Original Article

Uterine Niche and Secondary Infertility: Agreement in Diagnosis Using Hysterosalpingography vs. Hydrosonography

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ABSTRACT

Objectives: To compare the accuracy of hydrosonography and hysterosalpingography in diagnosis of niche and to evaluate the correlation between niche and sub-infertility.

Study Design: A prospective observational cross-sectional comparative study

Patients and Methods: The study was carried out on 50 women underwent at least one caesarean section with unexplained secondary infertility presented at the outpatient obstetric clinic at Fayoum university hospital. Assessment of uterine scar in each woman was performed using 2D transvaginal with Saline Infusion hydrosonography (SHG) followed by hysterosalpingography.

Results: The prevalence of niche among our studied women was (62%, 31 cases) as diagnosed by Hydrosonography, while by Hysterosalpingography, the prevalence was (56%, 28 cases). Hydrosonography and hysterosalpingography showed strong substantial agreement regarding niche with kappa (κ) 0.712. Using hysterosalpingography can diagnose post-CS niche as compared with hydrosonography with 83.9% sensitivity 89.5% specificity, 92.9% PPV, 77.3% NPP and 86% accuracy.

Conclusions: We detected a strong substantial agreement between hydrosonography and hysterosalpingography in diagnosis of niche.

Key Words: Cesarean section niche; diagnostic methods; HSG; hydrosonography; uterine niche.

Received: 19 September 2022, **Accepted:** 5th October 2022

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ISSN: 2090-7265, November 2022, Vol.12, No. 4

INTRODUCTION

There has been a dramatic increase in caesarean section rates and the number of women enduring numerous caesarean sections over the past several decades[1]. So, a rise in the number of complications has followed, consequently, isthmocele (Niche), a caesarean scar deformity, has emerged as a clinical pathology[2].

In women who have undergone caesarean delivery, a pouch-like abnormality on the anterior wall of the uterine isthmus is called a "niche"[3]. Symptoms such as heavy menstrual bleeding and irregular periods are often associated with it (AUB)[4], discomfort in the urinary tract, dyspareunia, and pelvic pain as well as secondary infertility has also recently been a topic of discussion[3–6].

Persistent menstrual blood in the pouch may have an impact on sperm motility and implantability, which lowers the fertility rate[5]. Infertility might also be caused by an inflammatory condition, as it is already known in pathologies characterized by chronic inflammatory states and oxidative stress, such as endometritis[6]. In Niche, fertility is affected by the presence of remaining menstrual blood, which may cause an environment of chronic inflammation[7].

Post-cesarean section niche is becoming more commonly diagnosed, and its reported incidence varies widely, between 24% and 84%[8]. This increase in diagnoses is due to several factors, including the increased rate of cesarean sections, increased awareness of obstetrics and gynecology practitioners and improvements in diagnostic tools[9].

The diagnosis is mostly determined by transvaginal ultrasound detection of an anechoic region at the level of the caesarean section scar (TVUS)[10], transvaginal sonohysterography[11], or diagnostic hysteroscopy.

TVUS can be considered the most common initial technique to identify isthmocele in patients with a history of previous CS[10], in the current study we aimed to compare the accuracy of hydrosonography and hysterosalpingography in diagnosis of niche and to evaluate the correlation between niche and sub-infertility.

DOI:10.21608/ebwhj.2022.163887.1202

PATIENTS AND METHODS

Ethical Consideration

The Fayoum University Faculty of Medicine's ethics committee has given its clearance to the current study on 10/1/2021, approval number: (M 522). The study's objectives were explained to the ladies before they agreed to participate in it, and they all verbally consented to taking part in it. The privacy of the database was protected.

Patients

During the time period from January 2022 to May 2022, a total of 50 women with secondary infertility following a minimum of one C.S. labour were randomly selected from the outpatient Obstetric Clinic at Fayoum University Hospital. We eliminated women with ovulation issues, such as Polycystic Ovarian Syndrome (PCOS), uterine fibroids or polyps, chronic disorders (such as diabetes or high blood pressure), male factor infertility, and use of contraceptive techniques from this study.

