

ORIGINAL ARTICLE

Effect of Endometritis on Caesarean Section Scar Thickness: A Sonographic Study

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Abstract

Background: Endometritis is an inflammation of the inner lining of the uterus, often caused by infection. It is a common postpartum complication, particularly following a caesarean section (C-section). The thickness of the C-section scar is an important factor in assessing uterine integrity and predicting the risk of complications in subsequent pregnancies.

Objective: To examine the effect of endometritis on caesarean section scar thickness in females.

Materials & Methods: This was a case-control study conducted at the University Ultrasound clinic, Green town, Lahore for the duration of 7 months. Convenient sampling technique was used to collect the data. The research utilized transabdominal ultrasound scans, employing high-frequency curvilinear transducers of 3.5–6MHz (Toshiba Xario).

Results: The mean thickness of the C-section scar was significantly different between the two groups: 2.46 ± 0.54 mm in women without endometritis and 5.29 ± 0.80 mm in those with endometritis ($P = 0.000$). The number of scars visualized sonographically did not significantly differ between groups. Fluid around the endometrium was significantly more common in the endometritis group (45.3%) compared to none in the no endometritis group ($P = 0.000$). The number of previous C-sections did not significantly differ between groups ($P = 0.580$), with similar distributions across both groups. The duration of the C-section procedure was significantly shorter in the endometritis group, averaging 2.79 ± 1.22 minutes compared to 14.5 ± 6.22 minutes in the no endometritis group ($P = 0.000$).

Conclusion: This study demonstrated that endometritis significantly affects the thickness of C-section scars, indicating impaired healing. The presence of fluid around the endometrium and increased endometrium thickness were additional markers of this adverse effect.

Keywords: Caesarean scar, Endometritis, Pelvic inflammatory disease, Caesarean section.

INTRODUCTION

Caesarean delivery (CD) is a frequently performed procedure, constituting approximately 32% of all childbirths. In 2014, nearly 1.3 million CD surgeries were conducted [1]. Like all surgical interventions, CD carries a risk of surgical site infections (SSIs), which encompass wound infections and endometritis. Furthermore, it is linked to increased maternal morbidity and mortality in subsequent pregnancies [2, 3].

Endometritis stands out as a prevalent source of infectious complications during the postpartum period, affecting up to 2–3% of vaginal deliveries and 15–20% of caesarean sections [4,5]. Interestingly, acute endometritis has also been observed to complicate medical and surgical pregnancy terminations in as many as 20% of cases [6].

Ultrasound plays a crucial role in diagnosing abdominal pain and fever in postpartum patients. When it comes to identifying endometritis through ultrasound, specific findings include a thickened and uneven endometrial lining, the presence of fluid within the uterus, and areas of gas within the uterine cavity. However, it is important to consider other potential diagnoses in the differential, such as retained products of conception, infected blood collections, and the accumulation of pus. In up to 24% of postpartum patients, ultrasound may reveal the presence of clots and debris [7].

Females with a caesarean section history may encounter the accumulation of menstrual blood in the uterine cavity, leading to the manifestation of menostaxis, because of ongoing insufficient drainage [8]. Moreover, the enduring accumulation of uterine effusion can contribute to the development of localized inflammation within the endometrial tissue [9]. Furthermore, the

persistent buildup of uterine effusion may lead to the emergence of localized inflammation in the endometrial tissue [10]; this can affect the receptivity of the endometrium, the process of implantation, and the ultimate outcomes of pregnancy [10–15].

The study aimed to address a clinically relevant question regarding the potential impact of endometritis on caesarean scar healing. The findings of this study contributed to better patient care, improved pregnancy planning for women with previous caesarean sections, and added valuable information to the field of obstetrics and gynaecology.

