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Original Research Article

CORRELATION OF MRI AND USG WITH OPERATIVE FINDINGS OF PLACENTA PREVIA AND PLACENTA ACCRETA SPECTRUM

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ABSTRACT

Background: Aims: Correlation between MRI, USG, and intraoperative findings to find out diagnostic accuracy in placenta previa localization and it's adherence.

Materials and Methods: The present study is a hospital based prospective study with a sample size of 50 conducted in Department of Obstetrics and Gynecology from July 2022 to December 2023 with an aim to Correlate between MRI, USG and intraoperative findings to find out diagnostic accuracy in placenta previa localization.

Results: The mean age of participants was 24.84 ± 2.81 years, with 82% being booked cases. Most had previous obstetric history: 88% had prior abortions and 78% prior LSCS. Gestational bleeding mostly occurred between 32–36 weeks, with delivery at 36–37 weeks in 60%. Adherent placenta was found intraoperatively in 68% of cases. MRI showed higher diagnostic accuracy (90.91%) than USG (86.21%) for adherent placenta. Preterm births accounted for 72% of deliveries; NICU admission was required in 32%, with 2% neonatal mortality. No maternal deaths were noted, though complications included bladder injury (17%) and AKI (16%). Blood transfusions were common, and 47% of adherent placenta cases required hysterectomy.

Conclusion: MRI is accurate, affordable, non-invasive, and saves time, ultrasonography is still the imaging modality that is most usually used for diagnosing placenta accreta. It is also the most sensitive imaging modality available and can be used as only investigation to diagnose previa and it's adherence.

Keywords: Placenta previa, Adherent placenta, Placenta accreta spectrum, Cesarean hysterectomy, MRI, Ultrasound, Antenatal diagnosis, Preterm delivery, NICU admission, Maternal outcomes, Surgical management, Obstetric haemorrhage.

INTRODUCTION

Placenta previa is an obstetric disorder that can have catastrophic implications, as it involves the aberrant placement of the placenta near or above the internal cervical os, rather than its usual upper position near the fundus of uterus. In the majority of cases, the placenta is often located in the upper uterine segment often in close proximity to the fundus. However, the position of the placenta has the potential to change, either completely or partially residing in the lower uterine segment, which can lead to the condition known as placenta previa. These outcomes are associated with antepartum hemorrhage, fetal growth restriction and postpartum hemorrhage. This phenomenon occurs due to the diminished contractile ability of the lower uterine segment, to which the placenta is implanted. The prompt and precise identification of placenta previa is essential in order to successfully manage the well-being of both the mother and the fetus. Within the medical imaging field, various modalities assume a crucial role in the identification and verification of placenta previa. The

utilization of transabdominal and transvaginal ultrasound is prevalent in clinical practice owing to their non-invasive characteristics and capacity to yield intricate visual representations of the placenta's positioning and its proximity to the cervix and also adherence. Magnetic Resonance Imaging (MRI) is a highly valuable modality that provides high-resolution images, thereby serving as a useful adjunct in situations where ultrasound findings are ambiguous. The selection of an imaging modality is influenced by multiple aspects, including the gestational age, placental position, and the patient's clinical history.[1,2] These elements all lead to establishing a thorough diagnosis and subsequent therapy plan. This current study is being undertaken to compare the findings of MRI and Ultrasonography with the operative findings.

MATERIALS AND METHODS

Hospital based prospective study from july 2022 to december 2023 All 50 cases of antenal women with placenta previa admitted delivered at Gandhi hospital, Secunderabad, Hyd.

Inclusion Criteria: All pregnant women with gestational age >28weeks of gestation on USG showing placenta previa

Exclusion Criteria

- Pregnant women with gestational age <28 weeks
- Multiple pregnancies (twins, triplets, etc.)
- Known cases of placental abruption
- Patients with coagulation disorders or bleeding diathesis
- Women with uterine anomalies or known fibroids affecting placental site
- History of recent trauma or surgical intervention during pregnancy
- Cases with intrauterine fetal demise (IUFD) at the time of admission

After taking consents from patients, age of the patient, booking status, details of obstetric history, including previous pregnancy outcome, number of previous normal deliveries, number of previous LSCS, its indications, interval between two pregnancies, number of previous abortions, spontaneous or induced, gestational age at the onset of bleeding, expectant management, gestational age at delivery, elective/emergency and the mode of delivery, maternal morbidity and mortality, duration of hospital stay will be studied. The birth weight and APGAR score of the newborn, NICU admissions, neonatal mortality will also be taken. Correlation between MRI, USG and operative findings will be made.