Methods

All included women were screened for comprehensive medical histories, with special attention given to (menstrual history, obstetric history, medical illness that affects pregnancy, and vaginal bleeding). For the evaluation of the uterine scar defect's size, number, degree, shape, depth, and myometrial thickness:

1. Hydrosonography was performed by transvaginal ultrasound (TVS) using (Philips Medical Systems) ultrasound apparatus with the 2D endovaginal probe with frequency 9.3 MHz and 20-40 ml warm sterile saline was instilled into the endometrial cavity syringe attached to the catheter while the transducer is moved from side to side (cornua to cornua) in a long axis position.

2. Hysterosalpingography using a fluid that contains a dye as contrast agent placed in the uterus and fallopian tubes to assess the body structures on an X-ray screen. The dye outlines the inner size and shape of the uterus and fallopian tubes. It also was possible to see how the dye moves through the body structures.

Statistical Methods of Analysis

The collected data was coded, entered, and analyzed using the IBM software statistical package for social sciences (SPSS) (version 25). For categorical variables, descriptive statistics were in the form of frequency and percentage, while for numerical variables in the form of mean and standard deviation. (mean ± SD). The proper statistical significance measures were used: (Independent Sample t-test, Chi-Square ($\chi 2$) test and Pearson's correlation analysis; {r- values: 0 to 0.3 positive or negative (slight), 0.3 to 0.7 (moderate) and 0.7 to 1 (strong). Statistical significance was described at a p-value of less than or equal to 0.05. Simple charts were used to demonstrate some findings. Assessing agreement between measurements with hydrosonography and hysterosalpingography was done using (Cohen's kappa), κ values ranged from − 1 to 1, and is interpreted as follows: 0 = agreement equivalent to chance; 0.10–0.20 = slight; 0.21–0.40 = fair; 0.41–0.60 = moderate; 0.61–0.80 = substantial; 0.81–0.99 = near-perfect; and 1.00 = perfect agreement. Negative values indicate that the observed agreement is worse than what would be expected by chance

RESULTS

The current study involved 50 women unexplained secondary infertility after a minimum of one C.S labour, (Figure 1) demonstrates the prevalence of Niche among studied women. The prevalence of niche among our studied women was (62%, 31 cases) as assessed by Hydrosonography, while it was (56%, 28 cases) as assessed by Hysterosalpingography. Hydrosonography and hysterosalpingography showed strong substantial agreement regarding niche with kappa (κ) 0.712. Using hysterosalpingography can diagnose post-CS niche as compared with hydrosonography with 83.9% sensitivity 89.5% specificity, 92.9% PPV, 77.3% NPP and 86% accuracy.

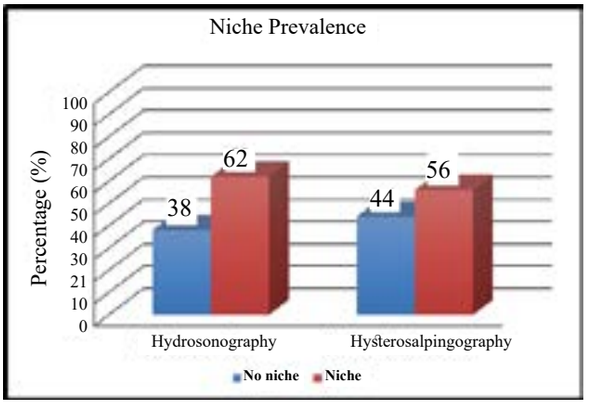

Fig. 1: Prevalence of Niche as detected by hysterosalpingography and hydrosonography

Regarding the relation between women Demographic data with Niches as diagnosed by hydrosonography and by Hydrosonography showed non-statistically significant differences (*p-values* >0.05), (Table 1).

There was no statistically significant relation between niche as diagnosed by hydrosonography and duration of

infertility. We also reported non statistically significant relation between niche detection with menstrual and obstetric history, (Table 1)

Regarding US assessment (Table-2), we found a statistically significant relation between niche detection and uterus length (p=0.013), uterine length was significantly higher among women with uterine scar defect (niche).

