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Hysteroscopy versus Transvaginal ultrasound in assessment of cesarean scar in non- pregnant female with previous one cesarean section

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Abstract
Background: Various imaging investigative protocols are used in cesarean section scar assessment such as Hysterography, sonography, saline infusion sonography and hysteroscopy. The role of ultrasound in visualization and detection of CS scar defect in non-pregnant females has been investigated. Two-dimensional transvaginal sonography is a precise imaging tool for measuring cesarean section scar thickness.
Aim: To investigate in a comparative analytical manner the sonographic versus hysteroscopic diagnostic approaches for evaluation of the cesarean section scar.
Methodology: It is a comparative cross-sectional clinical research trial conducted from June 2017 to May 2018. The research trial has recruited 70 female study subjects who have previous one cesarean delivery and visited Zagazig Outpatient Clinic. For all recruited Study subjects, detailed clinical history was taken, two-dimensional transvaginal ultrasound and doppler were used to evaluate scar thickness, location, vascular content, scar integrity and liability for distension by saline infusion. After ultrasound examination, a diagnostic hysteroscopy was used to comparatively evaluate -in relation to transvaginal ultrasound – the cesarean scar regarding the following: location, vascular content, integrity, distension liability.
Results: Correlations between findings of US and hysteroscopy regarding Liability for distension**,** Integrity **,**Vascular content (Kappa agreement (SE) = 0.161 (0.128), 0.625 (0.095), 0.736 (0.082) consecutively. The comparative statistical analysis -between findings of US and hysteroscopy- showed no statistically significant difference as regard Scar location**,** Liability for distension**,** Integrity, Vascular content (p values =0.853, 0.216, 0.145, 0.864 consecutively).
Conclusions: The current research effort has revealed that the sonography is more precise than the hysteroscopy in assessment of cesarean section scar thickness and scar defects being less invasive, less cost, and less complications).

Keywords: cesarean scar, hysteroscopy, ultrasonography

Introduction

Cesarean section is a frequently conducted operative procedure, it is crucial to investigate the reproductive sequalae. Cesarean section delivery has been correlated to a spectrum of complicated obstetric clinical scenarios, e.g. placenta previa, morbidly adherent or rupture uterus. with raised surgical risk of intestinal and bladder injury [1, 2, 3, 4].

Cesarean section deliveries are usually conducted via lower segment incision approaches with increased sequelae of scar healing and infectious issues. Assessment and evaluation of cesarean scar integrity have become one of the investigative tools whether performed sonographically or by hysteroscope that determine the safety of subsequent gestations [5, 6, 7].

Uterine rupture is one of the catastrophic complications that could develop during delivery by vaginal birth after cesarean (VBAC) with high risks of maternal and fetal morbidity and mortality issues such as cesarean hysterectomy or hypoxic ischemic encephalopathy [8, 9].

Many authors have tried to predict the possibility of scar dehiscence and uterine rupture. Prediction of scar dehiscence is very important in order to avoid these catastrophic complications and will help in patient selection for VBAC. Trails have been made to visualize previous CS scar [10, 11].

Various imaging investigative protocols are used in cesarean section scar assessment such as Hysterography, sonography, saline infusion sonography and hysteroscopy.

The role of ultrasound in visualization and detection of CS scar defects in non-pregnant females has been investigated. Two-dimensional transvaginal sonography was revealed and displayed to be a precise imaging tool for measuring cesarean section scar thickness, besides the integrated Doppler technology is highly valuable in scar vascularity assessment. Diagnostic hysteroscopy is observed by some practitioners to be the gold standard for diagnosis and direct observation of intrauterine abnormalities e.g. uterine scar and intrauterine adhesions [12, 13, 14].

Aim of the work

To investigate in a comparative analytical manner the sonographic versus hysteroscopic diagnostic approaches for evaluation of the cesarean section scar.

Methodology

It is a comparative cross-sectional clinical research trial conducted from June 2017 to May 2018. The research trial has recruited 70 female study subjects having previous cesarean deliveries visiting the outpatient clinic for pre pregnancy counselling.

This research was done according to Helsinki declaration for research in human being, informed written consent was taken from each woman participated in the study.

