

## An Investigation of the Placental Implantation Location in Cesarean Scar Pregnancy

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Article Type	ABSTRACT
Research Paper	<p><b>Background and Objective:</b> Cesarean Scar Pregnancy (CSP) is a rare and life-threatening complication that involves implantation of a gestational sac at the location of a previous cesarean scar. The presence of a cesarean scar in the uterus can have a significant effect on the placental implantation location. Knowing more about the location of placental implantation in CSP can help manage and prevent the threatening complications of this disorder. The aim of this study is to investigate the placental implantation location in cesarean scar pregnancies.</p> <p><b>Methods:</b> This cross-sectional study was conducted on 44 patients diagnosed with CSP in the first trimester of pregnancy at Imam Khomeini Hospital in Ahvaz from March 2020 to February 2022. Demographic and clinical information of mothers, number of pregnancies and previous cesarean deliveries, and ultrasound results and placental location were reviewed based on the patients' medical records. The location of the placenta was determined and checked based on four anatomical locations in the endometrial cavity by transabdominal ultrasound between the 11th and 14th weeks of pregnancy.</p> <p><b>Findings:</b> The mean age of the patients was <math>33.95 \pm 5.09</math> years. The number of previous cesarean sections was between 1 and 4 and the average was <math>2.32 \pm 0.93</math>. The most common location of the placenta was anterior (61.4%), followed by fundal (29.5%) and posterior (9.1%). The number of previous cesarean deliveries did not have a significant effect on the placental implantation location.</p> <p><b>Conclusion:</b> The results of this study showed that although the most common placental implantation location in CSP is the anterior location, the posterior placenta can also be present in scar pregnancy and it is not necessary to be in the anterior placenta to make the diagnosis of CSP.</p> <p><b>Keywords:</b> <i>Cesarean Scar Pregnancy, Placental Location, Cesarean Section, Ectopic Pregnancy.</i></p>

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## Introduction

Cesarean Scar Pregnancy (CSP) is a rare form of ectopic pregnancy and one of the long-term complications of cesarean delivery, which includes placental implantation and gestational sac growth inside the myometrium of a previous cesarean scar (1). Implantation of the placenta and gestational sac at the site of cesarean scar can cause serious and threatening complications such as severe bleeding and uterine rupture, and is one of the underlying causes of uterine adhesion disorders (Placenta Accreta Spectrum= PAS) and placenta previa (1-3).

With the increase in the rate of cesarean delivery, the incidence of complications in subsequent pregnancies and deliveries, such as abnormal placental invasion and cesarean scar pregnancy, has also increased (4) and the incidence of cesarean scar pregnancy has been estimated between 1 case in every 800 to 2500 pregnancies (5, 6). Since cesarean scar pregnancy can be a life-threatening condition for the mother, quick diagnosis and appropriate treatment can prevent mortality caused by abnormal placental implantation (6-8).

Examining the location of the placenta is one of the most important parts of ultrasound examination in pregnancy, and the anatomical location of placenta implantation in the uterus is very important for a successful pregnancy (9). In normal intrauterine pregnancy, the most common place of placenta implantation is in the fundal part of the uterus, followed by the posterior fundal and the anterior fundal (10). The results of some studies have shown that the presence of a cesarean scar in the uterus can have a significant effect on the place of placenta implantation in future pregnancies and reduce the possibility of fundal placental implantation (11-13). It has also been reported that the clinical manifestations and complications of various placental adhesion disorders depend on the location of placental implantation (14, 15).

Recently, Barati et al. reported that there are different types of CSP based on the gestational age, the size of the fetus and the placenta, and therefore the examination of the location of the placenta during pregnancy and the appearance of the endometrium in the upper part of the uterus in the early weeks of pregnancy play an important role in the diagnosis and management of these patients (16). Considering that the growth of the gestational sac at the site of the previous cesarean scar has been associated with abnormal placental implantation (17), therefore, careful evaluation of the placental site and screening for abnormal placental implantation in the first trimester of pregnancy can reduce mortality and morbidity in these women (5).

