

Seasonal Factors Associated with Surgical Site Infections Following Gynecologic and Obstetric Surgeries and Pathogen Identification: A Retrospective Study in A Single Center in China

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Background: Surgical site infections (SSIs) are one of the commonly reported nosocomial infections. Previous studies of SSI prevention have focused on patient characteristics. Relevant studies that consider both patient characteristics and seasonality are rare. This study investigated the independent risk factors associated with surgical site infections in patients undergoing gynecologic and obstetric surgeries in different seasons to determine whether the results showing increases in SSIs by season could be reproduced.

Methods: Medical records of 185 patients with SSIs among 201,912 patients who underwent gynecologic and obstetric surgeries at a hospital in southwestern China from September 2013 to June 2021 were analyzed. Univariate and multivariate logistic regression analyses were performed to identify factors associated with SSIs in patients undergoing gynecologic and obstetric surgeries in different seasons.

Results: Heart disease and the amount of intraoperative blood loss were the suspicious seasonal factors associated with SSIs. SSIs were more likely to occur in the patients with intraoperative blood loss ≥ 500 mL in spring and winter but were more likely to occur in the patients with intraoperative blood loss < 500 mL in autumn.

Conclusion: More attention should be paid to maintaining patient temperature during surgery, improving surgical skills, and standardizing aseptic techniques to prevent SSIs.

Keywords: gynecologic surgical procedures, obstetric surgical procedures, surgical wound infection, seasons

Introduction

Surgical site infections (SSIs) are the most common nosocomial infections in patients undergoing gynecologic and obstetric surgeries. SSIs increase patient discomfort, prolong hospital stays, and raise healthcare costs.^{1,2} Anderson et al³ reported that SSIs occurred in 2–5% of surgical procedures, accounting for 20% of nosocomial infections. Chen et al⁴ found that SSIs occurred in 3.79% of surgical procedures. Fu et al⁵ showed that SSIs represent the highest proportion of nosocomial infections in gynecologic and obstetric hospitals. Seasonal factors are a significant risk factor for SSIs.⁶ Previous studies have found that seasonality has a greater impact than age, duration of surgery, length of hospital stay, body mass index, or smoking.^{7,8} However, the impact of seasonality on SSIs varies across regions despite similar seasons, temperatures, and humidity.⁹ Anthony et al^{10,11} noted that SSIs correlate with temperature and weather, with the highest incidence in August and the lowest in January, accompanied by a high SSI incidence in total knee and hip arthroplasty in summer. Hu et al¹² reported high SSI incidence in orthopedic surgeries during summer and autumn. While previous studies on SSI prevention have focused on patient characteristics, research combining patient characteristics and seasonality is rare.¹³ This study investigated the incidences of SSIs in patients before, during, and after surgeries under the influence of seasonality.

This study was conducted at a tertiary grade-A obstetrics and gynecology hospital in southwestern China. It aimed to evaluate independent risk factors for SSIs associated with seasonal factors in 185 cases from September 2013 to June 2021.

Materials and Methods

Ethics Approval

This study was approved by the Medical Ethics Committee of the West China Second University Hospital, Sichuan University [2022 Medical Scientific Research for Ethical Approval No. (135)]. Verbal informed consent to participate in this study was obtained from all participants before data collection. The Medical Ethics Committee of West China Second University Hospital, Sichuan University approved the verbal informed consent procedure for this study.

Study Participants

This was a retrospective study involving 185 patients who developed SSIs following gynecologic and obstetric surgeries at a tertiary grade-A obstetrics and gynecology hospital in southwestern China from September 2013 to June 2021. Their average age was 45.40 ± 12.13 years.

The inclusion criteria were as follows: (1) patients who underwent abdominal, transvaginal, or laparoscopic surgery (including single-port laparoscopic surgery) to treat gynecologic tumors, teratomas, multiple uterine fibroids, or chocolate cysts, and (2) patients who underwent cesarean section due to poor fetal conditions or conditions unsuitable for vaginal delivery.

