Long-Term Complications of Caesarean Section, the Niche in the Scar: A Prospective Cohort Study on Niche Prevalence and its Relation to Abnormal Uterine Bleeding

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Abstract

Background: There have been several reports of an association between abnormal bleeding and a niche in particular, postmenstrual spotting seems to be a predominant symptom in women with a niche.

Aim of the Work: To study the prevalence of niches in the caesarean scar in a random population, and the relationship with postmenstrual spotting.

Patients and Methods: This prospective cohort study was performed on a total of 80 patients who underwent at least 1 lower segment caesarean section of single full-term pregnancy and conducted at Ain Shams University Hospital from April 2021 to December 2022. During this study, 100 patients were assessed for eligibility and 80 patients were included in the study. Of all eligible patients, 14 patients were excluded from the study based on the inclusion criteria and 6 patients refused to participate in of the study.

Results: Regarding TVUS and 3D findings of scar niche at weeks 6-12 and at month 6, our results revealed that there were no statistically significant differences according to scar niche regarding menstruation, premenstrual spotting, while Menstrual irregularity, BAC score, durations of menstruation, intermenstrual bleeding and postmenstrual spotting statistically were significantly higher among cases with scar niche. Our study results revealed that menstrual abnormalities and postmenstrual bleeding were statistically significantly found in cases with higher niche depth. Our study results revealed that there were no statistically significant differences according to menstrual abnormalities at week 6-12 regarding residual myometrium thickness with significantly lower ratio of residual myometrium thickness in cases with menstrual abnormalities except in intermenstrual spotting.

Conclusion: caesarean section scar was visible in all women at 6–12 weeks after caesarean section. The prevalence of niches detected by 3D is high after caesarean section (56.6%), and more niches are detected than using TVUS (41.3%), with a larger observed niche size and

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reduced residual myometrial thickness. The presence of a niche is significantly related to postmenstrual spotting.

Keywords: Caesarean Section; Niche; Abnormal Uterine Bleeding.

Introduction

Over the past few years, the rate of caesarean delivery has dramatically increased throughout the world. Nonetheless, about one-third of all deliveries are caesarean, a remarkable increase from even 20 years ago. In large part, this is because modern caesareans are quite safe with rare serious morbidity [1].

There is a downside to the increased rate of caesareans, however, that is just now becoming apparent. There is rare but serious morbidity for the mother and common but relatively minor respiratory morbidity for the neonate in the short term. In the long-term, there is a substantial increase in the risk for major maternal, fetal, and neonatal morbidity, primarily because of the consequences of abnormal placentation and placenta accreta. Only recently, gynecological symptoms such as painful menstruations and postmenstrual spotting have been associated with CSs [2].

The long-term complications of caesarean section in relation to future reproduction have been comprehensively examined in the previous few years. In the past decade several articles have described a defect that can be seen on ultrasound at the site of the caesarean section scar, known as a 'niche' The term CS niche (defect) describes the presence of a hypoechoic area within the myometrium in the isthmus (lower uterine segment) with discontinuation of myometrium at the site of previous CS. A niche has been described as the indentation of myometrium of at least 2 mm. Large niches are uncommon with reported varying incidence of 11-45% depending on the definition used. A significant niche is defined as involving a depth of at least 50-80% of anterior myometrium or the remaining myometrial thickness less than 2.2 mm when evaluated by transvaginal ultrasound scanning (TVS). Small niches may indeed be quite common but would be clinically unimportant. The large niches are most likely to give rise to long-term sequelae [3].

Presumably a lack of coordinated muscular contractions occurs around the cesarean scar, allowing the defect to collect menstrual debris. Subsequently, the debris leaches out through the cervix for several days after the majority of menstrual flow has ceased. There have been several reports of an association between abnormal bleeding and a niche in particular, postmenstrual spotting seems to be a predominant symptom in women with a niche [4].

With ultrasonographic higher frequency and proximity to the pelvic organ, transvaginal ultrasonography has offered unprecedentedly clear images of the female pelvic organs. Its value for the visualization of the lower uterine segment and cervix had been emphasized. This makes it particularly useful in observing previous section scars in the lower uterine segment [5].

The aim of this work is to study the prevalence of niches in the caesarean scar in a random population, and the relationship with postmenstrual spotting.

