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## Original Research Article

# Ultrasonographic placental localisation and extent of invasion in scarred versus non-scarred uterus and its correlation with obstetrical outcomes: a prospective study

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### ABSTRACT

**Background:** The site of implantation and resultant location of the placenta within the uterus are likely important determinants of placental blood flow and therefore pregnancy success. Abnormal placental implantation or 'placental invasion' is a rare, but potentially life-threatening, complication in the third stage of labour. Currently massive obstetric haemorrhage remains one of the leading causes of maternal mortality.

**Methods:** 140 antenatal women at  $\geq 34$  weeks of gestation were selected, out of which 70 had the history of previous caesarean section and 70 had the history of previous vaginal delivery. Detailed USG was done with special emphasis on edge to os distance (EOD), extent and depth of invasion of placenta. All cases were followed till delivery and their intraoperative assessment done and correlated with sonographic findings and obstetrical outcomes.

**Results:** With increasing number of previous caesarean section, depth and extent of invasion of placenta increases and edge to os distance (EOD) decreases. 8.5% cases with previous 1 caesarean section, 22.22% cases with previous 2 caesarean section and 50% cases with previous  $>2$  caesarean section had some adherence of placenta.

**Conclusions:** Uterine scar increases chances of low implantation of placenta as well as its adherence as compared with unscarred uterus. This risk increases with number of caesarean sections. These high-risk cases of scarred uterus especially those with multiple scars should be subjected to detailed sonographic scan by expert radiologist.

**Keywords:** PAS, Placenta accreta, Previous CS

### INTRODUCTION

The placenta in majority of cases is situated in the upper uterine segment usually near the fundus on the posterior wall of the uterus and less frequently on the anterior wall. But unfortunately, due to one or other causes placental position may alter, lying wholly or partially in the lower uterine segment resulting in placenta previa.

The site of implantation and resultant location of the placenta within the uterus are likely important determinants of placental blood flow and therefore pregnancy success.<sup>1</sup> Some studies reported that placental location might have implications for poor pregnancy outcome including preterm birth, small for gestational age

(SGA), foetal malposition, malpresentation and the development of pre-eclampsia.<sup>2,3</sup> Lateral placental location could contribute a higher risk of foetal intrauterine growth retardation (IUGR).<sup>1</sup>

Antenatal diagnosis of placental invasion has the potential to improve maternal and fetal outcomes.<sup>4,5</sup> Predelivery knowledge of morbidly adherent placenta allows for multidisciplinary planning and delivery before the onset of labor and/or vaginal bleeding.<sup>6</sup> This approach has lowered overall maternal morbidity rates, including less blood loss, as well as fewer transfusion requirements and intraoperative urologic injuries.<sup>4</sup> Our study focuses on how much uterine scar of previous caesarean section affects

placental localization or invasion and what impact it causes on fetomaternal outcomes.

## METHODS

The study was conducted in department of obstetrics and gynaecology, SN Medical College, Agra. Our study design was prospective comparative case control study. Cases were selected from antenatal outpatient department (OPD) and labour room on the basis of inclusion and exclusion criteria.

### *Inclusion criteria*

Antenatal cases  $\geq 34$  weeks singleton pregnancy with bleeding per vaginum with or without history of previous caesarean section were included in the study.

### *Exclusion criteria*

Primigravida, fetal malposition and malpresentation, history of previous myomectomy, previous D and C, smoking etc., pregnancies complicated by medical disorders (diabetes mellitus, hypertension, chronic renal diseases, chronic heart diseases), intrauterine death, antepartum haemorrhage cause abruptio placentae were excluded from the study. Out of 140 cases 70 cases had history of previous caesarean section. Cases were divided in two groups.

Group A (scarred group) having 70 cases with history of previous caesarean section. Group B (unscarred group) including 70 cases with history of previous vaginal delivery.

### *Ultrasonographic assessment*

We subjected all the cases to detailed ultrasound examination with special emphasis on edge to os (EOD) distance, extent and depth of invasion of placenta. In suspected cases of placenta accreta, patients were subjected to colour doppler scan.

Placenta was graded on the basis of edge to os distance (EOD) classification of ACOG (2009).<sup>7</sup> Grade 1-LPE  $>20$  mm from internal os. Grade 2-LPE 11-20 mm from internal os. Grade 3- LPE 0-10 mm from internal os. Grade 4- Overlapping the os by any distance.

