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A Prospective Observational Study of Sonographic Placental Localization in Scarred and Unscarred Uteri and its Correlation with Obstetric Outcome

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Abstract: ***Objective: To study the placental location in scarred and unscarred uteri. Methods: In this prospective observational study, women in third trimester admitted to the labour room in the hospital were recruited. The placental location was studied according to the third trimester ultrasound findings and classified as anterior, posterior, fundal, or low lying. Results: Most common location of placenta seen in scarred uterus cases was anterior (47%) followed by posterior (37.1%) and fundal (13.7%). Most common location of placenta seen in non-scarred uterus cases was posterior (44.6%) followed by anterior (37.9%) and fundal (15.5%). Conclusion: Anterior position of placenta was commonly observed in scarred uterus while posterior placenta was common in non-scarred uterus. Scarred uterus and anterior placement of placenta both were significantly associated with caesarean deliveries.***

Keywords: Placental location, Scarred uterus, Caesarean delivery, Anterior placenta, Unscarred uterus, Pregnancy outcome

1. Introduction

The placenta is an organ that attaches the uterine layers to developing foetus by the umbilical cord to permit nutrient uptake, thermo-regulation, waste removal, and gas exchange by the mother's blood supply; to fight against internal infection, and to produce hormones that help in continuation of the pregnancy. So, the determination of the site of the placenta in the endometrial cavity is useful to find any complications earlier and manage them accordingly [1]. The location of placental implantation is a significant element of placental blood source and therefore the foetal and maternal outcomes [2]. Several studies have defined that placental location has special effects on pregnant women including preterm birth [3], intrauterine growth retardation (IUGR) [2], foetal malposition and malpresentation, and the development of pregnancy induced hypertension [4,5]. It is commonly attached to the fundal, anterior, or posterior part of the uterus. In few cases, the placenta might implant on the lower part of the uterus. When this occurs, it is called a low-lying placenta (placenta Previa) [7].

Post any procedure, healing of the uterus takes place by secondary intention which involves deposition of collagen and scar formation. The expression of TNF β, VEGF and PDGF in human myometrial cells are involved in the uterine healing process. [9].

In a study done in London it was found that presence of C-section scars on the uterus was associated with an increased number of posterior placental implantation and reduced fundal placentae [10. In another study it was found that anterior placenta was associated with a shorter gestational age at delivery, low birth weight, lower Apgar score, increased postpartum haemorrhage as compared to women with lateral/posterior placenta. Similarly, women with a lateral implantation were found to be at a higher risk for small for gestational age babies, preterm delivery and MROP. Thus, the location of the placenta seems to have a significant role in pregnancy outcome.

In this study we aim to find if a scar on the uterus influences the location of the placenta and subsequently the outcome of the pregnancy.

2. Methodology

In this prospective observational study, women in third trimester admitted to the labour room in the hospital were recruited. The placental location was studied according to the third trimester ultrasound findings and classified as anterior, posterior, fundal, or low lying.

All women admitted in the hospital have a third trimester ultrasound scan which mentions the placental location which is the standard of care for all women admitted to the hospital. The placental localization was documented, and obliteration of planes (if any) was recorded. Also, in case of any obliteration of planes if any investigations were done such as MRI, those reports were also recorded. If the patient has more than 1 ultrasound scan report that was also recorded in the case record sheet. Follow up was done during and after third stage of labour. Also, the incidence of PPH in the third stage of labour and pregnancy outcome with respect to gestational age at delivery, birth weight and APGAR score between the two groups was recorded and compared. All the data was noted down in a pre-designed study proforma. Qualitative data was represented in the form of frequency and percentage. Association between qualitative variables was assessed by Chi-Square test. Quantitative data was represented using Mean ± SD. Analysis of Quantitative data between the two groups was done using unpaired t-test if data passed 'Normality test' and by Mann-Whitney Test if data failed 'Normality test'. A p-value < 0.05 was taken as level of significance. Results were graphically represented where deemed necessary. SPSS Version 26.0 was used for most analysis and Microsoft Excel 2021 for graphical representation.

