https://doi.org/ 10.33472/AFJBS.6.7.2024.153-159

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

Inter-Pregnancy Interval Effect on Lower Uterine Segment Caesarean Scar Thickness by Ultrasound Measurement

Nehal Abd El-Hady El-Setiha [1]*, Amira Ahmed Fathey [2], Shaimaa Abdel hameid Hassanein [3], Alaa Al-Dein Fathalla El-Halaby [2], Wael Gaber ElDamaty [2]

1. Obstetrics and Gynecology Department, El-Menshawy General Hospital, Ministry of Health, Tanta, Egypt
2. Obstetrics and Gynecology Department, Faculty of Medicine, Menoufia University, Menoufia, Egypt
3. Radiology Department, Faculty of Medicine, Menoufia University, Menoufia, Egypt

***Corresponding Author Email: nehalelsetiha94@gmail.com**

Article History
Volume 6,Issue 7, 2024
Received: 26 Feb 2024
Accepted : 22 Mar 2024
doi: 10.33472/AF5BS.6.7.2024.153-159

Abstract

Background: A cesarean scar greatly increases the likelihood of complications during subsequent pregnancies and, in particular, births. The risk of scar defect issues is considerable in all pregnancies in women who have had prior cesarean sections (CSs). Researching the correlation between the time between pregnancies and the thickness of lower segment Caesarean scars as determined by sonography was the primary objective of this research. **Methods:** The 60 pregnant women included in this descriptive cross-sectional research ranged in age from 20 to 35 years old and had a body mass index (BMI) between 18.5 and 24.9. All of them were carrying a singleton and had a history of one lower segment CS. The women were also in the third to third trimester of their pregnancies, as measured by the previous menstrual period. Each patient was randomly assigned to one of two groups: There are two groups: those whose intervals between pregnancies are more than 12 months, and those whose intervals are 12 months or less. **Results:** There was positive correlation between Cs scar and interpregnancy interval in both groups (r=0.95 and P <0.001). CS scar can significantly predict to discriminate an inter pregnancy interval (P <0.001 and AUC = 0958) at cut-off >3.81 with 93.33% sensitivity, 83.33% specificity, 84.8% positive predictive value and 92.6% negative predictive value. CS score was significantly higher in group A than group B (P<0.001). 13-18 months was significantly lower than >18 months in group A and higher than ≤ 6mnths and 7-12 months in group B (P <0.001). 18 months was significantly higher than ≤ 6mnths and 7-12 months in group B (P <0.001). **Conclusions:** The thickness of the lower segment cesarean scar, as assessed by sonography, is positively correlated with the time between pregnancies.

Keywords: Inter-Pregnancy, Interval Effect, Uterine, Caesarean Scar Thickness, Ultrasound.

Introduction:

According to the World Health Organization (WHO) publications, the percentage of Caesarean births should be as low as 10-15%. However, in recent years, it has surpassed the WHO standards in several nations. The evaluation of scar integrity has significance in mitigating the occurrence of recurrent caesarian section (CS) procedures. Predicting the likelihood of uterine rupture at a young age may assist in selecting individuals for a trial of labor[1].

Women having a history of just one prior cesarean section were more prone to have complications during their subsequent childbirth. The occurrence of malpresentation, placenta previa, antepartum hemorrhage, placenta accreta, protracted labor, uterine rupture, premature birth, low birth weight, and stillbirth was shown to be more prevalent among women who had their first caesarian delivery during their subsequent delivery[2].

Obstetricians have challenges in determining the method of delivery for future pregnancies in women with previous CS (1). Two desirable outcomes of contemporary obstetrical health policies globally are the successful implementation of trial of labor after cesarean (TOLAC) and subsequent vaginal birth after cesarean (VBAC). Developed nations are increasingly allocating resources towards implementing strategies that prioritize patient safety within a controlled hospital setting, while also aiming to minimize associated expenses[3].

The main reason to avoid TOLAC delivery is the possibility of uterine rupture [4].

The likelihood of uterine scar dehiscence or rupture is inversely proportional to the lower uterine segment (LUS) thickness as determined by trans abdominal sonography between 36 and 38 weeks of gestation. In 455 women with a LUS thickness greater than 3.5 mm, there were 2 cases of scar dehiscence and 1 case of uterine rupture, which accounts for 0.4% of the total. In 136 women with a measurement between 2.6 and 3.5 mm, there were 5 cases of scar dehiscence and 9 uterine ruptures, or 6.6% of the total. In 51 women with a measurement between 1.6 and 2.5 mm, there were 3 cases of scar dehiscence and 5 uterine ruptures, or 5.9% of the total ($P < 0.01$)[5].

