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Evaluation of Anatomical Characteristics of Cesarean Scar Niche by Sonohysterography and Diagnostic Hysteroscopy in Women with Secondary Infertility

Usama Helmy Almarzuki*, Taha Abdel Fattah Ahmed,
Tarek Mohamed AlBehedy, Hussein Mohamed Abdel Dayem
Obstetrics & Gynecology Department, Faculty of Medicine, Zagazig University, Sharkia, Egypt
***Corresponding author:** Usama H. Almarzuki, **Mobile:** (+20) 01060445668, **Email:** usama.helmy777@gmail.com

ABSTRACT

Background: Cesarean section complications are becoming more common as cesarean scar defects.

Objective: This study aimed to evaluate the anatomical characteristics of cesarean scar niche by diagnostic hysteroscopy and sonohysterography in women with unexplained secondary infertility.

Patients and methods: This observational cross-sectional study included 100 women who attended our outpatient clinic, complaining of unexplained secondary infertility with a history of at least one CS and showing scar niche in office hysteroscopy followed by re-assessment by saline infusion sonohysterography with the evaluation of scar depth, width, and shape in both methods.

Results: The present work revealed that 45 cases had unhealthy (fibrotic) scars, 41 cases had collected blood in the niche, 24 cases had infected scars, 5 cases had endometritis, and 4 cases had a small submucosal polyp, as well as one case, had a small uterine septum. There were 32 cases with post-menstrual spotting, the mean duration of post-menstrual spotting was 2.5 days (±0.9 SD), 19 cases had chronic pelvic pain, 15 cases had both post-menstrual spotting and chronic pelvic pain, 12 cases had dyspareunia. There were 25, 31, and 44 cases that had 2ry infertility ≥ 1, ≥ 2, and ≥ 3 years respectively. There was a non-significant correlation between features of the niche through diagnostic hysteroscopy and correlated symptoms.

Conclusion: Cesarean scar may play an intermediate role in fertility. Hysteroscopy is considered the golden standard tool for the diagnosis of different intrauterine lesions, however; the procedure of sonohysterography is well-tolerated, cost-effective, and can be performed in an office-based gynecological practice, and doesn't require special training.

Keywords: Hysteroscopy, Secondary infertility, Cesarean Scar Niche.

INTRODUCTION

Cesarean section (CS) rates have risen from 6.7 to 19.1 percent worldwide in recent decades, with a current European CS rate of 25 percent of all deliveries [(1)]. In Egypt, the incidence of CS has increased dramatically over the last decade, with the most recent Egypt Demographic and Health Survey (EDHS) reporting a CS rate of 52 percent, implying that cesarean birth may be overused or utilized for unsuitable reasons [(2)].

A scar defect, niche, isthmocele, uterine pouch, or diverticula are some of the terms used to describe the abnormality revealed by ultrasonography following a cesarean section. A niche is linked to a variety of symptoms, including abnormal uterine bleeding (AUB), which includes extended menstruation and postmenstrual spotting in 30% of women with a niche [(3)]. In the literature, uterine disease, intra-abdominal adhesions, and women's reproductive decisions have all been postulated as reasons for subfertility following Caesarean section. Not all niches induce symptoms, and the link between subfertility and a niche in the uterine scar requires more research because the direct proof is currently missing [(4)].

Ultrasound is a non-invasive way to examine the uterus and any scars that may be present. While ultrasonography (US) is quite useful in assessing the scars of a pregnant uterus, its use in assessing the scars of a non-pregnant uterus is limited. Saline infusion sonohysterography (SIS) is a type of examination in which anechoic contrast media is instilled into the uterine cavity to improve the transvaginal US of the uterus. As a result, SIS brings together the benefits of both US and hysterosalpingography [(5)]. The advancement of SIS in recent years has aided in the evaluation of the uterine cavity: the thickness of the remaining myometrium, the thickness of myometrium surrounding the scar, the depth of the filling defect in the scar (niche), and intrauterine adhesions connected to the scar may all be assessed [(6)].

In addition to being a safe, minimally invasive method, office hysteroscopy (OH) "gold standard" for the diagnosis of intrauterine abnormalities; has been proved to be a sensitive instrument for direct viewing of uterine scar and intrauterine adhesions [(7)]. The evolution of patient evaluation methods, particularly the vaginal speculum approach, which eliminates the need for a vaginal speculum to view the cervix or cervical instrumentation to grasp and steady the cervix, reducing patient pain and increasing operator experience, has been instrumental in expanding the use of Office Hysteroscopy with all of its benefits [(8)].

