 years. 12% were aged 31 to 40 years. 4% were aged below 20 years. The mean age is 26.9 years.

AGE GROUP	Frequency	Percent	Cum. Percent
21-30	42	84.00%	84.00%
31-40	6	12.00%	96.00%
Below 20	2	4.00%	100.00%
Total	50	100.00%	100.00%

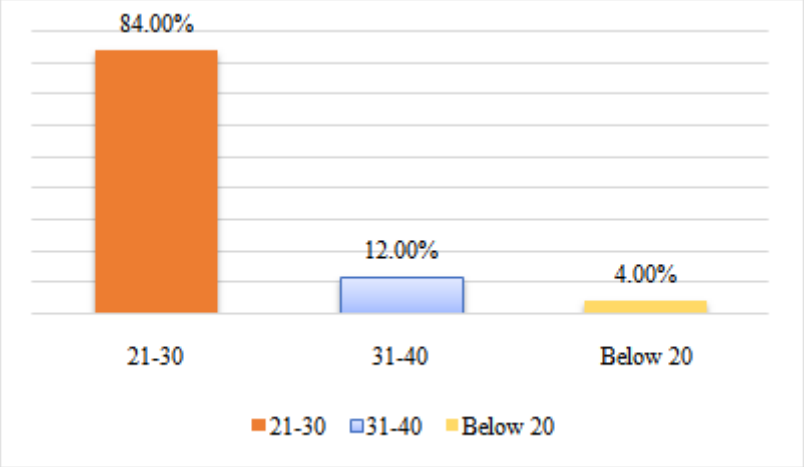

Table and Graph 1: Depicting the age distribution of the subjects.

Gestational age: Gestational age ranged from 28 – 39 weeks**.** The mean gestational age is 34.2 weeks.

Obs	Total	Mean	Variance	Std Dev
50.0000	1710.0000	34.2000	9.6735	3.1102
Minimum	Median	Maximum	Mode	
28.0000	35.0000	39.0000	36.0000	

H/o previous cesarean sections:58% of women underwent 1 previous caesarean section. 22% of women underwent 2 caesarean section. 1.08 is mean C section rate

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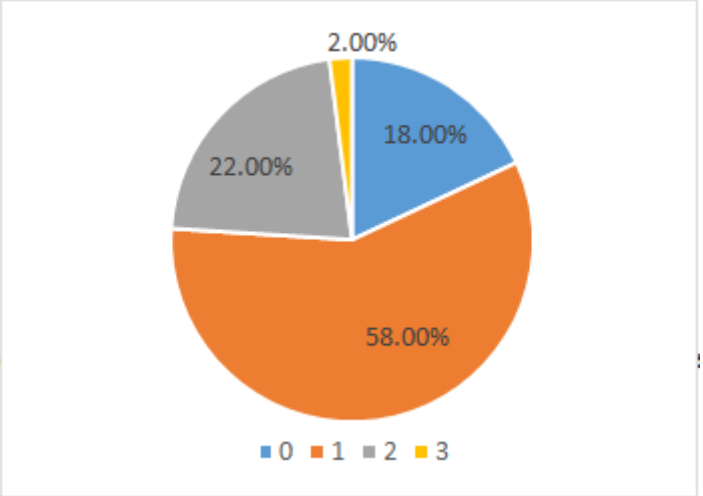
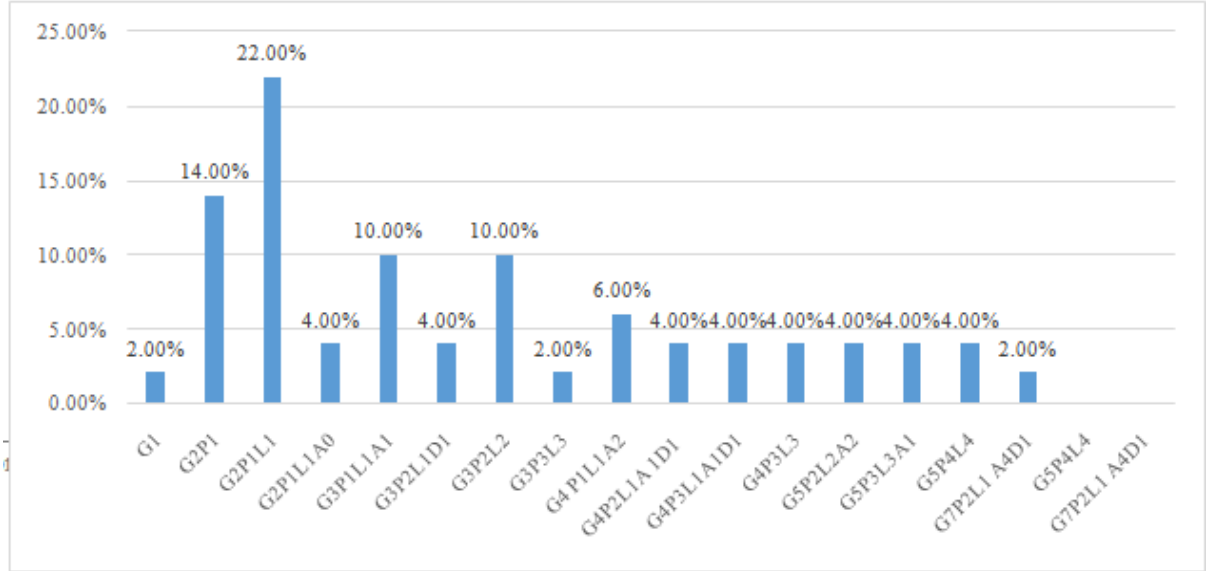
CESAREAN SECTIONS	Frequency	Percent
0	9	18.00%
1	29	58.00%
2	11	22.00%
3	1	2.00%
Total	50	100.00%



