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Prevalence and Risk Factors of Surgical Site Infections in Obstetrics and Gynaecology Post-Operative Patients: A Prospective Study from a Tertiary Care Centre in North India

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Abstract: ***Background/Purpose: Surgical site infections (SSIs) are among the most common postoperative complications in obstetric and gynaecological surgeries, contributing significantly to patient morbidity, prolonged hospital stay, and increased healthcare costs, particularly in low- and middle-income settings. Methods: A prospective observational study was conducted in the Department of Obstetrics and Gynaecology at a tertiary care hospital from March 2024 to December 2025. A total of 85 women undergoing major obstetric and gynaecological surgeries were enrolled and followed for 30 days postoperatively. SSIs were diagnosed per CDC criteria. Microbiological profiling and antibiotic susceptibility testing were performed. Data were analysed using SPSS version 25.0. Results: The overall SSI prevalence was 18.8% (16/85). Superficial incisional SSIs predominated (62.5%). Emergency surgeries had significantly higher SSI rates than elective procedures (31.6% vs. 8.5%, p=0.002). Anemia (p=0.008), diabetes mellitus (p=0.012), operative duration >90 minutes (p=0.018), preoperative stay >48 hours (p=0.048), contaminated/dirty wound class (p=0.031), blood loss >500 mL (p=0.041), and ASA grade III–IV (p=0.021) were significant risk factors. Gram-negative bacilli predominated (68.8%); 50% of culture-positive cases were multidrug-resistant. On multivariable analysis, emergency surgery (aOR 5.82, p=0.014) and prolonged operative duration (aOR 4.15, p=0.026) were independent predictors. Conclusion: SSIs impose a substantial postoperative burden in obstetric and gynaecological surgery. Emergency procedures and prolonged operative time are the strongest independent risk factors. Targeted prevention through preoperative optimisation, timely antibiotic prophylaxis, and antimicrobial stewardship is essential.***

Keywords: Surgical site infection · Obstetrics · Gynaecology · Risk factors · Antimicrobial resistance · Antibiotic prophylaxis

1. Introduction

Surgical site infections (SSIs) are defined by the Centres for Disease Control and Prevention (CDC) as infections occurring within 30 days of surgery (or within one year with an implant), involving the incision or deeper tissues [1]. SSIs are among the most frequent healthcare-associated infections globally, accounting for up to 20% of all hospital-acquired infections and representing a leading cause of postoperative morbidity, prolonged hospitalisation, and avoidable healthcare expenditure [2].

Globally, SSI incidence ranges from 3% to 15% across surgical specialties, with a declining trend in high-income countries attributable to advances in perioperative care, infection control, and antibiotic prophylaxis [2]. In low- and middle-income countries (LMICs) including India, the burden remains disproportionately high, driven by emergency workloads, resource constraints, and patient-level factors such as anaemia, malnutrition, and diabetes [3].

In obstetric and gynaecological surgery, the operative field lies in proximity to the genitourinary and gastrointestinal tracts, increasing the likelihood of both endogenous and exogenous contamination. The predominant pathogens- Gram-negative bacilli including Escherichia coli and Klebsiella pneumoniae, and Gram-positive cocci such as Staphylococcus aureus- reflect this flora [3, 4]. The growing prevalence of multidrug-resistant (MDR) organisms and extended-spectrum beta-lactamase (ESBL) producers further complicates management [5].

Local surveillance data from tertiary obstetric and gynaecological units in northern India remain limited. This prospective study was therefore undertaken to determine the prevalence and risk profile of SSIs, characterise the microbiological spectrum and antimicrobial resistance patterns, and evaluate differences between emergency and elective surgical procedures at a tertiary care centre in Hapur, Uttar Pradesh.

2. Material and Methods

Study design and setting

This was a prospective observational study conducted at the Department of Obstetrics and Gynaecology, Rama Medical

College Hospital and Research Centre, Hapur- a tertiary care teaching hospital- from March 2024 to December 2025. The study was approved by the Institutional Ethics Committee, and written informed consent was obtained from all participants.

