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Microbiological Profile and Demographic Determinants of Postoperative Infections: A Cross-Sectional Analysis of 100 Cases

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ABSTRACT

Purpose: This study aimed to delineate the demographic characteristics, surgical profiles, and microbiological spectrum of pathogens isolated from patients who developed postoperative infections, thereby informing targeted prophylactic and therapeutic strategies.

Materials and Methods: This cross-sectional study was conducted on a cohort of 100 patients who developed postoperative infections. Demographic variables including age, gender, and adult versus pediatric status were recorded. Surgical procedures were categorized, and microbiological cultures were processed to identify the spectrum of bacterial and fungal isolates. Descriptive statistics were employed to analyze frequency distributions and percentages.

Results: The cohort was predominantly female (70%, *n* = 70), with adults constituting the vast majority (97%, *n* = 97). The age distribution ranged from 2 to 70 years, with the highest concentration observed at 30 years (14%, *n* = 14). Cesarean section was the most frequently implicated surgical procedure (58%, *n* = 58), followed by cholecystectomy (13%, *n* = 13) and appendectomy (11%, *n* = 11). Microbiological analysis revealed *Klebsiella* species as the predominant isolate (24%, *n* = 24), followed by beta-hemolytic staphylococci (18%, *n* = 18). *Staphylococcus aureus* and beta-hemolytic streptococci each accounted for 12% (*n* = 12), while *Pseudomonas* species and *Escherichia coli* represented 10% (*n* = 10) and 8% (*n* = 8), respectively. Less common organisms included *Candida* (4%), *Bacillus* (3%), *Streptococcus viridans* (3%), *Enterobacter* (2%), and *Staphylococcus epidermidis* (1%).

Conclusion: The study highlights a pronounced female predominance driven largely by cesarean-related infections, alongside a diverse microbiological landscape dominated by Gram-negative bacilli and staphylococcal species. These findings underscore the necessity for procedure-specific infection control protocols and tailored antimicrobial prophylaxis, particularly in obstetric and abdominal surgical settings. (*Open J Biomed Res 2026;5:65-71*)

Keywords: Postoperative infection, surgical site infection, microbiological profile, *Klebsiella*, *Staphylococcus aureus*, cesarean section, antimicrobial resistance.

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AUDIOABSTRACT

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INTRODUCTION

Surgical site infections represent one of the most prevalent yet preventable complications in modern surgical practice, exerting a substantial burden on patient outcomes and healthcare systems worldwide.[1] Despite advances in aseptic techniques, antimicrobial

prophylaxis, and perioperative care, SSIs continue to complicate between 2% and 5% of all surgical procedures, with significantly higher rates reported in resource-limited settings.[2] The pathogenesis of these infections is multifactorial, intertwining patient-related determinants such as age, gender, and comorbid status with procedure-specific variables including the type of surgery, duration of operation, and institutional adherence to infection prevention bundles.[3]

The microbiological etiology of postoperative infections has evolved considerably over recent decades. While Gram-positive cocci, particularly *Staphylococcus aureus*, have historically dominated the epidemiological landscape, contemporary reports indicate a shifting paradigm toward Gram-negative bacilli, including *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, and *Escherichia coli*.[4] This transition is particularly pronounced in intra-abdominal and obstetric surgical procedures, where enteric flora and environmental contaminants play a pivotal role in wound colonization.[5] Furthermore, the emergence of multidrug-resistant organisms has complicated empirical therapeutic decision-making, necessitating a granular understanding of local microbiological patterns.[6]

Demographic disparities in SSI incidence have garnered increasing attention in the surgical literature. Female patients, particularly those undergoing cesarean delivery, exhibit disproportionately high infection rates attributable to physiological, immunological, and procedural factors.[7,8] Similarly, age-related variations in immune competence and wound healing capacity render certain age groups more vulnerable to postoperative infectious complications.[9] Understanding these demographic and procedural gradients is essential for risk stratification and the implementation of targeted preventive interventions.

In light of these considerations, the present study was undertaken to characterize the demographic architecture, surgical distribution, and microbiological spectrum of postoperative infections in a cohort of 100 patients. By elucidating the interplay between patient characteristics, operative variables, and pathogen profiles, this investigation seeks to contribute actionable insights to the local infection control discourse and inform evidence-based improvements in surgical care.

MATERIALS AND METHODS

Study Design and Setting

This cross-sectional observational study was conducted at a tertiary care facility located in western region of Libya, enrolling patients who developed postoperative infections during the study period. The investigation adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines to ensure methodological transparency and reproducibility.