Obstetric formula: Obstetric formula for most of the women was G2P1L1.Next common Obstetric formula was G2A1.



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Placental location:

30%of patients had posterior lower placenta, 28% had anterior lower placenta, 26% patients had anterior placenta and 10% had posterior placenta.

PLACENTAL LOCATION	Frequency	Percent
Anterior, posterior, lower segment	3	6.00%
Anterior and Lower segment	14	28.00%
Anterior	13	26.00%
Posterior and lower segment	15	30.00%
Posterior	5	10.00%
Total	50	100.00%

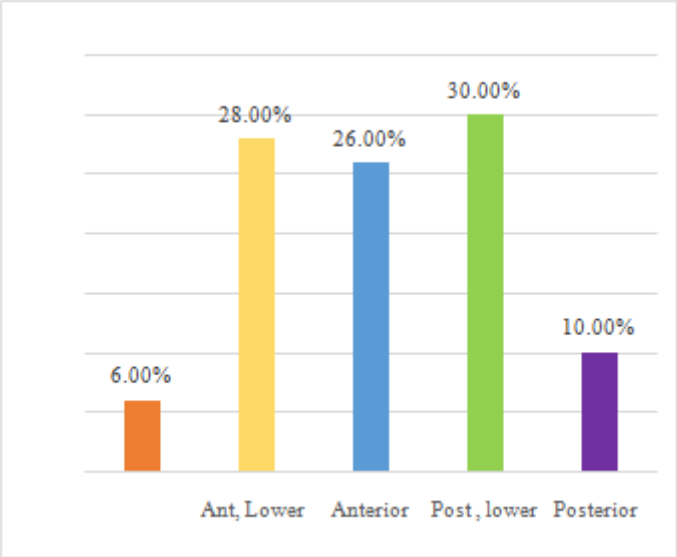

Table and graph :Depicting the placental location.

Accessory Lobes:

22% had accessory lobes out of which 14% had succenturiate placenta and 8% had bilobed placenta. 78% patients had no accessory lobe

ACCESSORY LOBES	Frequency	Percent
No	39	78.00%
Bilobed	4	8.00%

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Succenturiate	7	14.00%
Total	50	100.00%

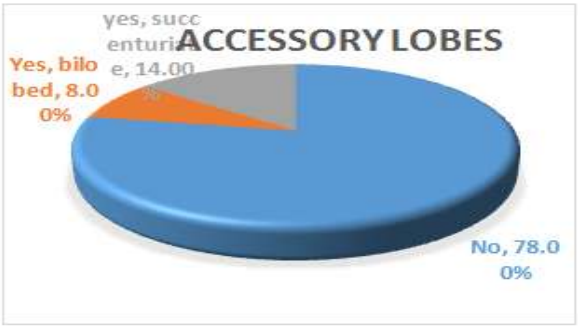

Table and graph:Depicting the accessory lobes.

Placenta previa& grading:
34 out of 50 had different grades of placenta previa. Out of which 23 subjects(67.6%) had Grade-IV, 4 (11.76%)subjects had grade-III, 6(17.4%) subjects had grade-II and 1(2.9%) had grade-I placenta previa.

PLACENTA PREVIA	Frequency	Percent
YES	34	68.00%
No	16	32.00%
Total	50	100.00%

Table: Frequency of placenta previa.

