



Research Article

Frequency of Wound Infection and Antibiotic Sensitivity in Patients Undergoing Emergency Cesarean Section.

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Abstract: **Background:** Early wound infection after emergency caesarean delivery can complicate maternal recovery. **Objective:** To describe early wound infection frequency, bacterial isolates, and recorded antibiotic susceptibility at Lady Reading Hospital, Peshawar. **Methods:** This descriptive cross-sectional study included 120 consecutively recruited women undergoing emergency caesarean section from 20 May to 20 November 2022. Wound infection was assessed through postoperative day seven. Purulent material was cultured, and descriptive and stratified analyses were performed. **Results:** Infection was recorded in 12/120 women (10.0%). *Staphylococcus aureus* accounted for four infections (33.3%). Three of these four isolates were reported susceptible to ceftriaxone and cefixime. Infection proportions were higher among women aged 31–45 years and those with higher parity or gravidity; these associations were unadjusted. **Conclusion:** The study describes an early postoperative infection burden and a small local isolate series. Short follow-up, limited susceptibility denominators, and a stratified table inconsistency restrict interpretation and preclude treatment recommendations.

Keywords: Wound infection, emergency caesarean section, antibiotic susceptibility, *Staphylococcus aureus*.

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INTRODUCTION

Surgical site infection following caesarean birth can delay recovery, disrupt newborn care, and increase the need for wound treatment, readmission, or further surgery. Infection may involve the incision or deeper tissues, and prevention requires attention to the entire perioperative pathway. Cesarean-specific literature describes a combination of maternal, obstetric, and procedural factors influencing risk.[1]

Standardized definitions are essential for comparing infection frequencies between hospitals. Surgical infection surveillance extends beyond the immediate inpatient period, because clinically important infections may become apparent after discharge. Guidance on prevention therefore needs to be paired with consistent case ascertainment and a clearly stated follow-up interval.[2] A seven-day assessment can describe early postoperative wound infection but cannot capture the complete burden over a longer surveillance period.

Emergency caesarean delivery deserves particular attention because labour, membrane rupture, and urgent clinical circumstances may coexist with limited opportunities for preparation. Evidence from a multicentre study identified prolonged membrane rupture and longer operating time among factors associated with postoperative infection.[3] These observations support detailed assessment of obstetric and operative exposures rather than attributing infection solely to demographic characteristics.

Antibiotic prophylaxis is an established component of prevention. WHO recommends prophylactic antibiotics for women undergoing caesarean section, with administration before skin incision and selection informed by appropriate clinical considerations.[4] A Cochrane review supports prophylaxis compared with no prophylaxis for reducing postoperative infection.[5] In a randomized trial involving nonelective caesarean delivery, adjunctive azithromycin reduced postoperative infectious morbidity when added to standard prophylaxis, although applicability depends on local protocols and clinical circumstances.[6]

Prevention also involves reducing microbial contamination. WHO recommendations address the choice and application of antiseptic agents for preoperative skin preparation.[7] Randomized evidence comparing chlorhexidine–alcohol with iodine–alcohol demonstrates that the preparation method can influence infection outcomes.[8] Vaginal preparation with an appropriate antiseptic is another component addressed by WHO guidance for caesarean birth.[9] These measures complement aseptic technique and appropriate prophylaxis rather than replacing them.

Once infection develops, microbiological assessment can support targeted treatment. A study from Calabar documented diverse organisms and susceptibility patterns in post-caesarean wound infections, illustrating why results from one institution should not be assumed to represent another.[10] Evidence on prevention bundles also indicates that coordinated use of established measures can improve the perioperative pathway, while unscheduled surgery remains an important context for residual risk.[11]

Local surveillance is therefore needed to establish early infection frequency, describe organisms recovered from infected wounds, and identify uncertainties that affect antimicrobial interpretation. This study assessed wound infection within seven postoperative days among women undergoing emergency caesarean section at Lady Reading Hospital, Peshawar. It also described the recorded bacterial isolates, *Staphylococcus aureus* susceptibility results, and unadjusted patterns by maternal age, parity, and gravidity. The findings were intended to support departmental review while acknowledging the limitations of surveillance.