Therefore, this study aimed to evaluate the anatomical characteristics of the cesarean scar niche by diagnostic hysteroscopy and sonohysterography in women with unexplained secondary infertility and to correlate the appearance of the scar with its related symptoms.

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PATIENTS AND METHODS

This observational cross-sectional study was conducted at the Outpatient Infertility Clinic and Endoscopy Unit, Zagazig University Hospitals, Department of Obstetrics & Gynecology, Faculty of Medicine, Zagazig University.

Inclusion criteria: Women with secondary infertility with at least one CS and seeking pregnancy.

Exclusion criteria: Women with anatomical uterine abnormalities whether congenital or acquired as adhesions or tumors, and women with previous uterine surgery other than C.S as myomectomy or hysterotomy.

Operative Assessment:

All cases were subjected to full history taking including the present, past, obstetric and menstrual history. Screening for anatomical uterine abnormalities, previous uterine surgery other than CS as myomectomy or hysterotomy, and acute pelvic inflammatory disease to be excluded.

Identification of additional variables such as previous surgery including curettage; previous cervical procedures such as cauterization; or hypogastric pain independent of the menstrual period. Education of the patients about the risks, benefits, and alternatives of the procedures and informed written consent were obtained.

Diagnostic hysteroscopy was performed for patients that meet inclusion criteria with a selection of cases showing CS scar niche. Subsequently, an assessment of uterine scar niche in the selected cases was performed using sonohysterography with an evaluation of scar depth, width, and shape in both methods. Detailed images of each procedure were taken with an illustration of scar depth, width, and shape**.**

Steps of Office Hysteroscopy:

The hysteroscopic examination was performed using a rigid 30-degree hysteroscope with a 4 mm diameter diagnostic sheath (Karl Storz Endoskope, Turrlingen, Germany). High-intensity cold light source and fiber optic cable were used to illuminate the uterine cavity. Normal saline solution was used to distend the uterine cavity with flow between 200 and 350 ml/min, at approximately 30-40 mmHg. If the view was unclear, compression cuffs were used to raise the flow and hence the pressure. Two bags were connected by a urological "Y" outflow and located 1.5 m above the patient.

Techniques of Office Hysteroscopy:

The patient was asked to evacuate her bladder and then placed in the dorsal lithotomy position. Under the antiseptic condition, the light source and distention medium were attached to their proper connection in the hysteroscopy then the endoscopic camera was attached to the eyepiece, focused and the image was displayed on the monitor. A vaginoscopic approach was performed; the tip of the hysteroscopy was positioned in the vaginal introitus, and the scope was then driven to the posterior vaginal fornix to visualize the cervix and the external os. After identification of the anatomical landmarks, a complete evaluation of the uterine cavity required a systematic approach that included visualization of the uterine cavity in a panoramic view, then close inspection of the anterior, posterior, and lateral uterine walls then the right and left tubal ostia. Detailed assessment of the CS scar and uterine cavity was done systematically.

Steps of Saline Infusion Sonohysterography:

All cases were performed using a 2D endocavitary probe RIC5-9W-RS GE voluson P 8 and E8 ultrasound system equipped with a 6–12 MHz 3D. In every case, where the 2D SHG images were taken, measurements of niche depth, width, volume, and RMT were made with great precision by the same expert sonographer to avoid inter-observer variability. No adverse effects occurred from this maneuver. The presence of uterine niche was recognized as a triangular anechoic filling defect behind the bladder recess, in the lower segment at the classic site at which low-transverse cesarean section was performed.

By transvaginal sonography, the scar was recognized in the sagittal plane of the uterus, and the following features were evaluated: RMT was described as the remaining anterior uterine wall thickness in front of the scar. The length was described as a distance from the outer and inner parts of the myometrium of the anterior uterine wall. The depth of the triangular hypoechoic niche was described as a space from the surface of the endometrial-endocervical layer of the anterior wall of the uterus to the tip of the hypoechoic triangle.

SHG ideally should be performed early in the follicular phase of the menstrual cycle before day 10 because the endometrium is thin at this point. A thin endometrium is critical so that the saline can more easily distend the uterine cavity and better accentuate endometrial pathology. The patient is placed in the lithotomy position. A speculum is inserted into the vaginal introitus and the cervical os is localized. A 5 to 7 French catheter is inserted through the cervical os and into the cervical canal. The catheter balloon tip is then inflated using 1-2 mL of saline. The speculum is subsequently removed.

