



Post-Surgical Wound Infection Suggestive of Histopathologically Confirmed Granulomatous Lesions after Cesarean Section



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Abstract

Background: Post-cesarean surgical wound infections associated with histopathologically confirmed granulomatous lesions are uncommon but clinically significant conditions that present diagnostic and therapeutic challenges, necessitating early recognition to improve patient outcomes. **Objective:** The purpose of the present study was to evaluate the clinical presentation, diagnostic findings, management, and outcomes of post-surgical wound infections suggestive of histopathologically confirmed granulomatous lesions following cesarean section. **Methodology:** This cross-sectional study was conducted in the Department of Gynaecology and Obstetrics, Enam Medical College Hospital, Savar, Dhaka, Bangladesh, from January 2024 to December 2025. The study included women who presented with post-surgical wound infection following cesarean section during the study period. Relevant socio-demographic, clinical, operative, laboratory, and histopathological data were collected using a structured data collection form. Tissue specimens obtained from wound lesions were subjected to histopathological examination to confirm granulomatous lesions. **Results:** A total of 21 patients with post-operative wound lesions were included in the study. The majority of participants were aged 20–30 years (57.1%), had undergone lower uterine cesarean section (LUCS) (85.7%), presented more than 2 years after surgery (66.7%), and had irregular discharge (57.1%). Histopathological examination revealed that granulomatous lesion was the predominant diagnosis in 76.2% of cases, followed by non-specific ulcer (19.0%) and hypertrophic scar (4.8%). Granulomatous lesions were the most frequent diagnosis across all age groups, post-operative durations, discharge types, and surgical procedures. No statistically significant association was observed between histopathological diagnosis and age group ($p=0.622$), post-operative time ($p=0.597$), discharge type ($p=0.582$), or type of surgery ($p=0.747$). These findings indicate that granulomatous inflammation was the predominant pathological lesion irrespective of the patients' clinical characteristics. **Conclusion:** Granulomatous lesion was the predominant histopathological diagnosis in persistent post-operative wound lesions, highlighting the importance of routine histopathological evaluation for accurate diagnosis and appropriate management irrespective of clinical presentation. [*Bangladesh Journal of Infectious Diseases, June 2026;13(1):63-70*]

Keywords: Post-surgical wound infection; histopathologically confirmed; granulomatous lesions; cesarean section

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Introduction

Cesarean section (CS) is one of the most commonly performed surgical procedures worldwide and has contributed substantially to reducing maternal and neonatal morbidity and mortality when medically indicated¹⁻³. In Bangladesh, the rate of cesarean delivery has increased markedly over the past two decades due to improved access to institutional delivery, changing obstetric practices, and increasing maternal preference for operative delivery⁴. Despite its benefits, cesarean section is associated with several post-operative complications, among which surgical site infection (SSI) remains one of the most important causes of maternal morbidity, prolonged hospitalization, repeated surgical interventions, and increased healthcare costs⁵.

Post-surgical wound infection following cesarean section typically presents with pain, erythema, swelling, persistent wound discharge, delayed healing, or sinus formation⁶. Although the majority of these infections respond to conventional antimicrobial therapy and routine wound care, a subset of patients develops chronic or recurrent non-healing wounds despite appropriate treatment. In such cases, the underlying pathology may not be a simple bacterial infection but rather chronic granulomatous inflammation resulting from retained suture material, foreign-body reaction, atypical bacterial infection, mycobacterial infection, fungal infection, or other chronic inflammatory processes⁷. These conditions often mimic routine surgical site infections clinically, making diagnosis challenging without histopathological confirmation.

Granulomatous lesions represent a distinctive chronic inflammatory response characterized by the aggregation of activated macrophages, epithelioid histiocytes, multinucleated giant cells, and surrounding lymphocytes⁸. Histopathological examination remains the gold standard for differentiating granulomatous lesions from non-specific ulcers, hypertrophic scars, neoplastic lesions, and other causes of persistent post-operative wound infection. Early histopathological diagnosis is essential because management strategies differ considerably depending on the underlying etiology, and delayed diagnosis may result in prolonged morbidity and repeated unsuccessful treatment⁹.