Considering the serious complications that scar pregnancy has for pregnant mothers and the relationship between the location of the placenta and pregnancy complications (18), knowing more about placental implantation location in cesarean scar pregnancy can be the basis for further studies in the future to diagnose, manage and prevent threatening complications that cause this disorder. Therefore, the present study was conducted with the aim of investigating the frequency of placental implantation locations in cesarean scar pregnancies.

## Methods

After obtaining permission from the Research Council and approval of the Ethics Committee of Ahvaz University of Medical Sciences with the code IR.AJUMS.HGOLESTAN.REC.1401.020, this retrospective cross-sectional study was conducted on patients with cesarean scar pregnancies at Imam Khomeini Hospital in Ahvaz from March 2020 to February 2022. In all stages of this research, the provisions of the ethics statement in Helsinki research and the principles of confidentiality of patient information were observed.

Determining the sample size was calculated based on the formula for ratio estimation, 95% confidence interval, 0.05 accuracy, 0.017 sensitivity and based on the results of the study of Panaitescu et al. (5). Finally, 44 pregnant mothers with caesarean scar pregnancies were included in the study in a non-random and consecutive manner.

Patients with a history of previous caesarean section, formation of a gestational sac at the site of a previous caesarean scar and entering complete patient information including basic characteristics, clinical records and ultrasound findings in the electronic system of Imam Khomeini Hospital of Ahvaz were included in the study, and women with multiple pregnancies and a history of any uterus surgery, except caesarean section, were excluded from the study.

Demographic and basic characteristics of the mother, including age, weight, height, body mass index (BMI), medical records and underlying diseases, pregnancy characteristics and number of previous caesarean deliveries, and ultrasound findings were collected by reviewing the patients' medical records.

Scar pregnancy was diagnosed by a gynecologist based on the history of caesarean delivery, positive pregnancy test result (hCG positive) and ultrasound results in the first trimester of pregnancy (between 7 and 9 weeks of pregnancy). Ultrasound diagnostic criteria included: empty uterine cavity without relation to the gestational sac and clearly visible endometrium, empty endocervical canal, gestational sac or placenta located in the lower and anterior walls of the uterus in the possible site of a previous caesarean scar, with or without fetus or yolk sac, with or without heartbeat (depending on gestational age), absent or thin (<5 mm) layer of myometrium between gestational sac and bladder wall and abundant peritrophoblastic blood flow around placental sac or pregnancy concentrated in anterior part of placental sac in Doppler ultrasound (7, 16).

The placental implantation location was divided into four anatomical locations in the endometrial cavity based on ultrasound examination:

**Fundal placenta:** The placenta implants in the highest part of the uterus.

**Lateral placenta:** The placenta is located on the right or left side of the uterus.

**Anterior placenta:** Placenta implantation is located in the front wall of the uterus.

**Posterior placenta:** When the placenta is in the back wall of the uterus (19).

Also, patients were divided into anterior and non-anterior groups (fundal, lateral, and posterior) based on the location of the placenta, because the anterior location of the placenta is associated with more complications compared to the non-anterior location (13, 19).

All ultrasounds were performed at 11-14 weeks of pregnancy, during the first trimester routine screening examinations, using a 4-5 MHz transabdominal probe. In women who had more than one ultrasound examination, placenta location information was extracted from the last ultrasound.

SPSS (SPSS Inc., Chicago, IL, U.S.A.) version 22 was used for statistical analysis. In quantitative variables, mean and standard deviation were used to describe the data, and in qualitative variables, frequency and percentage were used. Independent t-test was used to compare the mean variables between two groups, and chi-square test was used to compare qualitative variables between groups, and  $p < 0.05$  was considered significant.

## Results

In this study, 44 mothers with scar pregnancy with an average age of  $33.95 \pm 5.09$  years (22-44 years) were investigated. Underlying disease was observed in 21 people (47.7%), which included gestational diabetes, gestational hypertension, and hypothyroidism. There was a history of abortion in 32 (72.7%) women (Table 1), of which 18 (40.9%) had one abortion, 10 (22.7%) had two abortions and 4 (9.1%) had a

history of 3 to 5 abortions. On average, the studied women had  $2.32 \pm 0.93$  cases of previous cesarean section (between 1-4 cases), of which 9 people (20.5%) had one cesarean operation, 17 people (38.6%) had two cesarean operations, 13 people (29.5%) had a history of 3 cesarean operations and 5 people (11.4%) had a history of 4 cesarean operations.