A standard transvaginal ultrasound probe is then inserted alongside the catheter. Warm sterile saline is instilled into the endometrial cavity via a 20 mL syringe attached to the catheter while the transducer is moved from side to side in a long axis position. The amount of fluid instilled was varying depending on the distention of the uterus and patient tolerance. Usually, the amount of saline instilled is 40 mL. More fluid is instilled to obtain a detailed survey of the endometrium. Ideally, all portions of the endometrium should be imaged to exclude any abnormalities.

Ethical Consideration:

The study was approved by the Local Ethical Committee of Zagazig University. Written consent was obtained from every patient before the procedures. This study has been carried out following the code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical analysis:

Data were analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp). Qualitative data were described using numbers and percentages. The Kolmogorov-Smirnov test was used to verify the normality of distribution. Quantitative data were described using range (minimum and maximum), mean, standard deviation, median, and interquartile range (IQR). Mann Whitney test, Chi-square test (X^2), Z-test for percentage, and Odds ratio (OR). For all the above-mentioned statistical tests done, the threshold of significance was fixed at a 5% level (*P*-value). *P*-value of > 0.05 indicates non-significant results. P-value of < 0.05 indicates significant results.

RESULTS

The present study showed that 70 cases had abnormal vascular patterns, 90 cases had fibrotic tissue, 40 cases had mucous inside the defect, 20 cases had bleeding inside the defect, 7 cases had polyp like structures, 6 cases had a lateral branch, and 4 cases had cyst-like formation **(Table 1)**.

Table (1): Distribution of diagnostic hysteroscopy niche features in the studied cases (n=100)

Features of the niche	No.	%
Abnormal vascular pattern	**70**	**70.0**
Fibrotic tissue	**90**	**90.0**
Mucous inside the defect	**40**	**40.0**
Bleeding inside the defect	**20**	**20.0**
Polyp like structures	**7**	**7.0**
Lateral branch	**6**	**6.0**
Cyst like formation	**4**	**4.0**

The mean length was 8.75 (± 0.77 SD) mm, the mean depth was 7.02 (±0.36 SD) mm, the mean width was 15.4 (± 1.2 SD) mm, the mean RMT was 3.5 (± 0.88 SD) mm, the mean AMT was 8.35 (± 0.86 SD) mm, the mean volume was 0.5 (±0.1 SD) cm^3 **(Figure 1)**.