METHODS

This was a case control study conducted at the University Ultrasound clinic, Green town, Lahore for the duration of 7 months. A convenient sampling technique was used to collect the data. The research utilized transabdominal ultrasound scans, employing high-frequency curvilinear transducers of 3.5–6MHz (Toshiba Xario). **Inclusion criteria:** Females aged 18 to 45 years old and diagnosed with endometritis after caesarean section delivery. **Exclusion criteria:** Patients who underwent a hysterectomy following a Caesarean section, females with known uterine anomalies or congenital abnormalities, and females with known chronic medical conditions that may affect wound healing or uterine health.

Ultrasound Technique

A single expert sonographer performed the ultrasounds. All women underwent transabdominal ultrasound scans, which were performed using high-frequency curvilinear transducers of 3.5–6MHz (Toshiba Xario). On ultrasound scan, the uterus was examined in the longitudinal plane, and the internal os was

identified as the point of junction between the endometrial cavity and the cervical canal. The uterine flexion was determined by assessing the angle between the longitudinal axis of the uterus and the longitudinal axis of the cervix. Uterine ante flexion was diagnosed when the long axis of the uterine body was deviating anteriorly in relation to the long axis of the cervix, while posterior deviation was classified as retro flexion. An attempt was then made to ascertain the location of a Caesarean section scar within the anterior uterine wall. In cases of multiple previous Caesareans, the number of all visible scars was recorded. In all women, the distance

between the uterine Caesarean section scar and the top of the uterine cavity was measured in the longitudinal plane. Thickened, heterogeneous endometrium and intracavitary/cul-de-sac fluid were considered as endometritis.

Statistics

Data was analysed using SPSS software version 25. Mean $\pm$ SD were calculated for quantitative variables. Frequencies and percentages were calculated for qualitative variables. Chi-square test and independent sample t-test were applied. P-values less than 0.05 were considered significant.

Results:

Table 1: Characteristics

Variables		Freq (%)	
Age (years)		28.8 $\pm$ 5.9	
Endometritis	Yes	68	49.6 %
	No	69	50.4 %
Fluid around endometrium	No	75	54.7 %
	Yes	62	45.3 %
Number of scars visualized	1	122	89.1 %
	2	13	9.5 %
	3	2	1.5 %
Number of previous C-sections	1	71	51.8 %
	2	48	35.0 %
	3	14	10.2 %
	4	4	2.9 %
Post-partum uterus		15	10.9 %
Scar thickness (mm)	1.40-1.90	4	2.9 %
	2.00-2.90	46	33.6 %
	3.00-3.70	18	13.1 %
	4.00-4.90	15	10.9 %
	5.00-5.80	34	24.8 %
	6.00-7.50	20	14.6 %

The average age of the participants was 28.8 years, with a standard deviation of 5.9 years. Out of 137 participants 68 (49.6%) had endometritis and 69 (50.4%) had no signs of endometritis. Fluid around endometritis was

seen in 62 (45.3%) participants; the remaining 75 (54.7%) had no fluid around the endometrium. Out of 137 participants, 122 (89.1%) showed a single caesarean scar, 13 (9.5%) showed two scars, and 2 (1.5%)

participants showed three C-section scars. 71 (51.8%) women had 1 previous caesarean, 48 (35%) had 2, 14 (10.2%) had 3, and 4 (2.9%) had 4 previous caesareans. Out of 137 women, 4 (2.9%) participants had scar thickness of 1.4-1.9 mm, 46 (33.6%) had 2-2.9 mm scar, 18 (13.1%) had 3-3.7 mm, 15

(10.9%) had 4-4.9 mm scar thickness. 34 (24.8%) had 5.00-5.80 mm scar thickness, and 20 (14.6%) women had 6.00-7.50 mm scar thickness. Out of 137 participants, 122 (89.1%) had no other pathology detected on ultrasound, only 15 (10.9%) females had a post-partum uterus (Table 1).

Table 2: Comparison of endometritis with other variables.

