Assessment of Cesarean Section Niche Histopathologically after Hysterectomy in Symptomatic Patients

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Abstract: **Background:** Few histopathologic studies of lower uterine segment and Cesarean section scar have been published compared with that in other tissues. Our objective was to describe the incidence of various histopathological findings at the site of cesarean section scar defect (niche) and to determine its relation to gynecological symptoms in women with history of previous CS to acquire a better understanding of possible aberrations in uterine wound healing. **Methods:** The study included 44 non-pregnant women with abnormal gynecological symptoms, history of at least 1 cesarean delivery and their transvaginal ultrasound revealed a cesarean section scar defect (niche) at the uterus. Cases were divided into 2 groups, group A (24 cases) had no other associated pathology and group B (20 cases) with a cesarean section scar defect and associated pathology such as uterine fibroid considered as control group. The parity, number of previous cesarean deliveries, time elapsed between last cesarean delivery and first consultation, the width and depth of the defect and its shape and distance from the internal os by transvaginal ultrasound were recorded for each case, biopsy was taken from the defect after hysterectomy of all cases. A histopathological study for all specimens was done. The pathological findings were correlated to the clinical and ultrasonographic findings in both groups. Results: Women with a previous CS could have a gynecological symptoms related to the CS scar defect as abnormal uterine bleeding, dysmenorrhea and chronic pelvic pain and the most frequent clinical symptom related to the scar defect is postmenstrual spotting. Large defect size is a risk factor for more clinical symptoms especially postmenstrual bleeding. Also larger defects are associated with more histopathological changes such as congested endometrial fold, distortion of lower uterine segment and disorganized muscle fibers. High scars are associated with more clinical symptoms and histopathological changes. Multiple cesarean sections is a risk factor for larger cesarean scar defects, increased clinical symptoms and associated with increased histopathological changes at the defect site. **Conclusion:** The present study shed light on the role of histopathological study in detection of macroscopic and microscopic changes related to the cesarean scar defects and the possible relation between these changes and clinical presentations of those patients. Histopathological changes of such as congested endometrial fold, distortion of lower uterine segment and disorganized muscle fibers at the niche site are risk factors for abnormal gynecological symptoms. There is no doubt that further studies should be carried out in order to gain better understanding of the nature of niche and to have a better management of it.

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1. Introduction

In past decades the cesarean section rate has increased markedly **(Hamilton et al., 2007)**. Cesarean section is associated with complications in subsequent pregnancies, such as placenta previa, placenta accrete, increta or percreta, dehiscence or uterine rupture, scar pregnancy with life-threatening bleeding **(Fleisch et al., 2008)**. It is not known whether defects in cesarean section scars that are visible at transvaginal ultrasound examination of non-pregnant women are associated with a higher risk of these complications than apparently intact scars, or whether large defects are associated with a higher risk of complications than small defects, but this might be the case **(Kennar et al., 2007)**.

Apart from the well-known complications, such as uterine rupture and pathologically adherent placenta, the long term effects of this widely used procedure have been poorly studied. Some researchers have observed the presence of a niche at the site of the cesarean scar. A niche is a sonographic finding and is defined as a triangular, anechoic area at the presumed site of incision **(Monteagudo et al., 2001)**.

Cesarean section scar defects can be detected at transvaginal unenhanced ultrasound examination and seem to be common **(Alshiemy et al., 2013)**. However, using unenhanced ultrasound imaging is not always easy to determine the number and size of scar defects or the thickness of the remaining myometrium over the defect **(Osser et al., 2009)**. Saline contrast

sonohysterography (SCSH, also called hydrosonography or hysterosonography) has been shown to be useful for assessing the uterine cavity, in particular for detecting and evaluating intrauterine focal lesions **(Dreisler et al., 2009)**. **Alshiemy 2013** found that the best time to visualize the cesarean section scar defect by unenhanced transvaginal ultrasound examination is mid-cyclic as the cervical mucus acts as a good contrast media.

These anatomical defects resulting from previous cesarean surgery have been reported to be associated with symptoms such as prolonged postmenstrual spotting and chronic pelvic pain **(Fabres et al., 2005)**.

