



Prevalence of Uterine Niche Following Caesarean Section: A Hospital-Based Study

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Abstract

Background: The rate of cesarean section (CS) deliveries is on the rise globally, currently accounting for over one-fifth (21%) of all childbirths. A niche is mainly a sonographic finding and has been defined as a triangular anechoic area at the presumed site of incision. This work aimed to estimate the prevalence rate of CS niche among women who underwent their CS.

Methods: This prospective cohort study was carried out on 350 pregnant women admitted for CS either elective or selective. Participants were invited to a medical examination 6 months postoperatively, in which a 3D transvaginal ultrasonography (3D-TVUS) was performed to assess scar position and integrity after their CSs.

Results: 67.4% of the studied women reported presence of niche during sonographic follow up within 6 months of delivery compared to 32.6% who showed no detected niche. The mean age of women without detected niche was significantly lower than those with detected niche ($P < 0.05$). Moreover, participants without detected niche had lower mean previous C.S number compared to participants with detected niche ($P < 0.05$). It was found that the majority of the studied women with detected niche were had repeated C.S, while the majority of women with no detected niche had C.S due to primary causes ($P < 0.05$).

Conclusions: One of the most common long-term complications is the uterine niche, which had a prevalence of 67.4% in our study according to the European Task Force definition. This definition may require revision and broader application to ensure accurate detection of the niche.

Keywords: Prevalence, Uterine Niche, Caesarean Section, Transvaginal Ultrasound Sonography

DOI : 10.21608/SMJ.2025.366575.1547

Received: March 08, 2025

Accepted: May 10 , 2025

Published: Septamper 01, 2025

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Citation: Abdelrhamn Faisal Wasel . et al., Prevalence of Uterine Niche Following Caesarean Section: A Hospital-Based Study
SMJ,2025 Vol. 29 No (3) 2025. 19- 26

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Introduction

According to The World Health Organization, the rate of cesarean section (CS) deliveries is on the rise globally, currently accounting for over one-fifth (21%) of all childbirths. Moreover, Egypt has become one of the top five countries globally where the number of CS performed exceeds that of vaginal deliveries.⁽¹⁾

For example, in Egypt, a cross-sectional survey found that 72.8% of the women had their CS in their first delivery. 54.6% of women saw that CS is safer for the mother, and 63.7% that it is safer for the baby. Participants thought that CS compared to vaginal delivery is less painful (63.4%). In addition, 44% did not know that vaginal birth is possible after a CS, 28% would select a CS to avoid the lithotomy position, and 72.5% did not regret delivering by CS.⁽²⁾

Another retrospective study reported that the prevalence of CS was 45.9% and most of which were elective 59.8%. The associated significant risk factors were residence, educational and socioeconomic levels, and working status. The main indication of CS in this study was the previous CS 40.1%.⁽³⁾

A niche is mainly a sonographic finding and has been defined as a triangular anechoic area at the presumed site of incision.⁽⁴⁾ Over the past few years, there has been an increasing interest in the potential clinical relevance of a niche, as seen by the increasing number of published papers on the topic. For detecting and measuring a CS niche, various methods have been described including transvaginal ultrasound sonography (TVUS).⁽⁵⁻⁷⁾ sonohysterography (SHG).^(8, 9) hysteroscopy,^(10, 11) and hysterosalpingography.^(12, 13)

Up till now, there is no consensus about the gold standard for the identifying and quantifying of a niche.⁽¹⁴⁾ The exact prevalence of isthmocele is unknown, however, it seems logical that its clinical incidence is generally and globally increasing along with the increment of the CS rate.⁽¹⁵⁾ The difficulties in determining its actual prevalence are attributed to variations in the study population, the used criteria for a niche definition, the applied diagnostic method, and the evaluation timing relative to the operation.⁽¹⁶⁾

Furthermore, as not all women with a history of CS develop a niche, it is of interest to identify the risk factors that may predict their development.⁽¹⁷⁾ In addition, there is growing interest in potential

associations between a niche presence and various gynecological symptoms, and the possible mechanisms beyond the development of these symptoms.^(7, 18)

The aim of this work was to estimate the prevalence rate of CS niche among women who underwent their C.S. at Sohag University Hospital.