On colour doppler scan we assessed the extent of invasion using FIGO grading of extent of invasion of placenta (2016).<sup>5</sup> Grade 0- no obliteration of retroplacental interface. Grade 1- focal obliteration. Grade 2- partial obliteration. Grade 3- complete obliteration.

Depth of invasion of placenta was assessed using ultrasound staging system for placenta accreta spectrum (2019).<sup>8</sup> PAS 0: no ultrasound signs of invasion PAS 1:  $\geq 2$  of the following a) loss of the clear zone, b) placental lacunae, c) bladder wall interruption. PAS 2: PAS1 with

uterovesical hypervascularity. PAS 3: PAS1 or PAS 2 with Increased vascularity in the inferior part of the lower uterine segment.

### *Intrapartum/intraoperative assessment*

All patients whether in group A or group B were followed up till their delivery. Then we did intra partum assessment in the cases delivering vaginally in unscarred group and intraoperative assessment in cases delivering by caesarean section in both scarred and unscarred group. In cases with adherent placenta, we did grading according to FIGO clinical classification of PAS (2019).<sup>9</sup> Grade 1- complete placental separation at the third stage. Grade 2- a) incomplete separation with uterotonics and gentle cord traction, b) MRP required for abnormally adherent parts only. Grade 3- a) no separation with uterotonics and gentle cord traction, b) MRP required for whole placenta. Grade 4- a) placenta has invaded through serosa, b) clear surgical plane can be identified between the bladder and uterus. Grade 5- a) placenta has invaded through serosa, b) clear surgical plane cannot be identified between the bladder and uterus. Grade 6- placenta has invaded through serosa of the uterus with infiltration of the parametrium or any organ other than the urinary bladder.

Then we correlated the detection rates of USG with intraoperative findings and found what impact previous caesarean scar had on placental implantation, adherence and fetomaternal outcomes.

### *Statistical analysis*

The Chi-square test was used to find the significance of study parameters on categorical scale between variable groups. Independent t test: was used to identify whether there is significant difference between group A and group B.

Numerical data between two groups were compared using the student t-test.

Statistical software SPSS version 22 (IBM SPSS statistics, Somers NY, USA) was used to analyse the data. Appropriate tests of significance were used based on the type of data. P value (probability that the result is true) of  $<0.05$  was considered as statistically significant after assuming all the rules of statistical tests.

## RESULTS

Out of 140 cases which were selected, 70 had the history of previous caesarean section and hence cases were divided in 2 groups. Group A- scarred group, group B- unscarred group.

Both groups were comparable in terms of age, parity and gestational age (Table 1). 35 cases (50%) had history of 1 previous caesarean delivery, 27 cases (38.57%) had

history of 2 previous caesarean deliveries and only 8 cases (11.43%) had >2 previous caesarean deliveries.

**Table 1: Comparison of demographic characteristics of both groups.**

	Scarred group		Unscarred group		P value	
	N	%	N	%		
Mean age (in years)	31.14±4.21		30.54±3.81		0.189	
Parity	1	40	57.14	34	48.57	0.309
	2	28	40	27	38.57	
	>2	2	2.86	9	12.86	
Gestational age (in weeks)	35.82±1.89		36.51±1.76		0.063	

Then we compared the ultrasonographic features in both the groups. In scarred group 74% cases had EOD <20 mm, out of them 28.99% had grade 4 placenta (overlapping the os) while in unscarred group 50% had EOD <20 mm out of them 12.86% had grade 4 placenta.

**Table 2: Ultrasonographic detection of extent of invasion of placenta FIGO (2016).**

Extent of obliteration of retro placental interface	Group A (scarred)		Group B (unscarred)	
	N	%	N	%
Grade 0 (no obliteration)	48	68.57	60	85.71
Grade 1 (focal obliteration)	16	22.86	8	11.43
Grade 2 (partial obliteration)	2	2.86	1	1.43
Grade 3 (complete obliteration)	4	5.71	1	1.43
Total	70	100	70	100
P value	0.105			

**Table 4: Comparison of intraoperative findings in scarred uterus group and unscarred uterus group.**

Factors assessed	Group A (scarred) (N-70)		Group B (unscarred) (N-40)		Chi square	P value
	N	%	N	%		
Dilated vessels seen on anterior uterine surface	10	14.29	3	7.5	1.124	0.289
placental bulge seen	4	5.71	1	2.5	5.881	0.015
Absence of clear surgical plane between uterus and bladder	0	0	0	0	0	0
Variable adherence of placenta	13	18.57	5	12.5	4.08	0.034
Prolonged duration of surgery (>1 hour)	52	74.29	10	25	25.139	0.001
Post partum haemorrhage	31	44.29	10	25	4.049	0.044
Need for hysterectomy	8	11.43	2	5	1.272	0.259
Need for uterine artery ligation	3	4.29	1	2.5	0.231	0.63

On comparing the extent of invasion of placenta in both the groups, majority of cases in scarred group i.e. 68.57% and 85.71% in unscarred group showed no obliteration of retro placental interface (Table 2).