The exclusion criteria were as follows: (1) patients who underwent transvaginal cervical or hysteroscopic surgery for gynecologic diseases, (2) patients who underwent surgeries involving the intestines, (3) patients who underwent episiotomy and suturing during vaginal delivery, (4) patients with an infection prior to surgery, (5) patients hospitalized for more than 30 days, (6) patients admitted for a second surgery, and (7) patients with an SSI occurring 30 days after admission to an intensive care unit for non-gynecologic or non-obstetric conditions.

Criteria for Surgical Site Infections and Wound Healing

The Identifying Criteria for Nosocomial Infections (Tentative), issued by the Ministry of Health of China, classifies infections in superficial incisions, deep incisions, or organ/space within 30 days post-surgery, or in deep incisions or organ/space within one-year post-implant surgery, as SSIs.¹⁴ Surgical wound healing was evaluated as follows:¹⁵

Grade A: The incision healed well with no adverse reactions.

Grade B: The incision healed poorly, with defects but no suppuration.

Grade C: Pus appeared in the incision, which was left open or opened to remove pus.

Monitoring Indicators

The following indicators were monitored to determine possible factors for SSIs associated with seasonal changes:

- (1) Before surgery: age, length of hospital stay, body mass index, white blood cell count, hemoglobin count, presence of heart disease, hypertension, diabetes mellitus, cancer, malnutrition or anemia, wound classification, National Nosocomial Infections Surveillance (NNIS) system risk index, chemotherapy treatment, prior laparotomy, and skin preparation.
- (2) During surgery: surgical approach, type of surgery, type of anesthesia, blood transfusion, duration of surgery, and amount of blood loss.
- (3) After surgery: presence of a surgical drain, delayed wound closure with suture, and type of SSI.

In this study, spring spanned January to March, summer from April to June, autumn from July to September, and winter from October to December.

Data Collection

Data were collected from patients' medical records by researchers with over 7 years of clinical experience in obstetrics and gynecology and over 6 years in nosocomial infection control. Patients were informed of the study's purpose before data collection. Surgical incision drainage samples were inoculated on blood agar, MacConkey agar, and Sabouraud agar plates (Guangzhou Detgerm Microbiological Science Ltd., China), incubated at approximately 35 °C with 5% CO₂ and 15% O₂ in a FORMA 3111 CO₂ incubator. Bacterial isolation and culture followed the Guidelines on Clinical Laboratory Procedures of China. Pathogenic bacteria were identified using a VITEK[®] 2 Compact System mass spectrometer (BioMérieux, France).

Statistical Analysis

IBM SPSS Statistics 23.0 was used for data analysis. The Chi-square test was used for categorical variables in univariate analysis. Normality tests were performed on continuous numerical variables, with normally distributed variables analyzed using a one-way analysis of variance and non-normally distributed variables using a non-parametric k independent-sample test. Multivariate analysis was conducted for factors with $P < 0.01$. Multivariate logistic regression analyzed seasonal factors, with statistical significance set at $P < 0.05$.

Results

Distribution of Patients with SSIs

Of the 201,912 patients who underwent gynecologic and obstetric surgeries at the hospital from September 2013 to June 2021, 938 (0.46%) developed nosocomial infections. Of these, 254 (27.08%) had SSIs, the largest proportion of infections in patients undergoing gynecologic and obstetric surgeries. A total of 185 cases who met all inclusion criteria and did not meet any exclusion criteria were included. Of these, 167 underwent elective surgeries and 18 (15 obstetrics, 3 gynecologic) underwent emergency surgeries. Incision types included vertical (130), transverse (33), perineal (3), vulvar (11), endoscopic (4), oblique (3), and splayed (1). The median length of hospital stay was 20 days (interquartile range: 16–26), and the median time to SSI development was 7 days (interquartile range: 5–10). Surgical approaches included abdominal (164, 88.65%), transvaginal (11, 5.41%), and laparoscopic (10, 5.95%), including 3 single-port laparoscopic surgeries. SSI types were superficial incisional (168, 90.81%), deep incisional (13, 7.03%), and organ/space (4, 2.16%), with 1 case of superficial incisional SSI with bacteremia and 1 case of deep incisional SSI with urinary tract infection. Signs of SSIs included redness (or warmth), bleeding, odorous fluid, or pus, with necrotic tissue and cavities in severe cases and fever in some. Wound healing grades were A (109, 58.92%), B (68, 36.76%), and C (8, 4.32%) (Table 1).