Patients and Methods

This prospective cohort study was carried out on 350 pregnant women between 18 to 45 years old and were admitted for CS either elective or selective at the Department of Gynaecology and Obstetrics, Sohag University Hospital, Sohag, Egypt, between October 2019 and June 2021. An informed written consent was obtained from the patients. The study was done after approval from the Ethics Committee of the Faculty of Medicine, Sohag University (ID: EA2/069/19).

Exclusion criteria were age < 18 years and > 45 years and previous uterine surgery (myomectomy, and metroplasty, known uterine anomalies, uterine rupture, and uterine perforation).

All participating women were asked to answer a set of questions on symptoms and possible complaints, which had arisen since the CS. Participants were invited to a medical examination 6 months postoperatively, in which a 3D transvaginal ultrasonography (3D-TVUS) was performed to assess scar position and integrity after their CSs.

In all women, a lower-segment CS was performed by the attending obstetrician, with laparotomy via a transverse Pfannenstiel incision and hysterotomy via a transverse Monroe Kerr incision. Uterine closure was carried out using a locked or non-locked technique, according to the surgeon's preference.

3D-TVUS:

At the follow-up appointment, a 3D-TVUS assessment was performed by a Voluson P6 machine with a 5–9-MHz 3D transvaginal probe (GE Healthcare, Zipf, Austria). Briefly, after the woman had emptied her bladder, the transvaginal probe was introduced into the anterior fornix without applying undue pressure to not distort the cervical canal. The external os was identified as

the point at which the anterior and posterior lips of the cervix meet. The internal os was identified as the point at which the cervical mucosa ends (just below the endometrial cavity), which appears hypoechoic compared with the surrounding cervical stroma. The position of the scar relative to the internal cervical os (distance above or below the internal os) and the presence of a scar niche were assessed on a transvaginal, longitudinal ultrasound image of the uterus.

Our definition of a niche is based on Jordans et al.⁽¹⁹⁾ description of “an indentation at the site of the CS scar with a depth of at least 2 mm”. A niche was reported if an anechoic space without fluid or gel at the presumed site of the previous CS scar was formed. Upon niche identification, it was measured in the midsagittal plane to identify the position, length, and width of the niche and the double thickness of the endometrium. Additionally, it was screened for the presence of a niche branch, the extent of the adjacent myometrial thickness and the residual myometrial thickness (RMT) in front of the niche, the distance between the upper border of the defect, and the insertion of the urinary bladder were determined. Patient demographics and delivery data, in particular cervical dilatation (0 cm to 10 cm) determined by vaginal examination at the time of the CS, were recorded by the attending obstetricians were a requirement for entry into the study. At the follow-up appointment, a

transvaginal ultrasound assessment was performed as previously described.

Statistical analysis:

Data was analyzed and presented by the use of Statistical Package for the Social Science (SPSS) version 26 program for data entry and analysis. Descriptive tests were used to summarize quantitative parameters including mean \pm SD, median and range (minimum-maximum). Qualitative data was presented as number and percentage. Tests of normality like Kolmogorov-Smirnov were conducted and the data was found to be not normally distributed. Mann-Whitney U test was used to illustrate association between niche detection and qualitative data. Chi-squared test was used to illustrate association between niche detection and quantitative data. P value <0.05 was considered to be statistically significant.

Results

Table 1 shows that A total number of 350 pregnant lady were included in the study. Their mean age was 27.1 ± 6.3 , mean gravidity number was 2.1 ± 1.5 and their mean C.S number was 1.5 ± 1.3 . More than fifth of the studied women were diabetics (23.7%) and hypertensives (26%). Regarding indications of C.S, the majority of the participants had C.S due to repeated previous C.S (37.1%). The mean C.S gestational age was 35.1 ± 3.8 and the mean cervical dilatation was 2.4 ± 1.7 .

