

Isolation of Pyogenic Microorganism from Infected Wound in the General Surgery and Orthopedic and Traumatology Department of Near East University Hospital: A Retrospective Study

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Abstract

BACKGROUND/AIMS: Wound infection is characterized as the presence of a wound environment characterized by microorganisms inadequately large numbers, or of adequate virulence to aggregate an immune response locally or/and systemically. The aim of this study, conducted in a University Hospital in Northern Cyprus, is to determine the microorganisms that cause pus formation in wound infection.

MATERIALS and METHODS: One hundred eighty-five samples for this study considered from the period of September 2015 to August 2019 and were collected from Near East University Hospital Microbiology Laboratory, North Cyprus. The samples collected from two different departments. The sensitivity pattern of the organisms was determined by the BD-Phoenix instrument. The SPSS Version 22 was used for statistical analysis.

RESULTS: The orthopedic unit had a total of 123 patient samples while the general surgery unit had a total of 62 patient samples. Culture was positive in 56 (45.5%) of the 123 samples taken from the orthopedic clinic. There was no significant difference between gender and wound infection in the samples taken from the orthopedic clinic ($p=0.640$). The total number of outpatients is 15 (12.2%) and inpatients is 108 (87.8%) in the orthopedic department. In the general surgery department, there are a total of 62 patient samples and a total of 41 (66.1%) were culture positive. The predominant bacteria were *Escherichia coli* (22.6%).

CONCLUSION: With the ambition to communicate a summarized analysis of wound microbiology, and current opinion and controversies respecting wound treatment, this retrospective study has attempted to access microbiological aspects that are important to the administration of microorganisms in wounds.

Keywords: Microorganisms, wound infection, resistance

INTRODUCTION

Wound infection is characterized as the presence of a wound environment characterized by microorganisms inadequately large numbers, or of adequate virulence to aggregate an immune response locally or/and systemically.

The break-in skin integrity can cause bacteria to arrive at the body and proliferate and start multiplying. Absent of the protective barrier of the skin, sensitive tissues in the wound bed is may lead to microorganism colonization. The proliferation of microorganisms in a wound can damage wound healing as it

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can cause local tissue damage.¹ The subcutaneous or underlying tissue provides a moist, nutritious environment, which facilitates microbial colonization and generation. Wound colonization is poly microbial which means potentially pathogenic microorganisms are present, thus any wound is at risk of started infection.²

Staphylococcus aureus (*S. aureus*) and *Pseudomonas aeruginosa* (*P. aeruginosa*) are the most common pyogenic bacteria associated with wound infection. These two bacteria together account for up to 20%–40% of all nosocomial, post-surgery and burn infections. Enterococci and Enterobacter are other microorganisms that also been associated with wound infections, especially after abdominal surgery in immunocompromised patients.³ The mentioned risks associated and antibiotic resistance, makes wound infections a global problem. The antimicrobial resistance factors include changes in microbial ecology, genetics and the non-selective use of antimicrobial agents. Methicillin-resistant *Staphylococcus aureus* (MRSA), Vancomycin-resistant Enterococci (VRE) are the medically relevant examples.⁴ The aim of this study is to determine the microorganisms that cause pus formation in wound infection. The present study was conducted in North Cyprus from the September 2015 to the December 2019.

MATERIALS and METHODS

One hundred eighty-five samples for this study considered from the period of September 2015 to August 2019 and were collected from Near East University Hospital Microbiology Laboratory, North Cyprus. These samples included the samples collected from two different departments (general surgery and orthopedic departments). These samples only included wound and Pus culture test. The demographic information (age, sex) were obtained from the patient's medical record. The sensitivity pattern of the pyogenic organisms was determined against commonly used antibiotics using BD-Phoenix instrument. The samples were assigned accordingly and were subjected for analyzed in Microbiology Laboratory at Near East University Hospital North Cyprus, Nicosia.

Statistical Analysis

After the data were collected, they were analyzed by SPSS (Statistical Package for the Social Sciences) Version 22 and the results were being compared to the literature. Since our study is single centered, it does not reflect the whole Northern Cyprus and is seen as a limitation. Therefore, we think that multi-center studies should be conducted.

RESULTS

The orthopedic unit had a total of 123 patient samples while the general surgery unit had a total of 62 patient samples from the period of September 2015 to August 2019 (Table 1).