Inclusive research criteria were as follows involving non-pregnant cases having a history prior cesarean delivery since at least 6 months, with no medical diseases requiring management study subjects have been evaluated within the post menstrual period.

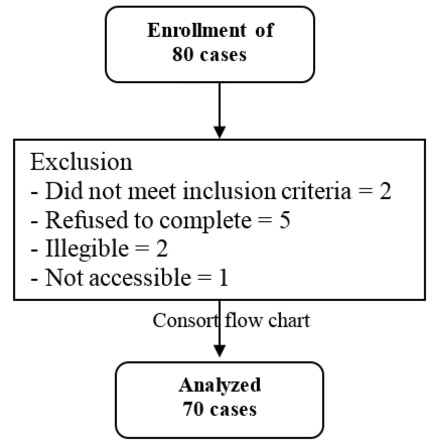
Exclusive research criteria were as follows pregnancy, cases having more than one previous cesarean section, gynecological focal lesion e.g. fibroids, endometrial polyp. An informed consent was obtained from each research study.

Study subjects recruited have been assessed by detailed clinical history, evaluated by transvaginal sonography using 2D sonography and Doppler with a GE Voluson pro machine with a 7.5 MHz transvaginal sonographic probe measuring the scar thickness evaluation of the location, vascular content and scar integrity liability for distension by saline infusion followed by hysteroscopic examination after the next cycle to evaluate in a comparative analytical manner their precision in evaluation of the cesarean section scar aspects (location, parameters, vascular content, integrity and distension liability).

Diagnostic office hysteroscopy by a single experienced gynecologist using a rigid 30° hysteroscope with a 4 mm diameter diagnostic sheath (Karl Storz Endoscopy, Germany). A high intensity cold light source and fiberoptic cable were used to illuminate the uterine cavity. Normal saline was used to distend the uterine cavity at a maximum pressure of 100 mmHg. Observing the location of the scar site, thickness, integrity, vascular content, and color (pinkish) or greyish/whitish (fibrosed) scar; existence of scar defect; existence of intrauterine adhesions; and its type (thin or thick), location and parameters.

Statistical Analysis

The sample size was calculated according to *El-Ewiny et al., 2019* who reported that the Kappa agreement between US and Hysteroscopy regarding site of scar was found 0.949 Using Epi Info program version 7 and was found to be 68 cases. Research Data was gathered, revised, coded and entered to the Statistical Package for Social Science (IBM SPSS) version 23. The quantitative research data have been presented as mean, standard deviations and ranges when their distribution found parametric and median with inter-quartile range when non parametric. Also, qualitative research data have been presented as number and percentages. The comparative analyses between two independent groups with qualitative research data have been performed using Chi-square test. Kappa agreement was used to evaluate the agreement between sonographic and hysteroscopic approaches. The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant at the level of < 0.05.



Consort flow chart

Results

Table 1 reveal and display the Demographic research data and clinical features of the investigated cases in which the Mean ± SD of age (years), BMI (kg/m2), Scar thickness (cm)= 29.62 ± 4.25, 24.36 ± 2.14, 1.68 ± 0.67 consecutively,whereas 66 cases were not smokers representing 94.3 % of the total research cohort, Median (IQR) of parity, Duration from last CS (years)= 2 (1 – 3), 3 (2 – 5) consecutively.

Table 2 and figure 1 reveal and display the comparative statistical analysis between findings of US and hysteroscopy in which there is was no statistically significant difference as regards Scar location**,** Liability for distension, Integrity Vascular content (p values =0.853, 0.216, 0.154, 0.864 consecutively)

Table 3 and figure 2 correlation between findings of US and hysteroscopy regarding location of scar Weather Above int. os, Below int. os agreement statistical analyses Kappa = 0.899 SE= 0.057, 95% CI=0.788 to 1.000

Table 4 and figure 3 reveal and display correlations between findings of US and hysteroscopy regarding Liability for distension**,** Integrity, Vascular content (Kappa agreement (SE)= 0.161 (0.128), 0.625 (0.095), 0.736 (0.082) consecutively.