Table 1: Obstetric history, and indications of C.S of the studied pregnant women

		n = 350
Obstetric history	Age (years)	27.1 ± 6.3
	Gravida	2.1 ± 1.5
	Abortions	0.8 ± 1.6
	Number of previous C.S	1.5 ± 1.3
	Diabetes	83 (23.7%)
	Hypertension	91 (26%)
	PROM	66 (18.9%)
	Gestational age	35.1 ± 3.8
	Preterm labor	163 (46.6%)
Indications of C.S	Progress failure	77 (22%)
	Primary C.S	105 (30%)
	Repeated C.S	130 (37.1%)
	Elective C.S	38 (10.9%)

Data are presented as mean \pm SD or frequency (%). C.S: cesarian section, PROM: premature rupture of membranes.

Figure 1 shows that 67.4% of the studied women reported presence of niche during sonographic

follow up within 6 months of delivery compared to 32.6% who showed no detected niche

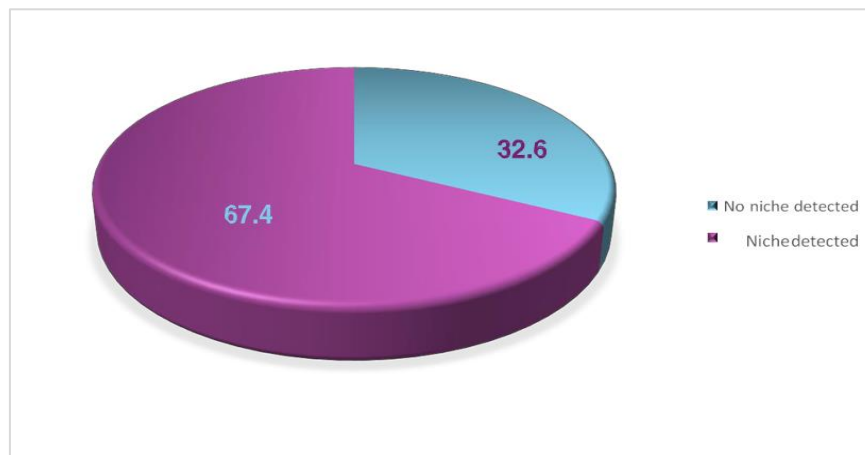


Figure 1: Niche detection of the studied pregnant women by TVS within 6 months follow-up, Sohag University Hospitals, 2024

The transvaginal sonography (TVS) scar characteristics within 6 months of delivery. The

mean depth of the uterine scars was 0.66 ± 0.52 .

Table 2

Table 2: TVS scar characteristics within 6 months of delivery

TVS scar	Mean \pm SD	Median (range)
Depth	0.66 ± 0.52	0.66 (0.02-1.76)
Distance	2.44 ± 0.64	2.5 (1.08:4.42)
Length	0.75 ± 0.37	0.69 (0.22:1.63)
Width	0.98 ± 0.5	0.87 (0.22:2.1)
Residual myometrium	0.69 ± 0.38	0.56 (0.18:1.78)
Adjacent myometrium	1.59 ± 0.36	1.56 (0.88:2.8)

Data are presented as mean \pm SD or frequency (%). TVS: Transvaginal sonography

Table 3 shows that the mean age of women without detected niche was significantly lower than those with detected niche ($P < 0.05$). Moreover, participants without detected niche had lower mean previous C.S number compared to participants with detected niche ($P < 0.05$). There was a statistically significant relation between diabetes and niche detection ($P < 0.05$). No significant association was found between niche

detection and abortion number, hypertension or PROM. Regarding indications of C.S, it was found that the majority of the studied women with detected niche were had repeated C.S, while the majority of women with no detected niche had C.S due to primary causes ($P < 0.05$). In addition, women with no detected niche had lower mean of gestational age than those with detected niche ($P < 0.05$).