METHODS

This descriptive cross-sectional study was conducted in the Department of Obstetrics and Gynaecology, Lady Reading Hospital, Peshawar, from 20 May to 20 November 2022. A total of 120 women undergoing emergency caesarean section were recruited through consecutive non-probability sampling. The reported sample-size calculation used an expected wound infection frequency of 8.5%, a 95% confidence level, and 5% absolute precision.

Women aged 15–45 years were eligible irrespective of the emergency indication. Elective procedures and women with diabetes mellitus, malignancy, body mass index above 29 kg/m², steroid treatment, or antibiotic use during the preceding week were excluded. The source manuscript reports institutional ethical approval and informed consent. Approval identifiers and the consent procedure for participants younger than 18 years were not supplied. Clinical history and examination were undertaken before surgery, which was performed by consultant gynaecologists.

Participants were followed until the seventh postoperative day for wound infection. The manuscript does not specify diagnostic criteria, whether assessment continued after discharge, or completeness of follow-up. Purulent wound material was collected aseptically from infected patients and submitted for bacterial culture. Listed organisms included *Staphylococcus aureus*, coagulase-negative staphylococci, group B streptococci, *Enterobacter*, *Enterococcus*, *Pseudomonas*, and *Escherichia coli*. Susceptibility testing was described for cephradine, ceftriaxone, cefixime, amoxicillin, gentamicin, metronidazole, levofloxacin, and an agent recorded as tazobactam. The partner antibiotic for tazobactam, testing technique, interpretive standard, and quality-control procedures were not specified. The supplied table reports susceptibility results only for *S. aureus*; no metronidazole results were provided.

Data were analysed in SPSS version 10.0. Continuous variables were described using means and standard deviations, and categorical variables using frequencies and percentages. Stratification by age, parity, and gravidity was followed by chi-square testing at a 5% significance level. These analyses were unadjusted. Because of sparse expected cells, two-sided Fisher exact tests were recalculated from the reported aggregate infection counts for age, parity, and gravidity; no participant-level reanalysis was possible. Because organism-specific and susceptibility denominators were small, their descriptive values are presented without interpreting unsupported hypothesis tests. No participant-level dataset was supplied for reanalysis.

RESULTS

Early postoperative wound infection was recorded in 12 of 120 participants (10.0%); 108 (90.0%) had no recorded infection during the seven-day follow-up. Among the 12 infections, *Staphylococcus aureus* accounted for four isolates (33.3%). Coagulase-negative staphylococci and *Enterococcus* each accounted for two (16.7%), while group B streptococci, *Enterobacter*, *Pseudomonas*, and *E. coli* each accounted for one (8.3%). These percentages use infected patients as the denominator.

Among the four *S. aureus* isolates, three were reported susceptible to ceftriaxone and cefixime (75.0% each). Two were susceptible to cephradine, amoxicillin, and the agent recorded as tazobactam (50.0% each); one was susceptible to gentamicin and levofloxacin (25.0% each). These are laboratory susceptibility observations, not comparative treatment outcomes. The exact tazobactam-containing preparation requires confirmation.

Infection was recorded in 4/90 women aged 15–30 years (4.4%) and 8/30 aged 31–45 years (26.7%). It occurred in 3/86 women with parity 0–2 (3.5%) and 9/34 with parity above two (26.5%). The gravidity strata showed the same reported counts: 3/86 for gravidity 1–3 and 9/34 for gravidity above three. Two-sided Fisher exact tests calculated from

these aggregate counts gave $p = 0.002$ for age and $p < 0.001$ for parity and gravidity. These findings describe unadjusted associations and do not establish independent predictors.

The supplied age-stratified *S. aureus* row contains an inconsistent older-group negative count. Its numerator is two, but the reported negative count of 14 is incompatible with eight infected older participants. In Table 2, Unverified* indicates that the source count requires verification; no replacement value has been inferred. The displayed percentages are retained as reported and are not independent verification of the missing count.