**Table 3: Ultrasonographic staging of depth of invasion of placenta in placenta accreta syndrome.<sup>8</sup>**

Depth of invasion of placenta	Group A (scarred)		Group B (unscarred)	
	N	%	N	%
PAS 0	64	91.43	68	97.14
PAS 1	6	8.57	2	2.86
PAS 2	0	0	0	0
PAS 3	0	0	0	0
Total	70	100	70	100
P value	0.014			

In scarred group 91.43% cases and in unscarred group 97.14% cases showed no signs of depth of invasion of placenta on ultrasonography hence graded as PAS 0 where as 8.57% cases in scarred and 2.86% cases in unscarred showed definite signs of invasion (Table 3). Mean gestational age at the time of delivery was 36.14±1.23 weeks in scarred and 37.04±1.14 weeks in unscarred group. All the cases in scarred group delivered by CS whereas in unscarred group, 42.86% cases delivered vaginally and 57.14% cases by CS.

In both the groups, we compared the intraoperative findings. The difference was statistically significant i.e.  $p < 0.05$  for prolonged time for placental separation, adherent placenta, postpartum haemorrhage and prolonged duration of surgery. Rest other parameters like dilated vessels seen on anterior uterine surface, need for hysterectomy and need for uterine artery ligation had statistically insignificant difference i.e.  $p > 0.05$  (Table 4).

Adherent placenta was seen in 8.57% cases with previous one caesarean section, 22.23% cases with previous two caesarean section and 50% cases in previous >2 caesarean section (Table 5).

**Table 5: Correlation between FIGO clinical grading of adherent placenta and number of previous caesarean section in scarred group.**

Placental adherence	Number of previous CS						
	1		2		3		
	N	%	N	%	N	%	
<b>Absent</b>	32	91.43	21	77.77	4	50	
<b>Present</b>	3	8.57	6	22.23	4	50	
<b>Grading of adherence if present</b>	Grade 1	1	2.85	2	7.40	0	00
	Grade 2	2	5.71	2	7.40	0	00
	Grade 3	0	00	1	3.70	1	12.50
	Grade 4	0	00	1	3.70	3	37.50
	Grade 5	0	00	0	00	0	00
	Grade 6	0	00	0	00	0	00
	N =35		N=27		N=8		

**Table 6: postpartum maternal complications in scarred and unscarred group.**

Factors assessed	Group A (scarred) (N-70)		Group B (unscarred) (N-70)		Chi square	P value
	N	%	N	%		
<b>Wound infection</b>	12	17.14	7	10	1.522	0.217
<b>Puerperal sepsis</b>	8	11.43	5	7.14	0.763	0.382
<b>Any urinary or other complications</b>	12	17.14	4	5.71	4.516	0.033
<b>Need for blood transfusion</b>	15	21.42	6	11.43	4.538	0.034
<b>Increased duration of hospital stay (&gt;7 days)</b>	14	20	10	14.29	0.805	0.369

44.29% cases landed in post-partum haemorrhage in scarred group compared to 25% cases in unscarred group. Caesarean hysterectomy was done in 2 cases (2.8%) in unscarred group for adherent placenta. In unscarred group 6 cases (8.57%) had caesarean hysterectomy for adherent placenta and 2 cases (2.8%) had caesarean hysterectomy for atonic PPH.

On comparing the maternal outcomes in both the groups, the difference between 2 groups was statistically significant for parameters like presence of any urinary or other complication and need for blood transfusion where p values were <0.05. Statistically insignificant difference (p>0.05) was seen between two groups for parameters like wound infection, puerperal sepsis and increased duration of hospital stay (Table 6).

Chi square value for preterm deliveries was 4.200 with p value <0.05 hence the difference was statistically significant whereas for other parameters like poor APGAR score, NICU admission and early neonatal mortality the difference between 2 groups was statistically insignificant (p>0.05).