In Bangladesh, post-cesarean wound infections continue to pose a significant clinical challenge because of the increasing number of cesarean deliveries, variations in infection prevention

practices, delayed patient presentation, and limited awareness regarding uncommon causes of chronic wound infection¹⁰. However, published data describing the histopathological spectrum of persistent post-cesarean wound lesions, particularly granulomatous inflammation, are scarce. Most available studies focus on the microbiological aspects of surgical site infections, with limited emphasis on histopathological evaluation of chronic non-healing wounds¹¹.

Therefore, the present study was undertaken to evaluate the histopathological patterns of persistent post-surgical wound infections following cesarean section, with particular emphasis on histopathologically confirmed granulomatous lesions, and to assess their association with selected clinical characteristics among patients attending a tertiary care hospital in Bangladesh. The findings of this study are expected to improve understanding of chronic post-cesarean wound pathology and support timely histopathological evaluation for appropriate diagnosis and management.

Methodology

Study Settings and Design: This hospital-based cross-sectional study was conducted in the Department of Obstetrics and Gynaecology, Enam Medical College Hospital, Savar, Dhaka, Bangladesh, over two years from January 2024 to December 2025. The study included patients who presented with post-operative wound lesions following obstetric or gynecological surgical procedures and fulfilled the predefined inclusion criteria.

Study Procedure: Eligible participants were enrolled consecutively during the study period after obtaining informed written consent. Relevant socio-demographic and clinical information was collected using a structured data collection form, and histopathological examination of tissue specimens was performed to establish the final diagnosis. The collected data were analyzed to determine the clinical and histopathological characteristics of post-operative wound lesions and their association with selected patient-related factors.

Statistical Analysis: Statistical analysis was performed using Windows-based software named as Statistical Package for Social Science (SPSS), version 22.0 (IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.). Continuous data were expressed as mean, standard deviation, minimum and maximum. Categorical data were summarized in terms of frequency counts

and percentages. Chi-square test was used for comparison of categorical variables and Student t test was applied for continuous variables. Every effort was made to obtain missing data. A two-sided P value of less than 0.05 was considered to indicate statistical significance.

Ethical Consideration: All procedures of the present study were carried out in accordance with the principles for human investigations (i.e., Helsinki Declaration 2013) and also with the ethical guidelines of the Institutional Research Ethics. Formal ethics approval was granted by the local ethics committee. Participants in the study were informed about the procedure and purpose of the study and confidentiality of information provided. All participants consented willingly to be a part of the study during the data collection periods. All data were collected anonymously and were analyzed using the coding system.

Results

A total number of 21 patients were recruited for this study after fulfilling the inclusion and exclusion criteria. Table 1 presents the age distribution of the study participants. The majority of patients were aged 20 to 30 years, comprising 12 (57.1%) of the total study population. Patients aged more than 30 years accounted for 6 (28.6%) cases, while those aged less than 20 years represented the smallest group, with 3 (14.3%) cases. Overall, more than half of the participants belonged to the 20 to 30 years age group, indicating that post-operative wound lesions were most frequently observed among young adults in this study.

Table 1: Distribution of Study Population according to Age Group

Age Group	Frequency	Percent
Less Than 20 Years	3	14.3
20 to 30 Years	12	57.1
More Than 30 Years	6	28.6
Total	21	100.0

Figure I illustrates the distribution of the types of previous surgery among the study participants. The majority of patients had undergone Lower Uterine Cesarean Section (LUCS), accounting for 18 (85.7%) of the total cases. In contrast, only 3 (14.3%) patients had a history of Total Abdominal Hysterectomy (TAH). The figure demonstrates that LUCS was by far the most common surgical procedure associated with the post-operative wound lesions in this study, representing more than five times the number of TAH cases.