According to Pearson correlation coefficient analysis as demonstrated in (Table 3), there was non-statistically significant linear correlation between infertility duration and menstrual days, with Uterine scar defect (Niche) thickness and adjacent myometrial thickness fundal to defect.

Table 1: Association between Niche detection and other studied variables

		Niche Prevalence		Test	*P*
		No niche	Niche		
		(n=19)	(n=31)		
Age; (years)	Range	21 – 35	21 – 36	t=0.134	0.89
	Mean ± SD	28 ± 5.06	27.81 ± 4.87		
Residence; N (%)	Rural	6 (32%)	13 (42%)	χ2=0.536	0.46
	Urban	13 (68%)	18 (58%)		
Socioeconomic level; N (%)	Low	4 (21%)	6 (19%)	χ2=0.085	0.96
	Satisfied	9 (47%)	16 (52%)		
	High	6 (32%)	9 (29%		
Occupation; N (%)	Not employed	7 (37%)	18 (58%)	χ2=2.122	0.15
	Employed	12 (63%)	13 (42%)		
Duration of infertility; (months)	Range	18 – 35	18 – 37	t=0.009	0.99
	Mean ± SD	27.21 ± 5.22	27.19 ± 6.64		
Duration of menstrual cycle; (days)	Range	26 – 29	26 – 29	t=0.813	0.42
	Mean ± SD	27.63 ± 1.12	27.35 ± 1.2		
Days of menstrual; (days)	Range	4 – 6	4 – 6	t=0.319	0.75
	Mean ± SD	5.05 ± 0.85	5.13 ± 0.81		
Last menses; (days)	Range	2 – 19	2 – 20	t=1.351	0.18
	Mean ± SD	9.16 ± 4.14	11.06 ± 5.22		

t: Student t-test χ2: Chi-square test
p: *p value* for comparing between different categories
*: Statistically significant at $p \leq 0.05$

Table 2: Association between Niche detection ultrasound findings

		Hydrosonography		Test	*P*
		No niche	Niche		
		(n=19)	(n=31)		
Uterus length (cm)	Range	5 – 8.1	5.4 – 9.2	t=2.587	0.013*
	Mean ± SD	6.47 ± 1.04	7.41 ± 1.36		
Uterus width (cm)	Range	2.5 – 5	2.7 – 4.9	t=0.266	0.791
	Mean ± SD	3.99 ± 0.81	3.94 ± 0.62		
Endometrial thickness (cm)	Range	8 – 12	8 – 12	t=0.721	0.474
	Mean ± SD	9.95 ± 1.51	10.26 ± 1.46		
Intracavitary fluid; N (%)	Range	17 (90%)	26 (84%)	χ2=0.307	0.579
	Mean ± SD	2 (11%)	5 (16%)		

t: Student t-test χ2: Chi-square test
p: *p value* for comparing between different categories
*: Statistically significant at $p \leq 0.05$

Table 3: Correlation between infertility duration and menstrual days, with Uterine scar defect (Niche) thickness and adjacent myometrial thickness fundal to defect

	Duration of infertility	Days of menstrual cycle
Uterine scar defect (Niche) thickness	r=0.04, p=0.831	r=-0.345, p=0.057
Adjacent myometrial thickness fundal to defect	r=0.056, p=0.766	r=-0.053, p=0.778

r: Pearson coefficient *p*: *p value* for comparing between different categories *: Statistically significant at $p \leq 0.05$

DISCUSSION

The current study was conducted to evaluate the correlation between niche and secondary infertility and to compare between hydrosonography and hysterosalpingography in diagnosis of post- C.S. uterine scar defect (niche)

In this study we found that the prevalence of niche among studied women was 31 (62%) as diagnosed by hydrosonography. Salah *et al*., showed that hysteroscopy-detected CS niche prevalence was 47.4%[12], the differences in prevalence could be contributed to the difference in sample size and different methodology between their study and ours. In a study conducted by El-Mazny *et al*., on 75 women with a previous history of CS who were tested for menstrual problems, in 23 women (31 %) who underwent hysteroscopy, doctors found evidence of CS niche[13]. In a study conducted by Borges *et al*., for a total of 43 women who had previously been diagnosed with CS and had complained of irregular uterine bleeding, CS niche was found to be prevalent by hysteroscopy in 88% of women[14]. This contradicts our study's findings, which could be explained by differences in population characteristics such as sample size, age group, the number of prior caesarean sections, and other factors that exacerbate the development of CS defects. (e.g., level of the uterine incision, uterine closure method, and wound healing factors).