## DISCUSSION

In our study there were 70 cases with history of previous caesarean section and 70 cases with history of previous normal vaginal delivery which were followed up till their delivery. Then we did intra partum assessment in the cases

delivering vaginally in unscarred group and intraoperative assessment in cases delivering by caesarean section in scarred and unscarred group. Then we correlated the detection rates of USG with intraoperative findings and assessed what impact previous caesarean scar had on placental implantation, adherence and fetomaternal outcomes.

In our study majority of the patients in both the groups belong to age group (30-35) years. Our study showed that with increasing maternal age the chances of placental adherence also increased. [Tovbin](#) et al studied that mean gestational age at diagnosis was 33.9 (range- 16-41) weeks.<sup>10</sup> Mean gestational age at delivery was 37.7±1.7 (range- 24-41) weeks. Similar were the results in the study of [Upreti](#) et al where most of the cases of adherent placenta presented at gestational age of <36 weeks.<sup>11</sup>

Majority of the cases in scarred group i.e. 28% cases had placenta which was overlapping the os and belonged to grade 4. In unscarred group majority of cases had EOD >20 mm. In scarred group we observed that with increasing number of caesarean section EOD progressively decreased and hence the chances of placenta previa also increased. The chances of placenta previa were more in scarred group than in unscarred group. Result was similar in study of [Lawrence](#) et al and [Sara](#) et al.<sup>12,13</sup>

31.43% cases in scarred group and 14.29% cases in unscarred group showed some degree of obliteration of

retroplacental interface. Not much studies have been done till date about extent of invasion of placenta in terms of retroplacental interface. Study by Cali et al had results similar to our study where complete obliteration of retroplacental interface was seen in 4.67% cases in scarred and 2.7% cases in unscarred group.<sup>8</sup> Emergency caesarean hysterectomy was done in such cases. According to ultrasound staging system for placenta accrete syndrome of 2019, 97% cases had no ultrasound signs of invasion (grade PAS0) in unscarred group whereas 91.43% cases of scarred uterus group showed no signs of invasion on ultrasound (grade PAS 0). Placenta accrete was confined to PAS 1 grade in both the groups. None of the cases in our study had bladder wall interruption.

Adherent placenta was seen in 8.57% cases with previous 1 CS, 22.22% cases with previous 2 CS and 50% cases with previous >2 CS. As the number of previous caesarean section increased clinical grade of adherent placenta which was found intraoperatively also increased. Similar results were seen in studies of Parikh et al, Kaur et al, Pravin et al and Katke et al.<sup>14-17</sup> Caesarean hysterectomy was done in 11.42% cases in scarred group and in 2.8% cases in unscarred group Nair et al found that obstetric hysterectomy was needed 1.7 times more in scarred group than in unscarred group.<sup>18</sup> Wong et al found that morbidly adherent placenta with previa was the most frequent indication for postpartum hysterectomy.<sup>19</sup>

To all the correlations that have been discussed above were an effort to find out if there existed a correlation amongst various variables.

## CONCLUSION

In general, the increasing number of CS delivery across the world is highly incriminated for the progressively increasing incidence of placental adherence. Women with three or more uterine CS scar were more than 10 times at higher risk of PAS than women with single uterine scar, which indicates the increased risk of PAS as the number of caesarean section scar increases.

There has been significant contribution of ultrasound parameters for detection of placental adherence to the overall prediction of morbidity adherent placenta with promising sensitivity and specificity. Majority of cases in scarred as well as unscarred group were accurately and timely diagnosed by ultrasound which helped us to have birth preparedness before delivery, timely interference and to decide the further plan of management which further proved to be lifesaving in morbidly adherent placenta cases.

Extent of invasion of placenta increases showing that there is more extensive obliteration of retroplacental interface with increasing incidence of previous caesarean section. Edge to os (EOD) distance decreases with increasing chances of caesarean scar showing that there are increased incidence of low lying placenta with increasing

CS. Depth of invasion is also directly related to increasing number of CS. The risk of placenta previa in a pregnancy after caesarean section is 1.5 times increased .8.5% cases with previous 1 caesarean section, 22.22% cases with previous 2 caesarean section and 50% cases with previous >2 caesarean section had some adherence of placenta. In scarred group 8.57% cases had caesarean hysterectomy for adherent placenta and 2.8% cases had caesarean hysterectomy for atonic PPH.

Uterine scar increases chances of low implantation of placenta as well as its adherence as compared with unscarred uterus. This risk increases with number of caesarean sections. These high-risk cases of scarred uterus especially those with multiple scars should be subjected to detailed sonographic scan by expert radiologist with special focus on placental and retroplacental area. However, more detailed studies with larger number of cases are suggested for more confirmatory results.

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