Out of the 123 samples cultured from the orthopedic department, 56 (45.5%) were found to be culture positive, while 67 (54.5%) were culture negative. Out of the 123 patients from the orthopedic unit, the minimum age considered is 21 while the maximum is 87 and the Mean age in the orthopedic department is 65. The number of male patients were 40 (32.5%) and females were 83 (67.5%). No significant difference was found between gender and wound infection ($p=0.640$). The total number of outpatients is 15 (12.2%) and inpatients is 108 (87.8%) in the orthopedic department. No significant difference was found between outpatient/inpatients between wound infection ($p=0.517$). The predominant bacteria were *Escherichia coli* (*E. coli*) (11.3%) and followed by *P. aeruginosa* (8.1%), *S. aureus* (8.1%), coagulase negative *Staphylococci* (CoNS) (4.8%), *Enterococcus faecium* (*E. faecium*) (2.4%), *Enterococcus faecalis* (*E. faecalis*) (2.4%), *Candida* species (1.6%), *Citrobacter* species (1.6%), *Acinetobacter baumannii* (*A. baumannii*) (1.6%), *Proteus* species (1.6%), *Enterobacter* species (0.8%), *Klebsiella pneumoniae* (*K. pneumoniae*) (1.1%) and *Burkholderia cepacia* (0.8%) (Figure 1). For the gram-negative bacteria *A. baumannii* ($n=2$) showed resistant to almost all the antibiotics and found only sensitivity to trimethoprim-sulfamethoxazole (SXT) and Tigecycline *P. aeruginosa* ($n=10$) found high resistance to Aztreonam (ATM) (80%). The *Enterobacteriaceae* ($n=20$) found the highest resistance to trimethoprim-sulfamethoxazole (SXT) (63%).

The general surgery department there are a total of 62 patient samples were considered for this study and a total of 41 (66.1%) were culture positive. The minimum age was 19 while the maximum age was 89; the mean age was 52.37 ± 20.99 . The male number were 23 (37.1%) and female number were 39 (62.9%). No significant difference was found between gender and wound infection ($p=0.907$). The total number of outpatients were 30 (48.4%) and inpatients were 32 (51.6%) in the orthopedic department. No significant difference was found between outpatient/inpatients between wound infection ($p=0.652$). The predominant bacteria was *E. coli* (22.6%) and followed by *P. aeruginosa* (9.7%), CoNS (9.7%), *Proteus* species (4.8%), *S. aureus* (4.8%), *Citrobacter* species (4.8%), *K. pneumoniae* (3.2%), *E. faecium* (1.6%), *Candida* species (1.6%), *A. baumannii* (1.6%), and *Enterobacter cloacae* (1.6%) (Figure 2).

For the gram-negative bacteria *A. baumannii* ($n=1$) resistant to almost all the antibiotics and sensitivity to Tigecycline (100%). *P. aeruginosa* ($n=6$) found the highest resistance to Aztreonam

Table 1. Percentage of patient from the two different departments

	Frequency	Percent (%)
Orthopedic	123	66.5
General surgery	62	33.5
Total	185	100.0

(ATM) (50%). The *Enterobacteriaceae* (n=23) found the highest resistance to Amoxicillin/Clavulanate (AMC) (100%). The Gram-positive bacteria sensitivity and resistant pattern in CoNS (n=6) found the highest resistance to Ciprofloxacin (CIP) (33%) and Trimethoprim-Sulphamethoxazole (SXT) (33%). *S. aureus* (n=3) had high resistance to Ciprofloxacin (CIP) (33%). *E. faecium* (n=1) had high resistance to Ciprofloxacin (CIP) (100%) and Erythromycin (E) (100%).

DISCUSSION

Wound infections are main problem for nosocomial infections despite the continuous progress in surgery and antibiotic prophylaxis therefore they important for the morbidity and mortality.^{5,6} Wound infection has been a main concern among health care practitioners.⁷ Whatever the cause, wounds have an important but often unrecognized brunt on those who suffer from them and on the health care system. Additionally, the phenomenon of wounds has been termed as the 'Silent Epidemic'.⁸

This study shows that the most frequently isolated microorganisms from both departments considered for this study is *E. coli* which had the highest percentage. Also, in the orthopedic department the gram-positive bacteria isolated shows that the percentage of MRCN: 3/6 (50%), MRSA: 5/10 (50%), VRSA: 1/10 (10%). Although, the infection in wounds, are aerobic or facultative pathogens for example *S. aureus*, *P. aeruginosa*, and beta-hemolytic *Streptococci*. The prevalence of *S. aureus* is large number in wounds.^{8,9} According to the studies include the wound infections, colonized wounds responsible bacteria is one-third of anaerobic