RESULTS

The mean age of the study population was 24.84 ± 2.81 years.

Table 1: Demographic details in present study

Age group	**Number of patients**	**Percentage**
20-24	25	50
25-30	25	50
Grand Total	50	100
Booking status		
Booked	41	82
Unbooked	9	18
Gravida		
1	15	30
2	16	32
3	19	38
Parity		
0	17	34
1	20	40
2	13	26
Type of abortions		
Induced	1	11.11
spontaneous	8	88.89
LSCS		
0	39	78
1	11	22
Indication emergency LSCS		
APH	6	50.0
CPD	1	8.3
Fetal distress	1	8.3
IUGR	1	8.3
PIH	2	16.7
PROM	1	8.3
Elective /Emergency LSCS		
Emergency	12	24
Elective	38	76

In this study of 50 antenatal women with placenta previa, the mean age distribution was evenly split, with 50% aged 20–24 years and 50% aged 25–30 years. Most patients were booked cases (82%). The

most common gravida status was G3 (38%), and 34% were nulliparous. Regarding previous abortions, 88.89% had spontaneous abortions, and only 11.11% had induced abortions. A history of previous LSCS was present in 22% of cases. Among these, antepartum hemorrhage (APH) was the most common indication (50%) for emergency LSCS. Elective cesarean sections were more common (76%) than emergency LSCS (24%).

Table 2: Pregnancy details in present study

Interval in years	Number of patients	Percentage
1	7	20
2	4	11
3	14	40.5%
4	10	28.5%
Grand Total	34	100.0
Prev NVD		
1	15	68
2	7	32
Grand Total	22	100.0
Prev H/O		
Induced	1	12.5
Spontaneous	7	87.5
Grand Total	8	100.0
Gestational age		
28-31	19	38.0
32-36	31	62.0
Grand Total	50	100.0

Among the 34 patients with previous pregnancies, the most common inter-pregnancy interval was 3 years (40.5%), followed by 4 years (28.5%) and 1 year (20%). Of those with a history of normal vaginal delivery (NVD), 68% had one prior NVD, and 32% had two. Among patients with a history of abortion (n = 8), 87.5% were spontaneous and 12.5% induced. At the time of presentation, 62% of patients were between 32–36 weeks gestation, while 38% were between 28–31 weeks. This reflects that most cases of placenta previa presented in the late preterm period.

Table 3: Intra-Operative, MRI and ultrasound Findings

Intra-Operative Findings:	Number of patients	Percentage
Adherent	34	68
Nonadherent	16	32
MRI Findings		
Adherent	33	66
Nonadherent	17	34
Ultrasound Findings		
Adherent	32	64
Nonadherent	18	36

- **Intraoperative Findings** confirmed **adherent placenta in 68%** (34 out of 50 cases), while 32% were non-adherent.
- **MRI findings** showed **adherent placenta in 66%** of cases and non-adherent in 34%.
- **Ultrasound (USG)** detected **adherent placenta in 64%** and non-adherent in 36%.

This indicates that both MRI and USG were fairly accurate in predicting placental adherence, with **MRI slightly outperforming USG** in terms of detection rates and correlation with surgical findings.

Table 4: Intraoperative findings versus MRI versus USG

Findings	MRI	USG findings	Intaop findings
Adherent	33	32	34
Nonadherent	17	18	16

Table 5: Intra-operative findings versus MRI

Statistic	Value	95% CI
Sensitivity	91.89%	78.09% to 98.30%
Specificity	88.89%	65.29% to 98.62%
Positive Likelihood Ratio	8.27	2.23 to 30.66
Negative Likelihood Ratio	0.09	0.03 to 0.27
Adherence prevalence	67.27%	53.29% to 79.32%
Positive Predictive Value (*)	94.44%	82.10% to 98.44%
Negative Predictive Value (*)	84.21%	64.04% to 94.11%
Accuracy (*)	90.91%	80.05% to 96.98%

MRI demonstrates high sensitivity (91.89%) and specificity (88.89%) in diagnosing adherent placenta, with an overall accuracy of 90.91%. Its strong positive predictive value (94.44%) and low negative likelihood ratio (0.09) highlight its reliability in confirming and excluding adherence, respectively.