Study Population

A total of 100 patients with clinically and microbiologically confirmed postoperative infections were included in the analysis. Patients were stratified according to age, gender, and adult versus pediatric classification. Pediatric status was defined as an age below 18 years.

Data Collection

Demographic data, including chronological age and gender, were extracted from medical records. Surgical procedures were categorized into distinct groups: appendectomy, bone surgery, cesarean section, cholecystectomy, and a composite "other surgery" category encompassing miscellaneous operative interventions. Microbiological data were obtained from culture and sensitivity reports of wound, tissue, or fluid specimens collected under aseptic conditions.

Microbiological Processing

Specimens were inoculated onto standard culture media and incubated under appropriate atmospheric conditions. Bacterial and fungal isolates were identified using conventional phenotypic methods and, where available, automated identification systems. Pathogens were recorded at the species or genus level as clinically reported.

Statistical Analysis

Descriptive statistics were utilized to summarize the study variables. Categorical variables were expressed as frequencies and percentages. Data were organized and analyzed using standard spreadsheet software.

RESULTS

Demographic Characteristics

The study cohort comprised 100 patients with postoperative infections. Female patients constituted the majority, accounting for 70% (*n* = 70) of the total sample, whereas male patients represented 30% (*n* = 30). The overwhelming majority of cases occurred in adults (97%, *n* = 97), with pediatric patients comprising a mere 3% (*n* = 3) of the cohort (Fig. 1).

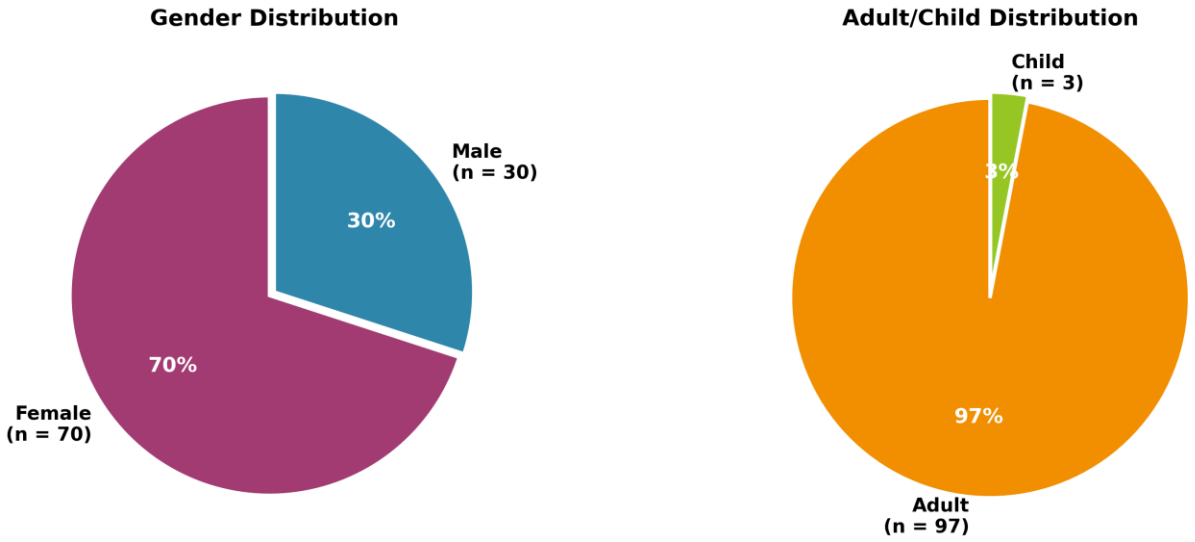


Fig 1: Demographic characteristics of the study cohort (*n* = 100). (A) Gender distribution showing female predominance (70%, *n* = 70). (B) Adult/child distribution demonstrating an adult-majority cohort (97%, *n* = 97).

Age distribution analysis revealed a broad spectrum ranging from 2 to 70 years. The most frequently represented age was 30 years, contributing 14% (*n* = 14) of all cases. Notable clustering was observed among patients in their mid-to-late twenties, with ages 25, 26, and 27 years accounting for 6%, 7%, and 6% of infections, respectively. The distribution exhibited a right-skewed pattern, with sporadic cases documented in the sixth and seventh decades of life (Fig. 2).

Surgical Procedure Distribution

Cesarean section emerged as the most frequently implicated surgical intervention, representing 58% (*n* = 58) of all postoperative infections. Cholecystectomy accounted for 13% (*n* = 13), followed closely by appendectomy at 11% (*n* = 11). Bone surgery contributed 8% (*n* = 8), while the remaining 10% (*n* = 10) were attributed to miscellaneous procedures aggregated under "other surgery" (Fig. 3).