In this study we demonstrated that there was no statistically significant relation between niche as diagnosed by hydrosonography and women demographic data. Van der Voet *et al*., found that there was no statistically significant relation between niche as diagnosed by hydrosonography and women demographic data (p=0.44)[15]. In study to Evaluate of uterine scar healing by transvaginal ultrasound in 607 nonpregnant women with a history of cesarean section, Zhou *et al*., showed that the average age of the two groups of patients was 35.09 ± 5.32 versus 34.00 ± 4.83 years old, and the median age of the two groups was 34 years old[16]. In which there was insignificant difference between both studied groups as regards demographic data.

Bij de Vaate *et al*., there was insignificant difference between Niche group and non-Niche group as regards demographic data (p =0.21)[17]. Salah *et al*., showed that there was statistical significance between patients with and without niche observed by hysteroscopy regarding age (*P value* <0.001)[12].

In study in our hands, we found that there was no statistically significant relation between niche as diagnosed by hydrosonography and duration of infertility. Bij de Vaate *et al*., there was insignificant difference between Niche group and non-Niche group as regards duration of infertility (p =0.25)[17]. Van der Voet *et al*., found that there was insignificant relation between development of niche and duration of infertility (p =0.12)[15].

In this study we illustrated that there was no statistically significant relation between niche as diagnosed by hydrosonography and menstrual history. Dysmenorrhea (53.1 percent) were the most reported gynecological symptoms in the study by Wang *et al*. to evaluate Cesarean scar defect: correlation between Cesarean section number, defect size, clinical symptoms and uterine position (*P values* were 0.001)[18]. Abdelfattah *et al*. found that there was insignificant difference between niche vs no niche group as regards menstrual history, in which the niche was accidentally found while doing routine ultrasonography[19].

In this study we found that there was no statistically significant relation between niche as diagnosed by hydrosonography and obstetric history. Savukyne *et al*. found that in the patient group with CS scar niches (n = 49) for comparison with the non-niche group (n = 46), there were no statistical differences in the type of delivery[20]. A total of 19 women had successful trials of labor in the niche group and 22 in the non-niche group (38.7% vs. 47.8%, p = 0.802). Fifteen underwent elective repeat Cesarean delivery for various clinical reasons in the niche group, in comparison with 33 women in the non-niche group (31.9% vs. 44.6% p = 0.337). Thirteen women required intrapartum emergency CS because of failed trials of labor in the niche group, versus 19 women in the non-niche group (40.6% vs. 46.3% p = 0.802).

Bij de Vaate *et al*., found that there was insignificant difference between niche group vs non niche group as regards obstetric history (p = 0.11)[17]. Van der Voet *et al*., found that there was insignificant relation between development of niche and number of cesarean section (p =0.55)[15]. Salah *et al*., showed that no statistical significance between patients with and without niche observed by hysteroscopy regarding parity (*P value*, 0.129)[12].

In this study we found that there was statistically significant relation between niche as diagnosed by hydrosonography and uterus length. Bij de Vaate *et al*., found that the mean length of the uterus was slightly greater in women with a niche (7.3 cm) than in women without a niche (6.9 cm) (P = 0.04), while the width of the uterus was the same for both groups (3.8 cm). The myometrium at the site of the Cesarean scar during GIS was significantly thinner in women with a niche (7.0 mm) than in women without a niche (9.6 mm) ($P < 0.001$)[17]. Van der Voet *et al*., found that the length and width of the uterus were no different between women who had or did not have a niche[15]. The niche was deeper when examined by GIS than by TVU (2.32 ± 3.35 and 3.03 ± 3.1 mm, respectively; $P < 0.001$). The thickness of the residual myometrium at the site of the uterine scar was approximately 2 mm less in women with a niche compared with those without a niche, as measured by TVU and GIS ($P < 0.001$ and P = 0.005, respectively).

