

Antimicrobial Resistance Pattern of Clinical Isolates of Infected Wounds

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ABSTRACT: *The progressively increasing invasive systemic infections are among the lead health problems caused by the wound infections. The morbidity and mortality rate is increased due to the widespread use of antibiotics and resistance caused by the microorganisms.*

AIMS & OBJECTIVES: *The aim of study is to isolate the causative organisms and study their pattern of drug susceptibility of bacteria cultured from superficial wound infections.*

METHODOLOGY: *Analytical cross-sectional study was conducted at King Edward Medical University. A total of 87 patients were selected who had superficial wound infection. Sterile cotton swabs were used to obtain the specimens from wounds and processed. Bacterial isolation done by culturing technique and susceptibility testing were performed. Identification of organisms was done by biomedical tests. Kirby-Baur disc diffusion method was used for sensitivity testing.*

RESULTS: *Eighty-seven patients having wound infection were selected for sample collection. Gram positive isolate were 43 (49.5%) and gram negative were 44 (50.5%). Forty two out of 87 (48.2%) isolated organisms were *S. aureus*, *Pseudomonas aeruginosa* (19.5%), *E. coli* (13.7%), *Enterobacter* (8.04%), *Acinetobacter* (5.7%) and *Klebsiella* (2.2%). Ninety-three per cent of gram positive isolates showed resistance to trimethoprim-sulphamethoxazole followed by 83.7% to penicillin, 72.1% to erythromycin and 2.3% resistance to linezolid. None of isolate exhibited resistance against vancomycin. Out of gram negative isolates, 97.7% were resistant to ceftriaxone followed by 93.1% to cefotaxime, and only 11.3% to imipenem.*

CONCLUSION: *Isolation of *S. aureus* were dominant among the both gram positive and gram negative broad spectrum*

bacteria. Most of them showed resistance to different tested antibiotics. In vitro testing for sensitivity was less effective by ampicillin, ceftriaxone, penicillin and trimethoprim-sulphamethoxazole. The greater effectiveness was shown by many antibiotics such as gentamicin, imipenem, linezolid, amikacin and vancomycin.

INTRODUCTION

The progressively increases invasive systemic infections are among the lead health problems caused by the wound infections. Wide range of microorganisms may cause wound infections including bacteria (aerobes and anaerobes), fungi and parasites. Bacteria are a predominant cause of wound infections. (1) Gram positive and gram negative bacteria both cause wound infection. In most studies high bacterial isolation rate >70% have been reported as *Staphylococcus aureus*, *Pseudomonas aeruginosa* and bacteria belonging to family Enterobacteriaceae. (2) Wound infection can lead to inhibition of the healing process that results in complication in treatment and management. Such Patients require prolonged hospitalization and in some cases wound infection may cause high morbidity and mortality. (3) Frequent use of inappropriate antibiotics prescribed in wound infection is the most common cause of increase pathogenic bacterial resistant strains (4). The purpose of this study is to find the current prevalence and distribution of bacterial infections in the local population. This study gives a view about the sensitivity and resistance pattern of isolates. It will help to understand the ongoing crisis and will provide out-line about choice of treatment.

METHODOLOGY

Pus /wound swab samples were collected from 87 patients of Mayo Hospital, Lahore with complaints of discharge, painful delayed and non-healing wound infection. Aseptic technique was used to collect the samples with swab from surface

exudates of open wounds. Moist sterile gauze and sterile normal saline were used to wash-off the contaminants. After removing the dressing, the sterile normal saline was used to decontaminate the wound. Sterile cotton swabs were used to collect the specimen with sufficient pressure and rotation. The inner surface of wound was swabbed gently and samples were sent to laboratory for culture, further identification and susceptibility testing. The transportation was done by using Amies transport media to laboratory. In the microbiology laboratory, samples were processed in biological safety hood. Routine culture plates including Chocolate agar, Blood agar and MacConkey plates were used to isolate the organisms. The specimens were inoculated through quadrant streaking method to get pure growth. These plates were incubated at 37 for 24 hours. A 0.5 McFarland suspension was prepared from the isolated colony and speeded through lawning method on Müller-Hinton agar plates. Appropriate antibiotic disc were applied on culture plate and incubated at 37 oC for 18 hours. After incubation zone of inhibition measured according to CLIC 2017.

DATA ANALYSIS PROCEDURE

The statistical package for social science (SPSS) version 21 was used to enter and analyze the data. The mean ± SD was used as quantitative variables like age. The gender as qualitative variable was presented with frequency and percentages. Ninety-five per cent confidence levels were used to evaluate and P< 0.05 was considered statistically significant. The frequencies and mean were used for descriptive analysis and tables and charts used for the presentation of data results.