Patients and Methods

This prospective cohort study was performed on a total of 80 patients who underwent at least 1 lower segment caesarean section of single full-term pregnancy and conducted at Ain Shams University Hospital from April 2021 to December 2022. During this study, 100 patients were assessed for eligibility and 80 patients were included in the study. Of all eligible patients, 14 patients were excluded from the study based on the inclusion criteria and 6 patients refused to participate in of the study. Ultimately, the analysis was based on the data of 80 patients who underwent at least

1 lower segment caesarean section of single full-term pregnancy.

The patient should be medically and surgically free. She was evaluated by both transvaginal ultrasound and 3D ultrasound after 6-12 weeks of uneventful lower segment CS followed by evaluation of her menstrual regularity and pattern. After 6 months of the CS, she is reevaluated for her menstrual pattern and regularity. The menstrual pattern is evaluated by questionnaire and validated menstrual score chart: The Pictorial Blood Assessment Chart (PBAC).

Statistical analysis

The data was collected, reviewed, coded and entered into an excel sheet. Data will be analyzed by using SPSS software. Descriptive statistics were done in terms of frequency and percentages for categorical variables. Mean (±SD) or median (interquartile range) was used for continuous variables. Statistical tests for comparing groups were used according to type of data. Differences were considered significant at a p-value less than or equal to 0.05.

Results

Table (1): Demographic characteristics among the studied cases

		Mean±SD	Range
Age (years)		27.1±3.4	21.0–35.0
BMI (Kg/m^2)		27.8±3.1	20.6–34.8
Number of previous sections		1.6±0.7	1.0–3.0
Time from last CS (weeks)		8.8±1.7	6.0–12.0
Gestational age at last section (weeks)		38.8±0.8	37.0–40.0
		n	**%**
Current breast feeding		78	97.5%
Current contraception	**None**	66	82.5%
	IUD	7	8.8%
	Hormonal	7	8.8%

Table (2): Comparison according to scar niche regarding demographic characteristics

		Niche	No niche	p-value
TVUS diagnosis				
		Total=34	**Total=46**	
Age (years)		27.0±3.3	27.1±3.5	^0.895
BMI (Kg/m²)		29.1±3.0	26.8±2.8	**^<0.001***
Number of previous sections		2.0±0.7	1.3±0.5	**^<0.001***
Time from last CS (weeks)		8.7±1.8	8.9±1.7	^0.654
Gestational age at last section (weeks)		38.7±0.8	38.9±0.8	^0.277
Current breast feeding		32 (94.1%)	46 (100.0%)	§0.178
Current contraception	**None**	29 (85.3%)	37 (80.4%)	§0.905
	IUD	3 (8.8%)	4 (8.7%)	
	Hormonal	2 (5.9%)	5 (10.9%)	
3DS diagnosis				
		Total=46	**Total=34**	
Age (years)		26.8±3.3	27.4±3.5	^0.422
BMI (Kg/m²)		28.4±3.3	26.9±2.6	**^0.027***
Number of previous sections		1.9±0.7	1.2±0.4	**^<0.001***
Time from last CS (weeks)		8.9±1.8	8.7±1.7	^0.564
Gestational age at last section (weeks)		38.7±0.9	38.9±0.8	^0.290
Current breast feeding		44 (95.7%)	34 (100.0%)	§0.505
Current contraception	**None**	38 (82.6%)	28 (82.4%)	§0.999
	IUD	4 (8.7%)	3 (8.8%)	
	Hormonal	4 (8.7%)	3 (8.8%)	

Table (3): Comparison according to scar niche regarding uterine characteristics

Findings		Niche	No niche	p-value
TVUS diagnosis				
		Total=34	**Total=46**	
Uterine position	**AVF**	24 (70.6%)	42 (91.3%)	**#0.016***
	RVF	10 (29.4%)	4 (8.7%)	
Uterine length (mm)		71.7±2.4	73.1±4.4	^0.115
Uterine width (mm)		42.3±2.4	41.7±4.1	^0.466
Endometrial thickness (mm)		6.0±1.1	6.1±0.9	^0.766
Anterior wall thickness (mm)		10.5±1.9	10.3±2.7	^0.700