Placenta previa grading	Frequency	Percent
Low lying- I	**1**	**2.9%**
Marginal, II	**6**	**17.4%**
Grade-III	**4**	**11.76%**
Complete, IV	**23**	**67.6%**
Total	**34**	**100%**

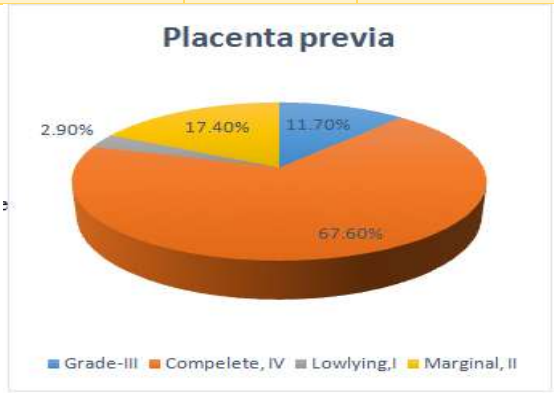

Table and Graph : Depicting the frequency of different grades of placenta previa.

Placental invasion spectrum:
Signs on MRI for detecting the placental invasion spectrum:

- ✓ Placental signal intensity – homogenous / heterogeneous.
- ✓ Presence of T2 dark bands
- ✓ Loss of retroplacental T2 dark zone

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- ✓ Presence of abnormal uterine bulge
- ✓ Presence of abnormal placental bulge
- ✓ Presence of myometrial thickening
- ✓ Presence of serosal invasion.

Depending on the above described signs different types of placental invasion spectrum are diagnosed. Placental invasion features are seen in 28 subjects (42%) out of which Placenta accreta is seen in 33.3%, increta is seen in 38% and percreta is seen in 28.5%.

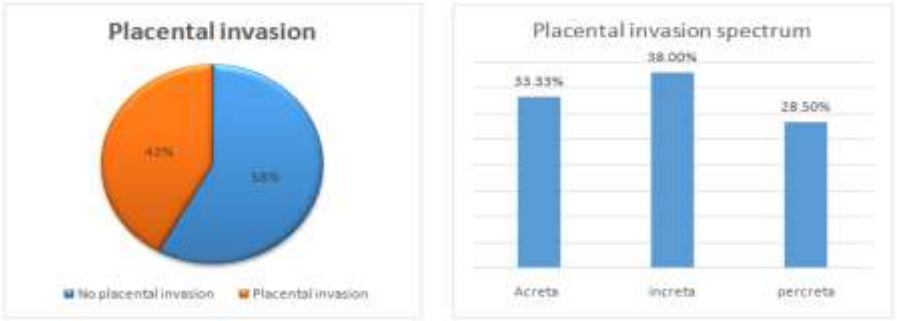
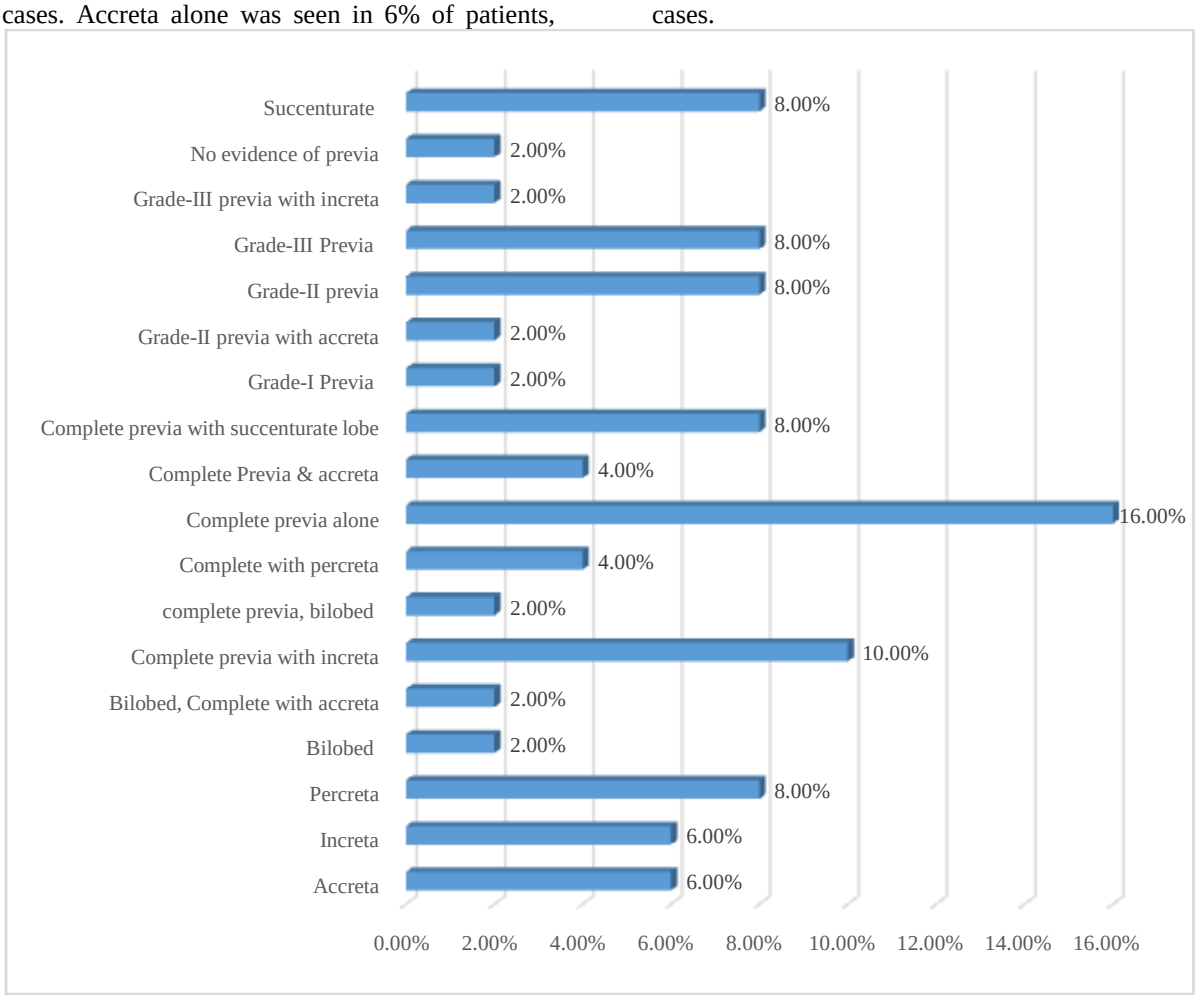