The diagnosis of a cesarean scar defect occurs when a hypo-echogenic indentation, which is a filling defect, is seen inside the myometrium of the left uterine sphincter (LUS) at the location of a prior cesarean incision that is connected to the uterine or cervical cavity. The presence of a cesarean scar poses a substantial danger for subsequent pregnancies, particularly for future births. Pregnancies in women with prior CSs are believed to be at a heightened risk owing to the potential for difficulties arising from scar defects[6].

Researching the correlation between the time between pregnancies and the thickness of lower segment Caesarean scars as determined by sonography was the primary objective of this research.

Patients and Methods:

This research was conducted as a descriptive cross-sectional investigation including a sample of 60 pregnant women ranging in age from 20 to 35 years. The participants were selected based on their normal weight (body mass index [BMI]) falling within the range of 18.5 to 24.9), singleton pregnancy with one previous lower segment coccyx (CS), and gestational age (GA) between 30-36 weeks as determined by the last menstrual period (LMP). The research was conducted between March 2022 and March 2023, after the authorization of the Ethical Committee of Menoufia University Hospitals in Menoufia, Egypt. The patients provided informed written consent.

Exclusion criteria were pregnant with multifetal gestation., patients with poly or oligohydramnios, abnormal placentation, medical health problems (diabetes, collagen disease), pregnant with any other previous uterine scars other than caesarean scar and multiple pregnancy.

Patients were divided into two equal groups: Group A: An inter-pregnancy interval of greater than 12 months and Group B: An inter-pregnancy interval of less than or equal to 12 months.

All patients were subjected to history taking [maternal age, parity, number of gestations, obstetric history: LMP, gravidity, parity and history of previous abortion or ectopic pregnancies, menstrual history: age of menarche, regularity of menstruation, first day of LMP, medical history (hypertension (HTN), diabetes mellitus (DM), Thyroid), surgical history (previous appendectomy, previous herrnioraphy, previous salpingectomy, previous lab cholecystectomy)], clinical examinations and ultrasonography.

Ultrasonography:
The duration between pregnancies for all women was measured in months, starting from the date of the last cesarean section to the date of the first day of the first menstrual period. A 2D trans abdominal ultrasound (Mindray nuewa i9) was used to assess the thickness of the LUS Caesarean scar in women between 30-36 weeks of pregnancy. The trans abdominal method was employed to quantify the whole thickness of the scar by concentrating on the thinnest section of the LUS. One cursor was positioned at the intersection of the urinary bladder and uterine wall, while the second cursor was positioned at the interface between the Chori amniotic membrane and amniotic fluid in order to quantify the scar. The cursor's vertical bar was aligned with the interfaces. The women that were recruited were classified into two groups, A and B, based on the length of the inter pregnancy period. Group A consists of individuals with an inter pregnancy gap exceeding 12 months, whereas Group B comprises those with an inter pregnancy period of 12 months or less. The analysis focused on determining the average scar thickness of the two groups. The mean scar thickness difference between the two groups was computed. The Pearson correlation coefficient was used to demonstrate the association between the space between pregnancies and the thickness of scars. **Figure 1**

Figure 1: Ultrasound imaging showing cesarean scar thickness (6.6mm) measurement from our study

Sample Size Calculation:
The computation of the sample size was conducted using MedCalc V.20, a software developed by MedCalc Software Ltd. The sample size was determined by taking into account the following factors: The research has a 95% power and a margin of error of 0.05. According to prior research [1], there was a correlation coefficient of 0.708 between the inter-pregnancy interval and the sonographically determined thickness of lower segment caesarean scars. Cases were introduced to address the issue of dropout. Consequently, we enlisted a total of 530 patients. After categorizing the research participants into two distinct groups, we proceeded to pick 30 women from each category, resulting in a total of 60 women participating in our study. The selected women were divided into two groups, A and B, based on the length of their inter-pregnancy gap. Group A consisted of 30 pregnant women who had an inter-pregnancy gap beyond 12 months, whereas Group B consisted of 30 pregnant women who had an inter-pregnancy interval of 12 months or less. The analysis focused on determining the average scar thickness of the two groups.