Table 1 Distribution of Patients with Surgical Site Infections in Different Seasons (n = 185)

| | Spring | Summer | Autumn | Winter |
|--|-----------------|-----------------|-----------------|-----------------|
| Departments | | | | |
| Gynecology | 18.79% (31/165) | 24.85% (41/165) | 28.48% (46/165) | 28.48% (47/165) |
| Obstetrics | 10% (2/20) | 25% (5/20) | 30% (6/20) | 35% (7/20) |
| Surgical approaches | | | | |
| Laparoscopic surgery | 6.06% (2/33) | 10.42% (5/48) | 3.84% (2/52) | 1.92% (1/52) |
| Abdominal surgery | 93.94% (31/33) | 83.33% (40/48) | 84.62% (44/52) | 94.23% (49/52) |
| Transvaginal surgery | 0.00% (0/33) | 6.25% (3/48) | 11.54% (6/52) | 3.85% (2/52) |
| Types of surgical site infections | | | | |
| Superficial incisional | 87.88% (29/33) | 87.50% (42/48) | 88.46% (46/52) | 98.08% (51/52) |
| Organ/space | 0.00% (0/33) | 4.17% (2/48) | 3.85% (2/52) | 0.00% (0/52) |
| Deep incisional | 9.09% (4/33) | 8.33% (4/48) | 7.69% (4/52) | 1.92% (1/52) |

(Continued)

Table 1 (Continued).

| | Spring | Summer | Autumn | Winter |
|-----------------------------|----------------|----------------|----------------|----------------|
| Wound healing grades | | | | |
| Grade A | 57.58% (19/33) | 64.58% (31/48) | 57.69% (30/52) | 55.77% (29/52) |
| Grade B | 42.42% (14/33) | 33.33% (16/48) | 34.62% (18/52) | 38.46% (20/52) |
| Grade C | 0.00% (0/33) | 2.08% (1/48) | 7.69% (4/52) | 5.77% (3/52) |

Pathogen Distribution in Patients with SSIs

Of the 185 patients, 1 had alleviated SSI symptoms after physical therapy, so her wound drainage was not sampled. Drainage samples from 184 patients yielded 196 pathogenic bacteria. One sample had no detectable pathogenic bacteria, and 13 samples contained two co-existing bacteria. Detected bacteria included *Staphylococcus epidermidis* (27.04%), *Enterococcus faecalis* (16.33%), *Escherichia coli* (14.29%), *Staphylococcus aureus* (11.73%), *Pseudomonas aeruginosa* (8.16%), Coagulase-negative staphylococci (4.59%), and *Klebsiella pneumoniae* (3.06%). Two drug-resistant *Staphylococcus aureus* strains were detected (Table 2).

Univariate Analysis

Univariate analysis of all monitoring indicators showed heart disease and intraoperative blood loss as potential factors associated with SSIs, with statistical significance at $P < 0.01$ (Table 3).

Multivariate Logistic Regression Analysis

Multivariate logistic regression analysis was performed for suspicious risk factors for SSIs associated with seasonality. A statistically significant difference was determined at $P < 0.05$ (Table 4).

