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Bacteriological profile and antibiogram profile of stitch site infection: A study from a maternity hospital in north Bihar

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Abstract

Background: Stitch site infections (SSIs) are among the most common postoperative complications, especially in obstetric surgeries, and contribute significantly to maternal morbidity. The identification of causative organisms and their antibiotic sensitivity patterns is essential for effective management and infection control.

Objectives: To determine the bacteriological profile and antibiogram of organisms isolated from stitch site infections among postoperative patients in a maternity hospital in North Bihar.

Materials and Methods: This was a prospective observational study conducted over one year in a maternity hospital in North Bihar. A total of 100 patients with clinical signs of stitch site infection were included. Pus or wound swabs were collected under aseptic conditions and subjected to Gram staining, aerobic culture, and antibiotic sensitivity testing using the Kirby-Bauer disc diffusion method as per CLSI guidelines.

Results: Out of 100 samples, 92% showed positive bacterial growth. The most common isolate was *Staphylococcus aureus* (38%), followed by *Escherichia coli* (22%), *Klebsiella pneumoniae* (14%), *Pseudomonasaeruginosa* (10%), *Enterococcus faecalis* (4%), and *Proteus mirabilis* (4%). Multidrug resistance (MDR) was observed in 54% of the isolates. *S. aureus* showed high sensitivity to vancomycin and linezolid, while gram-negative isolates were most sensitive to imipenem, amikacin, and piperacillin-tazobactam.

Conclusion: The study reveals a high prevalence of bacterial infections at stitch sites, predominantly caused by *S. aureus* and gram-negative bacilli, many of which are multidrug-resistant. Routine culture and sensitivity testing, strict infection control practices, and rational use of antibiotics are imperative to reduce the burden of SSIs and improve maternal outcomes in resource-limited settings.

Keywords: Stitch site infection, *Staphylococcus aureus*, antibiogram, maternity hospital, multidrug resistance, North Bihar.

INTRODUCTION

Surgical site infections (SSIs), commonly referred to as stitch site infections, are defined as infections that occur at or near a surgical incision within 30 days of the procedure, or within one year if an implant is placed [1]. They represent a major portion of hospital-acquired infections and are considered an important indicator of the quality of surgical care provided in any healthcare setting [2]. In maternity hospitals, especially in developing regions, SSIs following cesarean sections and episiotomy procedures are frequently encountered and contribute substantially to maternal morbidity [3].

The global incidence of SSIs varies widely, ranging from 2% to 20%, depending on the type of surgery, patient factors, and the level of aseptic precautions maintained [4]. In low- and middle-income countries like India, the burden is particularly high due to limited resources, overcrowded hospitals, suboptimal infection control practices, and delayed reporting [5]. Cesarean section, being one of the most commonly performed surgical procedures in obstetrics, is associated with an increased risk of postoperative wound infection due to several predisposing factors such as anemia, prolonged labor, rupture of membranes, emergency procedures, and poor nutritional status [6].

The bacteriological profile of SSIs is not uniform across geographic regions and healthcare settings. The most frequently isolated organisms include *Staphylococcus aureus*, particularly methicillin-resistant *S. aureus* (MRSA), followed by *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, and various *Enterococcus* species [7]. These organisms may originate from the patient's skin flora, gastrointestinal tract, environment, surgical instruments, or healthcare workers [8].

The management of SSIs is further challenged by the alarming rise in antimicrobial resistance. Multidrug-resistant organisms have emerged as a serious threat in both community and hospital settings, leading to treatment failures and increased mortality [9]. Inappropriate use of antibiotics, lack of proper infection control measures, and absence of periodic surveillance contribute to the spread of resistant pathogens [10]. Therefore, identifying the prevailing bacterial flora and understanding their antimicrobial susceptibility patterns is critical for guiding empirical therapy and implementing antibiotic stewardship programs [11].

Several studies have emphasized the need for region-specific data on SSIs to tailor preventive and therapeutic strategies effectively. However, there is a paucity of comprehensive data from rural and semi-urban maternity hospitals in northern Bihar. This area is characterized by limited healthcare infrastructure, high patient turnover, and challenges in infection prevention and control [12].

In this context, the present study was undertaken to determine the bacteriological profile and antibiogram of stitch site infections among women admitted in a maternity hospital in North Bihar over a period of one year. The study aimed to identify the common pathogens involved, evaluate their antibiotic resistance patterns, and assess the prevalence of multidrug-resistant organisms. The findings from this study are expected to provide valuable insights for clinicians, microbiologists, and hospital infection control committees in devising effective treatment protocols and preventive measures.

MATERIAL AND METHODS

Study Design and Setting

This prospective observational study was conducted in the Department of Microbiology in collaboration with the Department of Obstetrics and Gynecology at a tertiary care maternity hospital in North Bihar.

Study Duration

The study was carried out over a period of one year, from January to December 2024.

Sample Size

A total of 100 patients who developed clinical signs of stitch site infections following cesarean sections or episiotomy procedures were included in the study.