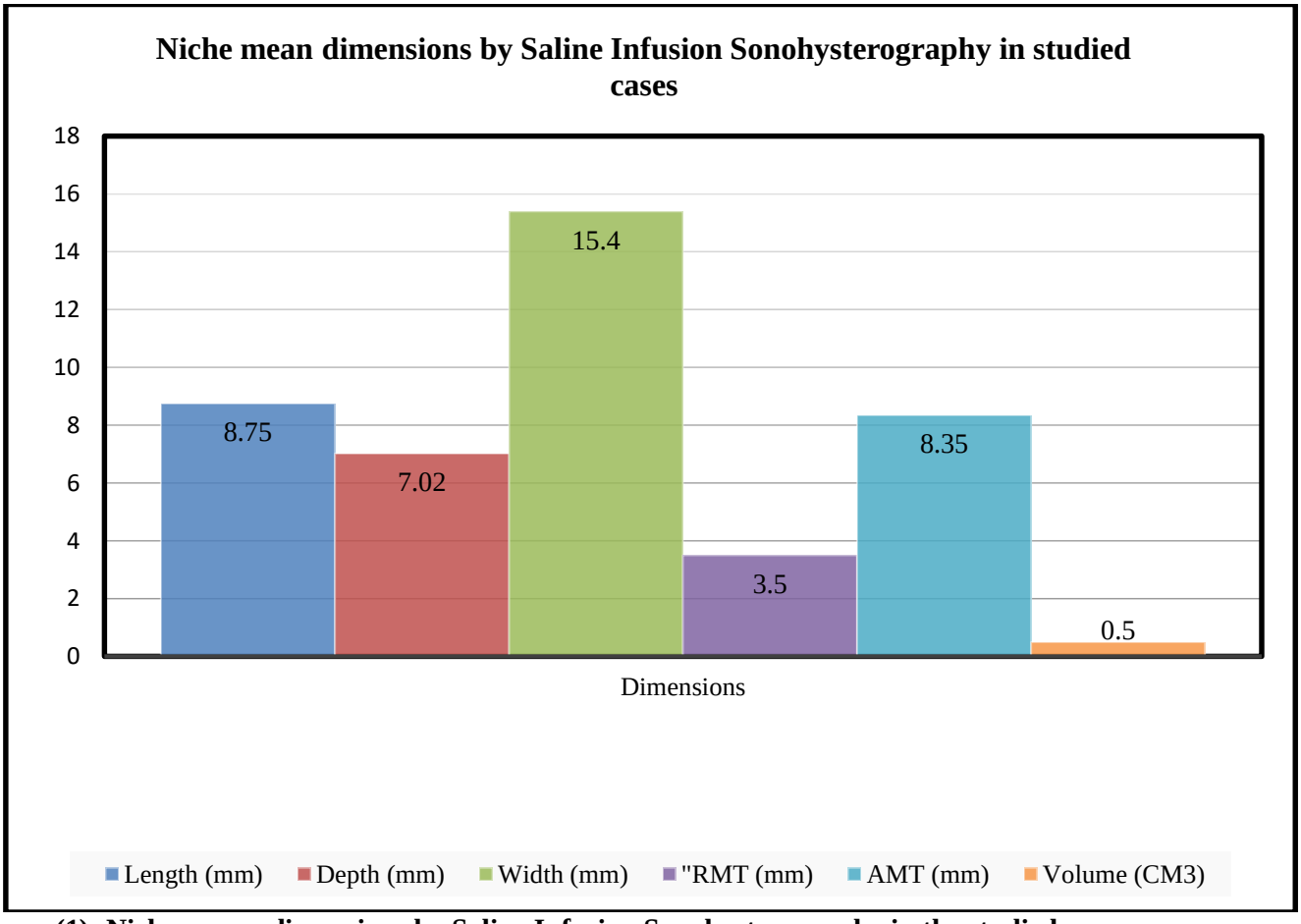

Figure (1): Niche means dimensions by Saline Infusion Sonohysterography in the studied cases

Fifteen cases had RVF uterus, 72 cases had a triangular defect, 21 cases had semicircular, and 5 cases had other shapes (2 outward protrusion, 2 droplets, and 1 rectangular) **(Table 2)**.

Table (2): Distribution of the studied cases according to saline infusion sonohysterography shape of the niche and position of the uterus (n = 100)

		No.	%
Niche shape	Triangular niche	72	72.0
	Semicircular niche	21	21.0
	outward protrusion	2	2.0
	Droplet	2	2.0
	Rectangular	1	1.0
Position of the uterus	RVF	20	20.0
	AVF	80	80.0

As regards hysteroscopy, 45 cases had unhealthy (fibrotic) scars, 41 cases had collected blood in the niche, 24 cases had infected scars, 5 cases had endometritis, 4 cases had small submucosal polyps, and 1 case had a small uterine septum. As regards SIS, the mean Niche width was 15.4 (± 1.2 SD) **mm (Figure 2)**.