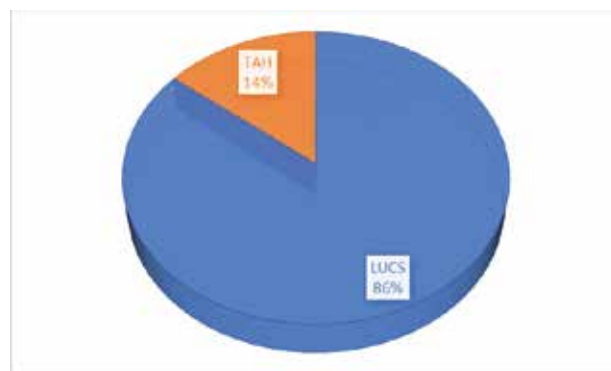


Figure I: Showing the Types of Surgery

Table 2 shows the distribution of patients according to the duration since the operative procedure. The majority of the study participants, 14 (66.7%), presented with post-operative wound complications more than 2 years after surgery, whereas 7 (33.3%) patients presented within 2 years of the operative procedure. Overall, approximately two-thirds of the patients experienced delayed post-operative presentation beyond two years, while one-third presented within the first two years following surgery.

Table 2: Distribution of Study Population according to Post-Operative Time

Post-Operative Time	Frequency	Percent
Less Than 2 Years	7	33.3
More Than 2 Years	14	66.7
Total	21	100.0

Table 3 presents the distribution of discharge types among the study participants. Irregular discharge was the most common clinical presentation, occurring in 12 (57.1%) patients. This was followed by chronic discharge, which was observed in 7 (33.3%) patients. Non-healing ulcer was the least common presentation, identified in 2 (9.5%) patients. Overall, more than half of the patients presented with irregular discharge, while approximately one-third had chronic discharge and fewer than one-tenth presented with a non-healing ulcer.

Table 3: Distribution of Study Population according to Discharge Type

Discharge Type	Frequency	Percent
Chronic Discharge	7	33.3
Irregular Discharge	12	57.1
Non-Healing Ulcer	2	9.5
Total	21	100.0

Figure II illustrates the distribution of histopathological diagnoses among the 21 study participants. Granulomatous lesion was the most common histopathological finding, accounting for 76.2% (16/21) of all cases. This was followed by non-specific ulcer, which constituted 19.0% (4/21) of the cases. Hypertrophic scar was the least frequent diagnosis, observed in only 4.8% (1/21) of the study population. The figure demonstrates that granulomatous lesions comprised more than three-quarters of all histopathological diagnoses, indicating that they were the predominant pathological finding among patients with post-operative wound lesions.

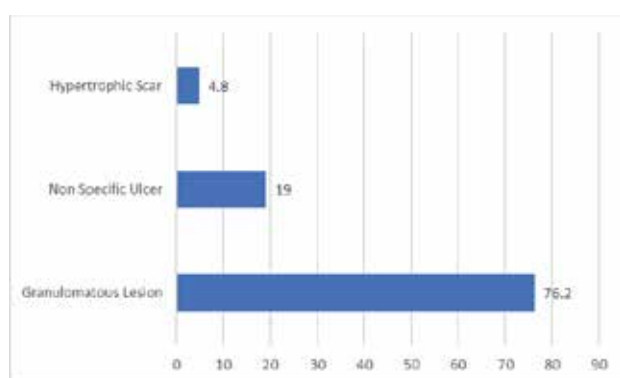


Figure II: Histopathological Diagnosis

Table 4 shows the association between histopathological diagnosis and selected clinical characteristics of the study participants. Overall, granulomatous lesion was the predominant histopathological finding, observed in 16(76.2%) cases, followed by non-specific ulcer in 4 (19.0%) cases and hypertrophic scar in 1 (4.8%) case. According to age group, among patients aged less than 20 years (n=3), granulomatous lesions were identified in 2(66.7%) cases and non-specific ulcers in 1(33.3%) case. In the 20 to 30 years age group (n=12), granulomatous lesions accounted for 10 (83.3%) cases, while non-specific ulcer and hypertrophic scar were each found in 1 (8.3%) case. Among patients aged more than 30 years (n=6), granulomatous lesions were present in 4 (66.7%) cases and non-specific ulcers in 2 (33.3%) cases. No statistically significant association was observed between age group and histopathological diagnosis ($p=0.622$). Regarding post-operative time, among patients presenting within less than 2 years after surgery (n=7), granulomatous lesions were found in 5 (71.4%) cases and non-specific ulcers in 2 (28.6%) cases. Among those presenting more than 2 years after surgery (n=14), granulomatous lesions were identified in 11 (78.6%) cases, non-specific ulcers in 2 (14.3%) cases, and hypertrophic scar in 1 (7.1%) case. The association between post-operative time and histopathological diagnosis