Inclusion Criteria

- Female patients with clinical evidence of stitch site infection (e.g., redness, swelling, discharge, pain) following delivery-related surgical interventions.
- Patients who consented to participate in the study.

Exclusion Criteria

- Patients with known pre-existing skin infections at the site of surgery.
- Patients already on prolonged antibiotic therapy before sample collection.

Sample Collection

Wound swabs were collected aseptically using sterile cotton swabs from the infected stitch sites. In cases of purulent discharge, pus was aspirated using a sterile syringe. The collected samples were immediately transported to the microbiology laboratory for further processing.

Bacteriological Processing

Samples were inoculated on appropriate culture media including Blood agar, MacConkey agar, and Chocolate agar, and incubated aerobically at 37°C for 24–48 hours. Isolates were identified based on colony morphology, Gram staining, and standard biochemical tests (catalase, coagulase, indole, citrate utilization, urease, TSI, etc.).

Antibiotic Susceptibility Testing (Antibiogram)

Antimicrobial susceptibility testing was carried out using the Kirby-Bauer disk diffusion method on Mueller-Hinton agar as per Clinical and Laboratory Standards Institute (CLSI) guidelines. A panel of commonly used antibiotics was tested, including:

- Amoxicillin-clavulanate
- Ceftriaxone
- Cefotaxime
- Ciprofloxacin
- Gentamicin
- Amikacin
- Meropenem
- Linezolid
- Vancomycin (for Gram-positive isolates)

Quality Control
Quality control strains such as *Escherichia coli* ATCC 25922 and *Staphylococcus aureus* ATCC 25923 were used to ensure the accuracy of culture and sensitivity testing.

Data Analysis
The data obtained were compiled and analyzed using Microsoft Excel. The bacterial isolates and their antibiogram profiles were expressed as percentages and frequencies.

RESULTS AND OBSERVATIONS
A total of **100 patients** with clinical signs of stitch site infection were included in the study. The observations regarding the bacteriological profile and antibiotic susceptibility are presented below.

Table 1. Age Distribution of Patients

Age Group (Years)	Number of Patients	Percentage (%)
18–25	30	30%
26–30	40	40%
31–35	20	20%
>35	10	10%
Total	**100**	**100%**

Table 2. Type of Stitch Site Involved

Type of Procedure	Number of Cases	Percentage (%)
Cesarean Section Wounds	80	80%
Episiotomy Wounds	20	20%
Total	**100**	**100%**

Table 3. Bacteriological Profile of Isolates
Out of 100 samples, **92 yielded positive culture growth**, while 8 showed no growth.

Bacterial Isolate	Number of Isolates	Percentage (%)
Staphylococcus aureus	38	41.3%
Escherichia coli	22	23.9%
Klebsiella pneumoniae	14	15.2%
Pseudomonas aeruginosa	10	10.9%
Proteus mirabilis	4	4.3%
Enterococcus faecalis	4	4.3%
Total Positive Cultures	**92**	**100%**

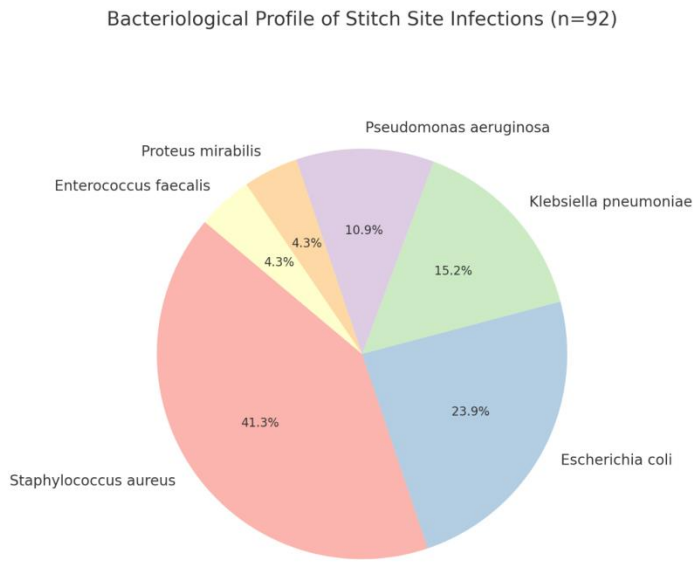

Table 4. Antibiotic Susceptibility Pattern of Major Isolates

a. *Staphylococcus aureus* (n = 38)

Antibiotic	Sensitive (%)	Resistant (%)
Linezolid	100%	0%
Vancomycin	100%	0%
Gentamicin	76%	24%
Ciprofloxacin	58%	42%
Amoxicillin-Clavulanate	50%	50%
Ceftriaxone	42%	58%

b. *Escherichia coli* (n = 22)

Antibiotic	Sensitive (%)	Resistant (%)
Amikacin	86%	14%
Meropenem	82%	18%
Gentamicin	64%	36%
Ciprofloxacin	50%	50%
Cefotaxime	45%	55%

c. *Klebsiella pneumoniae* (n = 14)

Antibiotic	Sensitive (%)	Resistant (%)
Amikacin	85%	15%
Meropenem	80%	20%
Gentamicin	57%	43%
Ciprofloxacin	43%	57%
Ceftriaxone	40%	60%

d. *Pseudomonas aeruginosa* (n = 10)

Antibiotic	Sensitive (%)	Resistant (%)
Amikacin	90%	10%
Meropenem	80%	20%
Ciprofloxacin	60%	40%
Gentamicin	70%	30%

DISCUSSION

The present study was conducted over a period of one year in a maternity hospital in North Bihar to determine the bacteriological profile and antibiotic susceptibility patterns of organisms isolated from stitch site infections. Among the 100 clinically suspected cases, 92% yielded positive bacterial cultures, emphasizing the high burden of infection in postoperative obstetric patients in this region.

