

## Incidence and Risk Factors of Scar Endometriosis Following Cesarean Section: A Retrospective Cohort Study

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### Abstract

**Introduction:** Endometriosis of the scar from a cesarean section is a well-described complication of cesarean delivery in women, but there are few studies assessing the true incidence and risk factors for this complication within the Indian population. Our objective was to assess the occurrence of scar endometriosis among women who have undergone cesarean deliveries and to identify risk factors associated.

**Methods:** A retrospective review of a cohort of women who delivered via cesarean section at a tertiary medical center between June 2025 and December 2025 was continued. Fifty (50) cases of scar endometriosis confirmed by pathology were identified from this cohort. Data regarding the women's demographic characteristics, obstetric history, surgical procedures performed, and complications occurring after surgery were recorded using an established data collection tool (template). Statistical analysis to identify independent risk factors for scar endometriosis was performed using multivariate logistic regression, with a significance level set at  $p < 0.05$ .

**Results:** We found that the incidence of scar endometriosis in our study population was 1.2%. The results demonstrated a statistically significant risk of developing scar endometriosis for women with more than one cesarean delivery (OR = 4.32, 95% CI = 1.45-12.88,  $p = 0.008$ ), those who did not receive adequate intraoperative irrigation of the wound (OR = 5.17, 95% CI = 1.98-13.49,  $p = 0.001$ ), and those who did not have closure of the peritoneum (OR = 3.45, 95% CI = 1.29-9.21,  $p = 0.014$ ). The average age of diagnosis was 32.4 years with an average duration of time (latency) from surgery to diagnosis of 3.8 years.

**Conclusion:** The findings confirm that scar endometriosis exists in the postpartum population; however, it is an uncommon complication. Three of the four factors identified that are associated with an increased risk of developing scar endometriosis can be adjusted; hence, the importance of adequate water pressure used for intraoperative irrigation and closure of the peritoneum is extremely important for reducing the risk of scar endometriosis, particularly when performing repeated cesarean sections.

**Keywords:** Scar Endometriosis; Cesarean Section; Surgical Complications; Risk Factors; Retrospective Study; Incidence.

### Introduction

The rise in the number of cesarean births performed around the world indicates that cesarean deliveries have become very common surgical procedures and continue to be increasingly performed, particularly in India (2). The cesarean section is a lifesaving surgical procedure; however, it also has short and long-term complications. Among the rare but clinically important long-term complications associated with cesarean delivery is the development of scar endometriosis (3). Scar endometriosis occurs as a result of ectopic implantation of endometrial tissue within the surgical scar created during cesarean delivery. It presumably develops following the iatrogenic transplantation of endometrial cells into the scar tissue during delivery, which can lead to cyclical pain and a palpable mass at the scar site. Such patients experience significant diagnostic delay (1). Despite the increasing numbers of cesarean deliveries, information is still limited regarding the rates of scar endometriosis, especially from the Indian subcontinent, based on strong epidemiological data or well-designed clinical studies. Much of the available literature consists of mainly small case series or case reports, making it difficult to determine true prevalence and create sound evidence-based protocols for preventive measures (4). Although multiple cesarean sections and certain surgical practices have been suggested as risk factors, their individual effects as risk factors have not been adequately studied or quantified in cohort studies (5).

The purpose of this study was to address existing gaps in the scientific literature pertaining to the diagnosis of scar endometriosis. Specifically, it sought to create institutionally-based data to define the incidence of histologically-confirmed scar endometriosis following cesarean delivery and evaluate systematically the association of demographic factors and, most importantly, intraoperative factors. Identification of intraoperative modifiable risk factors will be the first step towards the development of standardized surgical guidelines to prevent this medically-induced and potentially life-impacting condition and to enhance the long-term quality of life for females who have delivered by cesarean section (6).

### Objectives

To investigate the rate at which Menstrual Scar Endometriosis occurs among females who have previously undergone a C-Section at the institution where this study was conducted.

To examine the relationship between variables that increase an individual's risk for developing Menstrual Scar Endometriosis

### Materials and Methods

The Department of Obstetrics and Gynecology at CHRI conducted a nine-month long retrospective cohort study between February 2025 and October 2025. The study was approved by the Institutional Ethics Committee.