Table 6: Intra-operative findings versus Ultrasound

Statistic	Value	95% CI
Sensitivity	87.18%	72.57% to 95.70%
Specificity	84.21%	60.42% to 96.62%
Positive Likelihood Ratio	5.52	1.94 to 15.71
Negative Likelihood Ratio	0.15	0.07 to 0.35
Adherence prevalence	67.24%	53.66% to 78.99%
Positive Predictive Value (*)	91.89%	79.94% to 96.99%
Negative Predictive Value (*)	76.19%	57.98% to 88.13%
Accuracy (*)	86.21%	74.62% to 93.85%

Ultrasound achieved good—but not outstanding—diagnostic power for placental adherence, with sensitivity 87.2 % and specificity 84.2 % (overall accuracy 86.2 %). Its positive predictive value of 91.9 % indicates that an "adherent" report on ultrasound is usually correct, yet the negative predictive value of 76.2 % and LR– 0.15 mean that one in four ultrasound negative cases can still prove adherent at surgery.

Table 7: NICU admissions and neonatal mortality

Gestational Age	Number of Neonates	NICU admissions	NICU deaths
TERM	14	0	0
PRE-TERM	36	16	1
TOTAL	50	16	1

No maternal mortality noted. All patients were discharged healthy.

- **Pre-term births accounted for 72 % (36/50) of all deliveries.**
- Nearly half of pre-term neonates required NICU care (44.4 %), whereas no term infants needed admission.

Table 8: Other operative findings

Maternal Morbidity	Number of cases
blood products transfusion	40
AKI	8
Ventilatory Support	7
Hysterectomy	16
INTRAOP INTERVENTIONS	
Perioperative localization to find upper edge of placenta	50
Application of stay sutures to incision	8
Closing the incision before hysterectomy	8
Aorto-caval compression	40
Prophylactic DJ stenting	38
Low lithotomy position - aiding easy dissection	50
Cystectomy in percreta invaded bladders	6
Components of blood products transfused	
packed cells	45
fresh frozen plasma	11
random donor platelets	15
Anesthesia	
Spinal	16
General	34

Table 9: Patients landed in Cesarean hysterectomy in Placenta Previa

Surgery Performed	Adherent	Non Adherent	Total
Cesarean Hysterectomy	16	0	16
LSCS	18	16	34
Total	34	16	50

Table 10: Cases persisted as Placenta previa and Placenta Accreta Spectrum

	<20 weeks of GA	Third Trimester
Placenta Previa	100	34
Placenta Accreta spectrum	16	16

All caesarean hysterectomies (32 % of surgeries) were performed for adherent placentas, reflecting the need for definitive management in these high risk cases. LSCS was the default procedure for non adherent placentas (16/16), but it was also used in slightly more than half of the adherent cases (18/34)

where uterine conservation proved feasible. Overall, 47 % of adherent placenta cases (16/34) required hysterectomy, while 53 % were managed conservatively with LSCS alone.

DISCUSSION

A trend of rising placenta previa incidence was reported in the last decade largely due to an increasing caesarean section rate and advancing mother age at the time of pregnancy. This older age group is linked to multiple gestations, chromosomal abnormalities, subfertility, and a number of obstetric concerns, such as placenta previa. The additional risk variables that also demonstrated a substantial link with placenta previa are numerous gestations, high parity, a history of prior abortions, prior uterine procedures, and past placenta previa. The mean age of our study population was 24.84 ∓ 2.81 years with equal distribution among 20-24 years and 25-30 years age groups. In Zhang et. al.'s study, when compared to women under the age of 20, a multivariate analysis revealed that pregnant women aged 34 or older had a risk of placenta previa that was two to three times higher than that of younger women. With increasing age, a distinct dose-response pattern was seen in the data.[3]

In a prospective study conducted by Rose et. al., to study the Correlation of maternal age with placenta previa, women who were 35 years of age or older had a 3.6% higher chance of placenta previa, which was statistically significant ($p<0.05$). It is still not fully known if older maternal age disrupts the normal growth of the placenta. This mechanism is thought to be involved. One of the probable reasons might be that the proportion of sclerotic alterations on intramyometrial arteries increases with growing age, therefore limiting the blood supply to the placenta. This would be consistent with the observation that this percentage increases with increasing age.