In this thesis we found that was no significant correlation between scar thickness (niche) and duration of infertility. This was in agreement with the findings of Salah *et al*., which found secondary infertility in 16.8% of hysteroscopy-observed niche patients, (*P value*, 1.0) which was not statistically significant[12]. Talamonte *et al*. found that 13% of women with hysteroscopically detected CS defects also experienced secondary infertility (*p value*, 0.66)[21]. Abdelfattah *et al*. found that Fourteen patients (34.09%) with niche complained of DUB compared to 18 patients (42.19%) with no niche. This difference was statistically insignificant (P = 0.313)[19].

In this study we found that was no significant correlation between scar thickness (niche) and days of menstrual cycle. Van der Voet *et al*., found that there was insignificant difference between niche and non- niche groups as regards Days of blood loss during menstruation (5.9 (2.57) VS 6.1 (2.84), p = 0.75)[15]. Bij de Vaate *et al*., found that the mean number of days of intermenstrual bleeding was 0.8 for the group with a niche and 0.3 for the group without a niche (P = 0.001)[17]. Abdelfattah *et al*. found that patients had oligo-menstruation, all of them (100%) had niche, with statistically significant difference when compared with patients with no niche (p=0.016)[19].

In this study we demonstrated that the prevalence of niche patients among the cases was 28 (56%) diagnosed by hysterosalpingography, in which Hydrosonography and hysterosalpingography showed strong substantial agreement regarding niche with kappa (κ) 0.712. Van der Voet *et al*., found that Niche prevalence was 49.6% on evaluation with Transvaginal ultrasound (TVU) and and 64.5% with gel instillation sonohysterography (GIS)[15]. Bij de Vaate *et al*., found that A niche could be demonstrated by TVS in 54 out of 225 women (24.0%) and by GIS in 117 out of 209 women (56.0%)[17].

Using hysterosalpingography it was shown that it can diagnose post-CS niche as compared with hydrosonography with AUC of 0.867, level of sensitivity 83.9%, specificity 89.5%, PPV 92.9%, NPV 77.3% and accuracy 86%. El-Mazny *et al*., found that hysterography was comparable to diagnostic hysteroscopy as shown by sensitivity, specificity, +ve predictive value, −ve predictive value and overall accuracy of 87%, 100%, 100%, 95% and 96%, respectively, in the diagnosis of scar defect; and 76%, 100%, 100%, 87% and 91%, respectively, in the diagnosis of intrauterine adhesions[13].

Acholonu *et al*. found that the sensitivity of hysterosalpingography and sonohysterography was 58.2% and 81.8%, respectively. The specificity for hysterosalpingography and sonohysterography was 25.6% and 93.8%. The differences in sensitivity and specificity were both statistically significant. Hysterosalpingography had a general accuracy of 50.3%, while sonohysterography had a significantly higher accuracy of 75.5%[22].

The main limitation of our study is the small patient number. Many women were referrals and previous CS had been performed by different obstetricians in different institutions, Future research should focus on the relationship of niches to subsequent fertility, obstetric complications such as uterine rupture, and on the impact of a niche on a woman's well-being. There is a lack of information on the impact of niche-related bleeding disorders on women's quality of life, their sexual function, and their willingness to undergo treatment for related symptoms.

CONCLUSIONS

Our study concluded that the CS scar niche is a myometrial defect, which is not related to sub infertility, The prevalence of niches detected by hysterosalpingography is high after caesarean section (56%), and more niches are detected using hydrosonography than using hysterosalpingography, with a larger observed niche size and uterus length but overall Hydrosonography and hysterosalpingography showed strong substantial agreement regarding niche with kappa (κ) 0.712. The study results cannot provide recommendations regarding routine ultrasound examinations of CS scars in pregnant women to appropriately manage subsequent deliveries. Women should avoid CS without medical indications and multiple abortions with uterine curettage. Nevertheless, more prospective high-quality studies are needed to establish the clinical significance of the CS scar niche and to define guidelines for the possible prevention of the CS scar niche in a subsequent pregnancy.

CONFLICT OF INTERESTS

There are no conflicts of interest.

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