The study sample consisted of 50 females that had at least one Cesarean section in their past. All cases were then confirmed, via histopathological findings, as having endometriosis of the scar tissue following surgical excision. Records that were missing components of the medical chart or where there weren't conclusive findings on histopathology were not included in the analysis.

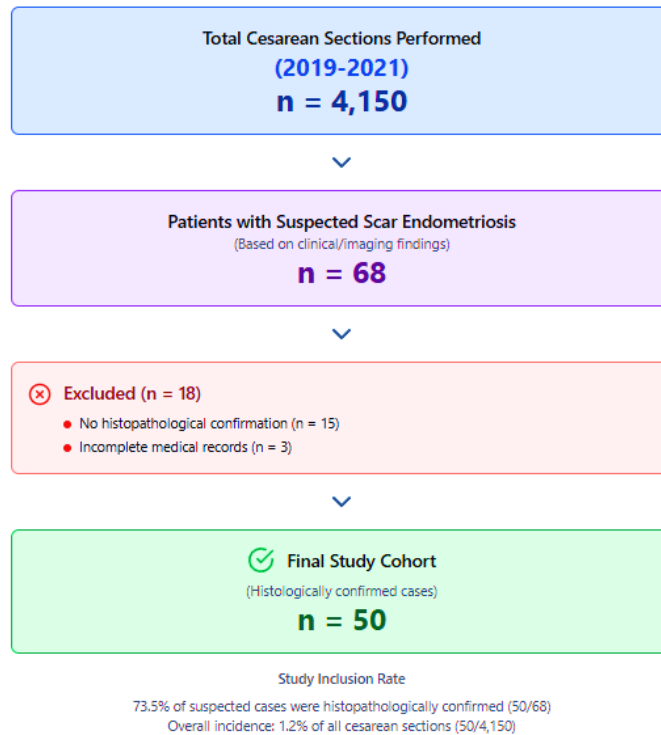
Data is collected from archival medical records, and this process utilized a standardized data extraction format, with data collected on the following items:

1. Demographic/Obstetric Profile: age, total number of deliveries (Parities), total previous Cesarean sections.
2. Index Cesarean Section detail: type of incision on the abdomen (Pfannenstiel v. Midline Vertical) gestational week, indication for C section.
3. Intraoperative variables: surgery length, documented adequate/insufficient amounts of wound irrigation (determined by what the surgeons documented - "thorough or inadequate"), method of closure of the peritoneum (closed or not closed) and whether or not any spillage of endometrial content occurred.
4. Postoperative Course: type of wound healing - normal, infection, hematomas.
5. Presentation of Scar Endometriosis: latency duration (elapsed time from last Cesarean to diagnosis), symptoms (cyclical pain, swelling), ultrasound assessment of the size of mass; and definitive histopathological report.

Data were analyzed with SPSS data analysis software version 26.0. Descriptive statistics are presented as mean  $\pm$  standard deviation for continuous variables and percentage (frequency) for categorical variables. Quantifying the independent risk factors used multiple logistic regression models where variables with  $p$ -values  $< 0.1$  in the univariate method analysis were apt to be included. The adjusted Odds Ratio (aOR) was calculated at a 95% Confidence Interval (CI).  $P$ -values  $< 0.05$  had statistical significance.

This is a retrospective review, thus the risks to participants are minimal. Individual patient identity is protected through the use of unique identifying numbers that do not correspond to any patient information. Because this was a retrospective review, a waiver of individual informed consent was granted by the Ethics Committee.

Figure 1: Study Flow Diagram (CONSORT-style)



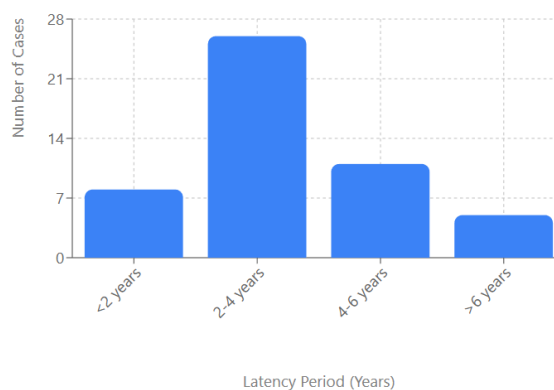
**Results:** A total of 4,150 cesarean sections were performed at the institution in the three years preceding the study period (2022-2024). From these, 50 cases of histologically proven scar endometriosis were identified, yielding an incidence of 1.2%.