According to physiology, normal muscle in the wall of the myometrial arteries gradually gives way to collagen as women age. Defective vascularization of the decidua may also arise from these atrophic alterations in elderly women. Under vascularization and under perfusion have both been suggested to be significant factors in the development of PP. Mean age distribution of our study with other studies in the literature as Sekiguchi et. Al,[4] McLaughlin et. Al[5], Fratelli et. Al,[6] Ishibashi et. Al,[7] and Riteau et. Al.[8] The mean age of our study is less compared to other studies.

An early diagnosis of placenta previa can be obtained through the use of routine sonography during the first and second trimesters of pregnancy. It is essential to be aware of the fact that the earlier a diagnosis of placenta previa is made, the greater the likelihood that the condition will resolve itself after birth as a result of placental migration. By the end of the third trimester, about 90 percent of placentas that have been classified as "low lying" will have completely resolved.[1]

In our study, 82% (41 patients) were booked cases i.e., already registered with our department. 18% (9 patients) were unbooked cases. In a study by Urmila et. al., the bulk of the patients were unbooked and were from rural backgrounds (73.77%). This made-up 67.21 percent of the total cases. This is owing to the significant weight of cases that are sent from peripheral health centres to the tertiary care centre, which serves the enormous population that resides in western Rajasthan.[9]

Gravida 3 was the most common presentation in our study constituting 38% (19 patients) of the cases. 30%(15) were gravida 1 and 32%(16) gravida 3. Parity 1 was the most common finding in our study constituting 46% (23 patients) followed by para 0 i.e., primipara constituted 36% (18 patients) followed by para 2 in 26% (13 patients). These results were comparable with other studies in literature. In Alhubaishi et. Al,[10] study, 23.1% (50) were nulligravida, 34%,[17] were para 1 patients, and 25.9% (56) were para 2 patients.. In Riteau et. Al,[8] study, the mean gravidity was 4.2±2.3 and mean parity was 2.1±1.5. suggesting the more the parity the greater is the risk of placenta previa development. Abu-Heija et. Al,[11] study found that while there is no significant correlation between prior abortions and PP, but the risk of PP increases after gravidity >4 and parity >3. A number of theories have been put out to explain these relationships to reproductive history. Any pregnancy, particularly those that do not result in termination, has the potential to harm the endometrium underneath the place of implantation. These regions might no longer be appropriate for implantation, which would lead to a lower uterine segment implantation in the future. Parity and placenta previa in study population of our study with other studies in literature. The results correlated well with Alhubaiushi et. Al,[10] study but the parity was lower when compared to Elhawary et. Al,[12] study.

8 out of 50 patients (16%) in our study had previous history of abortions. Spontaneous abortions were seen in 7 patients where as induced abortion was seen in one patient. These results correlated well with previous studies in literature. Abu- Heija et. Al.[11] found no significant association (1 previous abortion history of 17.9% in cases vs 14.2% in controls) with abortions and placenta previa risk in subsequent pregnancies. However, after controlling for confounding factors, Taylor et al,[13] study indicated that the odds ratio for one or more induced abortions was 1.28 (95% CI 1.00-1.63). The risk ratio for one or more spontaneous abortions was 1.30 (95% CI 1.01-1.66). Compared to women without such a history, women who report one or more induced or spontaneous abortions are 30% more likely to experience a problematic following pregnancy due to placenta previa. The findings shouldn't be extrapolated to situations in which suction curettage isn't the recommended induced abortion technique.