For SSIs, which were more likely in spring than autumn, patients with intraoperative blood loss ≥ 500 mL had a 2.640 times higher likelihood of SSIs compared to those with < 500 mL (95% confidence interval: 1.055–6.609). Patients with ≥ 500 mL blood loss were more likely to develop SSIs in spring, not autumn, while those with < 500 mL were more likely in autumn, not spring. The amount of intraoperative blood loss was associated with SSI incidences in spring and autumn. For SSIs more likely in winter than autumn, patients with ≥ 500 mL blood loss had a 2.567 times higher likelihood of SSIs compared to those with < 500 mL (95% confidence interval: 1.132–5.818). Patients with ≥ 500 mL blood loss were more

Table 2 Pathogen Distribution in Patients with Surgical Site Infections

| Pathogenic Bacteria | n | % |
|---------------------------------------|-----|--------|
| <i>Staphylococcus epidermidis</i> | 53 | 27.04 |
| <i>Enterococcus faecalis</i> | 32 | 16.33 |
| <i>Escherichia coli</i> | 28 | 14.29 |
| <i>Staphylococcus aureus</i> | 23 | 11.73 |
| <i>Pseudomonas aeruginosa</i> | 16 | 8.16 |
| Coagulase-negative staphylococci | 9 | 4.59 |
| <i>Klebsiella pneumoniae</i> | 6 | 3.06 |
| <i>Enterobacter aerogenes</i> | 5 | 2.55 |
| <i>Staphylococcus lugdunensis</i> | 4 | 2.04 |
| <i>Monilia albican</i> | 3 | 1.53 |
| <i>Morganella morganii</i> subspecies | 2 | 1.02 |
| <i>Proteus mirabilis</i> | 2 | 1.02 |
| <i>Enterobacter cloacae</i> | 2 | 1.02 |
| Other | 11 | 5.61 |
| Total | 196 | 100.00 |

Table 3 Univariate Analysis of Possible Risk Factors for Surgical Site Infections Associated with Seasonality

| Possible factors | | Chinese New Year | Summer | Autumn | Winter | χ^2 | P |
|---|----------------------|---------------------------|------------------------|------------------------|---------------------------|----------|--------|
| Age ^Δ | | 45.42 ± 12.248 | 45.35 ± 12.591 | 45.23 ± 12.695 | 45.6 ± 11.371 | 0.008 | 0.999 |
| Length of hospital stay [#] | | 20.00 (16.50–26.5) | 20.00 (15.00–25.75) | 20.00 (15.00–26.75) | 20.50 (17.00–28.00) | 1.045 | 0.790 |
| Body mass index [#] | | 25.39 (22.84–27.12) | 24.34 (22.44–26.97) | 24.19 (21.64–26.80) | 23.98 (21.65–27.01) | 0.772 | 0.856 |
| Preoperative white blood cell count [#] | | 6.30 (5.10–7.85) | 7.05 (5.83–8.67) | 6.60 (5.30–8.38) | 7.20 (5.93–8.67) | 4.988 | 0.173 |
| Preoperative hemoglobin count [#] | | 129.00 (112.50–136.00) | 129 (113.00–136.75) | 127 (113.00–134.75) | 128.50 (121.00–137.75) | 3.209 | 0.361 |
| Heart disease | Yes | 0 (0%) | 1 (20%) | 4 (80%) | 0 (0%) | 7.354 | 0.061* |
| | No | 33 (18.33%) | 47 (26.11%) | 48 (26.67%) | 52 (28.89%) | | |
| Hypertension | Yes | 3 (10.71%) | 6 (21.43%) | 13 (46.43%) | 6 (21.43%) | 5.662 | 0.129 |
| | No | 30 (19.11%) | 42 (26.75%) | 39 (24.84%) | 46 (29.3%) | | |
| Diabetes mellitus | Yes | 2 (11.11%) | 3 (16.67%) | 7 (38.89%) | 6 (33.33%) | 2.186 | 0.535 |
| | No | 31 (18.56%) | 45 (26.95%) | 45 (26.95%) | 46 (27.54%) | | |
| Cancer | Yes | 25 (20.66%) | 30 (24.79%) | 30 (24.79%) | 36 (29.75%) | 3.446 | 0.328 |
| | No | 8 (12.5%) | 18 (28.13%) | 22 (34.38%) | 16 (25%) | | |
| Malnutrition | Yes | 0 (0%) | 2 (100%) | 0 (0%) | 0 (0%) | 5.771 | 0.123 |
| | No | 33 (18.03%) | 46 (25.14%) | 52 (28.42%) | 52 (28.42%) | | |
| Anemia | Yes | 5 (25%) | 4 (20%) | 8 (40%) | 3 (15%) | 3.449 | 0.327 |
| | No | 28 (16.97%) | 44 (26.67%) | 44 (26.67%) | 49 (29.7%) | | |
| Preoperative wound classification | Class I | 2 (50%) | 1 (25%) | 1 (25%) | 0 (0%) | 7.289 | 0.295 |
| | Class II | 31 (17.82%) | 46 (26.44%) | 47 (27.01%) | 50 (28.74%) | | |
| | Class III | 0 (0%) | 1 (14.29%) | 4 (57.14%) | 2 (28.57%) | | |
| National Nosocomial Infections Surveillance system risk index | Scored 0 | 12 (15.38%) | 21 (26.92%) | 20 (25.64%) | 25 (32.05%) | 3.161 | 0.958 |
| | Scored 1 | 15 (20%) | 21 (28%) | 21 (28%) | 18 (24%) | | |
| | Scored 2 | 5 (20%) | 5 (20%) | 8 (32%) | 7 (28%) | | |
| | Scored 3 | 1 (14.29%) | 1 (14.29%) | 3 (42.86%) | 2 (28.57%) | | |
| Preoperative chemotherapy | Yes | 10 (28.57%) | 6 (17.14%) | 9 (25.71%) | 10 (28.57%) | 4.169 | 0.244 |
| | No | 23 (15.33%) | 42 (28%) | 43 (28.67%) | 42 (28%) | | |
| Prior laparotomy | Yes | 10 (20.83%) | 11 (22.92%) | 16 (33.33%) | 11 (22.92%) | 1.806 | 0.614 |
| | No | 23 (16.79%) | 37 (27.01%) | 36 (26.28%) | 41 (29.93%) | | |
| Skin preparation | Yes | 32 (17.88%) | 48 (26.82%) | 48 (26.82%) | 51 (28.49%) | 5.183 | 0.159 |
| | No | 1 (16.67%) | 0 (0%) | 4 (66.67%) | 1 (16.67%) | | |
| Surgical approaches | Laparoscopic surgery | 2 (20%) | 5 (50%) | 2 (20%) | 1 (10%) | 9.283 | 0.158 |
| | Abdominal surgery | 31 (18.9%) | 40 (24.39%) | 44 (26.83%) | 49 (29.88%) | | |
| | Transvaginal surgery | 0 (0%) | 3 (27.27%) | 6 (54.55%) | 2 (18.18%) | | |