Chart and graph: Depicting the frequency of placental invasion spectrum.

MRI Findings:

The most common MRI finding was complete previa alone, which was seen in 16% of cases. Accreta alone was seen in 6% of patients, percreta alone in 8% of cases, increate alone in 6% of cases. Complete previa with bilobed placenta in 2% if cases, complete previa with increta in 10% of cases.



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IV. DISCUSSION

Placenta is a multifunctional disc shaped organ developing from both maternal and fetal tissues which constitute dense branched villous structures which contribute in the exchange of blood between the foetus and the mother[5].The placenta's imaging appearance modifies with gestation[5]during 19-23 weeks- T2 imaging shows homogeneous signal intensity, during 24-31 weeks-placenta will become lobulated and septae appear between the placental lobules, T2W images in all planes shows heterogeneous signal intensity in late trimesters.

The normal placenta may be located anterior, posterior, fundal, or lateral. The tissue may migrate to different positions during the 1st 15 weeks of gestation as it seeks preferential areas of more blood supply. Few vascular flow voids of less than 5mm diameter may be seen in the retroplacental location and in placental parenchyma more often at the site of umbilical cord insertion[6].MRI is useful for[7] delineating accessory placental lobes or other placental variants, abnormal placental location& invasion, placental vascular anomalies etc..

Placental evaluation using MRI mainly depends on sequences that were acquired in three planes. Single-shot fast spin-echo or half-acquisition turbo spin-echo andBalanced steady-state free procession(Fast imaging employing steady state acquisition [FIESTA]).

In our study, age of the patients ranged from 19 – 38 years, the mean gestational age is 34.2 weeks, Obstetric formula for most of the women was G2P1L1, thenext common obstetric formula was G2A1.58% of women underwent 1 previous cesarean section. 30% of patients had posterior lower placenta, 28% had anterior lower placenta.22% of patients had accessory lob, of which 14% had succenturiate placenta and 8% had bilobed placenta. 68% of patients had placenta previa out of which complete placenta previa is more common accounting for 67.6%, grade-III placenta previa is seen in 11.76%,grade-II placenta previa in 17.4% and grade-I placenta previa in 2.9% of patients.Placental invasion features are seen in 28 subjects (42%) out of which Placenta accreta is seen in 33.3%, increta is seen in 38% and percreta is seen in 28.5%.