3. Results

Table 1: Distribution of study groups as per etiology of scarred uterus

Etiology of Scarred Uterus	N	%
LSCS	201	50.3%
D & C	196	49%
LSCS & D&C	3	0.8%
Total	400	100.0%

Most common etiology for scarring of uterus was LSCS (50.3%) followed by dilatation and curettage procedure (49%).

Table 2: Comparison of study groups as per Placental location

Placenta location	Group		Total
	Non Scarred Uterus	Scarred Uterus	
Anterior	152	189	341
	37.9%	47.0%	42.5%
Fundal	62	55	117
	15.5%	13.7%	14.6%
Posterior	179	149	328
	44.6%	37.1%	40.8%
Low lying	8	9	17
	2.0%	2.2%	2.1%
Total	401	402	803
	100.0%	100.0%	100.0%
p- value -0.28			

Most common location of placenta seen in scarred uterus cases was anterior (47%) followed by posterior (37.1%) and fundal (13.7%). Most common location of placenta seen in non-scarred uterus cases was posterior (44.6%) followed by anterior (37.9%) and fundal (15.5%). Low lying placenta was seen in 2.2% and 2% cases of scarred and non-scarred uterus respectively.

Table 3: Comparison of study groups as per term of gestation

Term of Gestation	Group		Total
	Non- Scarred Uterus	Scarred Uterus	
Pre-term	98	116	214
	24.5%	29.0%	26.8%
Term	302	284	586
	75.5%	71.0%	73.3%
Total	400	400	800
	100.0%	100.0%	100.0%
p- value - 0.32			

A total of 29% cases of scarred uterus delivered pre-term as compared to 24.5% in non-scarred uterus (p-0.32).

Table 4: Comparison of study groups as per mean duration of third stage of labour

Variables	Group	N	Mean	SD	p-value
Duration of Third stage of labour (mins)	Scarred Uterus	400	12.00	6.60	0.17
	Non- Scarred Uterus	400	12.87	6.70	

Mean duration of third stage of labour was comparable in scarred and non-scarred uterus (12 vs 12.87 mins; p-0.17).

Table 5: Association of placental position with mode of delivery

Position of Placenta	Mode of Delivery				p-value
	Unscarred Uterus		Scarred uterus		
	Vaginal	LSCS	Vaginal	LSCS	
Anterior	109	43	80	109	<0.01
	71.7%	28.3%	42.3%	57.7%	
Fundal	46	16	31	24	0.04
	74.2%	25.8%	56.4%	43.6%	
Posterior	128	51	77	72	<0.01
	71.5%	28.5%	51.7%	48.3%	
Low lying	0	8	0	9	1.00
	0.0%	100.0%	0.0%	100.0%	
Total	283	118	188	214	<0.01
	70.6%	29.4%	46.8%	53.2%	
p- value	<0.01		<0.01		

All the cases of low-lying placenta underwent LSCS both in scarred and non-scarred uterus group. Overall, high incidence of LSCS was observed in scarred uterus group in all other positions i.e., anterior, posterior and fundal. Among cases with scarred uterus, anterior and posterior position of placenta were observed to be significantly associated with requirement of LSCS.

Table 6: Association of placental position with mean duration of third stage of labour

Duration of Third stage of labour (mins)		N	Mean	SD	p- value
Unscarred Uterus	Anterior	152	12.87	7.12	0.99
	Fundal	62	12.91	6.11	
	Posterior	179	12.86	6.78	
Scarred uterus	Anterior	189	12.54	7.69	0.62
	Fundal	55	11.32	5.43	
	Posterior	149	11.74	5.85	

No difference was observed between third stage of labour among anterior, posterior or fundal position of placenta in scarred and non-scarred uterus (p>0.05).

Table 7: Association of placental position with mean birth weight

Birth weight (gm)		N	Mean	SD	p- value
Non Scarred Uterus	Anterior	152	2507.60	673.60	0.94
	Fundal	62	2567.54	653.46	
	Posterior	179	2538.90	683.90	
	Low Lying	8	2405.50	695.70	
Scarred uterus	Anterior	189	2572.05	609.80	0.46
	Fundal	55	2495.94	623.40	
	Posterior	149	2622.59	655.13	
	Low Lying	9	2383.11	437.10	

No difference was observed between birth weight among anterior, posterior or fundal position of placenta in both scarred and non-scarred groups. However lower birth weight was observed in cases of low-lying placenta due to higher incidence of pre-term deliveries in both groups.