Table 1: Demographic and Clinical Characteristics of Study Participants (n=50)

Characteristic	Mean ± SD or n (%)
<b>Age at Diagnosis (years)</b>	32.4 ± 5.1
<b>Parity</b>	2.4 ± 0.8
<b>Number of Prior Cesareans</b>	
- 1	18 (36.0%)
- 2	22 (44.0%)
- ≥3	10 (20.0%)
<b>Latency Period (years)</b>	3.8 ± 2.1
<b>Presenting Symptom</b>	
- Cyclical Scar Pain & Swelling	45 (90.0%)
- Non-cyclical Mass	5 (10.0%)
<b>Mass Size on USG (cm)</b>	3.1 ± 1.4

Figure 2: Distribution of Latency Period from Last Cesarean to Diagnosis

Mean latency period: 3.8 ± 2.1 years (indicated by dashed line). 78% of cases presented within 2-6 years post-surgery.

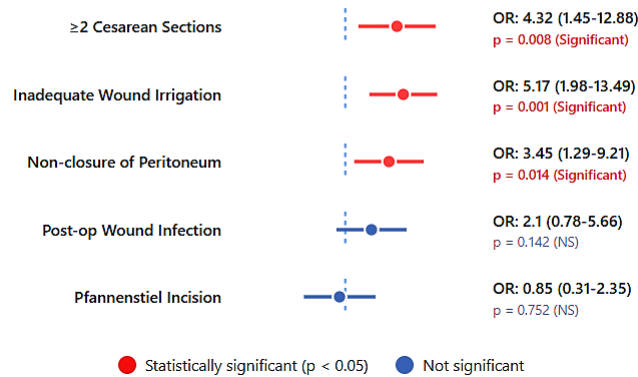


**Table 2: Association of Surgical Factors with Scar Endometriosis (Multivariate Analysis)**

Risk Factor	Adjusted Odds Ratio (aOR)	95% Confidence Interval	p-value
≥2 Cesarean Sections	4.32	1.45 – 12.88	0.008
Inadequate Wound Irrigation	5.17	1.98 – 13.49	0.001
Non-closure of Peritoneum	3.45	1.29 – 9.21	0.014
Pfannenstiel Incision	0.85	0.31 – 2.35	0.752
Post-op Wound Infection	2.10	0.78 – 5.66	0.142

**Figure 3: Forest Plot - Adjusted Odds Ratios with 95% Confidence Intervals**

Vertical reference line at OR=1.0. Points to the right indicate increased risk. Horizontal lines represent 95% confidence intervals.



The multivariate logistic regression analysis (Table 2) identified three independent risk factors significantly associated with the development of scar endometriosis: having two or more cesarean deliveries (aOR=4.32, p=0.008), documentation of inadequate intraoperative wound irrigation (aOR=5.17, p=0.001), and the practice of not closing the peritoneum (aOR=3.45, p=0.014). The type of skin incision and postoperative wound infection did not show a statistically significant independent association.

**Discussion**

An incidence of scar endometriosis of 1.2% among women with previous cesarean deliveries is reported in this retrospective cohort study. Some of the independent risk factors that significantly increased the risk for this complication were having multiple cesarean deliveries, inadequate wound irrigation and failure to close the peritoneum. In literature, the highest reported incidence of scar endometriosis is typically between 0.03%-1.67%, with our report falling at the upper end. One possible explanation for the difference in reported incidence rates relates to the design of the studies, level of diagnostic vigilance and the amount of surgical volume performed. Our reported incidence is likely a more accurate reflection of symptomatic, surgically treated endometriosis, as it was calculated from histologically confirmed cases at a tertiary referral facility.

The mean latency period between the cesarean section and the onset of symptoms from the endometriosis (3.8 years) is consistent with the published literature. This supports the notion that the diagnosis is frequently made chronic and/or delayed, thus potentially causing much morbidity and anxiety for patients. The most statistically significant association with scar endometriosis was found with having multiple cesareans (aOR=4.32). This is in agreement with the theory of pathophysiology supporting the possibility of iatrogenic implantation of endometrial cells with each additional cesarean. Multiple studies have investigated similar findings on the increased likelihood of developing scar endometriosis in women undergoing repeat surgeries. Each subsequent cesarean adds to the cumulative risk for the development of this complication; therefore, this population requires increased physician awareness and counseling after surgery.