Statistical analysis
The data obtained was synthesized, analyzed and presented in number, percentage, in the form of figures and diagram as required and suitable statistical test will be used to test the significant of results obtained. Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp). The qualitative data were represented using numerical values rather than percentages. The normality of the distribution was assessed using the Shapiro-Wilk test. the range (minimum and maximum), mean, standard deviation, median, and interquartile range (IQR)

were used to characterize the quantitative data. The Pearson moment correlation was used to establish the connection between several variables. The Roc curve was used to assess the diagnostic performance in terms of sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV). The statistical significance of the acquired findings was assessed at a significance level of 5%.

Results:

There was insignificantly difference between the studied groups regarding age, weight, GA in weeks, obstetric and surgical history. The mean of Inter pregnancy interval was 19.13±4.62 in group A while 7.5±2.27 in group B. **Table 1**

Table 1: Comparison between the two studied groups according to demographic data, and obstetric history

		Group A (n = 30)	Group B (n = 30)	p
Age (years)		26.20 ± 4.17	26.70 ± 4.37	0.652
Weight (kg)		69.57 ± 5.59	68.67 ± 4.26	0.486
GA (weeks)		32.07 ± 1.86	32.0 ± 1.68	0.982
Gravidity	**2**	21(70.0%)	24(80.0%)	0.853
	3	5(16.7%)	2(6.7%)	
	>3	4(13.3%)	4(13.3%)	
Parity	**1CS**	21(70.0%)	24(80.0%)	0.279
	1CS and 1 NVD	5(16.7%)	2(6.7%)	
	1CS and 2 NVD	2(6.7%)	4(13.3%)	
	1CS and 3 NVD	2(6.7%)	0(0.0%)	
Previous abortion		1.0 (1.0 - 2.0)	1.0 (1.0 – 1.50)	1.000
No		18(60.0%)	14(64.6%)	0.389
Yes		12(40.0%)	16(53.3%)	
Previous ectopic pregnancy		5(16.7%)	7(23.3%)	0.519
Previous abdominal scars other than SC	**Previous appendectomy**	2(6.7%)	3(10.0%)	0.875
	Previous herniorrhaphy	1(3.3%)	0(0.0%)	
	Previous salpingectomy	2(6.7%)	3(10.0%)	
	Previous lab chysystectomy	1(3.3%)	2(6.7%)	
Inter pregnancy interval (months)		19.13±4.62	7.5±2.27	--
≤6		0(0.0%)	10(33.3%)	
7 – 12		0(0.0%)	20(66.7%)	
13 – 18		16(53.3%)	0(0.0%)	
>18		14(46.7%)	0(0.0%)	

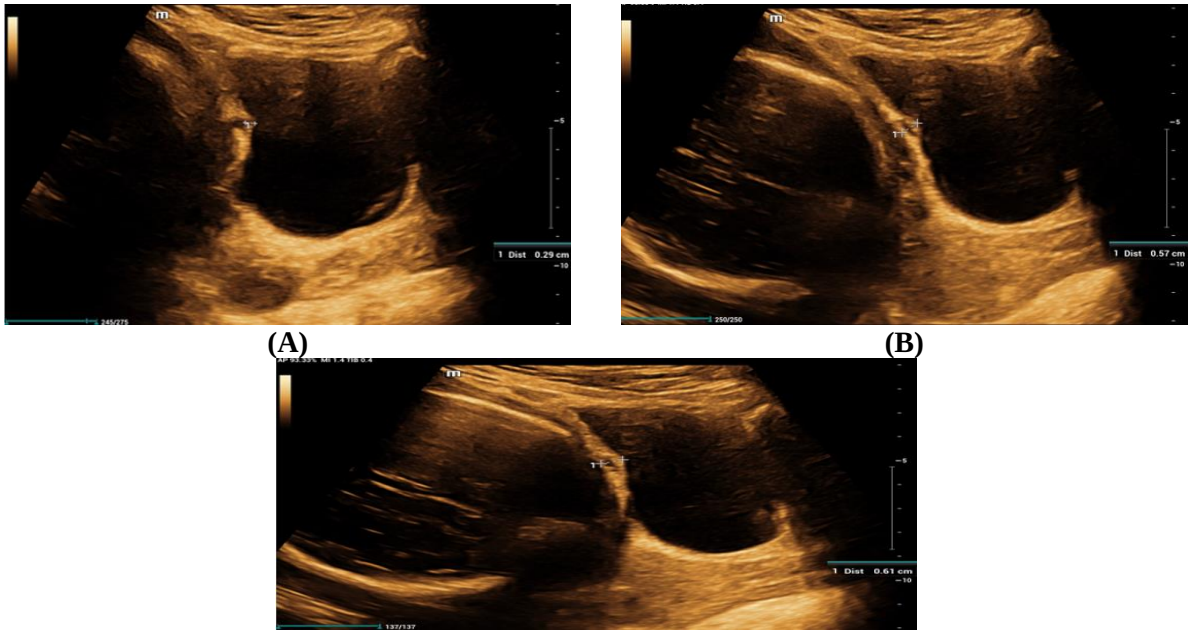
Data are presented as mean ± SD or frequency (%) or median (IQR). GA: gestational age, CS: cesarean section, NVD: normal vaginal delivery.