Participants and sample size

Women undergoing major elective or emergency obstetric and gynaecological surgeries were enrolled. Patients with pre-existing sepsis or fever at admission were excluded. Sample size was calculated using the formula $n = 4pq/d^2$, based on a prior SSI prevalence of 5.6% (95% CI, 80% power, margin of error 5%), yielding a minimum of 85 patients.

Data collection and follow-up

Preoperative assessment recorded age, parity, BMI, haemoglobin, blood glucose, comorbidities, and duration of preoperative hospital stay. Intraoperative variables included type and duration of surgery, wound classification (clean-contaminated vs. contaminated/dirty per CDC), intraoperative blood loss, drain use, and timing of prophylactic antibiotic administration. Patients were followed daily during admission and for 30 postoperative days (in-person or telephonically). SSIs were classified per CDC/NHSN criteria into superficial incisional, deep incisional, and organ/space types.

Microbiological analysis

Wound swabs were collected under aseptic precautions and processed within 2 hours. Aerobic bacterial culture, identification, and antibiotic susceptibility testing were performed using conventional biochemical methods and the Kirby-Bauer disc diffusion method, interpreted per CLSI guidelines. Multidrug resistance (MDR) was defined as resistance to ≥3 antibiotic classes.

Statistical analysis

Data were analysed using SPSS version 25.0. Descriptive statistics described the study population. Chi-square or Fisher's exact test assessed categorical associations; independent t-test compared continuous variables between SSI and non-SSI groups. Significant risk factors ($p < 0.05$) on univariable analysis were entered into a multivariable logistic regression model.

3. Results

SSI prevalence and types. Of 85 patients enrolled, 16 (18.8%) developed SSIs (Table 1). Superficial incisional SSI was the most common type (62.5%), followed by deep incisional (31.3%) and organ/space infection (6.2%).

Table 1: Prevalence and distribution of SSI types (n = 85)
Values are n (%)

Variable	n	%
Total surgeries	85	100
SSI — any type	16	18.8
Superficial incisional	10	62.5
Deep incisional	5	31.3
Organ/space	1	6.2

Emergency vs. elective surgery. SSI rates were significantly higher in emergency surgeries (31.6%) compared to elective procedures (8.5%, p = 0.002).

Patient-related risk factors. Anaemia (Hb < 11 g/dL) was present in 51 patients and was significantly associated with SSI (25.5% vs. 8.8%, p = 0.008). Diabetes mellitus carried the highest SSI rate (42.9% vs. 14.1%, p = 0.012). Hypertension and obesity were not independently significant (Table 2).

Table 2: Association of SSI with comorbidities and perioperative risk factors

Risk factor	Total	SSI n (%)	No SSI n (%)	p value
Anaemia (Hb < 11 g/dL)	51	13 (25.5)	38 (74.5)	**0.008**
Diabetes mellitus	14	6 (42.9)	8 (57.1)	**0.012**
Hypertension	11	3 (27.3)	8 (72.7)	0.401
Obesity (BMI ≥ 30 kg/m²)	19	5 (26.3)	14 (73.7)	0.332
Pre-op stay > 48 h	29	9 (31.0)	20 (69.0)	**0.048**
Duration of surgery > 90 min	33	10 (30.3)	23 (69.7)	**0.018**
Contaminated/dirty wound	22	7 (31.8)	15 (68.2)	**0.031**
Blood loss > 500 mL	17	6 (35.3)	11 (64.7)	**0.041**
ASA grade III–IV	23	8 (34.8)	15 (65.2)	**0.021**
Emergency surgery	38	12 (31.6)	26 (68.4)	**0.002**

Bold p values indicate statistical significance ($p < 0.05$); Chi-square test used throughout

Antibiotic prophylaxis timing. Timely administration (within 60 min before incision) was associated with a significantly lower SSI rate (16.2% vs. 33.3% when delayed >60 min, p = 0.038).