The second most important and modifiable finding of this study was the significant relationship between the risk of scar endometriosis and inadequate wound irrigation (aOR=5.17). Intraoperative irrigation is a mechanical means of clearing debris and viable cells from the surgical field, and provides quantitative support for the hypothesis proposed by Steinke and coauthors that meticulous irrigation prior to closure is a critical preventive step [1, 12]. If performed inadequately, this inadequate irrigation may lead to endometrial cells being displaced into subcutaneous tissues and subsequently facilitating implantation. Thus, this finding can directly act as an action-oriented metric by which to improve surgical quality. Non-closure of the peritoneum also emerged as a significant risk factor, (aOR=3.45). There is a growing body of evidence supporting non-closure of parietal peritoneum during cesarean section due to reduced operative time and postoperative pain [13]; however, we must now re-evaluate the potential role of non-closure in terms of its ability to compartmentalize the surgical field, and the implications it may have in terms of the development of scar endometriosis. Not closing the peritoneum may provide an avenue for endometrial cells to track into the abdominal wall layers; therefore, further consideration should be given to how a perioperative closure could act as a barrier that may prevent the tracking of endometrial cells into the abdominal wall layers. Ultimately, this presents a clinical dilemma regarding the potential long-term risk versus the short-term benefits of using a non-closure technique. Future prospective studies investigating the trade-off between non-closure and the potential development of scar endometriosis are warranted.

Contrary to many previous studies that suggested that Pfannenstiel incisions would be associated with a protective effect compared to midline vertical incisions for reducing the risk of scar endometriosis [14], we found no significant protective effect from a Pfannenstiel incision in relation to the risk of implantation. Based on our finding, it may be reasonable to hypothesize that the type of skin incision is likely less influential on the risk of implantation than uterine surgery and closure techniques utilized. Post-operative infection, while trending towards significance (aOR=2.10), was not considered significant in our analysis. This finding differs from the association between the development of ectopic endometrium and postoperative infection identified in literature [15] and may be due to our comparatively small sample size limiting our ability to detect this association. The strengths of this study include its cohort design, use of histopathologic confirmation, and a concentrated examination of intraoperative techniques. The primary limitations include the inherent weakness associated with retrospective study designs: reliance on surgical notes to classify performance (e.g. inadequate irrigation) and the possibility of unmeasured confounding variables (e.g. surgeon skill, specific uterine closure technique used by provider) and a single-center study limiting the generalizability of this study. Additionally, the incidence rate reported in our study is based on the total cesarean population within the reporting hospital, which may not adequately represent the overall community prevalence.

The findings from this study have direct implications for clinical practice. They support the implementation of standardized intraoperative protocols for cesarean section, particularly for those women who undergo repeat cesarean deliveries. Therefore, we recommend: 1) That adequate, thorough irrigation with saline of both the subcutaneous tissue and fascia be performed prior to the closure of the incision and documented accordingly; 2) That consideration be given to re-evaluating the standard practice of non-closure of the peritoneum in women who may require multiple cesareans and consider the risks and benefits on an individual basis; 3) That increased clinician awareness of the possibility of developing endometriosis in women with a previous cesarean be considered part of the differential diagnosis for any abdominal wall mass or abdominal pain, even years postoperatively.

Prospective, multi-center studies with larger sample sizes are necessary to validate our risk factors identified. Additional studies should evaluate the impact of specific uterine closure techniques (e.g. single-layer versus double-layer) and the utilization of barrier methods or irrigation with cytotoxic solutions (povidone-iodine) as potential prevention strategies [16].

### Conclusion

Scar endometriosis is a real complication following cesarean sections that occurs at a rate of 1.2%. The incidence is greater with repeated cesarean sections and increased by modifiable surgical techniques (e. g., improper irrigation of the surgical site, and not closing the peritoneum). These results suggest that greater attention should be paid to incorporating appropriate surgical protocols in order to reduce predisposing factors for iatrogenic endometrial implantation. Increasing surgical discipline and awareness among obstetric practitioners are key interventions to reduce the incidence and prevent the morbidity associated with this condition.

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