bacteria however infected wounds responsible with 50% of anaerobic bacteria. Aerobic and anaerobic pathogens may provide to infection in more than one type of the bacteria (poly microbial), therefore broad-spectrum antibiotics may effective to the administration of wound infections. Our result shows that only clindamycin or metronidazole with an aminoglycoside (e.g., gentamicin) or a cephalosporin (e.g., cefuroxime or cefotaxime) has confirmed to be high effective. In the United States cefoxitin or cephamycin are used as a single agent for treatment of already established infection not for prophylactics. But the new classes of antibiotics such as the ureidopenicillins, the carbapenems, and the B-lactam/B-lactamase inhibitor combinations has increased the choice for prophylactic and therapeutic treatment.¹⁰ Since *S. aureus* is mostly the most isolated microorganisms complicated in infected wounds, the most treatments are cephalosporin, macrolides, clindamycin, and semi synthetic penicillin (oxacillin).¹⁰ If strains of MRSA complicated, the vancomycin and teicoplanin are another choice for treatment.⁹ In other study, poly microbial growth reported from 59.6% of cultures and 61.5% multidrug-resistant organisms. Our results are similar from other studies.^{11,12} Selecting the antibiotics for treatment of the wound infections, we have to need an understanding of the normal flora, antimicrobial patterns of the microorganisms, and antimicrobial agents. Factors involved in the wound from colonization to infection even up to healing can help practitioners to clarify clinical findings and microbiological investigations of wounds. According to the topical antiseptics persists and the bacterial resistance, the new antimicrobial agents broadly effective and have a low incidence to get resistance.¹³

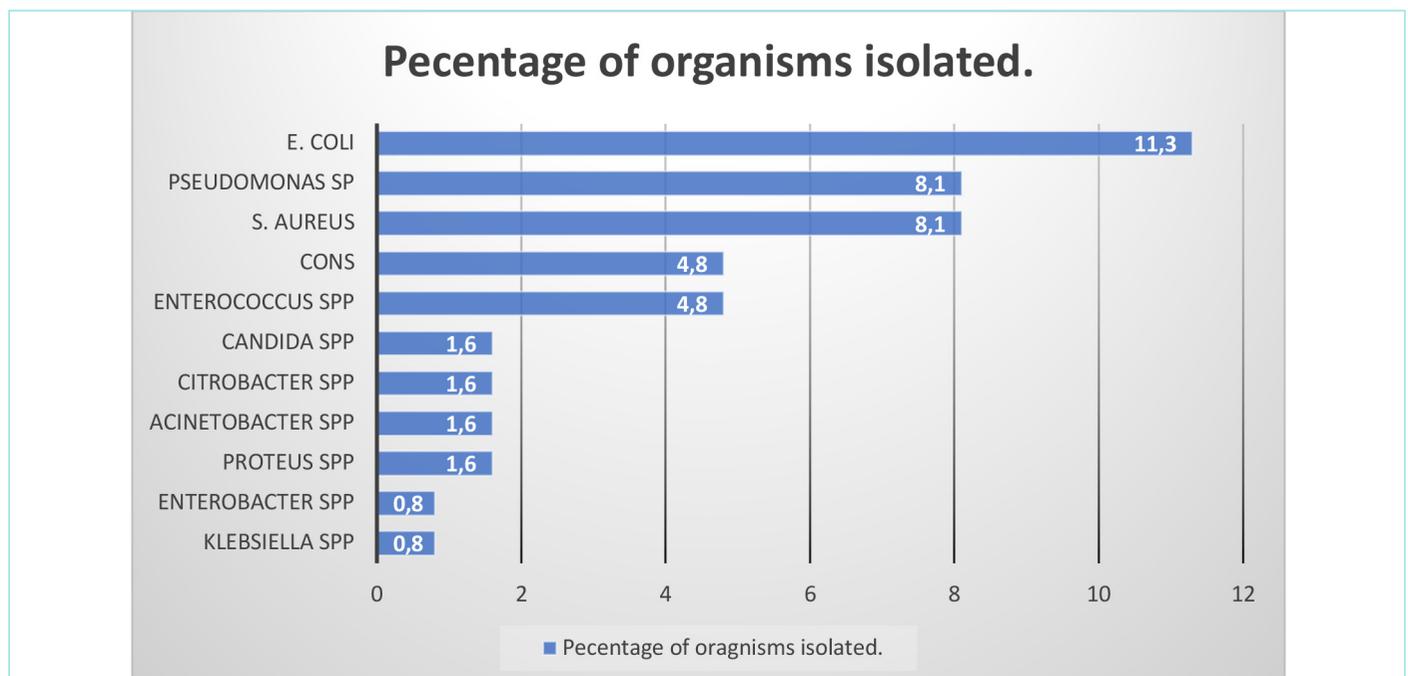


Figure 1. Percentage of organism isolated from the orthopedic department.