Table 1: Demographic research data and clinical features of the investigated cases

	Total No. = 70
Age (years)	
Mean ± SD	29.62 ± 4.25
Range	23 – 37
BMI (kg/m^2)	
Mean ± SD	24.36 ± 2.14
Range	21.5 – 28.3
Smoking	
Negative	66 (94.3%)
Positive	4 (5.7%)
Parity	
Median (IQR)	2 (1 – 3)
Range	1 – 4
Duration from last CS (years)	
Median (IQR)	3 (2 – 5)
Range	1 – 9
Scar thickness (cm)	
Mean ± SD	1.68 ± 0.67
Range	0.7 – 3.3

Table 2: Complications during hysteroscopy

	No.	%
Negative	67	95.7%
Positive	3	4.3%
Bleeding	2	2.9%
Perforation	0	0%
No access	0	0%
Pain	1	1.4%

Table 3: Comparative statistical analysis between findings of US and hysteroscopy

		US	Hysteroscopy	Test value*	P-value	Sig.
		No. = 70	No. = 70			
Scar location	Above int. os	22 (31.4%)	21 (30.0%)	0.034	0.853	NS
	Below int. os	48 (68.6%)	49 (70.0%)			
Liability for distension	Yes	12 (17.1%)	18 (25.7%)	1.527	0.216	NS
	No	58 (82.9%)	52 (74.3%)			
Integrity	Yes	50 (71.4%)	42 (60.0%)	2.029	0.154	NS
	No	20 (28.6%)	28 (40.0%)			
Vascular content	Yes	41 (58.6%)	40 (57.1%)	0.029	0.864	NS
	No	29 (41.4%)	30 (42.9%)			

* Data were presented as numbers and percentages and compared using Chi-square test

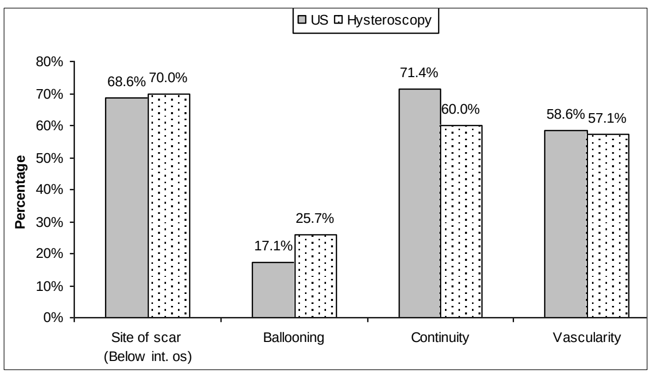


Fig 1: Comparative statistical analysis between findings of US and hysteroscopy

Table 4: Correlation between findings of US and hysteroscopy regarding site of scar

Scar location		US		Agreement	
		Above int. os	Below int. os	Kappa (SE)	95% CI
		No. = 22	No. = 48		
Hysteroscopy	Above int. os	20 (90.90%)	1 (2.10%)	0.899	0.788 to
	Below int. os	2 (9.10%)	47 (97.90%)	(0.057)	1.000

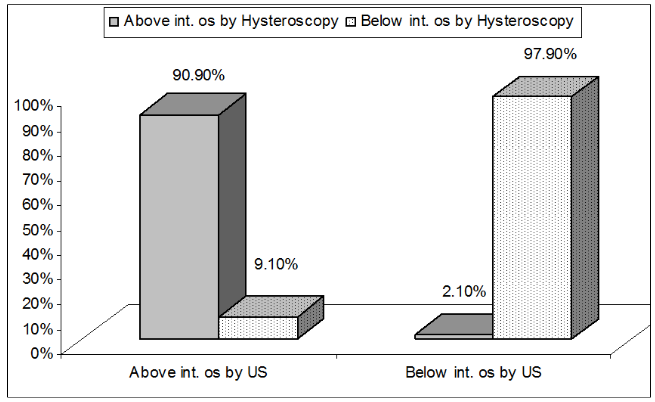


Fig 2: correlations between findings of US and hysteroscopy regarding site of scar

Table 5: correlations between findings of US and hysteroscopy regarding ballooning, continuity and vascularity