A histopathological study of hysterectomy specimens with cesarean section scars proposed three possible mechanisms underlying the pathogenesis of this condition: firstly, the presence of a congested endometrial fold (found in 31/51 (61%) cases) and small polyps in the scar recess (8/51 (16%)) are potential causes of menorrhagia and abnormal uterine bleeding; secondly, lymphocytic infiltration (33/51 (65%)) and distortion of the lower uterine segment (38/51 (75%)) could contribute to chronic pelvic pain and dyspareunia; thirdly, focal adenomyosis confined to the scar (28%) could account for dysmenorrhea **(Morris 1995)**. Since the work of **Morris 1995**, there was no such study concerning the pathological changes of the cesarean section scar defect.

Aim of the work

The aim of this study was to describe the incidence of various histopathological findings at the site of cesarean section scar defect (niche) and to determine its relation to gynecological symptoms in women with history of previous CS.

2. Patient and methods

This was a cross section observation study conducted in obstetrics and gynecology department at Al Azhar University hospital (Damietta) at the period started from January 2013 and ended in November 2013. We selected 44 cases of women with abnormal gynecological symptoms, history of at least 1 cesarean delivery and their transvaginal ultrasound revealed a cesarean section scar defect (niche) at the uterus. Cases were divided into 2 groups, group A (24 cases) had no other associated pathology and group B (20 cases) with a cesarean section scar defect and associated pathology such as uterine fibroid considered as control group. The parity, number of previous cesarean deliveries, time elapsed between last cesarean delivery and first consultation, the width and depth of the defect and its shape and distance from the internal os by transvaginal ultrasound were recorded for each case, biopsy was taken from the defect after hysterectomy in all cases in both groups. A histopathological study for all specimens was done. The pathological findings were correlated to the clinical and ultrasonographic findings in both groups.

Inclusion criteria:

Any Women who were scheduled for hysterectomy according to local ethics committee with history of previous cesarean section once or more with period more than 2years from the last cesarean section and had cesarean section scar defect diagnosed by TVUS.

Exclusion criteria:

All women with risk of pelvic inflammatory disease, cervical cancer, and previous surgery to the uterus other than cesarean section, postmenopausal women, heart disease, liver disease, renal impairment or bleeding tendency were excluded from the study. For each woman asked to join the study the nature of the procedure was explained carefully, a written consent and scientific committee agreement was taken and the following was done: careful history taken, the complaint of the patient was taken and carefully analyzed such as: abnormal uterine bleeding, dysmenorrhea, infertility, deep dyspareunia, and chronic pelvic pain. Each woman was asked about any previous uterine surgery other than CS. Transvaginal ultrasound was done to all cases at mid-cycle to detect: Number, site, shape, depth, width of the niche, residual myometrium over the niche & its distance from internal os. Biopsy was taken from the niche site directly from hysterectomy specimen and histopathological examination was done searching for: congested endometrial fold, polyps in the scar recess, lymphocytic infiltration, distortion of the lower uterine segment, focal adenomyosis, other pathological findings.

Statistical analysis of data:

The collected data was organized, tabulated and statistically analyzed using Statistical Package for Social Science (SPSS) version 16 (SPSS Inc, USA). For quantitative data, mean and standard deviation (SD) were calculated and for comparison between two means, the students (t) test was used. For qualitative data, the frequency and percent distribution were calculated and for comparison between groups, chi square (X2) was used. For interpretation of results p value was used.

3. Results

The present study included 44 cases of symptomatic women with niche present by TVS, 24 of the cases had the niche only and considered as group A and the other 20 cases had the niche and other associated pathology such as uterine fibroid, adenomyosis and ovarian cyst and considered as group B (all of them had hysterectomy). In our study parity and abortion showed a non significant difference in both groups. Group A showed a significant increase in

number of previous CS than group B (table 1). As regard age group A showed significant younger mean age compared to group B 46.95±1.75 vs. 48.50±1.53 respectively (table 2). In the current study the duration since the last CS, was ranged from 2 to 22 years with a mean of 11.58±4.79 years in group A and 14.50±3.56 years in group B with significant decrease in the mean of the duration since the last CS in group A (table 2). As regard to the associated pathology in group B necessitating hysterectomy it was uterine fibroid which represented 70% of cases, while adenomyosis in 25% and ovarian cyst in 5% of cases.