(Continued)

Table 3 (Continued).

| Possible factors | | Chinese New Year | Summer | Autumn | Winter | χ^2 | P |
|---|---|------------------|--------------------|------------------|-------------------|----------|--------|
| Types of surgery | Emergency surgery | 1 (5.56%) | 7 (38.89%) | 6 (33.33%) | 4 (22.22%) | 3.413 | 0.332 |
| | Elective surgery | 32 (19.16%) | 41 (24.55%) | 46 (27.54%) | 48 (28.74%) | | |
| Types of anesthesia | General anesthesia | 32 (18.08%) | 45 (25.42%) | 50 (28.25%) | 50 (28.25%) | 1.311 | 0.971 |
| | Combined spinal and epidural anesthesia | 1 (20%) | 2 (40%) | 1 (20%) | 1 (20%) | | |
| | Epidural anesthetic | 0 (0%) | 1 (33.33%) | 1 (33.33%) | 1 (33.33%) | | |
| Blood transfusion during surgery | Yes | 7 (22.58%) | 8 (25.81%) | 5 (16.13%) | 11 (35.48%) | 3.092 | 0.378 |
| | No | 26 (16.88%) | 40 (25.97%) | 47 (30.52%) | 41 (26.62%) | | |
| Duration of surgery [#] | | 245 (175–335) | 233 (134.75–307.5) | 207 (130–324.25) | 255.5 (190–337.5) | 2.968 | 0.397 |
| Blood loss during surgery | ≥500 mL | 18 (22.22%) | 20 (24.69%) | 15 (18.52%) | 28 (34.57%) | 8.493 | 0.037* |
| | <500 mL | 15 (14.42%) | 28 (26.92%) | 37 (35.58%) | 24 (23.08%) | | |
| A drainage tube being inserted into the wound | Yes | 33 (18.03%) | 47 (25.68%) | 51 (27.87%) | 52 (28.42%) | 1.725 | 0.631 |
| | No | 0 (0%) | 1 (50%) | 1 (50%) | 0 (0%) | | |
| Delayed wound closure with sutures | Yes | 1 (11.11%) | 3 (33.33%) | 2 (22.22%) | 3 (33.33%) | 0.647 | 0.885 |
| | No | 32 (18.18%) | 45 (25.57%) | 50 (28.41%) | 49 (27.84%) | | |
| Types of surgical site infections | Superficial incisional | 29 (17.26%) | 42 (25%) | 46 (27.38%) | 51 (30.36%) | 7.131 | 0.309 |
| | Organ/space | 0 (0%) | 2 (50%) | 2 (50%) | 0 (0%) | | |
| | Deep incisional | 4 (30.77%) | 4 (30.77%) | 4 (30.77%) | 1 (7.69%) | | |