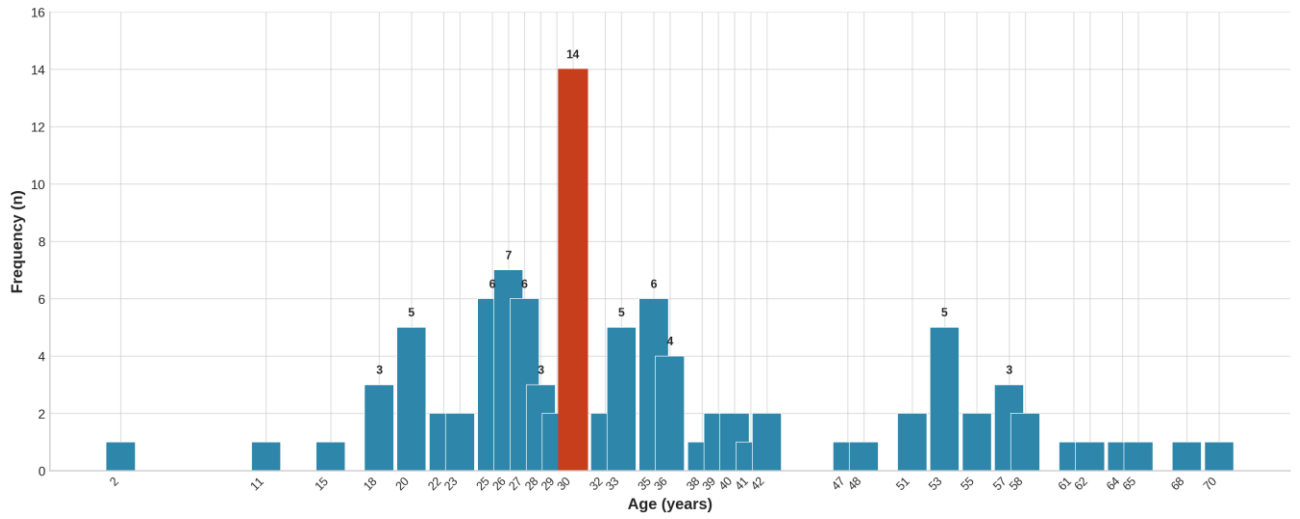


Fig 2: Age distribution of patients with postoperative infections (*n* = 100). The age spectrum ranged from 2 to 70 years, with the highest frequency observed at 30 years (*n* = 14, 14%).