Table (1) : Comparison between parity, abortion and number of previous CS in both groups :

Variables	Group A(1) (n. 24)		Group B(2) (n. 20)		Total (n. 44)		X^2	P
	No.	%	No.	%	No.	%		
Parity								
P1	1	4.2	0	0.0	1	2.3	1.911	0.168
P2	3	12.5	2	10.0	5	11.4		
P3	9	37.5	8	40.0	17	38.6		
P4	6	25.0	6	30.0	12	27.3		
P5	4	16.7	4	20.0	8	18.2		
P6	1	4.2	0	0.0	1	2.3		
Abortion								
0	11	45.8	10	50.0	21	47.7	0.978	0.807
1	8	33.3	6	30.0	14	31.8		
2	4	16.7	4	20.0	8	18.2		
3	1	4.2	0	0.0	1	2.3		
No. of previous CSs								
P 1cs	4	16.7	10	50.0	14	31.8	0.413	0.005*
P 2cs	8	33.3	2	10.0	10	22.7		
P 3cs or more	12	50.0	8	40.0	20	45.4		

(1) Group A : are patients with niche is the only pathology.
(2) Group B : are patients with other pathology associated with the presence of niche.
* = significant

Table (2) : Comparison between age, duration since last delivery in both groups :

Variables	Group A	Group B	t- test	P
	Mean ±SD	Mean ±SD		value
Age/years	46.95±1.75	48.50±1.53	2.89	0.00*
Last delivery/years	11.58±4.79	14.50±3.56	2.31	0.003*

As regard relation between clinical symptoms and number of CS, it was found that there is statistically significant increase of postmenstrual spotting, dyspareunia and chronic pelvic pain in both groups with increased number of previous CS. The present study showed more frequent clinical symptoms in group A, there was significant increase in postmenstrual spotting, secondary infertility, deep dyspareunia and chronic pelvic pain compared to group B (62.5%, 8.3%, 37.5%, 58.3% vs 10%, 0.0%, 20%, 40%) respectively (table 3). Abnormal uterine bleeding showed a significant increase in group B compared to group A (90% vs. 62.5%) respectively (table 3).The most frequent shape of niche by transvaginal ultrasound was mainly semicircular in group A (50%) and mainly triangular in in group B (60 %). In the present study we found a significant increase of histopathological findings (in the form of ; congested endometrial fold, distortion of lower uterine segment, lymphocytic infiltration, focal adenomyosis and disorganized muscle fibers at the scar site) in group A compared to group B (37.5%, 37.5%, 66.7%, 50%, 70.8% vs. 20%, 10%, 40%, 30%, 30%) respectively. we also found a significant increase of infiltration by

chronic inflammatory cells in group A compared to group B (62.5% vs. 40%) respectively. There was hyalinization at the scar detected in 61.3% of total cases included in the study with a non-significant difference between both groups (table 4). Ultrasound showed a significant increase of the mean width and depth in group A compared to group B (8.3±2.2, 12.6±2.9 vs. 6.6±2.3, 7.8±3.4 mm) respectively. This means that the larger the defect size the more associated clinical symptoms. We also found that there was a significant increase of niche dimensions (width and depth) with the increased parity (the mean width, depth in p1 compared to p5 were 6.4±2.2, 6.5±3.1 vs. 9.2±2.1, 13.7±1.4 mm respectively). The increase in parity is associated with larger defects. Both groups showed a significant increase of niche dimensions with increased number of previous cesarean sections (in group A the mean width and depth in previous 1cs compared to previous 3cs were 7.8±2.1, 10.3±2.9 vs. 10.2±3.1, 13.8±2.5 mm respectively), (in group B the mean width and depth in previous one CS compared to previous three CS were 5.6±2.5, 6.4±2.1 vs. 8.4±2.2, 9.2±2.3 mm respectively). In the present study the mean width and depth of the defect showed a significant increase with increased its distance from the internal os in both groups (P =0.00). This means that the higher the niche in the uterus the bigger its size. Both groups showed a significant increase in the incidence of congested endometrial fold (P =0.001) and distortion of the isthmus (P =0.00) with increased niche distance from the internal os. and pathological changes with increased number of cesarean sections. Congested endometrial fold in previous 1cs compared to previous 3cs was (23% vs. 46%), distortion of lower uterine segment was (9% vs. 63%), and disorganized muscle fibers were (13% vs. 52%). This means that multiple cesarean sections are a risk factor for more pathological changes.