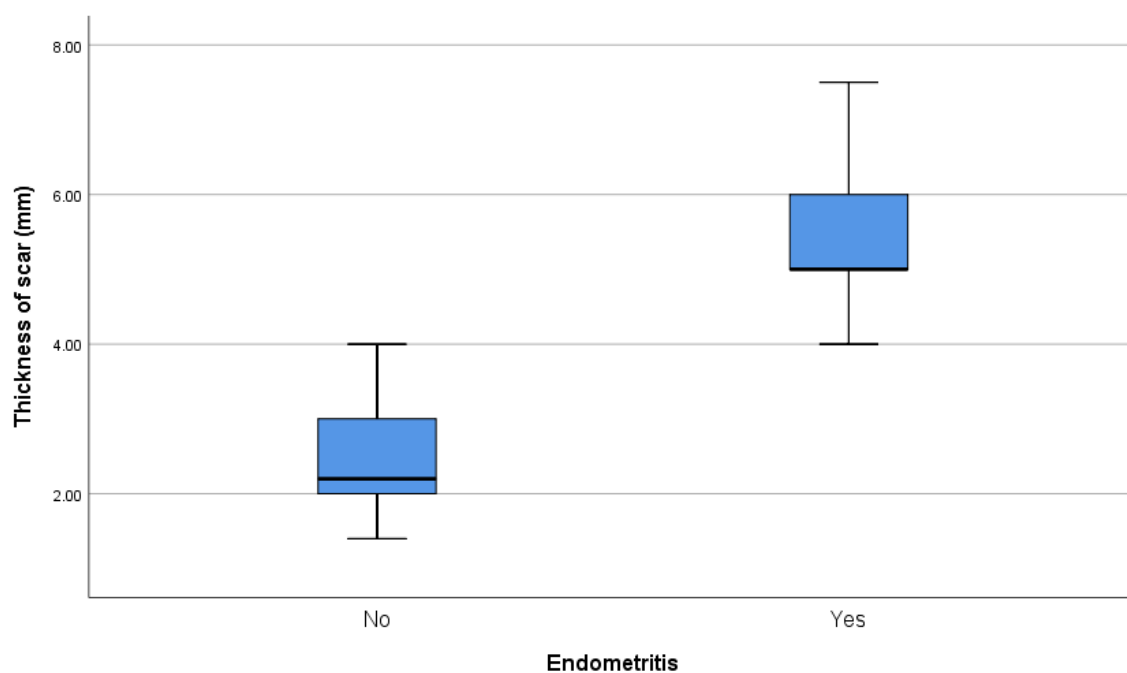
		Endometritis		P-value
		No (n=69)	Yes (n=68)	
Thickness of scar (mm)		2.46 ± 0.54	5.29 ± 0.80	0.000
According to category - Thickness of scar (mm)	1.40 – 1.90	4 (2.9%)	0 (0%)	0.000
	2.00 – 2.90	46 (33.6%)	0 (0%)	
	3.00 – 3.70	18 (13.1%)	0 (0%)	
	4.00 – 4.90	1 (0.7%)	14 (10.2%)	
	5.00 – 5.80	0 (0%)	34 (24.8%)	
	6.00 – 7.50	0 (0%)	20 (14.6%)	
Number of scars visualized	1	63 (46.0%)	59 (43.1%)	N.A
	2	5 (3.6%)	8 (5.8%)	
	3	1 (0.7%)	1 (0.7%)	
Fluids around endometrium	No	69 (50.4%)	6 (4.4%)	0.000
	Yes	0 (0%)	62 (45.3%)	
Number of C-section	1	33 (24.1%)	38 (27.7%)	0.580
	2	28 (20.4%)	20 (14.6%)	
	3	6 (4.4%)	8 (5.8%)	
	4	2 (1.5%)	2 (1.5%)	
Duration of C-section		14.5 ± 6.22	2.79 ± 1.22	0.000
Endometrium Thickness		8.39 ± 1.36	13.1 ± 1.41	0.000
Post-partum uterus		0 (0%)	15 (10.9%)	0.000