Notes: * $P < 0.01$; [#]Non-normal distribution (median) was identified after normality test using skewness; [^]Normal distribution (mean \pm standard deviation) was identified after normality test using skewness.

Table 4 Multivariate Logistic Regression Analysis of Suspicious Risk Factors for Surgical Site Infections Associated with Seasonality (Reference Category: Autumn)

| Season ^a | | B | Standard Error | Wald | Degree of Freedom | P | Odds Ratio | 95% Confidence Interval | |
|---------------------|------------------------------------|----------------|----------------|-------|-------------------|-------|------------|-------------------------|-------------|
| | | | | | | | | Lower Limit | Upper Limit |
| Spring | Intercept | -0.788 | 0.311 | 6.411 | 1 | 0.011 | | | |
| | Heart disease (No) | -19.614 | 0.000 | | 1 | | 3.033E-9 | 3.033E-9 | 3.033E-9 |
| | Blood loss \geq 500 mL (<500 mL) | 0.971 | 0.468 | 4.299 | 1 | 0.038 | 2.640 | 1.055 | 6.609 |
| Summer | Blood loss = 1 | 0 ^b | | | 0 | | | | |
| | Intercept | -0.201 | 0.259 | 0.598 | 1 | 0.439 | | | |
| | Heart disease (No) | -1.186 | 1.148 | 1.067 | 1 | 0.302 | 0.306 | 0.032 | 2.898 |
| | Blood loss \geq 500 mL (<500 mL) | 0.488 | 0.429 | 1.296 | 1 | 0.255 | 1.630 | 0.703 | 3.778 |
| | [Blood loss=1] | 0 ^b | | | 0 | | | | |

(Continued)

Table 4 (Continued).

| Season ^a | | B | Standard Error | Wald | Degree of Freedom | P | Odds Ratio | 95% Confidence Interval | |
|---------------------|------------------------------------|----------------|----------------|-------|-------------------|-------|------------|-------------------------|-------------|
| | | | | | | | | Lower Limit | Upper Limit |
| Winter | Intercept | -0.318 | 0.268 | 1.409 | 1 | 0.235 | | | |
| | Heart disease (No) | -19.629 | 0.000 | | 1 | | 2.987E-9 | 2.987E-9 | 2.987E-9 |
| | Blood loss \geq 500 mL (<500 mL) | 0.943 | 0.418 | 5.096 | 1 | 0.024 | 2.567 | 1.132 | 5.818 |
| | [Blood loss=1] | 0 ^b | | | 0 | | | | |

Notes: ^aReference category: autumn; ^bThis parameter was set to zero because it was redundant.

likely to develop SSIs in winter, not autumn, while those with <500 mL were more likely in autumn, not winter. Heart disease was not associated with SSI incidence in summer or autumn. Therefore, patients with \geq 500 mL intraoperative blood loss were more likely to develop SSIs in spring and winter, while those with <500 mL were more likely in autumn.