Table (3) : Comparison between frequency of symptoms in each group:

Variables	Group A (n. 24)		Group B (n. 20)		Total (n. 44)		X^2	p
	No.	%	No.	%	No.	%		
AUB								
No	1	4.2	0	0.0	1	2.3		
Yes	15	62.5	18	90.0	33	75.0	15.38	0.001*
PMS	9	37.5						
No	15	62.5	18	90.0	27	61.4		
Yes			2	10.0	17	38.6	12.69	0.00*
Dysmenorrhea								
No	15	62.5	12	60.0	2	61.4		
Yes	9	37.5	8	40.0	1	38.6	0.03	0.86
2ry Infertility								
No	22	91.7	20	100.0	42	95.5		
Yes	2	8.3	0	0.0	2	4.5	1.75	0.19
Dyspareunia								
No	15	62.5	16	80.0	31	70.5		
Yes	9	37.5	4	20.0	13	29.5	1.61	0.002*
Chronic pelvic pain								
No	10	41.7	12	60.0	22	50.0		
Yes	14	58.3	8	40.0	22	50.0	1.47	0.001*

Table (4) : Comparison between pathological findings in each group:

Variables	Group A (n. 24)		Group B (n. 20)		Total (n. 44)		X^2	P
	No.	%	No.	%	No.	%		
Congested endo. Fold								
No	15	62.5	16	80.0	31	70.5	1.61	0.001*
Yes	9	37.5	4	20.0	13	29.5		
Polyps in scar								
No	20	83.3	18	90.0	38	86.4	0.412	0.53
Yes	4	16.7	2	10.0	6	13.6		
Distortion of LUS								
No	15	62.5	18	90.0	33	75.0	4.40	0.003*
Yes	9	37.5	2	10.0	11	25.0		
Lymphocytic infiltration	8	33.3	12	60.0	20	45.5	3.12	0.005*
No	16	66.7	8	40.0	24	54.5		
Yes								
Localized adenomyosis								
No	12	50.0	14	70.0	26	59.1	1.81	0.00*
Yes	12	50.0	6	30.0	18	40.9		
Disorganized ms fibers								
No	7	29.2	14	70.0	21	47.7	7.29	0.00*
Yes	17	70.8	6	30.0	23	52.3		
Other finding:								
Hyalinization	15	62.5	12	60	27	61.3		
Chronic inflammatory cells	15	62.5	8	40	23	52.2	7.23	0.005*

Table (5): frequency of different shapes& mean of parameters of niche by TVUS in each group:

Variable of shape	Group A (n.24)		Group B (n.20)		X2	P- value
	No.	%	*No.*	*%*	*3.67*	*0.30*
rectangular	**3**	**12.5**	**2**	**10.0**		
semicircular	**12**	**50.0**	**6**	**30.0**		
circular	**1**	**4.2**	**0**	**0.00**		
triangular	**8**	**33.3**	**12**	**60.0**		
Variables of parameters	**mean± SD (mm)**		**mean± SD (mm)**		**P value**	
Width	**8.3± 2.2**		**6.6±2.3**		**0.002✶**	
Depth	**12.6±2.9**		**7.8±3.4**		**0.00✶**	
Distance from internal os.	**9.5±2.1**		**7.6±2.5**		**0.005✶**	
Residual myometrial thickness	**8.7±2.3**		**9.5±2.0**		**0.60**	