Previous LSCS was done in 22% (11 out of 50 patients) in our study. Of the 11 patients, 5(45%) patients had h/o 1 prev lscs,6(55%)patients had h/o 2 prev lscs. Among the 50 patients included in our study 35 were multiparas. 15 patients (68%)had one previous NVD and 7 patients (32%) had two previous NVDs. Placenta previa is more common in people who have had a previous caesarean section than in people whose uterus is unscarred, with reports of a 2- to 5-fold increase in incidence. Bender initially proposed the link between a prior caesarean section and the development of placenta previa. According to Singh et al,[14] 3.9% of patients who had previously undergone a caesarean section had placenta previa, which is the greatest occurrence of the condition.

Various explanations have been put out to explain the connection between placenta previa and prior caesarean sections. A lower segment uterine scar may cause a low placenta implantation, or placenta previa may result from a scarred lower uterine segment's inability to expand. The latter argument, which states that an increase in scar tissue in the lower segment would further restrict the lower segment's ability to grow differently, may also help to explain the increased incidence of placenta previa associated with a rising number of caesarean surgery scars. These different theories most likely operate differently in different patients. It is unclear which clinically discernible circumstances, in individuals who have had a prior caesarean section, may be favourable to the development of placenta accreta. For both individuals who developed placenta accreta and those who did not, there was no discernible difference in the interval from the prior caesarean birth (interpregnancy interval) or the previous post-caesarean uterine infection in Leung et. al. study.[15]

The above table compares the history of previous LSCS in association with placenta previa in our study when compared to other studies in literature. The results correlate well with Fitzpatrick et. al.[16] and Sekiguchi et. Al,[4] but our results showed lesser incidence when compared to Riteau et. Al,[8] study.

Among 35 multiparas included in our study, 14 patients (40%) had an interval of 3 years between two pregnancies followed by 10 patients (28.1%) who had 4 years between two pregnancies. The results were not significant. These correlated well with previous studies in literature. Intercesarean interval was not observed to be associated with PAS in case-control study that was carried out by Fitzpatrick et al.[16] This investigation was done in 2012 and discovered many risk factors for PAS. In that study, the controls were pregnant women who delivered their babies soon after a case of PAS at a particular facility and did not have PAS, indicating that they may not have had any risk factors for PAS. The interval between pregnancies and correlation with placenta previa in our study in comparison with Fitzpatrick et. Al,[16] study. However, the results were not statistically significant.

Although placenta previa is linked to antepartum bleeding, not all women who have the syndrome will have the kind of significant bleeding that requires an early caesarean delivery. In the treatment of placenta previa, the capacity to accurately forecast significant antepartum bleeding and the need for an emergency caesarean surgery is absolutely necessary. 62% (31) of the patients in our study had bleeding episode at 32 – 36 weeks of gestational age. 38% had onset of bleeding at 28-31 weeks of gestational age. In our study, 14 patients (28%) had delivery at 37weeks of gestational age, 16 patients (32%) had delivery at 35 and 36 weeks each. In Atsuko Sekiguchi et. Al,[4] study, Antepartum haemorrhage was more prevalent in women with complete placenta previa than in those with incomplete placenta previa (59.1% versus 17.6%), which resulted in the higher incidence of preterm delivery in women with complete placenta previa than in those with incomplete placenta previa [45.1% versus 8.8%; odds ratio (OR) 8.51; 95% confidence interval (CI) 3.59-20.18; $p < 0.001$]. It was shown that there was no significant difference in the incidence of antepartum haemorrhage between the anterior and the posterior groups in cases of full placenta previa. On the other hand, the gestational age at the commencement of bleeding was earlier in the anterior group than it was in the posterior group, and the incidence of preterm birth was greater in the anterior group than it was in the posterior group (76.2% versus 32.0%; OR 6.8; 95% CI 2.12-21.84; $p = 0.002$) Both of these findings were statistically significant. In cases of incomplete placenta previa, there was no statistically significant difference in gestational age at delivery between the anterior and posterior groups. Comparing gestational age (in weeks at onset of bleeding in our study with Sekiguchi et. Al,[4] study. These results correlated well. Comparing the gestational age at delivery in our study with other studies as Sekiguchi et. Al,[4] McLaughlin et. Al,[5] Fratelli et. Al,[6] and Elhawary et. Al.[12] Our results correlate well with the previous studies.