HABA RMet al. wanted to assess the diagnostic and prognostic reliability of US and MRI in placental disorders. 39 adult pregnant subjects with minimum of 1 previous C section were included. All women underwent both USG and MRI. The study was done at a tertiary maternity hospital 'CuzaVoda', from 2019 to 2021.[8]Intra-placental lacunae, myometrial thinning, loss of retroplacental hypoechoic zone, interruption of bladder wall, bridging vessels, placental bulging, and hypervascularity of retroplacental space were assessed.

MRI signs that were determined include placental bulging, intra-placental dark T2 bands, loss of the retroplacentalhyperintensity on T2W, bladder wall interruption, myometrial thinning, exophytic placental mass, and abnormal vascularization. Results showed that the presence of 3 or more US markers for accreta had a sensitivity of 84.6.6% and a specificity of 92.3%.The presence of three or more MRI markers added reliability to these results and were having a sensitivity of 92.3% and a specificity of 61.5% in predicting placental accreta spectrum.Authors concluded that presence of 3 or more image signs could significantly raise the diagnostic accuracy. US and MRI could act as very useful tools for evaluating prognostic and perinatal planning.

Annie Sophie[9]et al wanted to determine the accuracy of USG and MRI in diagnosing placenta accreta. They retrospectively reviewed medical records of patients referred with suspected placenta accreta. The study was done for 12 years from 2001 to 2012. They included 42 pregnant women who underwent both ultrasonography and MRI. Ultrasound images and MRI were reassessed for each patients by 2 radiologists to score features that predict abnormal invasion.Sensitivity in the diagnosis placenta accreta was found to be 100% with USG and 76.9% for MRI.Specificity was found to be 37.5% with USG and 50% for MRI.

The imaging features of greatest sensitivity on USG were intra-placental lacunae and loss of retroplacental clear space which is normal. More vascularization in uterine serosa-bladder wall interface and vascularization that is perpendicular to uterine wall showed best PPV which is 92%.Uterine bulging in MRI showed to have PPV of 85% and its combination with dark intraplacental bands on T2WI improved the predictive value to Ninety percent.

V. CONCLUSION

As per our study results, MRI is a reliable and reproducible method in prenatal diagnosis of placental abnormalities.It helps in planning a safe and proper delivery, which positively affects foetal and maternal outcomes.MRI criteria are reliable markers for detection and, staging of placental adhesion, that guide the obstetrician to achieve optimal surgical management. Though, ultrasound imaging is considered the mainstay of screening for placental abnormalities. MRI appears to be

complementary to USG, especially in presence of equivocal diagnosis.

REFERENCES

[1]. Hertzberg BS, Middleton WD. Ultrasound: the requisites. Elsevier Health Sciences; 2015 Jul 17.
[2]. Oyelese Y, Smulian JC. Placenta previa, placenta accreta, and vasa previa. Obstet Gynecol. 2006 Apr;107(4):927-41.
[3]. Cheung CS, Chan BC. The sonographic appearance and obstetric management of placenta accreta. Int J Women's Health. 2012; 4:587-94.
[4]. Zaghal AA, Hussain HK, Berjawi GA. MRI evaluation of the placenta from normal variants to abnormalities of implantation and malignancies. J MagnReson Imaging. 2019 Dec;50(6):1702-1717. doi: 10.1002/jmri.26764. Epub 2019 May 17. PMID: 31102327.
[5]. Allen BC, Leyendecker JR. Placental evaluation with magnetic resonance. Radiol. Clin. North Am. 2013;51 (6): 955-66. doi: 10.1016/j.rcl.2013.07.009.
[6]. Srisajjakul S, Prapaisilp P, Bangchokdee S. MRI of placental adhesive disorder. The British journal of radiology. 2014 Oct;87(1042):20140294.
[7]. Blaicher W, Brugger PC, Mittermayer C et-al. Magnetic resonance imaging of the normal placenta. Eur J Radiol. 2006;57 (2): 256-60. doi:10.1016/j.ejrad.2005.11.025.
[8]. Haba, R.M.; Pristavu, A.I.; Cobzeanu, M.-Let al. Predicting Placenta Accreta Spectrum Disorders in a Cohort of Pregnant Patients in the North-East Region of Romania—Diagnostic Accuracy of Ultrasound and Magnetic Resonance Imaging. Diagnostics 2022, 12, 2130.
[9]. Riteau A-S, Tassin M, Chambon G, Le Vaillant C, de Laveaucoupet J, Quéré M-P, et al. (2014) Accuracy of Ultrasonography and Magnetic Resonance Imaging in the Diagnosis of Placenta Accreta. PLoS ONE 9(4): e94866. https://doi.org/10.1371/journal.pone.0094866.