Table 1. Early wound infection, bacterial isolates, and *S. aureus* susceptibility

Category	Sub-category / Antibiotic	Frequency (Yes)	Frequency (No)	Percentage (Yes)	Percentage (No)
Wound Infection	Yes	12	108	10%	90%
Staphylococcus aureus	Yes	4	8	33.3%	66.7%
Coagulase-negative staphylococci	Yes	2	10	16.7%	83.3%
Group B Streptococci	Yes	1	11	8.3%	91.7%
Enterobacter	Yes	1	11	8.3%	91.7%
Enterococcus	Yes	2	10	16.7%	83.3%
Pseudomonas	Yes	1	11	8.3%	91.7%
E. coli	Yes	1	11	8.3%	91.7%
Sensitivity of Staphylococcus aureus	Cephadrine	Yes (2)	No (2)	50%	50%
	Ceftriaxone	Yes (3)	No (1)	75%	25%
	Cefixime	Yes (3)	No (1)	75%	25%
	Amoxicillin	Yes (2)	No (2)	50%	50%
	Gentamicin	Yes (1)	No (3)	25%	75%
	Levofloxacin	Yes (1)	No (3)	25%	75%
	Tazobactam	Yes (2)	No (2)	50%	50%

participants for wound infection ($n = 120$); infected participants for bacterial isolates ($n = 12$); *S. aureus* isolates for susceptibility ($n = 4$). Organism and susceptibility p -values are omitted because the hypotheses and tests were not specified. "Tazobactam" is the original recorded label; the combination tested requires verification.

Table 2. Reported stratification by age, parity, and gravidity

Stratification	Sub-category	Frequency (Yes)	Frequency (No)	Percentage (Yes)	Percentage (No)
Wound Infection by Age	15–30 years	4	86	4.4%	95.6%
	31–45 years	8	22	26.7%	73.3%
Wound Infection by Parity	0–2	3	83	3.5%	96.5%
	>2	9	25	26.5%	73.5%
Wound Infection by Gravidity	1–3	3	83	3.5%	96.5%
	>3	9	25	26.5%	73.5%
Staphylococcus aureus by Age	15–30 years	2	2	50%	50%
	31–45 years	2	Unverified*	25%	75%
Coagulase-negative	15–30 years	1	3	25%	75%

Stratification	Sub-category	Frequency (Yes)	Frequency (No)	Percentage (Yes)	Percentage (No)
staphylococci by Age	31-45 years	1	7	12.5%	87.5%
	15-30 years	0	4	0%	100%
Group B Streptococci by Age	31-45 years	1	7	12.5%	87.5%
	15-30 years	0	4	0%	100%
Enterobacter by Age	31-45 years	1	7	12.5%	87.5%
	15-30 years	0	4	0%	100%
Enterococcus by Age	31-45 years	2	6	25%	75%
	15-30 years	0	4	0%	100%
Pseudomonas by Age	31-45 years	1	7	12.5%	87.5%
	15-30 years	1	3	25%	75%
E. coli by Age	31-45 years	0	8	0%	100%

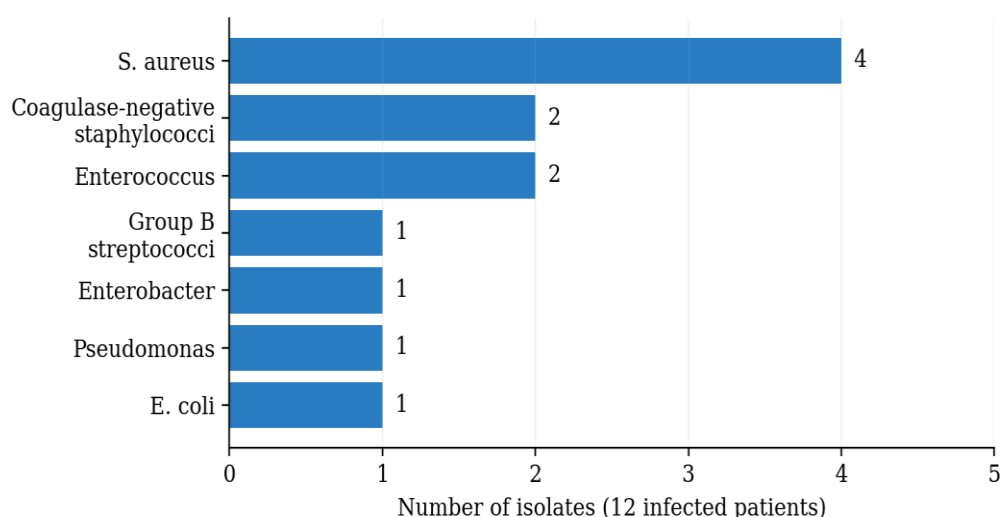


Figure 1. Bacterial isolate counts among the 12 early wound infections.