Table 3: Association of niche formation with obstetric history and indications of C.S of the studied pregnant women

		With niche n = 236	Without niche n = 114	P value
Obstetric history	Age	28.7 ± 6.4	23.9 ± 4.7	$<0.001^{*†}$
	Gravida	2.4 ± 1.6	1.4 ± 0.9	$<0.001^{*†}$
	Abortions	0.8 ± 1.6	0.9 ± 1.7	0.46 [†]
	Number of previous C.S.	1.7 ± 1.4	0.9 ± 0.9	$<0.001^{*†}$
	Diabetes	67 (28.4%)	16 (14%)	0.003 ^{*‡}
	Hypertension	67 (28.4%)	24 (21.1%)	0.14 [‡]
	PROM	50 (21.2%)	16 (14%)	0.11 [‡]
	Gestational age	35.5 ± 3.5	34.2 ± 3.5	$0.007^{*†}$
Indications of C.S	Preterm labor	98 (41.5%)	65 (57%)	0.006 ^{*‡}
	Progress failure	47 (19.9%)	30 (26.4%)	$<0.001^{*‡}$
	Primary C.S	62 (26.3%)	43 (37.7%)	
	Repeated C.S	109 (46.2%)	21 (18.4%)	
	Elective C.S	18 (7.6%)	20 (17.5%)	

Data are presented as mean \pm SD or frequency (%). CS: cesarian section, PROM: premature rupture of membranes, \dagger Mann-Whiteny U test
 \ddagger Chi-squared test *significant at P value<0.05.

Discussion

As of the latest data, Egypt has one of the highest rates of C.S deliveries globally. The high rate of C.S in Egypt has raised concerns about the potential overuse of this procedure. The need for research like ours has increased as the incidence of complications related to CS, such as uterine niches. These complications may result in conditions like ruptured uterus or morbidly adherent placenta. Such complications greatly affect both the mother and fetus, and they can also cause short-term issues such as menstrual disturbances and infertility. ⁽²⁰⁾

Prevalence of Niche detection in our study by TVS was 67.4% The exact prevalence of the niche is not fully elucidated in the literature. Differences in diagnostic criteria, imaging modalities, and likely subclinical presentation of cesarean scar defect (CSD) contribute to the variability in the reported prevalence of this condition.

Vaate et al. ⁽²¹⁾ noted a prevalence of 24% to 70% and 56% to 84% when the presence of a CSD was assessed using TVUS and saline-infused sonohysterography (SIS), respectively. As expected, less stringent definitions of uterine CSD have resulted in higher reported prevalence.

In a random population of patients with a history of one or more cesarean deliveries, Osseer et al. ⁽²²⁾ defined a CSD as "any indentation or other defect in the scar" reporting a high prevalence of 84% with SIS and 70% with TVUS. In their consensus, Meuleman et al. ⁽²³⁾ reported that the cesarean scar niche varied between 42 and 84%. Using 3D ultrasound for detecting cesarean scar niches can provide more detailed and accurate images compared to 2D ultrasound. The prevalence of niches detected by 3D ultrasound varies, but it generally offers higher sensitivity and specificity. Studies have shown that 3D ultrasound can detect niches in a significant number of cases that might be missed by 2D ultrasound.

3D ultrasound allows for better visualization of the niche's shape, size, and location, which can be crucial for planning any necessary treatments. This modality is particularly useful in assessing the depth and volume of the niche, which are important factors in determining the clinical significance of the defect.

The prevalence of a cesarean scar niche can vary depending on the diagnostic method and the duration since the last CS. Generally, studies have reported that niches are observed in about 50-60% of women within the first few months after a CS. This prevalence can be influenced by factors such as the number of previous CSs and the specific criteria used to define a niche.

In our study, we performed 3D ultrasound after 6 months of CS. Many studies suggest that diagnosis at least 3 months after the CS will provide a clearer assessment, as the healing process is more complete by this time.