CS score was significantly higher in group A than group B (P value<0.001). 13-18 months was significantly lower than >18 months in group A and higher than ≤ 6mnths and 7-12 months in group B (P <0.001). 18 months was significantly higher than ≤ 6mnths and 7-12 months in group B (P <0.001). **Figure 2, Table 2**

Table 2: Comparison between the different studied groups according to Cs scar thickness in mm

	Group A (n = 30)		Group B (n = 30)		p
	13 – 18 months (n = 16)	**>18 months (n = 14)**	**≤6 months (n = 10)**	**7 – 12 months (n = 20)**	
CS scar thickness (mm)	4.24 ± 0.45	6.07 ± 0.18	2.61 ± 0.26	3.44 ± 0.48	**<0.001***
Sig. bet. Grps	**p_1<0.001*, p_2<0.001*, p_3<0.001*, p_4<0.001*, p_5<0.001*, p_6<0.001***				

Data are presented as mean ± SD or frequency (%), * significant p value <0.05, p1: p value for comparing between 13 – 18 and >18, p2: p value for comparing between 13 – 18 and ≤6, p3: p value for comparing between 13 – 18 and 7 – 12, p4: p value for comparing between >18 and ≤6, p5: p value for comparing between >18 and 7 – 12, p6: p value for comparing between >18 and 7 – 12, CS: cesarean section.



(A) **(B)**

(C)

Figure 2: Ultrasound CS thickness (A) 2.9mm, (B) 5.7mm and (C) 6.1mm from our study

There was positive correlation between Cs scar and interpregnancy interval in both groups (r=0.95 and P <0.001). **Table 3**

Table 3: Correlation between Inter pregnancy interval and Caesarean Scar thickness in each group

	Inter pregnancy interval	
	r_s	**p**
Group A (n = 30)	0.950*	<0.001*
Group B (n = 30)	0.951*	<0.001*

rs: Spearman coefficient, *: Statistically significant at p ≤ 0.05.

CS scar can significantly predict to discriminate an inter pregnancy interval (P <0.001 and AUC = 0958) at cut-off >3.81 with 93.33% sensitivity, 83.33% specificity, 84.8% PPV and 92.6% NPV. **Figure 3**

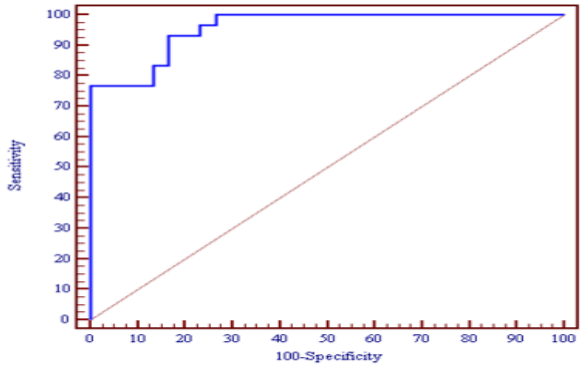


Figure 3: ROC curve for Cs scar thickness to discriminate An inter-pregnancy interval of >12 months patients (n = 30) from inter-pregnancy ≤12 months (Group A from B).

Discussion

Prior to C.S., all patients received a TAS examination on a partly full bladder to measure the thickness of the inner lining of the bladder, from the muscularis and mucosa on the exterior side to the chorioamniotic membrane within, with the myometrium in between. Almas et al. [1] corroborated our findings by reporting a mean± SD age of 26.94±3.15 years and a mean GA (weeks) of 31.5200± 1.68111. According to Pario et al. [(7)], the average values for age, gestational age (GA), and parity were 28.22±4.59 years, 37.60±0.78 weeks, and 1.73±0.94, respectively.