Discussion

Durkin et al¹⁶ reported no seasonal differences in SSIs in tropical regions but noted a 2.1% increased SSI risk with a 2.8°C temperature rise. Lin et al¹⁷ found that the deep incisional SSI rate in summer was significantly higher than in winter for cesarean sections, confirming seasonality as an independent risk factor. Zhang et al¹⁸ showed that summer is independently associated with wound infections following laparoscopic surgery for ectopic pregnancies.

Our study revealed that patients with a blood loss \geq 500 mL during surgery were more likely to develop SSIs following gynecologic and obstetric surgeries in spring and winter. The seasonal divisions in our study (spring: January–March, summer: April–June, autumn: July–September, winter: October–December) differ from local conventions (spring: March–May, summer: June–August, autumn: September–November, winter: December–February).¹⁹ Locally, summer (June–August, >25°C) and winter (December–February, >8°C) are typically high-risk seasons for SSIs in other studies. The possible reasons were as follows: (1) as a teaching hospital, staff vacations during certain periods reduce available personnel; (2) high temperatures may dilate pores, facilitating microbial invasion; while low temperature may constrict capillaries, delaying wound healing; (3) intraoperative blood loss reduces hemoglobin levels, with \geq 500 mL causing adverse effects like infections and poor wound healing.²⁰

Bacterial infections are a key cause of SSIs. Preoperative skin cleaning, surgical site disinfection, and strict aseptic techniques are critical for reducing pathogenic microbial colonization and preventing SSIs. Anderson et al³ identified *Escherichia coli* (34.86%), *Pseudomonas aeruginosa* (22.02%), and *Staphylococcus aureus* (16.97%) as common SSI pathogens. Rózańska et al²¹ reported higher SSI incidences caused by *Enterococcus* and *Enterobacter* from November–January and June–August. Ou et al²² found no differences in Gram-positive versus Gram-negative bacteria in SSIs post-gynecologic surgeries, with *Escherichia coli* (36.10%), *Staphylococcus aureus* (18.10%), *Staphylococcus epidermidis* (12.50%), and *Enterococcus faecalis* (8.30%) as top pathogens, aligning with our findings. Enhanced monitoring of pathogen distribution, improved SSI treatment, and better bacterial identification and drug susceptibility testing are essential for SSI prevention.

This study cannot rule out that other monitoring indicators affected SSIs under seasonal influences. Not all indicators could be monitored in every season, and a small number of cases for some indicators were observed in certain seasons. This led to statistically significant differences in only a few monitoring indicators in univariate analysis. For example, no drainage tubes were inserted into wounds in spring (January–March) or winter (October–December), and no transvaginal surgeries occurred in spring (January–March). Similarly, of 5 heart disease cases included, the proportions for spring, summer, autumn, and winter were 0/5, 1/5, 4/5, and 0/5, respectively, limiting multivariate analysis in spring (January–March) and winter (October–December). Thus, a larger sample size is needed to analyze further seasonality's influence on SSIs following gynecologic and obstetrics surgeries. Multi-center studies are suggested to monitor the influence of seasonality on SSIs in these surgeries.

Conclusions

As climate and temperature vary greatly across regions, even within the same season, it is recommended to establish standardized seasonal monitoring standards to monitor better the impact of seasons and patients' characteristics on SSIs, thereby reducing the influence of seasonality on SSIs. Additionally, attention should be paid to strengthening warming measures for patients during surgery to maintain normal body temperature. To improve SSI treatment efficiency, incisional secretion samples should be submitted promptly for bacteria identification and drug susceptibility testings.

Data Sharing Statement

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Ethics Approval

This study was conducted in accordance with the principles of the Declaration of Helsinki. All research methods were conducted in accordance with relevant guidelines and regulations. This study was approved by the Medical Ethics Committee of the West China Second University Hospital, Sichuan University [2022 Medical Scientific Research for Ethical Approval No. (135)].

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Disclosure

The authors declare that they have no competing interests in this work.

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