Hysteroscopy		US Yes	US No	Kappa agreement (SE)	95% CI
Liability for distension	Yes	5 (41.7%)	13 (22.4%)	0.161	-0.0900 to
	No	7 (58.3%)	45 (77.6%)	(0.128)	0.411
Integrity	Yes	40 (80.0%)	2 (10.0%)	0.625	0.439 to
	No	10 (20.0%)	18 (90.0%)	(0.095)	0.811
Vascular content	Yes	36 (87.8%)	4 (13.8%)	0.736	0.576 to
	No	5 (12.2%)	25 (86.2%)	(0.082)	0.897

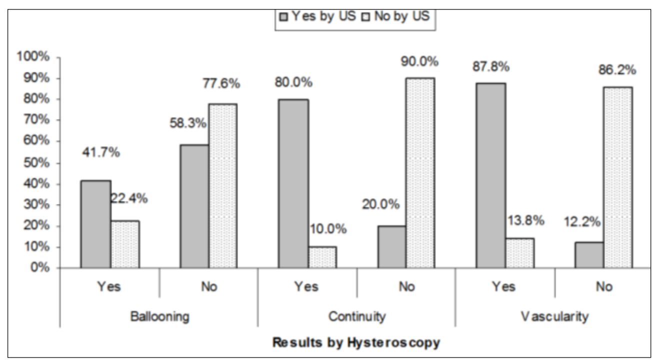


Fig 3: Correlation between findings of US and hysteroscopy regarding ballooning, continuity and vascularity

Discussion

Cesarean mode of delivery has increased in a considerable manner however various researchers (Gizzo *et al*., 2013) [15] have raised the concerns around the cesarean section scar safety issues in subsequent pregnancy that is due to reported scar defects that arise during the healing process [15, 16].

Research efforts are raised all over the globe to determine the safety and health status of the uterine scar after cesarean section deliveries particularly when there is raised risks of uterine rupture and other unfavorable clinical scenarios such as morbidly adherent placenta.

A prior research study (Jarvela *et al*., 2012) [5] like the current research in approach and methodology have shown that hysteroscopy couldn't evaluate the scar thickens parameters at all, but transvaginal sonography could accurately evaluate the scar thickness showing that the mean value 1.57 mm among their investigated study subjects [1, 3, 5, 7].

Furthermore it was revealed and displayed by the research team of investigators (Crowther *et al*., 2012) [2] that there is a statistically significant correlation between the sonographic and hysteroscopy in determination of the site, continuity and vascularity of scar, while there is a statistically insignificant correlation between ultrasound and hysteroscopy in determination of the ballooning of the scar. The research team (Monteagudo *et al*., 2011) [4] have come to the conclusion that sonographic examination is more precise in evaluation of cesarean section scar thickness and integrity those research findings verify the current study findings however hysteroscopy is preferred to be used in conjunction to sonography for endometrial abnormalities diagnosis and histopathological examination by direct biopsy taking [2, 4, 9].

A prior research team (Abosrie *et al*., 2015) [10] of investigators have implemented the usage of 3D sonography in evaluation of cesarean section scar integrity in comparison to 2D ultrasound. It was observed that both sonographic modes had a highly statistical significant correlation to the actual thickness of the scar intraoperative with no superiority of one mode over the other On the other hand research (Kok *et al*., 2013) [13] debate exists around the safest scar thickness at which there is lowest rate of complications prior research efforts have revealed the safe cut-off point had a range from 1.5 mm to 4mm [10, 13].

Interestingly it was observed by (Zimmer and colleagues, 2014) [6] that thin myometrial wall within the isthmic anatomical area after Cesarean delivery is a predictive tool for arousal of obstetric complications related to the uterus in subsequent pregnancies [6, 14].

Conclusions and recommendations for future research

The current research effort have revealed that sonography is more precise than hysteroscopy in assessment of cesarean section scar thickness and scar defects; less invasive and has less complication; however, future research efforts are required to determine the role of operative hysteroscopy in repair of scar defects since hysteroscopy permits the direct visualization of the endometrial lining aiding in biopsy taking and histopathological examination in case of detection of suspicious lesions.

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