3DS diagnosis				
		Total=46	**Total=34**	
Uterine position	**AVF**	34 (73.9%)	32 (94.1%)	**#0.019***
	RVF	12 (26.1%)	2 (5.9%)	
Uterine length (mm)		72.5±3.3	72.4±4.3	^0.904
Uterine width (mm)		42.5±3.4	41.1±3.5	^0.077
Endometrial thickness (mm)		6.0±1.1	6.1±0.8	^0.525
Anterior wall thickness (mm)		10.3±2.1	10.4±2.7	^0.771

Table (4): Comparison according to scar niche (TVUS) regarding abnormalities findings at weeks 6-12

Findings	Niche	No niche	p-value
	Total=34	**Total=46**	
Menstruation	31 (91.2%)	43 (93.5%)	§0.695
	Total=31	**Total=43**	
Menstrual duration (day)	5.8±2.0	4.2±1.1	**^<0.001***
PBAC score	161.3±28.4	135.8±30.0	**^<0.001***
Menstrual irregularity	14 (45.2%)	3 (7.0%)	**#<0.001***
Premenstrual spotting	0 (0.0%)	1 (2.3%)	§0.999
Intermenstrual bleeding	4 (12.9%)	0 (0.0%)	**§0.027***
Postmenstrual spotting	11 (35.5%)	3 (7.0%)	**#0.002***
	Total=0	**Total=1**	
Premenstrual spotting days		4.0	NA
	Total=4	**Total=0**	
Intermenstrual spotting days	2.8±0.5		NA
	Total=11	**Total=3**	
Postmenstrual spotting days	6.2±1.3	2.3±0.6	**^<0.001***

NA: Not applicable. ^Independent t-test. #Chi square test. §Fisher's Exact test. *Significant

Table (4) showed that: No statistically significant differences according to scar niche regarding menstruation and premenstrual spotting. Menstrual irregularity, Intermenstrual bleeding and Postmenstrual spotting statistically was significantly more frequent among cases with scar niche. PBAC score as well as durations of menstruation, Postmenstrual spotting were significantly higher among cases with scar niche.

Table (5): Comparison according to scar niche (3DS) regarding abnormalities findings at month-6

Findings	Niche	No niche	p-value
	Total=22	**Total=15**	
Menstruation	22 (100.0%)	15 (100.0%)	NA
	Total=22	**Total=15**	
Menstrual duration (day)	6.1±1.9	4.3±0.6	^<0.001*
PBAC score	160.4±31.7	140.5±20.5	^0.040*
Menstrual irregularity	12 (54.5%)	2 (13.3%)	#0.011*
Premenstrual spotting	0 (0.0%)	0 (0.0%)	NA
Intermenstrual bleeding	5 (22.7%)	1 (6.7%)	§0.368
Postmenstrual spotting	11 (50.0%)	2 (13.3%)	#0.022*
	Total=5	**Total=1**	
Intermenstrual spotting days	3.4±0.5	3.0	¤0.541
	Total=11	**Total=2**	
Postmenstrual spotting days	5.6±1.1	3.0±1.4	^0.012*

Table (6): Comparison according to menstrual abnormalities at week 6-12 regarding scar niche depth (mm)

Abnormalities	Findings	TVUS		3DS	
		Total	Mean±SD	Total	Mean±SD
Menstrual irregularity	**Present**	14	5.5±0.9	15	5.7±1.3
	Absent	17	3.3±0.9	28	3.3±1.3
	p-value	**<0.001***		**<0.001***	
Intermenstrual bleeding	**Present**	4	5.0±0.8	4	5.3±0.5
	Absent	27	4.2±1.5	39	4.0±1.8
	p-value	0.299		0.176	
Postmenstrual spotting	**Present**	11	5.6±0.9	12	5.8±1.5
	Absent	20	3.6±1.1	31	3.5±1.4
	p-value	**<0.001***		**<0.001***	

Table (6) showed that: Cases with menstrual abnormalities and postmenstrual spotting had significantly higher nich depth.

Discussion

Different studies were done evaluating the prevalence of niches in the caesarean scar with the relationship with postmenstrual spotting, some of them agree and others differ from our results.

The current study revealed that Cesarean section scar niche found by transvaginal ultrasonography in 42.5% of the studied cases and was in 57.5% by 3D.

According to the demographic characteristics, BMI and the Number of previous sections were significantly higher among cases with scar niche. Using TVUS; BMI was (29.1±3.0, p value = <0.001) and the Number of previous sections was (2.0±0.7, p value = <0.001). While using 3D; BMI was (28.4±3.3, p value = 0.027) and the Number of previous sections was (1.9±0.7, p value = <0.001). Age, Time from last CS, Gestational age at last CS, Current breast feeding, and current contraception were insignificant.