Table 4: Association of Histopathological Diagnosis with Different Variables

Variables	Histopathological Diagnosis			Total	P value
	Granulomatous Lesion	Non-Specific Ulcer	Hypertrophic Scar		
Age Group					
Less Than 20 Years	2(66.7%)	1(33.3%)	0(0.0%)	3(100.0%)	0.622
20 to 30 Years	10(83.3%)	1(8.3%)	1(8.3%)	12(100.0%)	
More Than 30 Years	4(66.7%)	2(33.3%)	0(0.0%)	6(100.0%)	
Total	16(76.2%)	4(19.0%)	1(4.8%)	21(100.0%)	
Post-Operative Time					
Less Than 2 Years	5(71.4%)	2(28.6%)	0(0.0%)	7(100.0%)	0.597
More Than 2 Years	11(78.6%)	2(14.3%)	1(7.1%)	14(100.0%)	
Total	16(76.2%)	4(19.0%)	1(4.8%)	21(100.0%)	
Discharge Type					
Chronic Discharge	5(71.4%)	1(14.3%)	1(14.3%)	7(100.0%)	0.582
Irregular Discharge	9(75.0%)	3(25.0%)	0(0.0%)	12(100.0%)	
Non-Healing Ulcer	2(100.0%)	0(0.0%)	0(0.0%)	2(100.0%)	
Total	16(76.2%)	4(19.0%)	1(4.8%)	21(100.0%)	
Type Surgery					
LUCS	14(77.8%)	3(16.7%)	1(5.6%)	18(100.0%)	0.747
TAH	2(66.7%)	1(33.3%)	0(0.0%)	3(100.0%)	
Total	16(76.2%)	4(19.0%)	1(4.8%)	21(100.0%)	

was not statistically significant ($p=0.597$). With respect to discharge type, granulomatous lesions were observed in 5 (71.4%) of patients with chronic discharge, 9 (75.0%) of those with irregular discharge, and all 2 (100.0%) patients presenting with a non-healing ulcer. Non-specific ulcers were detected in 1 (14.3%) patient with chronic discharge and 3 (25.0%) patients with irregular discharge, whereas the only hypertrophic scar was found among patients with chronic discharge (1, 14.3%). There was no significant association between discharge type and histopathological diagnosis ($p=0.582$). According to the type of surgery, among patients who underwent lower uterine cesarean section (LUCS) ($n=18$), granulomatous lesions were present in 14 (77.8%) cases, non-specific ulcers in 3 (16.7%) cases, and hypertrophic scar in 1 (5.6%) case. Among patients who underwent total abdominal hysterectomy (TAH) ($n=3$), granulomatous lesions were observed in 2 (66.7%) cases and non-specific ulcers in 1 (33.3%) case. No statistically significant association was found between the type of surgery and histopathological diagnosis ($p=0.747$).

Discussion

In the present study, a total of 21 patients with post-operative wound lesions were included, and the majority of the participants (57.1%) were aged 20 to 30 years, followed by those aged more than 30 years (28.6%) and less than 20 years (14.3%). This age distribution likely reflects the reproductive age group in which obstetric and gynecological surgeries, particularly lower uterine cesarean section (LUCS), are most frequently performed. As a result, women in this age group may have a greater likelihood of developing post-operative wound-related complications requiring histopathological evaluation. The predominance of patients aged 20 to 30 years is consistent with several studies¹¹⁻¹³ conducted in obstetric populations, where most women undergoing cesarean section or other gynecological procedures were within the second and third decades of life. Similar findings have been reported by studies from South Asian countries¹⁴⁻¹⁵, including Bangladesh and India, where the highest frequency of post-cesarean wound complications occurred among women aged 20 to 30 years due to the higher rate of childbirth in this age group.