Table 8: Association of etiology of scarred uterus with placental position

Group		N	%
One LSCS (n-142)	Anterior	71	50.0%
	Fundal	12	8.5%
	Posterior	56	39.4%
	Low Lying	3	2.1%
Multiple LSCS (n-59)	Anterior	37	62.7%
	Fundal	5	8.5%
	Posterior	16	27.1%
	Low Lying	1	1.7%
D & C (n-195)	Anterior	78	40.0%
	Fundal	38	19.5%
	Posterior	74	37.9%
	Low Lying	5	2.6%
LSCS + D & C (n-3)	Anterior	1	33.3%
	Posterior	2	66.7%
p- 0.084			

No significant association was observed between the etiology of scarred uterus with placental position (p-0.084).

Table 9: Placental location in patients with LSCS scars

Placenta location	Group		Total
	Unscarred Uterus	LSCS	
Anterior	152	108	260
	37.9%	53.7%	43.2%
Fundal	62	17	79
	15.5%	8.4%	13.1%
Posterior	179	72	251
	44.6%	35.8%	41.6%
Low lying	8	4	12
	2.0%	1.9%	1.9%
Total	401	201	602
	100.0%	100.0%	100.0%
p-0.43			

No significant association was found between the location of placenta in patients with LSCS scars.

Table 10: Mode of delivery as per aetiology of the scar

	Vaginal	LSCS	Total
1 LSCS	35	107	142
	24.6%	75.4%	100%
>1 LSCS	0	59	59
	0	100%	100%
LSCS and D&C	1	2	3
	33.3%	66.6%	100%
D&C	144	52	196
	73.4%	26.5%	100%
Total	180	220	
p-value-0			

No significant association was found between the mode of delivery and the aetiology of the scar.

Table 11: Association of hypertension with position of placenta

HTN	Yes	No	%
Anterior	26	315	7.6%
Posterior	29	299	8.8%
Fundal	8	109	6.8%
Low- Lying	1	16	5.8%
P value- 0.8			

No significant association was found between the position of placenta and the development of hypertension.

4. Discussion

The location of placental implantation and the placenta location inside the uterus are significant elements of placental blood source and therefore the fetal and maternal outcomes [2]. Post any procedure, healing of the uterus takes place by secondary intention which involves deposition of collagen and scar formation. Studies have shown a significant correlation between scarring of uterus and location of placenta and subsequent pregnancy outcomes [10-13]. In present study, we thus aimed to find the placental location in scarred and unscarred uterus and to study the effect of site of implantation on third stage of labour and pregnancy outcome. Present study included a total of 800 cases. A total of 400 cases were of scarred uterus while remaining 400 were of unscarred uterus. The placental localization was documented after third trimester ultrasound scan. Follow up was done during and after third stage of labour.

Scarred Vs Unscarred Uterus

The scarring of the uterus is caused by trauma to the endometrial lining either with a procedure or inflammation or both. When there is a uterine procedure done in the setting of an infection, the rates of scarring are highest. The Caesarean-section rates worldwide show an increasing trend from 6.7% in 1990 to 19.1% in 2014 [8] and there was also an increase in procedures like HSG due to infertility treatments. All this has led to an increased prevalence of scarred uterus. In present study too, we observed that most common etiology for scarring of uterus was LSCS (50.3%) followed by dilatation and curettage procedure (48.8%). Mean age of cases with scarred uterus was significantly more (28.35 vs 25.7 years; $p<0.01$) and most of them were multi-parous (88.8% vs 36%) ($p<0.01$). The higher mean age in cases with scarred uterus can be attributed to multi-parous status of most of these females who have undergone LSCS during their prior deliveries.

