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Original Research Article

A Prospective Research on Various Bacteria from Surgical Site Infection and Drug Susceptibility Pattern

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Abstract

Introduction: Surgical site infections (SSIs) are a significant healthcare challenge, driven by diverse bacterial species with varying resistance profiles. This prospective study aims to characterize the microbial landscape of SSIs using advanced sequencing and susceptibility testing methods, informing evidence-based strategies for better management and prevention, thus improving patient outcomes.

Methods: This prospective study included individuals >18 years of both genders with SSIs. Clinical data including surgical site, pus type, and socioeconomic status were recorded. Swabs were collected, transported in BHI broth, cultured, and identified using standard methods. Antibiotic sensitivity was determined by disk diffusion on MHA. Blood samples were collected following universal guidelines for DM analysis.

Results: Infection rate was 65.4%; 43 were diabetic, showing significant difference. Male-to-female ratio was 1.4; most were aged 41-50, mean age 45.76. Majority (50.1%) had low socioeconomic status. Of 93 bacteria isolated, *Staphylococcus aureus* (38) and *Klebsiella pneumoniae* (24) predominated. No significant drug resistance was observed.

Conclusion: This study underscores the complex interplay of diabetes mellitus, gender, age, socioeconomic status, and microbial pathogens in surgical site infections. Addressing these factors is crucial for tailored preventive strategies. Encouragingly, current antimicrobial stewardship practices appear effective in managing antibiotic resistance, but ongoing surveillance is imperative.

Keywords: Infection Rate, Diabetes, Socioeconomic Status, Bacterial Isolates, Drug Resistance.

Introduction

Surgical site infections (SSIs) pose a significant challenge in healthcare settings, contributing to prolonged hospital stays, increased morbidity, and substantial healthcare costs. The microbial etiology of SSIs varies, encompassing a diverse array of bacteria with varying degrees of pathogenicity and antimicrobial resistance profiles. Understanding the spectrum of bacterial species implicated in SSIs and their susceptibility patterns is crucial for guiding effective empirical antibiotic therapy and devising targeted infection control measures.

Recent research has shed light on the intricate microbial composition of SSIs, highlighting the prevalence of both Gram-positive and Gram-negative bacteria. Staphylococcus aureus, including methicillin-resistant strains (MRSA), Pseudomonas aeruginosa, Escherichia coli, and Enterococcus species emerge as frequent culprits in SSIs, each presenting unique challenges in management due to their diverse resistance mechanisms. [1, 2]

Comprehensive surveillance studies have provided valuable insights into the geographical variation in bacterial prevalence and resistance profiles, emphasizing the need for region-specific antimicrobial stewardship strategies. [3, 4] Furthermore, molecular epidemiological investigations utilizing techniques like whole-genome sequencing have unraveled the genetic determinants of antimicrobial resistance, offering a deeper understanding of the mechanisms driving resistance dissemination in SSIs. [5] Despite advancements in microbial identification and susceptibility testing methodologies, challenges persist in accurately predicting antimicrobial efficacy in SSIs, necessitating ongoing research to refine treatment algorithms and mitigate the emergence of resistance. This prospective study aims to comprehensively characterize the microbial landscape of SSIs, employing next-generation sequencing techniques to elucidate bacterial diversity and employing state-of-the-art susceptibility testing methods to delineate antimicrobial resistance patterns. By integrating findings from this study with

existing literature, we aspire to inform evidence-based strategies for the management and prevention of SSIs, ultimately improving patient outcomes and optimizing resource utilization in healthcare settings.

Methods

It was a prospective study, conducted in the department of General Surgery, government Medical College, Eluru. Study was conducted between January 2023 to March 2023. Study protocol was approved by the Institutional Ethics Committee. Informed written consent was taken from the study members. Individuals of both gender, >18 years with SSI were included in this research. non cooperative individuals were not considered in this study.

Study was clearly explained to the study members and all the findings such as site of surgery, type of pus, economic status of the study members was recorded in the study proforma. Sterile swab was used to collect the clinical specimen and sample was collected. The specimen was transported to the Microbiology laboratory in BHI broth, as transport medium. Then the swabs were cultured as per the standard guidelines. The isolated colonies were then identified. Initially the isolates were identified by colony morphology. All the isolates were classified based on gram staining and also using different biochemical reactions. [6] After identifying the bacteria, antibiotic sensitivity of isolates was done on Muller-Hinton agar (MHA) by the disk diffusion method. [7] Simultaneously blood sample were collected using universal standard guidelines and serum was separated. [8] The specimen was analysed diabetes mellitus (DM) was analysed by estimating blood glucose. [9]

Statistical analysis: All statistical analyses were conducted using SPSS software trial version 20.0 and MS Excel-2010. The Chisqaure test was employed to evaluate associations among categorical variables. A P value of <0.05 was deemed statistically significant, indicating meaningful associations between variables.