Microbiological profile. Gram-negative bacilli predominated (68.8%), with Escherichia coli (31.3%) and Klebsiella pneumoniae (25.0%) as the leading isolates, followed by Pseudomonas aeruginosa (12.5%). Gram-positive cocci accounted for 31.2% (Staphylococcus aureus MSSA 18.8%, Enterococcus faecalis 12.5%). Polymicrobial growth was found in 18.8%; 12.5% were culture-negative. Among Gram-negative isolates, fluoroquinolone resistance was 100% for E. coli and K. pneumoniae, and third-generation cephalosporin resistance was 75–80%. Resistance to piperacillin-tazobactam and carbapenems was substantially lower (0–25%). Of 14 culture-positive cases, 50% harboured MDR organisms, with ESBL producers in 35.7% (Table 3).

Table 3: Antibiotic resistance pattern of Gram-negative isolates (n = 11)

Antibiotic class	E. coli (n = 5) %R	K. pneumoniae (n = 4) %R	P. aeruginosa (n = 2) %R
3rd-gen cephalosporins	80	75	—
Fluoroquinolones	100	100	50
Aminoglycosides	40	50	0
Piperacillin-tazobactam	20	25	0
Carbapenems	0	25	0

%R resistance rate; — not tested

Multivariable analysis. Logistic regression identified emergency surgery (aOR 5.82, 95% CI 1.42–23.87, p = 0.014) and operative duration > 90 min (aOR 4.15, 95% CI 1.18–14.61, p = 0.026) as independent predictors of SSI.

Anaemia and diabetes showed elevated ORs but did not reach significance (Table 4). The model demonstrated good fit (Hosmer–Lemeshow p = 0.512).

Table 4: Multivariable logistic regression- independent predictors of SSI

Risk factor	aOR	95% CI	p value
Emergency surgery	5.82	1.42–23.87	**0.014**
Duration of surgery > 90 min	4.15	1.18–14.61	**0.026**
Pre-existing anaemia (Hb < 11 g/dL)	3.91	0.95–16.12	0.059
Diabetes mellitus	3.24	0.83–12.68	0.091

aOR adjusted odds ratio; CI confidence interval; bold = statistically significant independent predictor

4. Discussion

The overall SSI prevalence of 18.8% in the present study falls within the 12–22% range reported from comparable Indian tertiary care settings. Mohan et al. [6] from Trichy reported 17.1%, Jatoliya et al. [7] reported 20.5% from a government hospital in Jodhpur, and Snehaa et al. [8] reported 12.3% from Port Blair. These figures collectively reflect the substantial and persistent SSI burden in Indian obstetric and gynaecological units, where emergency workloads and resource constraints compound baseline infection risk.

The nearly fourfold higher SSI rate in emergency versus elective surgeries (31.6% vs. 8.5%) is a consistent finding in the literature. Jatoliya et al. [7] reported 34.8% vs. 10.6%, and Mohan et al. [6] observed 29.3% vs. 7.2%—both closely mirroring our data. Emergency settings preclude adequate preoperative preparation, optimisation of haemoglobin, or correction of glycaemia, while contaminated surgical fields and prolonged labour in obstetric emergencies further increase contamination risk.

Anaemia and diabetes were the most consistently significant patient-level risk factors. Anaemia reduces tissue oxygen tension, impairing neutrophil oxidative burst and collagen synthesis [9]. Diabetes compounds risk through neutrophil chemotaxis defects and impaired phagocytosis secondary to hyperglycaemia [10]. Indian studies uniformly corroborate these associations; Jatoliya et al. [7] found 40% SSI rate among diabetics, and Snehaa et al. [8] reported 36.7%- both concordant with our 42.9%. Preoperative correction of haemoglobin and glycaemic optimisation before elective procedures therefore represent high-impact, low-cost preventive measures.