	Kavita B et al		Basavaradder et al		Naji O et al		Present Study	
	Scarred	Unscarred	Scarred	Unscarred	Scarred	Unscarred	Scarred	Unscarred
Anterior	63.8%	47.7%	30%	-	-	-	53.7%	37.9%
Posterior	-	-	30%	-	-	-	35.8%	44.6%
Fundal	-	-	-	-	-	-	8.4%	15.5%
Low lying	2.75%	1.4%	5%	-	1.5%	0.9%	1.9%	2%

Scarring of Uterus & Placental Location

Most common location of placenta seen in scarred uterus cases was anterior (53.7%) followed by posterior (35.8%) and fundal (8.4%). Most common location of placenta seen in unscarred uterus cases was posterior (44.6%) followed by anterior (37.9%) and fundal (15.5%). The table compares only the LSCS scars by the other 3 authors and in the present study. Kavitha B et al. [53] studied the location of placenta in

scarred and unscarred uterus clinically. A retrospective study was done of 80 cases obtained from case records, which were divided into two groups- A (scarred uterus) and B (unscarred uterus)/ Anterior placenta was seen in 63.8% in group-A and 47.7% in group-B which in the present study was 53.7% and 37.9%. It was observed that incidence of placenta previa in scarred uterus (A) was 2.75% which was much higher than in unscarred uterus (B) - 1.4% [*P* value 0.001]. [53], however in the present study they were comparable (1.9% and 2% respectively). Basavaradder VS et al. [56] aimed to study the placental localisation and study of maternal and foetal outcome in previous caesarean delivery patients. In most, placenta was situated fundo-anterior and fundo-posterior (30% each) and five (5%) patients had placenta previa. In the study conducted by Naji O et al., There was no significant difference in the incidence of low-lying placenta between groups (1.5 vs 0.9%) [52] which was corresponding with the present study.

Scarring of Uterus & Mode of Delivery

	Hua Z et al		Barnabe et al		Valere et al		Present Study	
	Scarred	Unscarred	Scarred	Unscarred	Scarred	Unscarred	Scarred	Unscarred
Vaginal	48.1%	-	34.3%	-	75.8%	87.5%	17.4%	70.5%
LSCS	51.9%	-	65.7%	-	-	-	82.5%	29.5%

The table compares only the LSCS scars by the other 3 authors and in the present study. A total of 29% cases of scarred uterus delivered pre-term as compared to 24.5% in unscarred uterus (p-0.32). Most common indication being patients not willing for VBAC. There were no patients with primary or secondary PPH in both the groups and none of the patients required any intervention for removal of placenta. Mean birth weight was comparable between scarred and unscarred uterus (2.57 vs 2.53 Kg; p – 0.335). Hua Z et al. [57] observed the mode of delivery for pregnant women with uterine scar. A total of 51.69% had a cesarean section as compared to 82.5% in the present study. Valère MK et al. [59] studied 33 grand multi-paras with a lower segment uterine scar and 120 grand multiparas without a uterine scar. The incidence of vaginal delivery was 75.8 and 87.5% in grand multiparas with and without a uterine scar respectively (OR 0.17–1.16; P = 0.085) as compared to 17.4% and 70.5% in the present study. Higher rates of cesarean section in the scarred group could be attributed to the fact that most patients were not willing for a VBAC.

Location of Placenta & Pregnancy Outcome

Low lying placenta has a significant association with pre-term delivery as compared to other positions of placenta in both scarred and non-scarred groups ($p<0.01$). All the cases of low-lying placenta underwent LSCS both in scarred and non-scarred uterus group. Overall, high incidence of LSCS was observed in scarred uterus group. Among cases with scarred uterus, anterior and posterior position of placenta, were observed to be significantly associated with requirement of LSCS. However, in the research material, studies with the same groups i.e., scarred and unscarred uterus could not be found and hence, a comparison could not be made.

5. Conclusion

Present Study observed that anterior position of placenta was commonly observed in scarred uterus while posterior placenta was common in non-scarred uterus. Scarred uterus and anterior placement of placenta both were significantly associated with caesarean deliveries. However, no difference was observed between the study groups in terms of duration of third stage of labour, term of gestation and birth weight. Both groups have equal prevalence of low-lying placenta. The low-lying placenta was associated with higher rates of caesarean and pre-term deliveries.

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