Also, according to uterine characteristics the current study revealed that Cesarean section scar niche was significantly more frequent in RVF uterus. Using TVUS; RVF uterus was (29.4%, p value = 0.016). While using 3D; it was (26.1%, p value = 0.019). Uterine length, Uterine width, Endometrial thickness, and Anterior wall thickness were insignificant.

Regarding TVUS and 3D findings of scar niche at weeks 6-12 and at 6 months, our results revealed that there were no statistically significant differences according to scar niche regarding menstruation, premenstrual spotting, and intermenstrual bleeding.

While Menstrual irregularity, PBAC score, durations of menstruation, and postmenstrual spotting statistically were significantly higher among cases with scar niche.

At weeks 6-12, using TVUS; Menstrual irregularity was (45.2%, p value = <0.001), PBAC score was (161.3±28.4, p value = <0.001), duration of menstruation was (5.8±2.0, p value = <0.001), and postmenstrual spotting was (35.5%, p value = 0.002). While using 3D; Menstrual irregularity was (34.9%, p value = 0.004), PBAC score was (153.0±31.2, p value = 0.038), duration of menstruation was (5.3±1.9, p value = 0.017), and postmenstrual spotting was (27.9%, p value = 0.020).

At 6 months, using TVUS; Menstrual irregularity was (70.6%, p value = <0.001), PBAC score was (163.7±31.5, p value = 0.027), duration of menstruation was (6.6±1.8, p value = <0.001), and postmenstrual spotting was (64.7%, p value = <0.001). While using 3D; Menstrual irregularity was (54.5%, p value = 0.011), PBAC score was (160.4±31.7, p value = 0.040), duration of menstruation was (6.1±1.9, p value = <0.001), and postmenstrual spotting was (50.0%, p value = 0.022).

These findings are in agreement with previous studies. Van der Voet et al., [2] conducted a prospective cohort study that enrolled 263 non-pregnant women delivered by caesarean section to study the prevalence of niches in the caesarean scar in a random population, and the relationship with postmenstrual spotting.

In agreement with our results, Van der Voet et al., [2] reported that Niche prevalence was 49.6% when evaluated by TVU and 64.5% when evaluated by Sono hysterography (3D) and number of previous sections were significantly correlated with higher prevalence of scar niche as in women with one caesarean section, 62% who underwent 3D had a niche, compared with 68.2% of women with two caesarean sections and 77.8% of women with three caesarean sections which is in harmony with our results.

In a study conducted by Bij de Vaate et al. [6], on 225 patients with a previous history of cesarean section examined for disorders of menstruation, CS niche was detected by TVS in 54 women (24%), and the definition of the niche was an anechoic region at the line of the CS scar with at least 1mm depth.

On the contrary, another prospective study, in which the examination was conducted six months after a cesarean section, showed the incidence of the niche of 22.4% with TVS [7]. The difference in prevalence percentage was dependent of different sample sizes.

At week 6-12, according to menstrual abnormalities, our study results revealed that there were no statistically significant differences regarding residual myometrium thickness with significantly lower ratio of residual myometrium thickness in cases with menstrual abnormalities like Menstrual irregularity by using both TVUS and 3D (p value = <0.001) and Postmenstrual spotting using TVUS (p value = <0.002) and using 3D (p value = <0.001) but not in intermenstrual spotting which was not significant statistically.

Consequently, our study results revealed that there were statistically significant positive correlations between scar depth and each PBAC score; TVUS (p value = <0.002) and 3D (p value = <0.001) as well as durations of Menstrual duration; TVUS (p value = <0.001) and 3D (p value = <0.001) and Postmenstrual spotting; TVUS (p value = <0.014) and 3D (p value = <0.001). While there were no statistically significant correlations between Residual myometrium thickness and menstrual bleeding durations, PBAC score or postmenstrual spotting. Yet, there was statistically significant negative correlations between Ratio of residual myometrium thickness and each PBAC score; TVUS (r = -0.462, p value = 0.009) and 3D (r = -0.644, p value = <0.001) score as well as Menstrual duration; TVUS (r = -0.424, p value = 0.018) and 3D (r = -0.463, p value = 0.002) and Postmenstrual spotting duration; TVUS (r = -0.691, p value = 0.018) and 3D (r = -0.686, p value = 0.014).