In contrast, some studies from developed countries have reported a relatively higher mean age of affected patients, often ranging from 30 to 40 years. This difference may be attributed to delayed childbearing, increasing maternal age at first pregnancy, and

differences in obstetric practices and healthcare-seeking behavior. Additionally, studies involving post-operative wound lesions following non-obstetric gynecological surgeries have reported older patient populations because procedures such as hysterectomy are more commonly performed in women over 40 years of age¹¹.

The observed differences in age distribution between studies may also be explained by variations in study design, sample size, inclusion criteria, and the types of surgical procedures evaluated. Since the present study predominantly included patients with previous LUCS, the concentration of participants in the 20 to 30 years age group is expected and reflects the demographic profile of women undergoing obstetric surgery in Bangladesh⁵. Therefore, the findings of the present study are comparable with reports from similar obstetric settings while differing from studies that included predominantly gynecological or mixed surgical populations.

In the present study, granulomatous lesion was the predominant histopathological diagnosis, accounting for 76.2% (16/21) of all cases, followed by non-specific ulcer (19.0%) and hypertrophic scar (4.8%). The predominance of granulomatous lesions indicates that chronic inflammatory reactions, most commonly related to retained suture material, foreign-body reaction, chronic infection, or delayed wound healing, represent the major pathological process underlying persistent post-operative wound lesions¹⁵. These findings emphasize the importance of histopathological examination in establishing the definitive diagnosis of chronic non-healing surgical wounds.

The predominance of granulomatous lesions observed in the present study is comparable with several published studies^{7,11,15} evaluating chronic post-operative wound lesions and stitch sinus, where foreign-body granuloma or suture granuloma was identified as the most frequent histopathological diagnosis. Previous investigators have reported that retained non-absorbable suture materials, chronic inflammatory responses, and low-grade bacterial infections frequently result in granulomatous inflammation, making it the most common pathological finding in persistent post-operative wounds. Similar observations have also been reported in studies of post-cesarean section abdominal wall lesions, in which chronic granulomatous inflammation constituted the majority of excised lesions.

In contrast, some studies have reported hypertrophic scar or keloid formation as the predominant histopathological diagnosis, particularly among

patients presenting primarily with cosmetic scar abnormalities rather than persistent wound discharge or sinus formation¹⁶. Other investigators have found a higher frequency of non-specific chronic inflammatory ulcers or infectious lesions, especially in populations with delayed presentation, poorly controlled diabetes, or a high prevalence of tuberculosis and actinomycosis. These differences may be attributed to variations in patient selection, underlying etiology, surgical procedures, local infection rates, and the criteria used for histopathological classification.

The relatively low proportion of hypertrophic scar (4.8%) in the present study differs from studies conducted in dermatologic and plastic surgery settings, where hypertrophic scars are more commonly encountered because patients usually seek treatment for cosmetic concerns. In contrast, the current study included patients presenting with persistent discharge and non-healing wounds, conditions that are more likely to reflect chronic inflammatory or granulomatous pathology than simple scar formation. Similarly, the proportion of non-specific ulcer (19.0%) observed in this study is comparable to reports in which chronic ulcers represented a smaller proportion of post-operative wound lesions after exclusion of malignant and specific infectious causes. However, studies involving larger numbers of chronic surgical wounds have occasionally demonstrated a greater prevalence of non-specific ulcers, particularly in elderly patients or those with vascular insufficiency and multiple comorbidities¹³.

In the present study, granulomatous lesion was the predominant histopathological diagnosis, accounting for 76.2% of all cases, followed by non-specific ulcer (19.0%) and hypertrophic scar (4.8%). The predominance of granulomatous lesions suggests that chronic inflammatory processes remain the principal pathological finding in persistent post-operative wound lesions. Similar observations have been reported in previous studies investigating chronic non-healing surgical wounds, stitch sinus, and foreign body granulomas, where granulomatous inflammation was identified as the most frequent histopathological pattern¹¹. These lesions are generally attributed to retained suture material, chronic infection, foreign body reaction, or delayed wound healing.