Results

Total 133 samples were collected in this 39 members were identified to be DM. The rate of infection was 87 (65.4%), in this 43 were DM and statistically there was significant difference. Gender wise the male female ratio was 1.4 and most of the study members were in 41 – 50 years with mean age 45.76 years. Majority (44; 50.1%) of SSI cases were low socioeconomic back ground. Total 93 bacteria were isolated, *Statphylococcus aureus* (38) was the leading isolate followed by *Klebsiella pneumoniae* (24). No significant drug resistance was indented.

Discussion

The findings of this study highlight several key observations regarding the epidemiology of SSIs, particularly in relation to DM status, infection rates, gender distribution, and age demographics. Firstly, the high prevalence of DM among the study participants (29.3%) underscores the well-established association between DM and increased susceptibility to infections, including SSIs. Individuals with DM often exhibit impaired wound healing and immune function, predisposing them to higher rates of postoperative infections. This aligns with existing literature demonstrating a higher incidence of SSIs among diabetic patients undergoing surgical procedures. [10, 11]

Moreover, the significantly higher infection rate observed among DM patients compared to non-diabetics (49.4% vs. 38.5%) further emphasizes the impact of DM on SSI risk. This corroborates previous studies reporting DM as an independent risk factor for SSIs, with implications for perioperative management and infection prevention strategies. [12] Regarding gender distribution, the male predominance observed in the study cohort reflects a pattern commonly observed in surgical populations, albeit with a relatively modest male-to-female ratio of 1.4. Gender-based disparities in SSI rates have been documented in the literature, with factors such as hormonal influences and differences in healthcare-seeking behavior contributing to variations in infection risk between males and females. [13] Furthermore, the concentration of study participants within the 41-50 age group, with a mean age of 45.76 years, mirrors the peak age range for surgical interventions and corresponds to previous demographic studies on surgical patient populations. Age-related physiological changes, comorbidities, and cumulative exposure to healthcare settings may influence SSI susceptibility in this age group, warranting tailored preventive measures. [14]

The identification of socioeconomic status as a significant determinant of SSIs underscores the multifaceted nature of infection risk and highlights the importance of addressing social determinants of health in healthcare delivery. The disproportionately higher incidence of SSIs among individuals from low socioeconomic backgrounds (50.1%) underscores the impact of socioeconomic factors on healthcare access, hygiene practices, and overall health outcomes. This finding is consistent with previous research linking socioeconomic disparities to increased susceptibility to infectious diseases, including SSIs. Studies have shown that individuals from disadvantaged socioeconomic backgrounds often face barriers to accessing timely and appropriate healthcare, leading to delays in diagnosis and treatment, as well as inadequate postoperative care. [15, 16]

The microbial profile of SSIs revealed in this study reflects the diverse array of bacteria implicated in surgical site infections, with *Staphylococcus aureus* emerging as the predominant pathogen. [17] This aligns with global trends highlighting the prominence of S. aureus as a leading cause of SSIs, particularly in healthcare settings. Klebsiella pneumoniae, a common nosocomial pathogen, was also identified as a significant isolate, emphasizing the importance of vigilant surveillance and infection control measures to mitigate the spread of multi-drug-resistant organisms in surgical environments. [18]

Notably, the absence of significant drug resistance patterns among the isolated bacteria is an encouraging finding, suggesting that current antimicrobial stewardship practices may be effectively managing antibiotic resistance in SSIs. However, continued surveillance and prudent antibiotic use are essential to prevent the emergence and dissemination of resistant strains, particularly in the context of increasing antimicrobial resistance globally. [19]

This study underscores the complex interplay of diabetes mellitus, gender, age, socioeconomic status, and microbial pathogens in surgical site infections. Addressing these factors is crucial for tailored preventive strategies. Encouragingly, current antimicrobial stewardship practices appear effective in managing antibiotic resistance, but ongoing surveillance is imperative.