68% (34 patients) in our study had adherent placenta previa at delivery. 66% had adherent placenta previa on MRI whereas, 64%(34) had adherent placenta previa as per USG findings. Sensitivity of MRI in our study was 91.89% (95% CI - 78.09% to 98.30%) whereas USG was 87.18% (95% CI - 72.57% to 95.70%) showing a greater sensitivity of MRI in diagnosing Placenta previa and adherence than USG. Specificity of MRI in our study was 88.89% (95% CI - 65.29% to 98.62%) whereas USG was 84.21% (95% CI - 60.42% to 96.62%) showing a greater specificity of MRI in diagnosing Placenta previa and adherence than USG. Positive Predictive Value (PPV) of MRI in our study was 94.44% (95% CI - 82.10% to 98.44%) whereas USG was 91.89% (95% CI - 79.94% to 96.99%) showing a greater PPV of MRI in diagnosing Placenta previa and adherence than USG. The overall accuracy of MRI to diagnose placenta previa is more when compared to USG in our study. (90.91% in MRI vs 86.21% in USG).

Comparing the sensitivity in diagnosis of placenta previa on MRI and USG of our study with other

studies Algebally et. Al,[17] and Elhawary et. Al,[12] as literature which showed greater sensitivity of MRI. Our results correlate well with most of the studies but in contrast with Riteau et. Al,[8] study.

The above table compares the specificity in diagnosis of placenta previa on MRI and USG of our study with other studies Riteau et. Al,[8] Algebally et. Al,[17] in literature which showed greater specificity of MRI. Our results correlate well with most of the studies but in contrast with Elhawary et. Al,[12] study. Comparing the PPV and NPV in diagnosis of placenta previa on MRI and USG of our study with other studies in literature which showed greater PPV and NPV of MRI.

The above table compares the accuracy in diagnosis of placenta previa on MRI and USG of our study with other studies in literature which showed greater accuracy of MRI. Our results correlate well with most of the studies but in contrast with Elhawary et. Al,[12] study.

Out of 50 neonates born ,14(28%) were delivered at term with birth weight >2.5kgs 32(64%)were delivered at late preterm (34-36weeks) with birth weight of 2-2.5kgs. 4(8%)were delivered at early preterm (30 to 34 weeks) with birthweight 1.5kgs-2kgs. 16(32%) out of 36 preterm neonates needed NICU admissions,1 (2%)neonate died on day 5 of life due to respiratory distress

All patients were discharged healthy. No mortality reported. Duration of hospital stay 19 (38%)patients discharged after 7 days,24(48%)patients discharged between 8-14days,7(14%)patients discharged between 15-21days. Blood Transfusions 40 patients received blood tansfusions, out of which 40 (80%)patients received packed cells, 15 (30%) patients received Random donor platelets,11(22%)patients received Fresh Frozen Plasma. Anesthesia given in 34 (46%) pateints were operated under General anesthesia, 16 (32%) patients were operated under Spinal anesthesia. Patients landed in hysterectomy out of 34 adherent cases,16 (47%) cases needed hysterectomy in 18(53%)cases uterus was preserved. Organ Dysfunction 8(16%) landed in acute kidney injury, needed dialysis.7(14%) cases were intubated due to hemodynamic unstability. Ureteric stenting in 34 adherent cases prophylactic DJ stenting done. Out of which 16(50%) cases were attended by urologist, bladder injury noted in 6(17%) cases.

CONCLUSION

MRI is accurate, affordable, non-invasive, and saves time, ultrasonography is still the imaging modality that is most usually used for diagnosing placenta accreta. It is also the most sensitive imaging modality available. The use of MRI looks to be beneficial in conjunction with ultrasonography, particularly in cases when there are few ultrasound signals. In situations like these, it is essential to determine the value of each feature not just in accordance with its PPV, but also in accordance with the NPV of qualities that are missing. When the findings of USG are inconclusive, MR imaging is the method that is most definitely suggested.So in resource poor settings USG can be used as only investigation in diagnosing previa and it's adherence.

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