Table(6) correlation between number of Cs & distance of nich from internal os & pathological findings

pathology	No. of cases			P-value
	P1CS	P2CS	P3Cs or more	
Congested endometrial fold	3(23%)	4(30%)	6(46%)	0.001✶
Polyp at scar site	2(33%)	3(50%0	1(16%)	0.426
Distortion of isthmus	1(9%)	3(27%)	7(63%)	0.001✶
Lymphocytic infiltration	7(29%)	9(37%)	8(33%)	0.08
Localized adenomyosis	7(38%)	5(27%)	6(33%)	0.06
Disorganized muscle fibers	3(13%)	8(34%)	12(52%)	0.001✶
Pathology	Distance from internal os			P-value
	5-7mm	8-10mm	>10mm	
Congested endometrial fold	2(15%)	4(30%)	7(53%)	0.001✶
Polyps at scar	2(33%)	3(50%)	1(16%)	0.31
Distortion of the isthmus	1(9%)	3(27%)	7(63%)	0.001✶

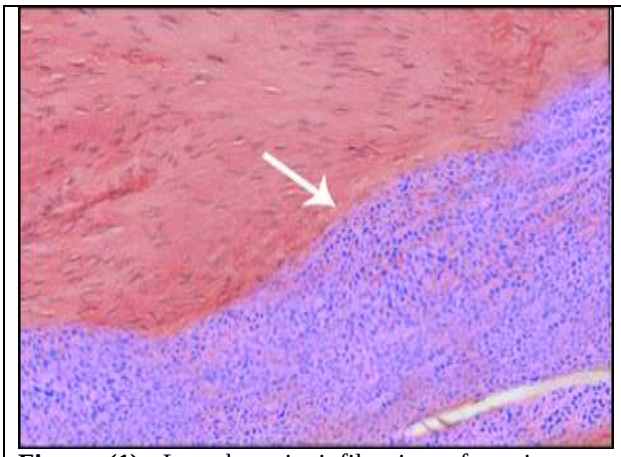

Figure (1): Lymphocytic infiltration of uterine scar (arrow) of a case of previous C.S (hematoxylin-eosin stain, original magnification ×200).

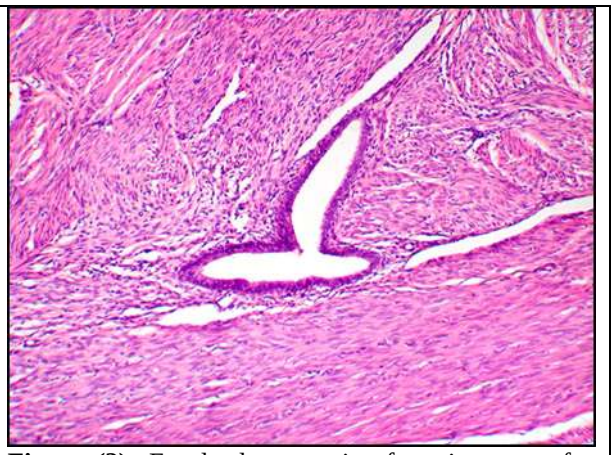

Figure (2): Focal adenomyosis of uterine scar of a case of previous C.S (hematoxylin-eosin stain, original magnification ×200).