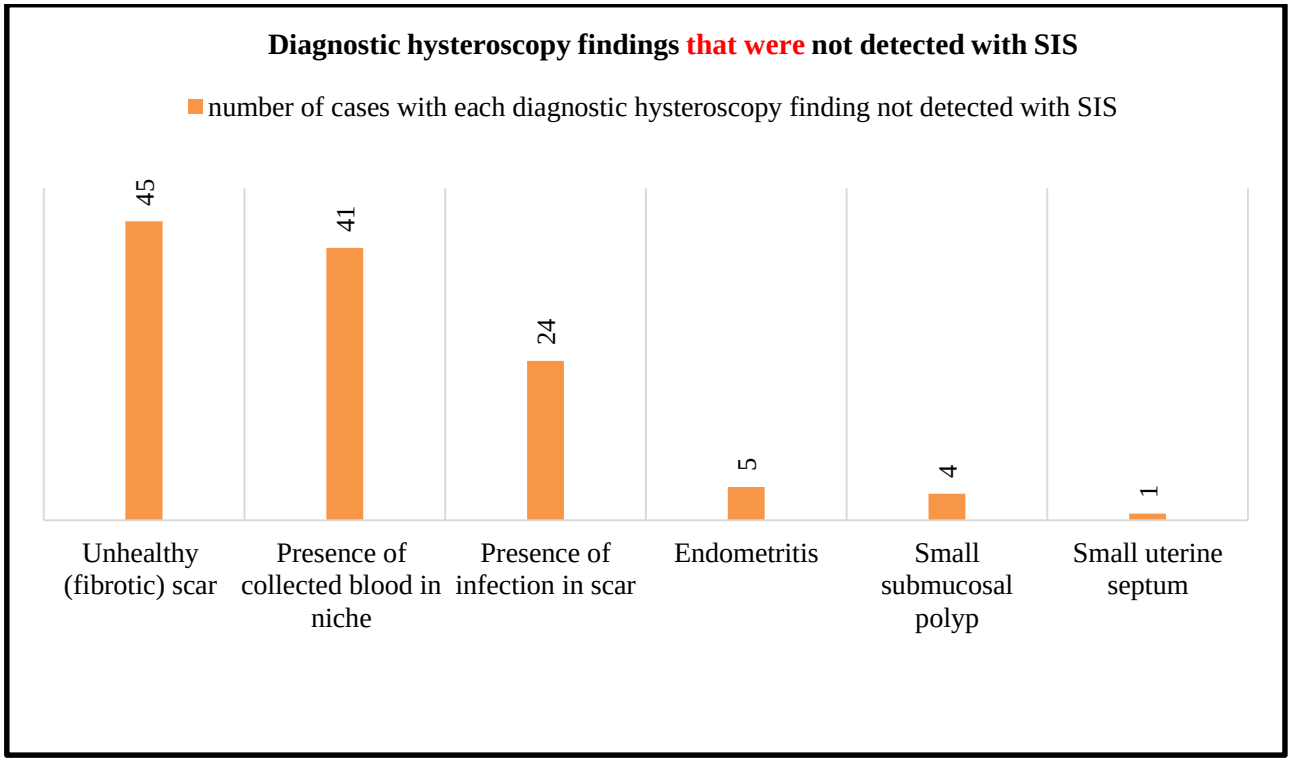

Figure (2): Diagnostic hysteroscopy findings that were not detected with saline infusion Sonohysterography

Thirty-two cases had post-menstrual spotting, the mean duration of post-menstrual spotting was 2.5 (±0.9 SD) days, 19 cases had chronic pelvic pain, 15 cases had both post-menstrual spotting and chronic pelvic pain, 12 cases had dyspareunia, 13 cases had dysmenorrhea and 9 cases had intermittent spotting **(Table 3)**.

Table (3): Distribution of the studied cases according to niche-related symptoms (n=100)

	No.	%
Post-menstrual spotting	32	32.0
Chronic pelvic pain	19	19.0
Post-menstrual spotting and chronic pelvic pain	15	15.0
Intermittent spotting	9	9.0
Dyspareunia	12	12.0
Dysmenorrhea	13	13.0
Duration of Post-menstrual spotting (days)	2.5 mean ± 0.9 SD	

There were 25, 31, and 44 cases with 2ry infertility ≥ 1, ≥ 2, and ≥ 3 years respectively with a mean duration of 2.5 (± 1.03 SD) years, and the mean duration from the last CS was 3.5 (± 0.52 SD) years **(Table 4)**.

Table (4): Distribution of the studied cases according to infertility-related history (n=100)

Duration of 2ry Infertility	No.	%
≥ 1 year	25	25.0
≥ 2 years	31	31.0
≥ 3 years	44	44.0
Duration of 2ry Infertility (Mean ± SD)	2.5 ± 1.03	
Duration from last CS (years)- Mean ± SD	3.5 ± 0.52	

There was a non-significant correlation between features of the niche through diagnostic hysteroscopy in comparison to related symptoms **(Table 5)**.

Table (5): Correlation between features of the niche through diagnostic hysteroscopy in comparison to related symptoms in the studied cases

	Hysteroscopic niche features					
	Abnormal vascular pattern		Fibrotic tissue		Mucous inside the defect	
Niche-related symptoms	R	P	R	P	R	P
Post-menstrual spotting	0.018	0.44	0.22	0.69	0.015	0.23
Dyspareunia	0.12	0.88	0.36	0.89	0.056	0.45
Chronic pelvic pain	0.55	0.88	0.50	0.79	0.02	0.12

DISCUSSION

Cesarean Scar Defects (CSDS)/Niche/Isthmocele, involve myometrial discontinuity at the site of a previous Cesarean section scar. The degree of cervical dilatation and potentially the contractile effort of the uterine muscle, resulting in thinning at the uterine incision site, were both contributors to the development of faulty uterine scars/niches following cesarean section. It was also hypothesized that persistent inflammation or a specific configuration of myometrial fibers in the region of uterine closure might lead to a disparity at the incision level [(9)].