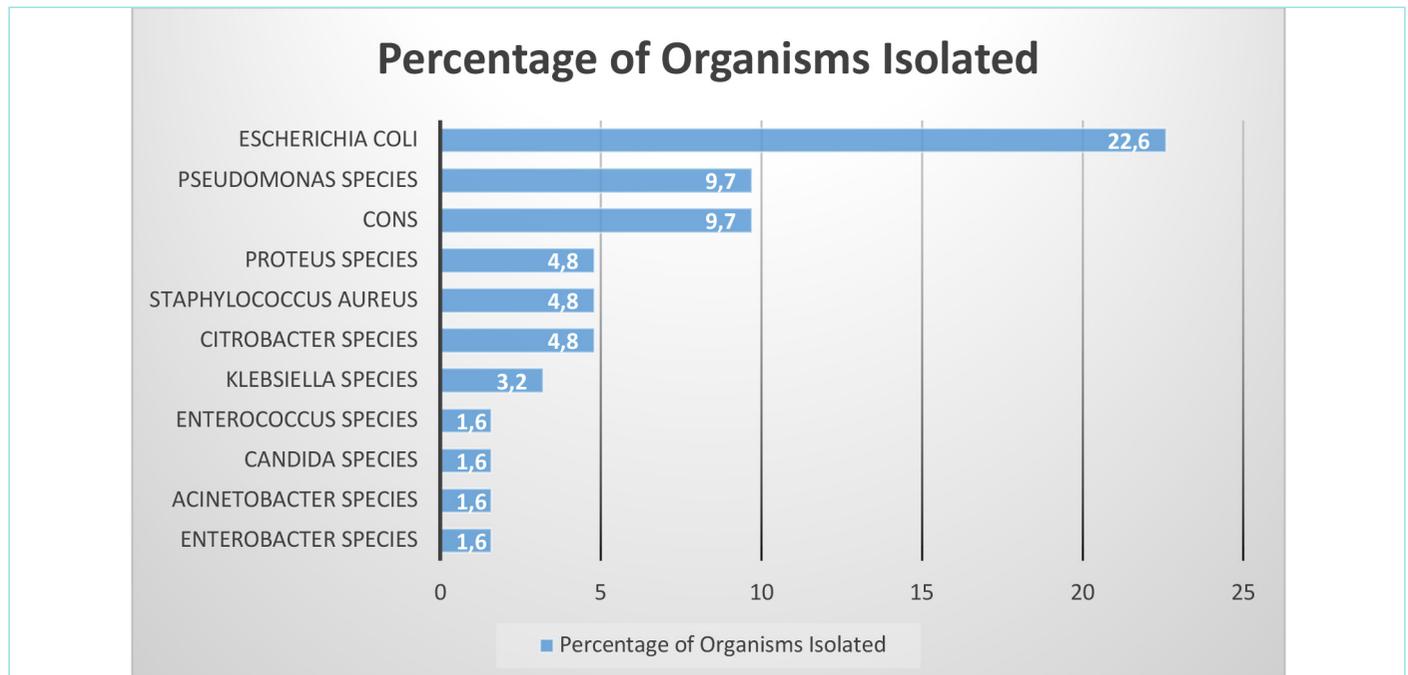


Figure 2. Percentage of organisms isolated from the general surgery department.

CONCLUSION

Furthermore, the microbiology of wounds has been actively researched in recent years, and there is still quiet much to be learned and discovered about the microbial mechanisms these pyogenic microorganisms use that induce infection and prevent wound healing.^{10,14} As a result, debate and theories respecting microbial involvement in wound healing is likely to continue. With the desire to communicate a summarized analysis of wound microbiology, together with current opinion and controversies respecting wound evaluation and treatment, this retrospective study has attempted to approach microbiological aspects that are important to the management of microorganisms in wounds.¹⁵

Main Points

Wound infection is characterized as the presence of a wound environment characterized by microorganisms inadequately large numbers, or of adequate virulence to aggregate an immune response locally or/and systemically.

The risk factors stated in this study and antibiotic resistance problem have made wound infections a global problem.

The antimicrobial resistance factors include changes in microbial ecology, genetics and the non-selective use of antimicrobial agents. Methicillin-resistant *S. aureus* (MRSA), Vancomycin-resistant *Enterococci* (VRE) are the medically relevant examples

The aim of this work is to determine the microorganisms that cause pus formation in wound infection. conducted in North Cyprus.

ETHICS

Ethics Committee Approval: It is not necessary since the study is retrospective and conducted before January 2021.

Informed Consent: Retrospective study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Conception: E.G., N.Ç., K.S., Design: E.G., N.Ç., K.S., Supervision: H.E., E.E., N.Ç., K.S., Fundings: H.E., E.E., Materials: H.A., Data Collection and/or Processing: H.A., E.G., Analysis and/or Interpretation: M.G., E.G., Literature Review: M.G., Writing: M.G., Critical Review: M.G., K.S.

DISCLOSURES

Conflict of Interest: The authors declare no conflicts of interest.

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