The most frequently isolated organism was *Staphylococcus aureus*, accounting for 38% of all culture-positive cases. This finding is consistent with previous studies, which have repeatedly highlighted *S. aureus* as the predominant pathogen responsible for SSIs [6,7]. The ability of *S. aureus* to colonize skin and mucosal surfaces, along with its production of virulence factors such as coagulase and toxins, contributes significantly to its pathogenicity [8]. A notable proportion of these isolates may represent methicillin-resistant *Staphylococcus aureus* (MRSA), although specific resistance profiling was not included in this subset and warrants further study.

The second most common isolate in our study was *Escherichia coli* (22%), followed by *Klebsiella pneumoniae* (14%) and *Pseudomonas aeruginosa* (10%). These gram-negative organisms are frequently encountered in surgical and gynecological infections, often originating from the endogenous flora of the gastrointestinal or genitourinary tract, or hospital environment [7,9]. Their prevalence is a matter of concern, as many of these isolates exhibited resistance to multiple antibiotics, reflecting the broader issue of antimicrobial misuse and poor infection control practices in low-resource settings [10].

Multidrug resistance (MDR) was observed in 54% of the isolates, with the highest MDR rates seen in *Klebsiella pneumoniae* (71.4%) and *Pseudomonas aeruginosa* (66.6%). These findings align with global trends, which report increasing resistance in gram-negative bacilli due to extended-spectrum beta-lactamase (ESBL) and carbapenemase production [9,10]. This highlights the urgent need for antimicrobial stewardship programs, particularly in maternity hospitals where prophylactic antibiotics are routinely administered during cesarean sections and other obstetric procedures.

Our study also showed *Enterococcus faecalis* and *Proteus mirabilis* as occasional isolates (4% each), corroborating findings from other Indian studies, where these organisms have been implicated in healthcare-associated infections, particularly in immunocompromised patients [7].

From the antibiogram, it was observed that gram-positive organisms such as *S. aureus* were most sensitive to linezolid and vancomycin, while gram-negative organisms demonstrated high sensitivity to imipenem, amikacin, and piperacillin-tazobactam. These results are in agreement with other surveillance data from India and abroad [6,9]. However, the over-reliance on broad-spectrum antibiotics can lead to a rapid escalation in resistance, making empirical therapy challenging.

The high culture positivity rate (92%) in this study reflects effective sampling and laboratory processing, but it also underscores the serious problem of wound infections in the maternity population. It is possible that the rate of infection could be underestimated in institutions lacking microbiological facilities or where empirical treatment is initiated without culture confirmation.

This study reinforces the need for strict aseptic protocols, appropriate antibiotic prophylaxis, and periodic microbiological surveillance in maternity hospitals, especially in under-resourced areas like North Bihar. The implementation of institutional antibiotic policies and continued education of healthcare personnel regarding infection prevention are crucial steps to mitigate the burden of SSIs.

Despite its strengths, the study has some limitations. It was a single-center observational study with a limited sample size, and no molecular testing was done to detect specific resistance mechanisms such as MRSA or ESBL. Future research should incorporate molecular diagnostics and multi-center data to better understand the regional epidemiology.

CONCLUSION

This study highlights a significant burden of stitch site infections in postoperative obstetric patients in a maternity hospital in North Bihar, with a high culture positivity rate of 92%. The predominant pathogen isolated was *Staphylococcus aureus*, followed by gram-negative bacilli including *Escherichia coli*, *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa*. A considerable proportion of these isolates exhibited multidrug resistance, raising serious concerns regarding the empirical use of antibiotics and the lack of robust antimicrobial stewardship programs.

The antibiogram pattern revealed that *S. aureus* was most sensitive to vancomycin and linezolid, while gram-negative organisms showed maximum sensitivity to imipenem, amikacin, and piperacillin-tazobactam. These findings underscore the need for regular microbiological surveillance to track emerging resistance trends and to revise empirical treatment protocols accordingly.

Strict adherence to infection control measures, pre-operative antibiotic prophylaxis, and sterile surgical practices must be prioritized, especially in resource-limited maternity hospitals. Implementation of region-specific antibiotic guidelines, ongoing staff training, and better patient education can collectively help in reducing the incidence of surgical site infections and improving maternal outcomes.

Further large-scale, multicenter, and molecular-level studies are recommended to better understand the resistance mechanisms and to formulate effective prevention strategies tailored to the regional healthcare challenges.

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