Examining the placental implantation location showed that the most common location of placenta was in the anterior (61.4%), fundal (29.5%) and posterior (9.1%) positions, respectively. None of the investigated variables, including mother's age, height, weight, BMI, history of underlying disease, number of pregnancies, number of deliveries, number of cesarean sections, emergency or elective cesarean section, history of abortion and scar pregnancy in mothers with scar pregnancy showed effects on anterior or non-anterior placental implantation location (Table 2).

**Table 1. Characteristics of pregnancy and delivery of mothers with cesarean section scars**

Variable	Mean±SD or Number(%)
Number of pregnancies	3.91±1.17
Number of births	2.34±0.96
<b>Parity</b>	
Nullipara	9(20.5)
Multipara	35(79.5)
History of abortion	32(72.7)
Number of abortions	1.18±1.06
The number of cesarean sections	2.32±0.93
Scar pregnancy history	11(25.0)
<b>Type of caesarean section</b>	
Elective	20(45.5)
Emergency	24(54.5)
<b>Location of the placenta</b>	
Anterior	27(61.4)
Fundal	13(29.5)
Posterior	4(9.1)
<b>Fetus Presentation</b>	
Cephalic	23(52.3)
Breech	21(47.7)

**Table 2. Different characteristics of mothers with scar pregnancy according to anterior and non-anterior placental implantation location**

Mother's profile	Anterior placenta (27 cases) Mean±SD or Number(%)	Non-anterior placenta (17 cases) Mean±SD or Number(%)	p-value
Mother's age (years)	33.67±4.74	34.41±5.59	0.638*
Height (cm)	162.11±5.98	162.70±5.77	0.746*
Weight (kg)	74.59±11.15	78.11±9.72	0.290*
BMI (kg/m <sup>2</sup> )	28.35±3.88	29.48±3.20	0.323*
Underlying disease	13(48.1)	8(47.1)	0.944**
Smoking	0(0)	1(5.9)	0.366**
Alcohol consumption	1(3.7)	1(5.9)	0.736**

<b>Mother's profile</b>	<b>Anterior placenta (27 cases) Mean±SD or Number(%)</b>	<b>Non-anterior placenta (17 cases) Mean±SD or Number(%)</b>	<b>p-value</b>
Number of pregnancies	3.81±1.21	4.06±1.14	0.510*
Number of births	2.15±0.81	2.65±1.11	0.095*
<b>Parity</b>			
Nullipara	6(22.2)	3(17.6)	0.714**
Multipara	21(77.8)	14(82.4)	
History of abortion	21(77.8)	11(64.7)	0.343**
Number of abortions	1.33±1.14	0.94±0.89	0.238*
The number of cesarean sections	2.22±0.89	2.47±1.00	0.397*
Scar pregnancy history	7(25.9)	4(23.5)	0.858**
<b>Type of caesarean section</b>			
Elective	13(48.1)	7(41.2)	0.651**
Emergency	14(51.9)	10(58.8)	
<b>Fetus Presentation</b>			
Cephalic	12(44.4)	9(52.9)	0.583**
Breech	15(55.6)	8(47.1)	

\*Independent t-test, \*\*Chi-square test

## Discussion

The results of the present study showed that the most common location of the placenta was in the anterior (61.4%), followed by the fundal (29.5%) and posterior (9.1%) locations, and no significant relationship was observed between the number of cesarean sections and the placental implantation location. The development of the gestational sac at the site of the previous cesarean scar is associated with abnormal implantation of the placenta and its negative consequences (17, 20). It has been reported that these complications and negative outcomes of pregnancy, including severe postpartum bleeding, are more common in placentas located in the anterior wall, which covers the scar of a previous cesarean section in the uterus (15, 18, 21). Therefore, ultrasonography in the first trimester of pregnancy and examination of the placenta is very important for predicting the status and development of CSP.