A similar study was conducted at Al-Mansoura University where niche evaluation was conducted between 6 and 12 months after CS using 3-D ultrasound.

In our study, we used 2 mm depth to diagnose the niche 6 months after the CS. The European Task Force and many other studies typically use this method for diagnosis.

The risk of developing a cesarean scar niche increases with the number of CSs a woman undergoes. Studies have shown that having multiple CSs is a significant risk factor for niche development. Specifically, women who have had two or more CSs are at a higher risk compared to those who have had only one. This finding matches our results, where niche development significantly increases with the increasing number of CSs.

Women with the presence of a niche were older, with an average age of 35.9 years compared to 31.6 years in those without. They also had higher gravidity (1.8 vs. 1.3) and parity (1.7 vs. 1.2). Additionally, repeat CS were more common among those with a niche (30.4% vs. 12.6%), while elective CS were less common (33.5% vs. 67.9%). ⁽²⁴⁾

In our study, the mean age of women with a niche was 28.7 ± 6.4 years, influenced by earlier marriage ages in our community. The mean gravidity was 2.4 ± 1.6 , and the mean number of CSs was 1.7 ± 1.4 . This may be related to the higher number of CSs performed on women with greater parity, leading to more niches being detected. More than a fifth of the studied women (23.7%) had diabetes, and niche detection was observed in 67 (28.4%) of these cases. Similarly,

among women with hypertension (26%), niche detection was again found in 67 (28.4%) instances.

A study by Lumbanraja et al. ⁽²⁵⁾ reported a prevalence of niche at 44.3% using TVUS. Additionally, there were no statistically significant relationships found between maternal age, gestational age, parity, nutritional status based on upper arm circumference, hypertension in pregnancy, anemia status, surgical indications, duration of surgery, blood loss volume, and puerperal infection concerning Niche development (P-value > 0.05).

In our study, no significant relationship was found between the presence of Niche and the number of abortions, possibly due to the lower parity and younger age of these women. Only advancing age and diabetes were found to be significant factors for the presence of Niche (P-value < 0.05).

It was also suggested that a premature rupture of membranes lasting more than 24 hours should be considered when evaluating for larger Niche formations. ⁽²⁶⁾

In our study, we found 50 instances of premature rupture of membranes among women with Niche (21.2%), but this lacked statistical significance (P-value > 0.05), as most of these women had no previous history of CS and were attempting vaginal birth.

Stegwee et al. ⁽²⁷⁾ developed two models to predict niche development: one for the total population and another specifically for those with elective CS at gestational age.

In our study, we found the average gestational age to be 28.7 ± 6.4 weeks. This suggests that the lower marriage age in our population may contribute to differences compared to Western populations.

Kulshrestha et al. ⁽²⁸⁾ reported that cervical dilation greater than 5 cm, a labor duration exceeding 5 hours, and an advanced fetal station are associated with the development of large niches. This is attributed to the thinner or less vascularized myometrium, which leads to inadequate healing.

The limitation of the study included that we invited 140 women to participate in the study, but unfortunately, about 90% were lost to follow-up.

Conclusions

One of the most common long-term complications is the uterine niche, which had a prevalence of 67.4% in our study according to the European Task Force definition. This definition may require revision and broader application to ensure accurate detection of the niche.

Therefore, further research is needed that include all risk factors for Niche formation, more longitudinal follow up for women after CS and entanglement of all cs performing hospitals and centers in larger studies for further encounter for our prevalence of cs rate and Niche rate.

Financial support and sponsorship: Nil

Conflict of Interest: Nil

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3D-TVUS	3D transvaginal ultrasonography
CS	Cesarean section
CSD	Cesarean scar defect
PROM	premature rupture of membranes
RMT	Residual myometrial thickness
SIS	Saline-infused sonohysterography
SPSS	Statistical Package for the Social Science
TVS	Transvaginal sonography
TVUS	Transvaginal ultrasonography