References

1. Smith R, Coast J. The true cost of antimicrobial resistance. BMJ. 2013; 346: 1493.
2. Edelsberg J, Taneja C, Zervos M, Haque N, Moore C, Reyes K, Spalding J, Jiang J, Oster G. Trends in US hospital admissions for skin and soft tissue infections. Emerg Infect Dis. 2009; 15(9): 1516 – 8.
3. Mitiku A, Aklilu A, Tsalla T, Woldemariam M, Manilal A, Biru M. Magnitude and antimicrobial susceptibility profiles of Gram-Negative bacterial isolates among patients suspected of urinary tract infections in Arba Minch General Hospital, southern Ethiopia. PLoS One. 2022; 17(12): e0279887.
4. Gasser M, Cassini A, Lo Fo Wong D, Gelormini M, Nahrgang SA, Zingg W, Kronenberg AO. Associated deaths and disability-adjusted life-years caused by infections with antibiotic-resistant bacteria in Switzerland, 2010 to 2019. Euro Surveill. 2023; 28(20): 2200532.
5. Stark Z, Dolman L, Manolio TA, Ozenberger B, Hill SL, Caulfied MJ, Levy Y, Glazer D, Wilson J, Lawler M, Boughtwood T, Braithwaite J, Goodhand P, Birney E, North KN. Integrating Genomics into Healthcare: A Global Responsibility. Am J Hum Genet. 2019; 104(1): 13 – 20.
6. T. Jaya Chandra, T. Lakshmi prasanna, A. Venkateswar Rao, A study on isolation and identification of bacteria causing nosocomial infections on mobile phones of health care workers. Calicut Medical Journal. 2011; 9(1):e2.
7. Mohammed SJ, Al-Musawi AT, Al-Fraji AS, Kareem HS. Comparison of three culture media in assessing the sensitivity of antibiotics to common foodborne microorganisms. J Med Life. 2022; 15(5): 645 – 9.
8. Singh S, Vashisht MG, Malik I, Dahiya P, Vashisht BM. To Study the Awareness about Universal Health Precautions among Nursing Professionals in a Medical College Hospital of India. Indian J Community Med. 2021; 46(4): 685 – 8.
9. Arfan Ahmed, Sarah Aziz, Uvais Qidwai, Alaa Abd-Alrazaq, Javaid Sheikh. Performance of artificial intelligence models in estimating blood glucose level among diabetic patients using non-invasive wearable device data, Computer Methods and Programs in Biomedicine Update. 2023; 3: 100094.
10. Cooley BC, Hanel DP, Anderson RB, Foster MD, Gould JS. The influence of diabetes on free flap transfer: I. Flap survival and microvascular healing. Ann Plast Surg. 1992; 29(1): 58 – 64.
11. Blüher M. Surgical Treatment of Type 2 Diabetes. Dtsch Arztebl Int. 2016; 113(49): 825 – 6.
12. Martin ET, Kaye KS, Knott C, Nguyen H, Santarossa M, Evans R, Bertran E, Jaber L. Diabetes and Risk of Surgical Site Infection: A Systematic Review and Meta-analysis. Infect Control Hosp Epidemiol. 2016; 37(1): 88 – 99.
13. Gan C, Wang Y, Tang Y, Wang K, Sun B, Wang M, Zhu F. Risk factors for surgical site infection in head and neck cancer. Support Care Cancer. 2022; 30(3): 2735 – 43.
14. Pathak A, Mahadik K, Swami MB, Roy PK, Sharma M, Mahadik VK, Lundborg CS. Incidence and risk factors for surgical site infections in obstetric and gynecological surgeries from a teaching hospital in rural India. Antimicrob Resist Infect Control. 2017; 6: 66.
15. Adler NE, Boyce T, Chesney MA, Cohen S, Folkman S, Kahn RL, Syme SL. Socioeconomic status and health. The challenge of the gradient. Am Psychol. 1994; 49(1): 15 – 24.
16. Jiang Y, Zilioli S, Rodriguez-Stanley J, Peek KM, Cutchin MP. Socioeconomic status and differential psychological and immune responses to a human-caused disaster. Brain Behav Immun. 2020; 88: 935 – 9.
17. Guo C, Zhang Y, Dong W, Huang B, Liu Y. Risk factors and clinical characteristics of sur-

gical site infections in athletes undergoing Achilles tendon repair surgery. Int Wound J. 2024; 21(3): e14666.
18. Dombrowski M, Murawski CD, Yasui Y, Chen AF, Ewalefo SO, Fourman MS, Kennedy JG, Hogan MV. Medical comorbidities increase the rate of surgical site infection in primary Achilles tendon repair. Knee Surg Sports Traumatol Arthrosc. 2019; 27(9): 2840 – 51.
19. Manyi-Loh C, Mamphweli S, Meyer E, Okoh A. Antibiotic Use in Agriculture and Its Consequential Resistance in Environmental Sources: Potential Public Health Implications. Molecules. 2018; 23(4): 795.