The current research observed a substantial increase in CS scar thickness in group A compared to group B. Consistent with our findings, Almas et al. [1] observed a significant increase in the thickness of the CS scar among individuals with an inter-pregnancy gap over 18 months, as compared to those with an inter-pregnancy interval below 18 months. Corroborating our findings, Gizzo et al. [8] observed that IPI had a substantial impact on the thickness of previous CS scars.

The timing of VBAC is a crucial factor in accurately forecasting its success. A research conducted by Bujold et al. [9] found that among those who had VBAC within 12 months after their prior cesarean section, 4.8% experienced scar rupture. For those who underwent VBAC between 13-24 months following their cesarean, the rupture rate was 2.7%. For those who underwent VBAC beyond 25 months, the rupture rate was 0.9%. To more accurately determine the minimum duration between a previous cesarean section and a successful VBAC, Bujold et al. [10] conducted follow-up research 8 years later. The study revealed that the likelihood of uterine scar rupture is 2-3 times greater when attempting VBAC within 18 months after a previous cesarean section. Nevertheless, the incidence of rupture between the ages of 18-24 months and above 24 months was found to be similar, with rates of 1.9% and 1.3% respectively. Additionally, it was shown that the incidence of rupture is seven times higher when the prior cesarean section was performed with a single layer closure.

The current investigation found a significant and favorable association between the time between pregnancies and the thickness of Cs scars in both groups. Almas et al. [1] also observed a strong positive association between inter pregnancy interval and scar thickness, as shown by a Pearson correlation coefficient of r=0.71 and a p-value of 0.000 (=0.05). Increasing the IPI leads to a corresponding rise in scar thickness. In a study conducted by Bujold et al. [10], a noteworthy positive association was seen between the likelihood of uterine scar rupture and the duration since the last cesarean section.

In the present study, regarding ROC curve analysis, Cs scar thickness was a significant predictor to discriminate an inter-pregnancy interval of >12 months patients from inter-pregnancy ≤12 months at cut-off >3.81 with 93.33% sensitivity, 83.33% specificity, 84.4% PPV, 92.6% NPV and AUC 0.958. These findings correspond with the results reported by Almas et al. [1], which indicated that women who had undergone a previous cesarean section (CS) and had an incision and incision (IPI) of more than 12 months had thicker scars and experienced more successful outcomes during the trial of labor. Additionally, an increase in IPI of more than 12 months was associated with an increase in scar thickness and a decrease in the risk of uterine rupture by 1%. Conversely, a decrease in IPI of less than 6 months resulted in a thinning of the scar and a higher risk of scar dehiscence, with a risk of 3.05%. Sharma et al. [11] found that a complete thickness of 2.5 mm of the LUS was the only feature that showed a correlation with transparent LUS (C3) (8.8% vs. 0%; P = 0.02). The study used transabdominal ultrasonography and had sensitivity, specificity,PPV, NPV of 90.9%, 84%, 71.4%, and 95.5%, respectively.

The use of sonographic examination to verify the integrity of a prior CS scar is a straightforward and valuable diagnostic method that offers obstetricians standardized instructions in this context [12]. The findings of the current research confirm that there is a correlation between the thickness of post caesarian scars as assessed by sonography and the time between pregnancies. It may serve as a dependable approach for determining the manner of delivery in women who have already had cesarean section.

The healing process of uterine scars after a Caesarian section requires a sufficient duration. Consequently, a brief inter-pregnancy period might impede the healing process and diminish the strength of the scar [1]. The careful selection of patients for the trial of labor after cesarean section (CS) is crucial in order to achieve a favorable result.

The recommended age range for achieving favorable delivery outcomes is 18-23 months [13] The documented length of short IPI is 18 months or fewer, whereas long IPI is more than 5 years [14]. Short

IPI increases the likelihood of uterine scar rupture by about 1.1 and 6.6 times, with a percentage range of 0.1% to 0.5%. Additionally, it increases the odds of dehiscence by 0.5% to 1.5%. [15].
One of the limitations of this research was the very small sample size. The research was conducted at a singular facility. It is indicated that the thickness of Cs scars serves as a key predictor for distinguishing between different pregnancies. Extend the duration between pregnancies beyond 12 months. More follow up of caesarean scar thickness of cases. Furthers prospective multicenter studies with larger sample size is needed. Surgical technique of uterine closure and the material used in stitching in previous cesarean section should be evaluated.

Conclusions:
The thickness of the lower segment cesarean scar, as assessed by sonography, is positively correlated with the time between pregnancies.
Financial support and sponsorship: Nil
Conflict of Interest: Nil

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