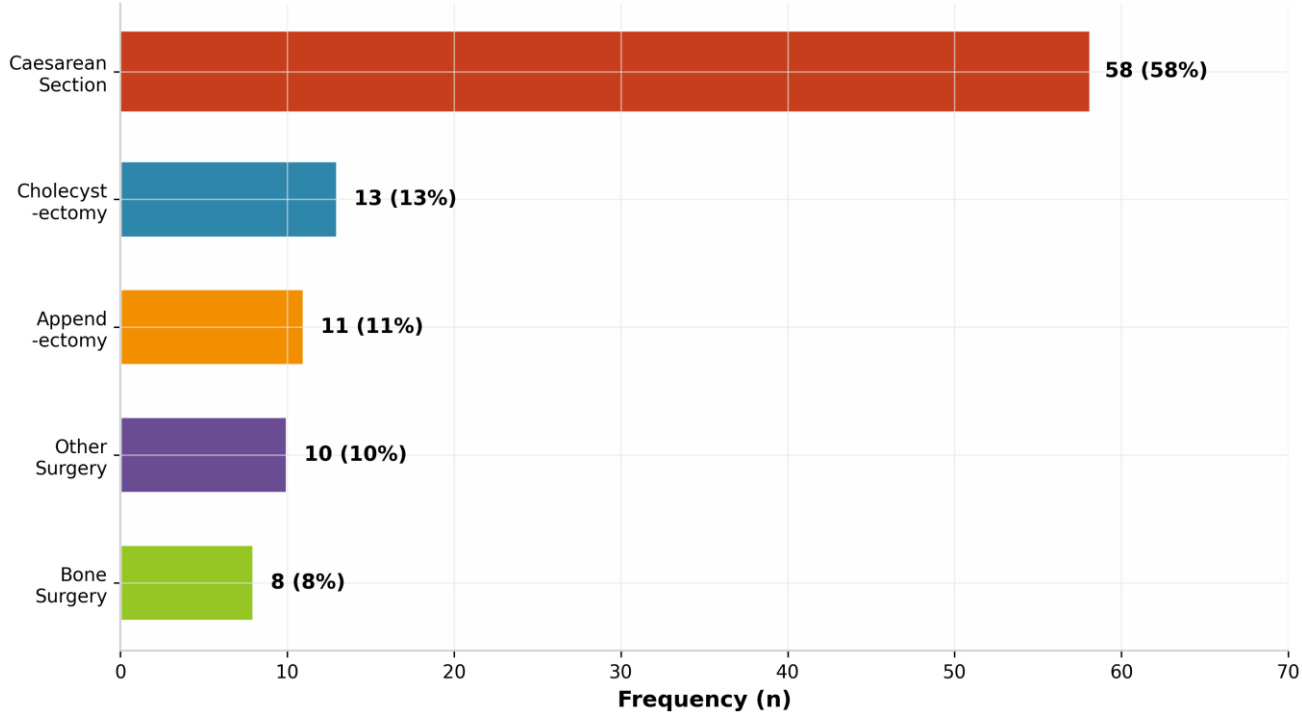


Fig 3: Distribution of surgical procedures among patients with postoperative infections (*n* = 100). Cesarean section was the most common procedure (58%, *n* = 58), followed by cholecystectomy (13%, *n* = 13) and appendectomy (11%, *n* = 11).

Microbiological Spectrum

Microbial profiling of the infected cohort identified *Klebsiella* species as the predominant isolate, comprising nearly a quarter of all cultured organisms (24%, *n* = 24). Beta-hemolytic staphylococci represented the second most common group, accounting for 18% (*n* = 18) of isolates. *Staphylococcus aureus* and beta-hemolytic streptococci each constituted 12% (*n* = 12) of the microbiological yield.

Pseudomonas species were detected in 10% (*n* = 10) of cultures, while *Escherichia coli* was identified in 8% (*n* = 8). Less prevalent organisms included *Candida* species (4%, *n* = 4), *Bacillus* species (3%, *n* = 3), beta-hemolytic organisms (3%, *n* = 3), *Streptococcus viridans* (3%, *n* = 3), *Enterobacter* species (2%, *n* = 2), and *Staphylococcus epidermidis* (1%, *n* = 1) (Fig. 4).

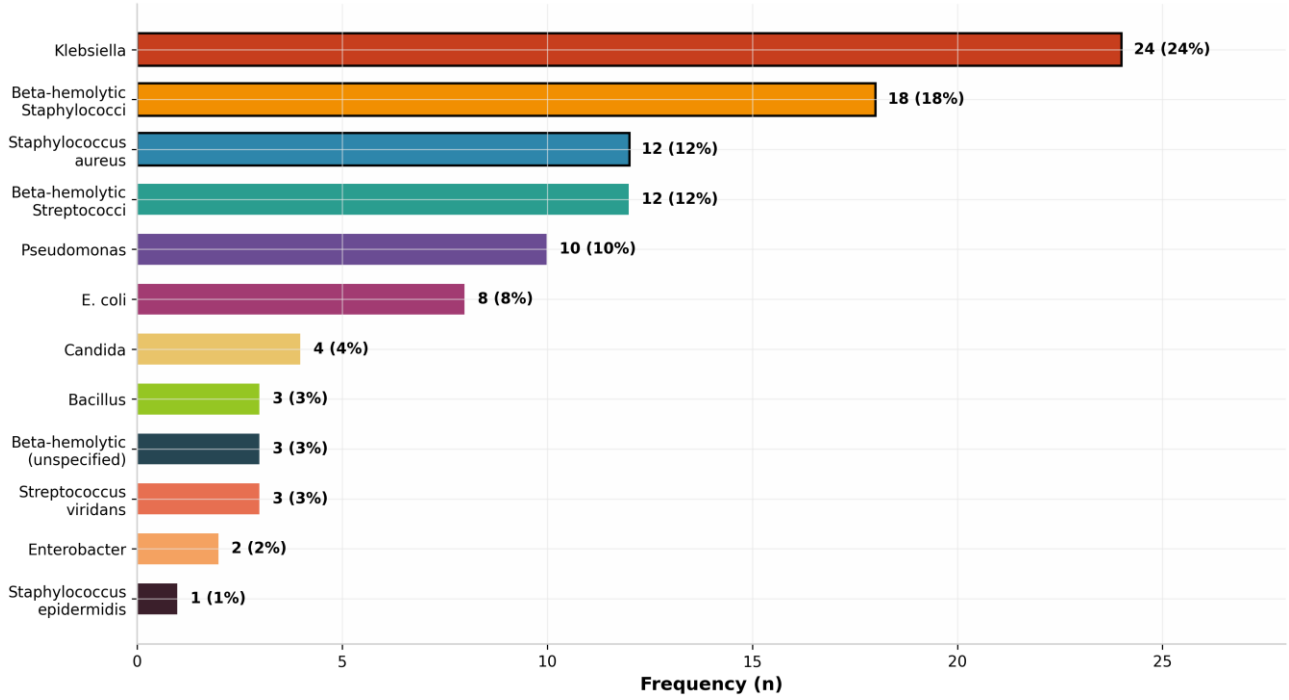


Fig 4: Microbiological spectrum of isolated pathogens from postoperative infections (*n* = 100). *Klebsiella* species were the most frequently isolated organisms (24%, *n* = 24), followed by beta-hemolytic staphylococci (18%, *n* = 18).