At 6 months, according to menstrual abnormalities, our study results revealed that there were no statistically significant differences regarding residual myometrium thickness with significantly lower ratio of residual myometrium thickness in cases with menstrual abnormalities like Menstrual irregularity by using both TVUS (p value<0.007) and 3D (p value<0.008) and Postmenstrual spotting using TVUS (p value<0.019) and using 3D (p value<0.031) but not in intermenstrual spotting which was not significant statistically.

Consequently, our study results revealed that there were statistically significant positive correlations between scar depth and each PBAC score; TVUS (p value = <0.001) and 3D (p value = 0.003) as well as durations of Menstrual duration; TVUS (p value = <0.001) and 3D (p value = <0.001) and Postmenstrual spotting; TVUS (p value = <0.001) and 3D (p value = <0.026).While there were no statistically significant correlations between Residual myometrium thickness and menstrual bleeding durations, PBAC score or postmenstrual spotting. Yet, there was statistically significant negative correlations between Ratio of residual myometrium thickness and each PBAC score; TVUS (r = -0.704, p value = 0.002) and 3D (r = -0.388, p value = 0.044) score as well as Menstrual duration; TVUS (r = -0.579, p value = 0.015) and 3D (r = -0.547, p value = 0.008) and Postmenstrual spotting duration; TVUS (r = -0.771, p value = 0.005) and 3D (r = -0.545, p value = 0.043).

In agreement with our results, El-Samie et al. [8] conducted a prospective study that enrolled 100 Patients, who had a previous cesarean section and complained of unexplained abnormal uterine bleeding to evaluate the prevalence of uterine niche after CS in women with abnormal uterine bleeding and revealed that there was a statistically significant difference (P<0.05) as regards the type of abnormal uterine bleeding and associated pain with a higher percentage of postmenstrual spotting pattern of abnormal bleeding (65.2%) and dysmenorrhea (60.9%).

In a previous study on 207 women with prior CS performed by Wang et al. [9], to evaluate the prevalence of clinical symptoms

related to niches within the cesarean scar, the most common clinical presentation was postmenstrual spotting found in 63.8% (131/207) of patients (P< 0.001). That agreed with the results of our study which was statistically significant and reveals an association between CS niche and postmenstrual spotting.

In agreement with our results, Van der Voet et al. [2] compared the results of 3D with TVU and revealed that women with a ratio of residual myometrium of less than half of the adjacent myometrium (ratio <0.5) measured by TVU or GIS reported postmenstrual spotting more often than women with a ratio of >0.5.

Also, niche prevalence was higher, measured niche depth was greater, and residual myometrium was thinner when detected by SIS and postmenstrual spotting 1 year after caesarean section was strongly related to the presence of a niche detected by both TVU and 3D [2].

Bij de Vaate et al. [6] findings were in agreement with our results in that postmenstrual spotting was reported by 33.6% of women with a niche and 15.2% of women without a niche (P = 0.002) that indicated significant correlation between niche and postmenstrual bleeding. The niche size was significantly different between women with and without postmenstrual spotting (P = 0.02) that was larger in women with postmenstrual bleeding.

Several previous studies agreed with our results and indicated a positive relationship between large niches and postmenstrual spotting. Large niches (those with a residual myometrium with thickness of <50% of that of the adjacent myometrium) was significantly related to postmenstrual spotting [2].

This parameter and cut-off level were also used by Ofilli-Yebovi et al. [10] who reported a high prevalence of women with a ratio of less of than 50% in a population with gynecological symptoms. A potential relationship between niche size and postmenstrual spotting is in line with the hypothesis that spotting is induced by the accumulation of blood inside the niche. A depth of more than half the myometrial thickness makes the anterior part of the niche possibly large enough to obstruct the direct outflow of menstrual blood. This, in combination with lower contractility as a result of fibrosis, may induce the accumulation of blood in a niche [2].

Conclusion

Caesarean section scar was visible in all women at 6–12 weeks and 6 months after caesarean section. The prevalence of niches detected by 3D is high after caesarean section (56.6%). More niches are detected than using TVUS (41.3%), with a larger observed niche size and reduced residual myometrial thickness. The presence of a niche is significantly related to intermenstrual and postmenstrual spotting.

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