4. Discussion

The increasing rate of CS and its complications has awakened an interest in CS scars. Cesarean scar defects (CSDs), was considered as deficient uterine scars or scar dehiscence following a cesarean section, involve myometrial discontinuity at the site of a previous cesarean section scar **(Klemm et al., 2005).** It is important to learn more about the clinical consequences of niche. Several small studies have demonstrated that niche may be responsible for abnormal gynecological symptoms such as prolonged postmenstrual spotting, dysmenorrhea, secondary infertility, dyspareunia, chronic pelvic pain **(Fabres et al., 2003).** Many reports emphasized that using unenhanced ultrasound imaging is not always easy to determine the number and size of scar defects or the thickness of the remaining myometrium over the defect. Using of Saline contrast sonohysterography (SCSH) makes the scar defects more clear and easy detectable by TVS **(Osser et al., 2009).** But recently **Alshiemy, 2013** found that TVS at mid-cycle gives the same results in detection of scar defects as that with Gel Instillation Sonography (GIS) and is more applicable**.** There has been very little published material on the histopathology of scarring in myometrium. Although there are a few studies exploring the biochemistry and biomechanics of human uterine scars **(Buhimschi et al., 2006).** Because variation in myometrial wound healing is not widely discussed in gynecology or pathology textbooks, intensive scrutiny of myometrial wound healing is not performed by pathologists in routine practice. However, obstetrician–gynecologists in daily clinical practice are now frequently witnessing the relevance of uterine wound healing with regard to the dehiscence of uterine scars and subsequent rupture during parturition **(ACOG 2010).** A histopathological study by **Morris 1995** of hysterectomy specimens with cesarean section scars proposed three possible mechanisms underlying the pathogenesis of symptoms related to the CS scar : *firstly*, the presence of a congested endometrial fold and small polyps in the scar recess are potential causes of menorrhagia and abnormal uterine bleeding; *secondly*, lymphocytic infiltration and distortion of the lower uterine segment could contribute to chronic pelvic pain and dyspareunia; *thirdly*, iatrogenic adenomyosis confined to the scar could account for dysmenorrhea. There was no such study concerning the histopathology of the CS scar defect since this study.

The aim of the current study is to correlate between the histopathological findings of cesarean section scar defect and the presence of gynecological symptoms in women with history of previous CS. We studied 44 cases of symptomatic women with niche present by TVS, 24 of the cases had the niche only and considered as group A (20 of them had hysterectomy and 4 cases had D&C) and the other 20 cases had the niche and other associated pathology such as uterine fibroid, adenomyosis and ovarian cyst and considered as group B (all of them had hysterectomy).

In our study parity and abortion showed a non-significant difference in both groups**.** these results are not in agreement with the study of **Osser et al., 2010** which included 108 women who had undergone one caesarean section and showed significant increase in parity and number of abortions in cases with defect scar than scar intact cases the discrepancy could be explained that the two groups in our study had niche present but only one group had niche in their study.

Group A showed a significant increase in number of previous CS than group B, the results are in agreement with **Osser et al., 2010 and Alshiemy, 2013** and it also confirmed the finding of **Armstrong et al., 2003 and Ofili-Yebovi et al 2008** the more increase

the number of CS the higher the prevalence of deficient scars. This seems logic, because healing conditions are likely to be poorer in tissue where there is already a scar.

The mean age in our study was increased 46.95±1.75 in comparison to the study of **Wang et al., 2009** and **Alshiemy, 2013** 35.2 ± 6.1 and 29.07±4.18 years respectively that was because most cases in our study were undergoing hysterectomy with relatively older age.

In the current study the duration since the last CS, was ranged from 2 to 22 years with a mean of 11.58±4.79 years in group A and 14.50±3.56 years in group B the significant decrease in the mean of the duration since the last CS in group A may be due to the younger age of cases included in that group.

As regard to the associated pathology in group B necessitating hysterectomy it was uterine fibroid which represented 70% of cases, while adenomyosis in 25% and ovarian cyst in 5% of cases.

As regard relation between clinical symptoms and number of CS, it was found that there is statistically significant increase of postmenstrual spotting, dyspareunia and chronic pelvic pain in group A with increased number of previous CS.

Also there was statistically significant increase of dysmenorrhoea and chronic pelvic pain in group B with the increased number of previous CS. It can be said that, clinical symptoms increased with increased number of previous CS. these results are in agreement with **Alshiemy, 2013.**

The present study showed more frequent clinical symptoms in group A, there was significant increase in posmenstrual spotting, secondary infertility, dysparueunia and chronic pelvic pain compared to group B (62.5%, 8.3%, 37.5%, 58.3% vs 10%, 0.0%, 20%, 40%) respectively. results are in agreement with **Wang et al., 2009.**

Bij de Vaate et al. 2011 reported that, post menstrual spotting was present in 39 women with a scar defect (33.6%) and 14 women without a defect (15.2%). Logistic regression analysis demonstrated a relationship between the presence of a defect and postmenstrual spotting. They added that Information about intermenstrual bleeding was obtained from 197 women, and this symptom was reported by 33 of 110 women with a niche (30.0%) and 9 of 87 women without a niche (10.3%) (P = 0.001). These results are in agreement with that of the present study as it was (38.6%) in all cases with niche but it increased in patients with niche only (62.5%). On the other hand, the same authors reported that, the pain experienced during menstruation, reported with the use of a visual analog scale (VAS) score, was similar for women with and without a niche (P = 0.95).in our study there was no significant difference between group A and B as regard dysmenorrhoea 37.5% vs 40% respectively but there was significant increase of chronic pelvic pain in cases with niche only compared with cases with associated pathology (58.3% vs. 40%) respectively**,** the difference of percentage may be due to different sample size compared with the previous study which included 225 women with previous CS.