The mean thickness of the C-section scar was significantly different between the two groups: 2.46 ± 0.54 mm in women without endometritis and 5.29 ± 0.80 mm in those with endometritis (P = 0.000) (Graph1). When categorized by scar thickness, none of the women with endometritis had scar thicknesses within the 1.40-3.70 mm range, whereas 68.6% of women without endometritis fell within this range. Conversely, higher scar thickness categories

(4.00-7.50 mm) were exclusively seen in the endometritis group, with 10.2% having scar thickness between 4.00-4.90 mm, 24.8% between 5.00-5.80 mm, and 14.6% between 6.00-7.50 mm. The number of scars visualized sonographically did not significantly differ between groups, with 46.0% of the no endometritis group and 43.1% of the endometritis group having one scar, while 3.6% and 5.8% had two scars, and 0.7% had three scars in both groups,

respectively. Fluid around the endometrium was significantly more common in the endometritis group (45.3%) compared to none in the no endometritis group ($P = 0.000$). The number of previous C-sections did not significantly differ between groups ($P = 0.580$), with similar distributions across both groups. The duration of the C-section procedure was significantly shorter in the endometritis group, averaging 2.79 ± 1.22

minutes compared to 14.5 ± 6.22 minutes in the no endometritis group ($P = 0.000$). Additionally, the endometrium thickness was significantly greater in the endometritis group, measuring 13.1 ± 1.41 mm compared to 8.39 ± 1.36 mm in the no endometritis group ($P = 0.000$). Finally, abnormal postpartum uterine findings were only present in the endometritis group, with 15 women (10.9%) affected ($P = 0.000$) (Table 2).



Graph 1: Box-plot shows the difference in scar thickness with and without endometritis

DISCUSSION

Endometritis is a significant contributor to puerperal sepsis and poses a potential life-threatening risk following various pregnancy-related procedures, including miscarriage, termination of pregnancy, vaginal delivery, and caesarean section [4, 16].

The results of this study highlight the significant impact of endometritis on the thickness of the caesarean section (C-section) scar, as observed through sonographic

measurements. Women with endometritis had a markedly thicker scar (5.29 ± 0.80 mm) compared to those without endometritis (2.46 ± 0.54 mm), with a highly significant P-value (0.000). This suggests that endometritis severely impairs the normal healing process of the uterine scar following a C-section. The observed increase in scar thickness in women with endometritis aligns with previous research. A study by Osseir et al. (2010) found that infections postpartum, including endometritis, could lead to impaired healing

and increased scar thickness. They reported that inflammation and infection disrupt the normal wound healing process, leading to thicker, less elastic scars, similar to our findings [17]. The categorization of scar thickness in our study revealed that higher scar thickness categories were exclusively seen in the endometritis group. Similar observations were made by Pompeii et al. (2016), who reported that women with postpartum infections, including endometritis, were more likely to have thicker uterine scars when measured via sonography [18]. Their study highlighted the role of infection in altering scar tissue remodelling, contributing to increased thickness.

The significant presence of fluid around the endometrium in the endometritis group (45.3%) compared to none in the control group ($P = 0.000$) corroborates findings by Acharya et al. (2015). They demonstrated that fluid presence is a sonographic marker of ongoing inflammation or infection, often associated with endometritis [19].

The shorter duration of C-section in the endometritis group (2.79 ± 1.22 minutes vs. 14.5 ± 6.22 minutes; $P = 0.000$) is an unusual finding and differs from typical expectations. Most literature, including a comprehensive review by Kankuri et al. (2013), suggests that prolonged surgical time is more commonly associated with postoperative infections. This discrepancy in our study might be due to variations in recording practices or specific patient management protocols [20].