DISCUSSION

The findings of this study illuminate several critical dimensions of postoperative infection epidemiology within the analyzed cohort. The pronounced female predominance (70%) is striking and aligns closely with the overwhelming representation of cesarean sections, which accounted for more than half of all infectious complications. This observation resonates with existing literature documenting elevated SSI rates following cesarean delivery, particularly in settings where emergency procedures, prolonged labor, and suboptimal antibiotic prophylaxis may converge to heighten infectious risk.[10,11] The physiological and immunological alterations of pregnancy, compounded by surgical trauma and microbial exposure from the lower genital tract, create a permissive environment for wound colonization and subsequent infection.[12]

The adult-centric nature of the cohort (97%) is consistent with the broader epidemiology of surgical interventions, as adults undergo the majority of elective and emergency procedures. The age clustering around the third decade of life further reinforces the obstetric influence, reflecting the typical reproductive age range of women undergoing cesarean delivery. The sporadic representation of older age groups likely corresponds to the lower frequency of major surgical interventions in elderly populations within the study setting, or conversely, may reflect successful infection prevention in this demographic.

From a microbiological standpoint, the ascendancy of *Klebsiella* species as the leading isolate is particularly noteworthy. This Gram-negative bacillus, a commensal of the human gastrointestinal tract, has increasingly

been implicated in healthcare-associated infections, including SSIs following abdominal and obstetric surgery.[13] Its predominance in the present cohort likely reflects the high volume of intra-abdominal and pelvic procedures, where enteric flora translocation and direct wound contamination are plausible mechanisms of infection. The substantial representation of beta-hemolytic staphylococci (18%) and *Staphylococcus aureus* (12%) underscores the enduring significance of Gram-positive skin flora as etiological agents of postoperative infections, particularly in clean-contaminated and contaminated surgical fields.[14]

The co-occurrence of *Pseudomonas aeruginosa* (10%) and *Escherichia coli* (8%) further enriches the microbiological tapestry, highlighting the polymicrobial nature of many surgical infections. *Pseudomonas* species, notorious for their intrinsic resistance to multiple antimicrobial classes and their propensity to colonize moist wound environments, pose formidable therapeutic challenges.[15] The presence of *Candida* species (4%), albeit in smaller numbers, serves as a reminder of the opportunistic fungal pathogens that can superinfect surgical wounds, particularly in patients with prolonged antibiotic exposure, immunosuppression, or indwelling catheters.[16]

The relatively low prevalence of *Staphylococcus epidermidis* (1%) and *Enterobacter* species (2%) in this cohort contrasts with some reports from high-resource settings, where coagulase-negative staphylococci and enteric bacilli feature more prominently. This divergence may reflect differences in patient demographics, surgical case-mix, local antimicrobial stewardship practices, or microbiological detection methodologies.[17]

Several limitations warrant acknowledgment. The cross-sectional design precludes the establishment of temporal or causal relationships between specific risk factors and infection outcomes. The absence of data on antimicrobial susceptibility patterns, comorbid conditions, and perioperative variables (e.g., operation duration, blood loss) restricts the depth of risk factor analysis. Furthermore, the aggregation of miscellaneous procedures under "other surgery" limits granular insights into less common operative interventions.

CONCLUSION

This study delineates a postoperative infection landscape heavily influenced by obstetric surgical practice, with cesarean sections driving both the female predominance and the age distribution of affected patients. The microbiological profile, dominated by *Klebsiella* species, beta-hemolytic staphylococci, and *Staphylococcus aureus*, reflects a confluence of enteric and cutaneous flora typical of abdominal and pelvic surgery. These findings advocate for the implementation of procedure-specific infection prevention bundles, enhanced antimicrobial stewardship tailored to local resistance patterns, and heightened vigilance in obstetric surgical care. Future research should incorporate longitudinal designs, antimicrobial susceptibility data, and comprehensive risk factor profiling to further refine preventive and therapeutic paradigms.

Conflicts of Interest

The authors declare no conflicts of interest.

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