Operative duration >90 minutes and preoperative stay >48 hours were the most impactful modifiable surgical risk factors. Both emerged as independent predictors in multivariable analysis, consistent with data by Maleknejad et al. [11] (aOR 3.7 for duration >90 min) and Birhanu and Endalamaw [12] (aOR 5.31 for emergency surgery). Prolonged preoperative hospitalisation promotes colonisation with hospital-acquired resistant flora, while longer operative time increases tissue handling and exposure of the wound to environmental contamination.

The predominance of Gram-negative bacilli (68.8%), particularly E. coli and K. pneumoniae, reflects the endogenous genitourinary and gastrointestinal flora that contaminates the operative field in obstetric and gynaecological procedures [3]. Universal fluoroquinolone resistance (100%) among enterobacteria and high third-generation cephalosporin resistance (75–80%) render these common empirical agents largely ineffective, consistent with data from Mohan et al. [6] and Jatoliya et al. [7]. Carbapenems and piperacillin-tazobactam, with resistance rates of 0–25%, represent viable therapeutic options and should be reserved for culture-confirmed MDR infections in accordance with antimicrobial stewardship principles.

The 50% MDR prevalence and 35.7% ESBL rate among culture-positive SSIs underscore the critical antimicrobial resistance burden in postoperative infections. Timely prophylactic antibiotics (within 60 min of incision) reduced SSI incidence from 33.3% to 16.2% (p = 0.038), validating WHO and CDC prophylaxis guidelines and highlighting adherence as a readily modifiable protective intervention.

Limitations of this study include its single-centre design and relatively small sample size, which may limit generalisability. Microbiological analysis was restricted to aerobic cultures; anaerobic and fungal pathogens were not evaluated. Some late-onset SSIs may have been missed despite telephonic follow-up. Despite these limitations, the study provides clinically relevant insights into the local SSI burden and microbial epidemiology.

5. Conclusion

SSIs impose a substantial postoperative burden in obstetric and gynaecological surgery, affecting approximately one in five patients at this tertiary care centre. Emergency surgery and prolonged operative time are the strongest independent predictors, while anaemia, diabetes, contaminated wounds, extended preoperative stay, and intraoperative blood loss significantly compound risk. Gram-negative organisms with high MDR prevalence dominate the microbiological spectrum, demanding local antibiogram-guided empirical therapy. Timely antibiotic prophylaxis is a proven protective measure. A multidisciplinary approach encompassing preoperative patient optimisation, streamlined surgical planning, strict aseptic practice, and robust antimicrobial stewardship is essential to reduce SSI burden in resource-limited tertiary care settings.

Compliance with Ethical Standards

Ethics approval: All procedures involving human participants were in accordance with the 1964 Declaration of Helsinki and its later amendments. This study was approved by the Institutional Ethics Committee, Rama Medical College Hospital and Research Centre, Hapur.

Consent to participate: Written informed consent was obtained from all participants prior to enrolment.

Conflict of interest: The authors declare no conflict of interest.

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Author contributions: Dr. Ankita: data collection, analysis, and manuscript preparation. Dr. Smita: study conception, design, supervision, and critical revision. Dr. Muzaffari Yasmeen: microbiological analysis and interpretation. All authors read and approved the final manuscript.

Ethical Statements

Ethics approval: This study was approved by the Institutional Ethics Committee, Rama Medical College Hospital and Research Centre, Hapur (IEC Ref. No.: RMCH/IEC/2024/OBG/07). All procedures were in accordance with the 1964 Declaration of Helsinki and its later amendments.

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Author Profile

Dr. Ankita is a Postgraduate Resident in the Department of Obstetrics and Gynaecology at Rama Medical College Hospital and Research Centre, Hapur, affiliated with Atal Bihari Vajpayee Medical University, Lucknow, for the academic period 2023–2026. She completed her MBBS from a recognised medical college in Maharashtra, India. Her academic interests include surgical infections, perioperative care, and maternal health outcomes. The present prospective study on surgical site infections in obstetric and gynaecological post-operative patients forms the basis of her MS dissertation. She is committed to evidence-based surgical practice and infection control and aims to contribute to improving patient safety and infection prevention strategies in tertiary care settings in India.