The greater endometrium thickness observed in the endometritis group (13.1 ± 1.41 mm vs. 8.39 ± 1.36 mm; $P = 0.000$) is consistent with inflammatory changes reported in previous studies. For example, a study by Halis et al. [21] found similar

increases in endometrium thickness in women with endometritis, reflecting the inflammatory response and fluid accumulation. Additionally, abnormal postpartum uterine findings were present only in the endometritis group (10.9%; $P = 0.000$), which aligned with the findings of Slavin et al. [22], who noted increased rates of abnormal uterine findings in women with postpartum infections. In a study conducted by Mulic-Lutvica et al., uterine dimensions were assessed in puerperal patients, alongside various subjective observations aimed at identifying patients with endometritis. The results indicated that sonographic measurements and the overall appearance of the uterus did not significantly differ from those of women who experienced an uncomplicated postpartum period [23]. The findings have several clinical implications. The significant increase in scar thickness among women with endometritis suggests a higher risk of scar-related complications in future pregnancies, such as uterine rupture. Routine sonographic monitoring of scar thickness and endometrial health in women diagnosed with endometritis could be beneficial in early detection and management of potential complications.

CONCLUSION

This study demonstrates that endometritis significantly affects the thickness of C-section scars, indicating impaired healing. The presence of fluid around the endometrium and increased endometrium thickness are additional markers of this adverse effect. These findings underscore the importance of monitoring and managing endometritis promptly to ensure proper uterine healing and reduce the risk of complications in subsequent pregnancies.

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تأثير التهاب بطانة الرحم على سُمك ندبة العملية القيصرية: دراسة باستخدام التصوير بالموجات فوق الصوتية

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الملخص

الخلفية: يُعد التهاب بطانة الرحم حالة التهابية تصيب الطبقة الداخلية للرحم، وغالبًا ما تتجم عن عدوى. وتُعد هذه الحالة من المضاعفات الشائعة بعد الولادة، لا سيما عقب إجراء عملية قيصرية. ويُعتبر سُمك ندبة العملية القيصرية مؤشرًا هامًا لتقييم سلامة الرحم والتنبؤ بمخاطر المضاعفات في الأحمال المستقبلية.

الهدف: دراسة تأثير التهاب بطانة الرحم على سُمك ندبة العملية القيصرية لدى النساء.

المواد والطرق: أُجريت هذه الدراسة كدراسة حالة وشاهد في عيادة الموجات فوق الصوتية بجامعة لاهور في منطقة جرين تاون، لاهور، على مدى 7 أشهر، باستخدام تقنية العينة الميسرة. تم استخدام الفحص بالموجات فوق الصوتية عبر البطن باستخدام مجس منحني عالي التردد (3.5–6 ميغاهيرتز) من نوع Toshiba Xario.

النتائج: كان متوسط سُمك ندبة العملية القيصرية مختلفًا بشكل ملحوظ بين المجموعتين؛ حيث بلغ 2.46 ± 0.54 مم لدى النساء غير المصابات بالتهاب بطانة الرحم، مقابل 5.29 ± 0.80 مم لدى المصابات ($P = 0.000$). لم يكن هناك فرق معنوي في عدد الندبات الظاهرة بالموجات فوق الصوتية بين المجموعتين. كما لوحظ وجود سوائيل حول بطانة الرحم بنسبة أعلى بكثير في مجموعة التهاب بطانة الرحم (45.3%) مقارنة بعدم وجود سوائيل في المجموعة الأخرى ($P = 0.000$). ولم يظهر اختلاف معنوي في عدد العمليات القيصرية السابقة بين المجموعتين ($P = 0.580$). أما مدة إجراء العملية القيصرية، فكانت أقصر بشكل ملحوظ في مجموعة التهاب بطانة الرحم، بمتوسط 2.79 ± 1.22 دقيقة، مقارنة بـ 14.5 ± 6.22 دقيقة في المجموعة الأخرى ($P = 0.000$).

الاستنتاج: تُظهر هذه الدراسة أن التهاب بطانة الرحم يؤثر بشكل كبير على سُمك ندبة العملية القيصرية، مما يشير إلى ضعف في عملية الالتئام. كما أن وجود سوائيل حول بطانة الرحم وزيادة سُمكها يُعدان من المؤشرات الإضافية لهذا التأثير الضار.

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