Although granulomatous lesions were more frequently observed among patients aged 20-30 years (83.3%) than among those aged less than 20 years or more than 30 years (66.7% each), the association

between age and histopathological diagnosis was not statistically significant ($p=0.622$). This finding is comparable to previous reports demonstrating that histopathological characteristics of chronic post-operative wound lesions are largely independent of patient age. However, some investigators have reported an increased frequency of chronic inflammatory lesions among older patients, possibly because of age-related impairment of wound healing, multiple comorbidities, and prolonged inflammatory responses¹⁷. The discrepancy may be explained by differences in study populations, sample size, and the predominance of younger women undergoing obstetric surgery in the present study.

The duration between surgery and presentation also showed no significant association with histopathological diagnosis ($p=0.597$). Granulomatous lesions remained the predominant diagnosis in both patients presenting within two years (71.4%) and those presenting after more than two years (78.6%). Similar findings have been described in studies reporting that retained suture granulomas and chronic inflammatory lesions may develop months or even several years after surgery. Conversely, some studies have suggested that prolonged post-operative duration is associated with a higher incidence of foreign body granulomas and chronic sinus formation¹⁵. Such differences may reflect variations in suture materials, surgical techniques, infection control measures, and the timing of patient presentation.

About clinical presentation, granulomatous lesions predominated across all discharge types, including chronic discharge (71.4%), irregular discharge (75.0%), and non-healing ulcer (100%), with no statistically significant association ($p=0.582$). Similar findings have been reported in studies of chronic surgical site lesions, where persistent discharge was considered a common manifestation of granulomatous inflammation rather than a reliable predictor of a specific histopathological diagnosis. In contrast, a few studies have found that non-healing ulcers are more frequently associated with malignancy or specific chronic infections such as tuberculosis or actinomycosis^{12,16}. The absence of such findings in the present study may be related to the relatively small sample size and the predominance of benign inflammatory lesions.

The type of previous surgery also showed no significant relationship with histopathological diagnosis ($p=0.747$). Granulomatous lesions were the most common diagnosis following both lower uterine cesarean section (77.8%) and total abdominal

hysterectomy (66.7%). This finding is consistent with studies indicating that chronic granulomatous inflammation is more closely related to factors such as retained suture material, foreign body reaction, and chronic infection than to the type of surgical procedure itself. However, some authors have reported a higher incidence of post-operative granulomas following cesarean section because of the greater number of obstetric procedures performed and the use of non-absorbable or delayed-absorbable suture materials¹⁵. Differences in surgical volume, operative techniques, suture materials, and institutional protocols may explain the variations observed among different studies.

Overall, the present findings indicate that granulomatous inflammation is the predominant histopathological diagnosis irrespective of age, duration after surgery, discharge characteristics, or type of surgery, and none of these clinical variables demonstrated a statistically significant association with histopathological outcome. These findings support previous evidence that histopathological examination remains essential for the definitive diagnosis of persistent post-operative wound lesions, as clinical features alone are insufficient to reliably predict the underlying pathology.

Conclusion

Granulomatous lesion was the most common histopathological diagnosis among patients with persistent post-operative wound lesions following obstetric and gynecological surgery. Most patients were young adults aged 20–30 years, had undergone lower uterine cesarean section, and presented more than two years after surgery with irregular wound discharge. No significant association was found between histopathological diagnosis and age group, post-operative duration, discharge type, or type of surgery. These findings highlight the importance of histopathological examination for the accurate diagnosis of chronic post-operative wound lesions, as clinical characteristics alone are insufficient to predict the underlying pathology. Early recognition and appropriate pathological evaluation may facilitate timely management and improve patient outcomes.

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Conflict of interest:

The authors declare that there is no conflict of interest regarding the publication of this study.

Financial Disclosure

None.

Authors' contributions

Khanum T, Shirin A, Begum M contribution in methodology, sample collection, and laboratory work; Begum M, Shamima MTN, Nupur RP, Nasrin R: Supervision, Formal Analysis, Writing – Review & Editing. All the authors approved the final manuscript.

Data Availability

Any questions regarding the availability of the study's supporting data should be addressed to the corresponding author, who can provide it upon justifiable request.

Ethics Approval and Consent to Participate

The Institutional Review Board granted the study ethical approval. Since this was a cross-sectional study, every study participant provided formal informed consent. Each method followed the appropriate rules and regulations.

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