Abnormal uterine bleeding showed a significant increase in group B compared to group A (90% vs. 62.5%) respectively this may be due to the associated pathology with niche which acts as an additional cause of abnormal uterine bleeding.

Several hypotheses have been postulated to explain the etiology of bleeding disorders in relation to the scar defect. It has been assumed that abnormal uterine bleeding may be due to the retention of menstrual blood in the niche, which is intermittently expelled after the majority of the menstruation has ceased, causing postmenstrual spotting. **Fabres et al., 2005** reported that this condition may depend on poor contractility of the uterine muscle around the niche.

In addition, the presence of fibrotic tissue below the niche may impair the drainage of menstrual flow through the cervix **(Fabres et al., 2005).** It cannot be ruled out that the accumulated blood is produced in situ, as suggested by **Morris 1995** based on the presence of free blood cells in the lining stroma, suggesting a recent hemorrhage.

Alshiemy, 2013 proposed the presence of a valve like action of an endometrial fold or polyp at the mouth of the niche which causes accumulation of menstrual blood inside the niche and this valve opened post menestrually during uterine contraction causing post menstrual bleeding. This valve action may be augmented by the presence of RVF uterus.

As regard the shape of niche by transvaginal ultrasound it was mainly semicircular in group A (50%) and mainly triangular in in group B (60 %). These results are in agreement with **Bij De Vaate et al., 2011** who reported that the Semicircular and triangular niches were most common. The clinical symptoms may be more frequent with the semicircular niche as it was mainly present in group A.

In the present study we found a significant increase of histopathological findings (in the form of ; congested endometrial fold, distortion of the isthmus, lymphocytic infiltration, iatrogenic adenomyosis and disorganized muscle fibers at the scar site) in group A compared to group B (37.5%, 37.5%, 66.7%, 50%, 70.8% vs. 20%, 10%, 40%, 30%, 30%) respectively. we also found a significant increase of infiltration by chronic inflammatory cells in group A compared to group B (62.5% vs. 40%) respectively. There was hyalinization at the scar detected in 61.3% of total cases included in the study with a non-significant difference between both groups. There is an agreement

between our study and the results of **Morris 1995** as regard lymphocytic infiltration (65%) and iatrogenic adenomyosis (28%). The disagreement in the other results may be due to different sample size and different mean age in the study group it was 36.7 years in the study of **Morris** which was younger than that in our study (46.9 years).

A histopathological study of 7 hystrectomy specimens after iatrogenic trauma to the myometrium was done by **Roeder et al., 2012** and revealed evidence of altered healing including myofiber disarray (MD), elastosis, tissue edema, and inflammation. Small fibroids, myometrial hyperplasia (MMH), a keloid-like region of scar and adenomyosis were also observed. These histopathological changes may be markers of aberrancy in wound healing after iatrogenic uterine trauma. Altered myometrial scarring in these cases may have contributed to the clinical outcome necessitating hysterectomies. The study included CS scar in 2 cases and scars of other procedures such as Novasure ablation, endomyometrial resection and previous myomectomy in 5 cases.

Myofiber disarray (MD) or disorganized muscle fibers was smooth muscle fibers swirling in all directions, in contrast to the usual alignment noted in uninvolved myometrium. It was seen in the 7 cases (100%) of **Roeder** et al.,2012 study. In our study we detected disorganized muscle fibers in 17 cases (70%) of group A. The difference between our study and the previous study may attributed to **Roeder** et al.,2012 study included procedures other than CS such as Novasure ablation, endomyometrial resection and previous myomectomy with trauma to the uterine corpus and larger scars.