RESULTS

A total of 87 wound swab samples from patients of different age.s and sex were included in this study. The male and female ratio was 1:1.3, 49 (56.3%) were male whereas 38 (43.6%) were female. A total of 87 bacterial isolates were obtained, 43 (49.4%) were gram positive while 44 (50.5%) were gram negative bacteria. S. aureus showed predominance with 43 (49.4%), followed by Pseudomonas aeruginosa 17(19.5%), E. coli 12 (13.7%), Enterobacter 7 (8.04%), Acinetobacter 5 (5.7%) and Klebsiella spp. 2 (2.2%) (Fig.1)

Seven antibiotics were slected to test the gram positive

isolates.The organisms showed variation in their patterns of susceptibility to all the antibiotics used. Gram positive isolates were sensitive to a higher extent to gentamicin(86.4%). Maximum number of isolates were resistant to trimethoprim-sulphamethoxazole followed by penicillin G (83.7%), clindamycin (69.7%), erythromycin (72.1%) and least resistant to linezolid (2.3%) illustrated in (Fig. 2).Gram negative bacteria (n=44) were tested against seven selected antibiotics. The isolates showed resistance to ceftriaxone in 97.7% cases including cefotaxime (93.1%), Augmentin (88.6%) and at minimum extent to imipenum(11.3%). Susceptibility pattern of all gram negative isolates is shown by simple bar graph in (Figure.3).