Scar niche has been highlighted as an underappreciated source of irregular uterine bleeding and persistent pelvic discomfort, a frequent gynecologic complaint, in premenopausal women. As a result, knowing whether or not a uterine niche exists may provide referring clinicians with diagnostic information that can help them figure out what's causing abnormal uterine bleeding or chronic pelvic pain in fertile patients, as both complaints are frequently linked to functional disorders of the menstrual cycle or intrauterine abnormalities. Furthermore, discoveries have shown a definite link between the existence of niche and secondary infertility, suggesting that surgical correction of a cesarean-induced scar defect may be able to restore fertility while also alleviating symptoms [(10)].

Different methods have been employed to test the integrity of the anterior uterine wall, ranging from hysterography to ultrasonographic examination, and Office Hysteroscopy is now regarded as the gold standard instrument for evaluating any intrauterine abnormality [(11)].

This study was designed to evaluate the anatomical characteristics of the cesarean scar niche by diagnostic hysteroscopy and sonohysterography in women with unexplained secondary infertility and to correlate the appearance of the scar with its related symptoms.

Our study included 100 women who attended our outpatient clinic, complaining of unexplained secondary infertility with a history of at least one CS and showing scar niche in office hysteroscopy followed by re-assessment by saline infusion sonohysterography.

Regarding the associated gynecological complaints, our study cleared that 70% of cases complained of post-menstrual spotting, with a mean duration of 2.5 (±0.9 SD) days, 40% of cases had dysmenorrhea, and 30% of cases had chronic pelvic pain, and 20% of cases were suffering from dyspareunia.

In a study conducted by **Mohamed *et al.*** [(12)] for a total of 195 females who had at least one previous cesarean section and complained of vaginal spotting following their menstrual period, they showed that the duration of bleeding ranged from 3 to 10 days with a mean 5±2 days, the postmenstrual spotting was found in 30.7% of patients, regarding associated gynecological complaints dysmenorrhea, dyspareunia and chronic pelvic pain were found in 51.2%, 22.5% and 26.1% of patients respectively.

Also, multiple previous studies: **Bij De Vaate *et al.*** [(3)], **Florio *et al.*** [(13)], and **Iannone *et al.*** [(14)] reported that there is a relationship between CS scar niche and multiple gynecological symptoms.

Tang *et al.* [(15)] revealed that the most common complaints related to CSD are prolonged menstrual bleeding and postmenstrual spotting (in up to three-quarters of women with CSD), followed by pelvic pain (39.6%), dysmenorrhea (53.1%), dyspareunia (18.3%), and secondary infertility.

Regarding the correlation of the niche characteristics (different shapes and dimensions

measured by Saline Infusion Sonohysterography and different niche features on Office Hysteroscopy) with the duration of secondary infertility, we did not find a significant correlation between any of the niche dimensions (width, depth, RMT, and volume) or its different shapes by SIS or different features on Office Hysteroscopy with the duration of secondary infertility in studied cases.

The retrospective nature of our study renders this particular finding in need of further future studies that may find a correlation, but at least -at present- this result may support the several hypothetical mechanisms by which a scar niche could cause subfertility as postulated by **Vikhareva *et al.* [(4)]**.

Multiple previous studies by **Bij De Vaate *et al.*[(3)], Vikhareva *et al.* [(16)],** and **Naji *et al.*[(17)]** have postulated that there is a relation between scar niche volume, residual adjacent myometrial thickness, and development of postmenstrual spotting based on the transvaginal ultrasound as a diagnostic method.

CONCLUSION

The cesarean scar may play an intermediate role in secondary fertility, and with the limited available evidence, the relation between subfertility and a scar niche still needs to be fully proved.

Hysteroscopy is considered the golden standard tool for the diagnosis of different intrauterine lesions, however; the procedure of sonohysterography is well-tolerated, cost-effective, and can be performed in an office-based gynecological practice, and doesn't require special training.

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Author contribution: Authors contributed equally to the study.

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