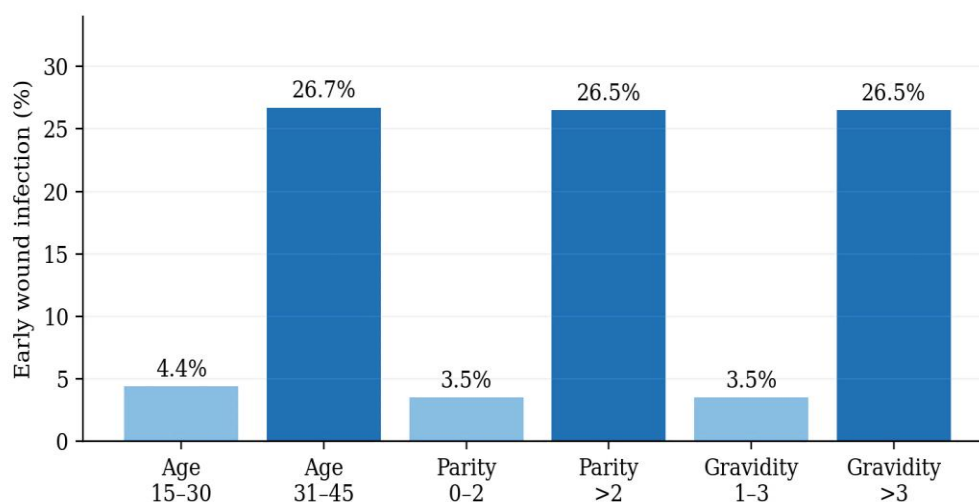


Figure 2. Early wound infection proportions by age, parity, and gravidity.

DISCUSSION

Early wound infection occurred in 12 of 120 women following emergency caesarean section, giving a seven-day frequency of 10.0%. This finding indicates a relevant postoperative burden in the enrolled population, but it is not a complete estimate of infection throughout recovery. Caesarean infection literature shows that case selection, surveillance, definitions, and preventive practice influence observed frequencies.[1] The present estimate should therefore be described with its short follow-up period and eligibility restrictions whenever it is compared with other settings.

A global meta-analysis reported a pooled post-caesarean surgical site infection incidence of 5.63%, with substantial regional variation.[12] A subsequent synthesis reported an overall estimate of 7.0% using studies with a 30-day outcome window and found differences between income settings.[13] The present 10.0% frequency is numerically higher than these pooled estimates, but this does not establish inferior care. Emergency procedures, referral patterns, excluded comorbidities, surveillance completeness, and outcome definitions differ. Comparisons are most informative when these features are aligned.

Surveillance is a particularly important limitation. CDC prevention guidance provides a framework for consistent perioperative infection prevention, whereas the study observed participants only through postoperative day seven.[2] WHO global guidance likewise treats prevention as a coordinated process across preoperative, intraoperative, and postoperative care.[14] In a large retrospective cohort, Ketcheson and colleagues examined infection through 30 days and distinguished pre-discharge from post-discharge risk patterns.[15] Extending local follow-up and recording the date and diagnostic basis of each event would improve the estimate and identify infections currently missed.

Older age, higher parity, and higher gravidity were associated with higher infection proportions, but these were unadjusted comparisons. Research in an extended-spectrum prophylaxis trial identified clinically relevant obstetric and procedural exposures, illustrating why demographic associations require adjustment.[3] Vallejo and colleagues also reported associations involving body mass index, previous births, comorbidities, smoking, and emergency delivery in a rural tertiary population.[16] The present results cannot determine whether age or reproductive history independently increases risk because labour duration, anaemia, operative difficulty, and prevention practices were incompletely recorded.