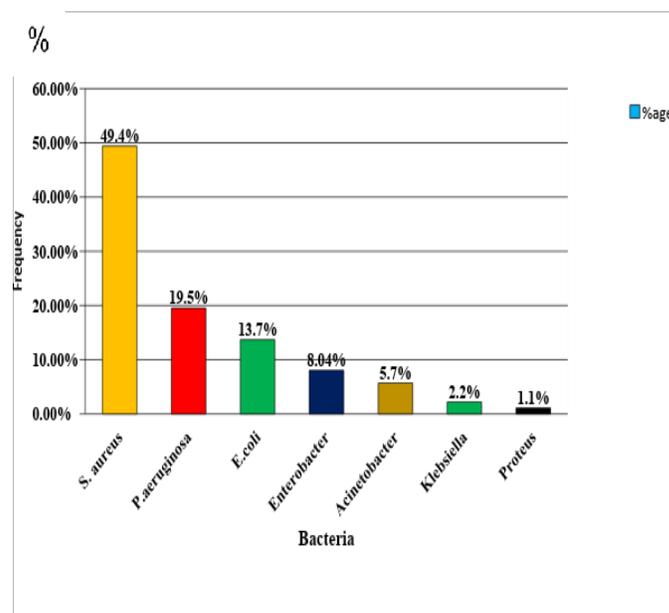


Fig. 1 Frequency of bacteria isolation from infected wounds

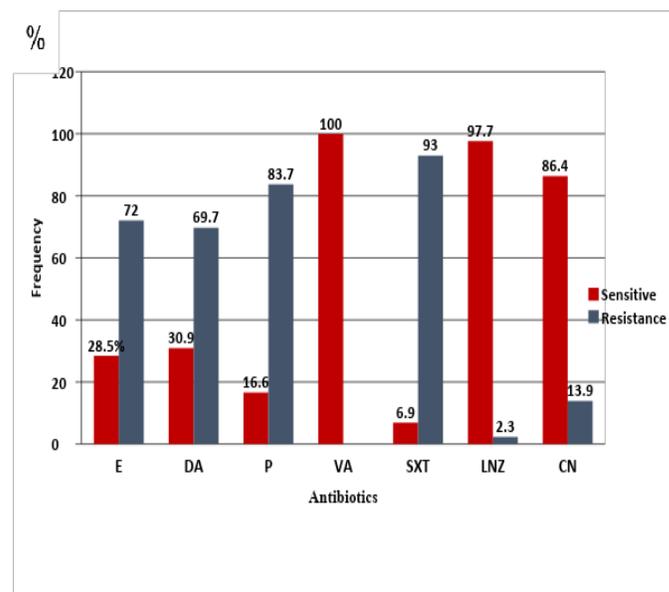


Fig. 2 Susceptibility pattern of Gram positive bacteria

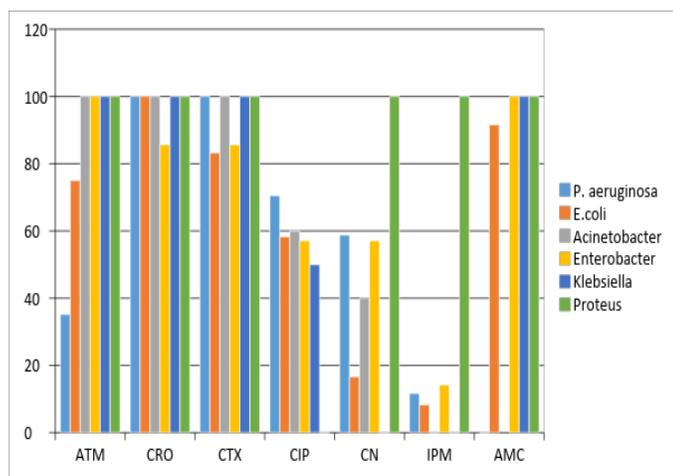


Fig. 3 Susceptibility pattern of Gram negative bacteria

CN: Gentamicin, SXT: Trimethoprim-sulphamethoxazole, P: Penicillin G, E:Erythromycin, LNZ: Linezolid, IMP: Imipenem, VA: Vancomycin, DA:Clindamycin, CRO: Ceftriaxone, CTX: Cefotaxime, ATM: Augmentin, CIP: Ciprofloxacin

DISCUSSION

The mortality and morbidity rate is significant among the patients with wound infection and invoke substantial costs in hospitals. The complication in wound infection, costs of associated procedures and treatment goes on increasing due to antimicrobial resistance developed in wound pathogens.(5) Identification of pathogens and determination of their susceptibility pattern from clinical specimens is useful to improve patient care and chemotherapy selection .(6) In the present study the male patients were more than females. This correlate with many studies done in different locations in Pakistan and other countries.(7) The explanation of male dominance in wound infection is due to their exposure to trauma because of their work such as industry workers, construction employees, transporters and farmers.(8) The studies that indicate the predominance of *S. aureus* and *E. coli* in the wound isolates was reported in Ethiopia and other parts of world (9). The endogenous source of infection such as nose may be the cause of high prevalence of *S. aureus* in wound infections. The contamination from equipment for example surgical instruments is one of the reasons of this organism to cause infection.(10) Due to common distribution of *S. aureus*, as normal flora of skin the bacterium has easy access to enter in wound when the skin ruptures. *S. aureus*, has a higher rate of resistance to selected antimicrobial medicine. (9) An Indian study has shown similar results. (11) In the present study, the

gentamicin, vancomycin and linezolid showed higher sensitivity to same isolates. A study from Ethiopia reported similar results with 100% sensitivity patterns to vancomycin and gentamicin from the clinical isolate of *Staphylococci*.(11) The cost, less availability and toxic effects are the main reasons of remarkable susceptibility of gram positive bacteria to vancomycin and aminoglycosides (gentamicin) due to less prescription and use of these drugs. All of the *E.coli* isolates described in present study were resistant to ceftriaxone and gentamicin. For nosocomial infection, the reduction in sensitivity of antibiotics for *E.coli* suggests importance in clinical settings. Absolute resistance to ceftriaxone was noted for *K. pneumoniae*. The sensitivity of gentamicin was noted. This is comparable with results of previous studies from different countries. The ampicillin and chloramphenicol were resistant to most of gram negative isolates. The long time use and oral administration of these antibiotics affect absorption and cause resistant drugs patterns. The over and increasing use of some drugs as prophylaxis in patients also contribute in resistance to organisms.(12) The commonly used antibiotics such as ceftriaxone, cefotaxim were less sensitive to *P. aeruginosa* whereas it showed high sensitivity to imipenem, gentamicin, and ciprofloxacin respectively in present study. For treatment of *P. aeruginosa* infections, the most effective drug used is oral Ciprofloxacin. This report is in agreement with the study conducted in Afghanistan.(13) In present study, imipenem followed by gentamicin and ciprofloxacin were sensitive to *Acinetobacter*. The maximum resistance was seen against ceftriazone, cefotaxim, aztreonam and trimethoprim-sulphamethoxazol about (98%) same case was seen in a medical literature.(14) In conclusion it can clearly be seen that most effective drugs against gram negative isolates were gentamicin, imipenem and ciprofloxacin whereas for gram positive isolates vancomycin and linezolid are the effective drugs. The limitation in the study is we could not elaborate the etiology of wound infections due to unavailability of clinical data. The number of antimicrobials was also limited in some isolates.

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