In two cases reported by Giroux et al. (22) and Hsu et al. (23), pregnancy ultrasound examination of the caesarean scar area showed that the placental implantation location was in the anterior part of the lower half of the uterus, and the invasion of the placenta from the uterine myometrium had also reached the bladder. Both cases had heavy bleeding during delivery. Also, Kutlesic et al. reported a case of cesarean scar pregnancy in the 7th week of pregnancy, in which the gestational sac was placed in the anterior wall of the uterus and penetrated more than half of the myometrium (24). In the study of Shafqat et al., three cases of pregnancy at the site of cesarean scar were reported, and the placenta was located in the anterior wall of the uterus in all three cases. These results show that cesarean scar pregnancies tend to be placed eccentrically in the lower anterior part of the uterine wall above the cervix. It has also been reported that the larger the anterior uterine wall defect, the more likely scar implantation is, possibly due to the greater surface area (25). In the study conducted by Jelena et al., examining the location of the placenta after one or more cesarean sections showed that there is a direct relationship between pregnancy at the site of the cesarean scar and the anterior place of the placenta (26). In the study of Zosmer et al., the ultrasonography of the placenta in 10 women with cesarean scar pregnancy in the first trimester of pregnancy showed that the most

common placental implantation location was the anterior part of the uterus (5 cases), and one case was left lateral and four cases were complete placenta previa. This shows that in cesarean scar pregnancies, gradually with the progress of pregnancy, a major part of the placenta tissue is placed on the myometrium of the anterior wall of the uterus, that is, towards the area that has many vessels (27). Recently, in a study by Abotorabi et al., it was also reported that in women with PAS, the anterior placental location (57%) is more than the posterior (27%) and lateral (16%) locations (14). In the study of Li et al. (28) and Liu et al. (29), it was also reported that the location of the placenta in cesarean scar pregnancies is more in the anterior part (68.1% and 68.76%, respectively). These results, in line with the present study, show that although the anterior location of the placenta can help in the diagnosis of cesarean scar pregnancies, other locations should also be considered for the diagnosis of scar pregnancies. In addition, it should be noted that some differences in the prevalence of placenta previa in scar pregnancy in different studies can be related to the difference in the characteristics of the samples and the studied population and the difference in the sample size.

The results of the present study also showed that most of the women with cesarean scar pregnancies were multiparous (79.5%) and had a history of at least 1-5 miscarriages (72.7%) and history of 1-4 cesarean sections (mean  $2.32 \pm 0.93$ ). The high number of previous cesarean operations in our examined patients is probably due to the increasing trend in the rate of cesarean operations, which caused the frequency of cesarean scar pregnancy, which is a rare type of ectopic pregnancy. In addition, progress in diagnostic and imaging methods are also not ineffective in this matter. However, it is not possible to draw conclusions about the relationship between the risk of scar pregnancy and the number of previous cesarean operations. In other studies, like the present study, a high number of previous cesarean operations in patients with scar pregnancies has been reported. However, the number of previous cesarean sections did not have a significant effect on the placental implantation location (7, 11, 13, 14, 26).

The current study also faced limitations, including the retrospective nature of the study and the lack of access to some patient information, as well as the small number of examined samples, which is the reason for the rarity of this disorder. Also, in this study, the placental implantation location was divided into four anatomical regions: fundal, anterior, posterior, and lateral. However, the placental implantation location is rarely completely in any of these positions. Therefore, this division may not be very accurate (because there is no gold standard for defining placental location). Also, placental migration was not investigated in this study because most of the ultrasounds in this study were performed around week 12, after which placental migration is possible. By conducting more studies in a prospective and multi-centered manner, better results can be achieved in understanding the pregnancy characteristics of the scar location.

The results of the present study showed that the most common placental implantation location in cesarean scar pregnancies is in the anterior place and also showed that the posterior placenta can also be present in scar pregnancies and it is not necessary for the place of the placenta to be anterior to make a scar diagnosis. Also, the number of previous cesarean sections had no effect on placenta location. Considering the high prevalence of anterior placenta in these patients, it is necessary to pay attention to this situation in the diagnosis, management and treatment of cesarean scar pregnancies.

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