The findings justify reviewing prevention processes, but they do not test a prophylactic intervention. WHO recommends appropriate antibiotic prophylaxis for caesarean delivery.[4] Cochrane evidence comparing prophylaxis with no prophylaxis supports its preventive value.[5] The randomized trial of adjunctive azithromycin demonstrated reduced infectious morbidity in a defined nonelective caesarean population.[6] These sources support protocol-based prevention; they do not allow the four local *S. aureus* isolates to determine which regimen should be used across the institution.

Skin and vaginal preparation should be assessed separately from antibiotic selection. WHO recommendations specify preoperative skin antisepsis, and randomized evidence comparing chlorhexidine–alcohol with iodine–alcohol demonstrates the value of studying preparation methods directly.[7] These procedures require consistent application as well as an appropriate agent.[8] WHO also recommends vaginal antiseptic preparation before caesarean section.[9] The present study did not document adherence, so no causal explanation for its infection frequency can be assigned to these practices.

S. aureus was the most frequent isolate, accounting for four infections. The Calabar study illustrates that post-caesarean microbiology and susceptibility patterns vary between institutions.[10] Here, three susceptible isolates correspond to 75%, and one additional isolate would change that estimate by 25 percentage points. Such a denominator is insufficient for ranking antibiotics or establishing a hospital antibiogram. The actual drug combination recorded as tazobactam, susceptibility testing method, interpretive standard, and inconsistent age-stratified cell all require confirmation before clinical interpretation.

Evidence also cautions against assuming that additional preventive technology will necessarily improve outcomes. In a randomized trial involving women with obesity, prophylactic negative-pressure wound therapy did not significantly reduce surgical site infection compared with standard dressings and produced more adverse skin reactions.[17] An earlier trial found benefit from postoperative oral cephalexin and metronidazole after standard preoperative

prophylaxis in women with obesity.[18] These populations differ from this study, which excluded women with higher body mass index, limiting direct applicability.

The Cochrane review of vaginal antiseptic preparation found probable reductions in endometritis, fever, and wound infection, supporting review of this component within a broader prevention pathway.[19] By contrast, a 2025 trial found no significant additional benefit from postoperative cephalexin and metronidazole when women with obesity and ruptured membranes had already received cefazolin and azithromycin.[20] The difference underscores the influence of baseline prophylaxis and eligibility. The PREPS pilot trial further demonstrated the feasibility of recruiting emergency and elective caesarean patients and collecting later postoperative outcomes, without establishing definitive efficacy.[21]

Evidence on coordinated perioperative interventions supports auditing the full care pathway rather than selecting treatment from this small isolate series.[11] Future work should document clinical infection criteria, prophylaxis timing and dose, preparation adherence, laboratory methods, treatment outcomes, and follow-up completion. Reporting should distinguish missing data from negative findings and resolve inconsistent denominators, as required for transparent observational research.[22] A larger prospective cohort with longer surveillance and adjusted analyses would provide stronger evidence for local prevention priorities.

CONCLUSION

Wound infection was recorded in 12/120 women (10.0%) within seven days after emergency caesarean section. *S. aureus* was the most frequent isolate, accounting for four infections. Higher infection proportions were observed among older women and those with higher parity or gravidity, but these were unadjusted associations. The small susceptibility denominator, incomplete laboratory methods, short follow-up, and inconsistent stratified cell prevent firm treatment recommendations. Standardized surveillance and source-data verification are needed to strengthen the clinical value of these findings.

AUTHOR CONTRIBUTIONS

Shamal Dawood conceptualized the study, designed the methodology, and conducted the investigation, including participant recruitment, clinical assessment, and postoperative follow-up. **Samreen Hassan** performed data curation, including data entry, verification, and maintenance of the study database in SPSS version 10.0, and drafted the manuscript. **Sajida** critically revised the manuscript for important intellectual content and contributed to interpretation of the findings. **Ikram Ullah** supervised the study, provided overall guidance on study conduct, statistical analysis, and manuscript preparation. All authors reviewed and approved the final manuscript and agree to be accountable for all aspects of the work.

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