Elastosis is a focal globular accumulation of thick elastic fibers that can best be visualized by light microscopy with Weigert-Van Gieson stain, it was detected in 3 cases of **Roeder** study one of them had CS scar. In our study we had not detect elastosis in CS scars this may attributed to we did not use Weigert-Van Gieson stain in our study.

In **Roeder** study there were inflammatory cells detected in 1 CS scar (50%) of CS scars in the study. That was in agreement with our study as we detect infiltration of CS scars by chronic inflammatory cells in 15 cases (62.5%) in group A.

Myometrial hyperplasia is a structural variation with irregular zones of increased cellularity and immature-appearing smooth muscle cells with an increased nucleus/cell ratio, compared to normal myometrium in the outer third of the same uterus. It was hypothesized that MMH is a reaction to repetitive endometrial breakdown and repair similar to the suggestions that adenomyosis and endometriosis are caused by monthly autotraumatization of the uterus. In **Roeder** study a myometrial hyperplasia (MMH) was noted adjacent to scar of the corpus in one case, also a myometrial keloid-like area was seen at the scar of the corpus in 1 case. In our study we did not detect a similar findings that may because of we did not include scars other than CS scar in our study. The previous findings were found in scars related to the uterine corpus which shows more histopathological changes. Also the usage of additional stains such as Kreyberg stain and MIB-1 (Ki-67) immunocytochemistry in **Roeder** study may play a role in better detection of these findings.

Ultrasound showed a significant increase of the mean width and depth in group A compared to group B (8.3±2.2, 12.6±2.9 vs. 6.6±2.3, 7.8±3.4 mm) respectively. This means that the larger the defect size the more associated clinical symptoms. These results are in agreement with **Wang et al., 2009.**

We also found that there was a significant increase of niche dimensions (width and depth) with the increased parity (the mean width, depth in p1 compared to p5 were 6.4±2.2, 6.5±3.1 vs. 9.2±2.1, 13.7±1.4 mm respectively). The increase in parity is associated with larger defects; this is in agreement with **Ofili-Yebovi et al 2008**.while no significant difference as regard the residual myometrial thickness in both groups.

Both groups showed a significant increase of niche dimensions with increased number of previous cesarean sections (in group A the mean width and depth in previous 1cs compared to previous 3cs were 7.8±2.1, 10.3±2.9 vs. 10.2±3.1, 13.8±2.5 mm respectively), (in group B the mean width and depth in previous 1cs compared to previous 3cs were 5.6±2.5, 6.4±2.1 vs. 8.4±2.2, 9.2±2.3 mm respectively). These results are in agreement with **Wang et al., 2009**; this means that multiple cesarean sections are a risk factor for larger cesarean scar defects.

In the present study the mean width and depth of the defect showed a significant increase with increased its distance from the internal os in both groups (P =0.00). This means that the higher the niche in the uterus the bigger its size, these results showed an agreement with the study of **Alshiemy 2013**.

Both groups showed a significant increase in the incidence of congested endometrial fold (P =0.001) and distortion of the isthmus (P =0.00) with increased niche distance from the internal os. This probably means that the higher the defect is a risk factor for more pathological changes.

Both groups showed a significant increase in the incidence of some pathological changes with increased number of cesarean sections. Congested endometrial fold in previous 1cs compared to previous 3cs was (23% vs. 46%), distortion of lower uterine segment was (9% vs. 63%), and disorganized muscle fibers were

(13% vs. 52%). This means that multiple cesarean sections is a risk factor for more pathological changes.

In brief, the present study shed a light on the role of histopathology in detection of cesarean scar defects and its long term complications and also helping in understanding its pathogenesis. Hence, treatment of cs scar defects may be the optimal management for many symptomatic patients with a non-significant other uterine pathology instead of a major surgery such as hysterectomy. Scanning of an old cs scar should be mandatory even in non-pregnant women in every case during routine TVS and it will not add much extra time but it seems to add much to the survey of the presenting gynecological symptoms. It must be said that cesarean scars should have more concern in the future studies in order to learn more about its nature.

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