



Examination of Bacterial Pathogens an in Intensive Care Unit of a Military Hospital in Alkharj

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

Aim: The present study was undertaken to identify the most common infectious agents for Intensive Care Unit (ICU) patients in a military hospital in Alkharj – Saudi Arabia.

Methodology: This study was conducted in a military hospital in Alkharj – Saudi Arabia. Identification of Gram-negative and Gram-positive bacteria was performed with standard microbiological methods.

The isolates that are collected from ICU from blood, urine and other samples in the year 2019 are included.

Results: Out of 992 bacterial isolates only 6.15% were collected from ICU. The majority of the bacteria that were found in the ICU were Gram-positive bacteria. The most common bacteria that were found in ICU were *Staphylococcus aureus* followed by *Pseudomonas aeruginosa* and *Escherichia coli*.

Conclusion: We found differences in the prevalence of bacteria in the ICU compared to other studies. The predominant bacteria in ICU were *Staphylococcus aureus*. The present data could help physicians to know the causative organisms and to administer the most suitable antibiotics for treatment of nosocomial infections in Alkharj area after knowing the susceptibility rate of bacteria to different antibiotics.

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1. INTRODUCTION

The development of antibiotics and their use in clinical practice is one of the important achievements of modern medicine. However, after their development, the resistant bacteria causing infections soon appeared, and antibiotic resistance became a serious public health issue. It is estimated that in Europe and in the United States, up to 60% of the nosocomial infections are caused by resistant bacteria [1-3].

The Center for Disease Control and prevention (CDC) has estimated that in the United States, antibiotic resistance is responsible for 2 million infections and 23,000 deaths yearly with losses of productivity equivalent to 33 billion dollars and a direct cost of 20 billion dollars [4]. The European Center for Disease Control, ECDC, have estimated that infections caused by multi-resistant bacteria accounts for 1.5 billion € and 25,000 additional deaths yearly [5]. These bacterial resistance lead to many consequences such as increase rate of negative outcomes, mortality, treatment failure and increased the health care cost. Mario and Fernando reported that the consequences of antibiotic resistance include longer hospital stays, an increasing burden on the healthcare infrastructure in addition to other negative outcomes [6].

The prevalence of infections in intensive care units (ICU) was higher than the prevalence in other hospital sections. This might be due to prolonged stay in the ICU and to the severity of disease [7]. Furthermore, in the ICU there are a high number of invasive devices in addition to the immunosuppression of ICU patients that are considered among the major risk factors for developing multidrug resistant bacterial infections [7,8].

World Health Organization (WHO) revealed that the frequency of ICU-acquired infection is at least 2–3 higher in low- and middle-income countries than in high-income countries [9].

Patients in ICUs are one of the main target populations for hospital pathogens. Though ICU-acquired infections constitute a high percentage of all Healthcare-Associated Infections (HAIs)

[10]. The present study was undertaken to identify the most common infectious agents for ICU patients in a military hospital in Alkharj – Saudi Arabia.

2. METHODOLOGY

This study was conducted in a military hospital in Alkharj – Saudi Arabia. Identification of Gram-negative and Gram-positive bacteria was performed with standard microbiological methods.

The isolates that are collected from ICU from blood, urine and other samples from January to December 2019 were included. The exclusion criteria include the isolates in other hospital units and the isolates before or after 2019.

The bacterial cultures data were collected from microbiology department. The descriptive data were represented by numbers and frequencies. This study is approved by the IRB committee in the military hospital No: 4101728.

3. RESULTS

Out of 992 bacterial isolates only 6.15% were collected from the ICU. Table 1 shows the number and percentage of isolates in the ICU.

Table 1. The number and percentage of isolates in the ICU

Variable	Number	Percentage
Isolates in ICU	61	6.15
A&E	413	41.63
Isolates in other units	518	52.22

The majority of the bacteria that were found in the ICU were Gram-positive bacteria (68.85%). Table 2 shows the number and percentage of gram positive and gram negative bacteria in the ICU.

The most common bacteria that were found in ICU were *Staphylococcus aureus* (65.57%) followed by *Pseudomonas aeruginosa* (13.11) and *Escherichia coli* (11.47). The most common bacteria that were found in ICU are shown in Table 3.

Table 2. The number and percentage of gram positive and gram negative bacteria in the ICU

Bacteria	Number of isolates in ICU	Percentage of isolates in ICU
Gram-negative bacteria	19	31.14
Gram-positive bacteria	42	68.85

Table 3. The most common bacteria that were found in ICU

Bacteria	Number of isolates in ICU	Percentage of isolates in ICU
<i>E.coli</i>	7	11.47
<i>P.aeruginosa</i>	8	13.11
<i>Acinetobacter baumannii</i>	4	6.55
<i>S.aureus</i>	40	65.57
<i>Coagulase-negative staphylococci</i>	2	3.27

Table 4. The percentage of bacteria in ICU in compared with the total prevalence of bacteria

Bacteria	Total number	Number of isolates in ICU	Percentage of isolates in ICU in compared with total isolates
<i>E. coli</i>	249	7	2.81
<i>P. aeruginosa</i>	97	8	8.24
<i>A. baumannii</i>	19	4	21.05
<i>S. aureus</i>	298	40	13.42
<i>Coagulase-negative staphylococci</i>	32	2	6.25

Only 2.81% of the total *E. coli* was collected from ICU specimens. Table 4 represents the percentage of different bacteria in ICU in compared with the total prevalence of these bacteria.

The most commonly prescribed antibiotics in the inpatient were metronidazole, cefuroxime, azithromycin and amoxicillin/clavulanic acid all as a tablet. But as injection the commonly prescribed was ceftriaxone.

4. DISCUSSION

The majority of the bacteria that were found in the ICU in the present study were gram positive bacteria. The most common bacteria that were found in ICU were *S. aureus* followed by *P. aeruginosa* and *E. coli*. In contrast to that Bahram Esfahani et al. [11] reported that Gram-negative bacteria were more common than Gram-positive and reported that *P. aeruginosa* (13.9%), *Klebsiella spp.* (11%), and *E. coli* (6.4%) were the most prevalent bacterial infections. Spencer RC [12] reported that the bacterial isolates were equally divided between Gram-negative and Gram-positive species and that the commonly reported bacteria were *Enterobacteriaceae* (34%), *S. aureus* (30%), *P. aeruginosa* (29%), coagulase-negative staphylococci (19%) and enterococci (12%). Mario et al. reported that *Pseudomonas spp.*

(78.7% compared to 85.1%) and *Acinetobacter spp.* (19.6% compared to 10.9%), were the most prevalent [13].

The European Centre for Disease Prevention and Control in the annual epidemiological report 2016 stated that regarding healthcare-associated infections acquired in intensive care units, the most frequently isolated microorganism was *Pseudomonas aeruginosae* specially in ICU-acquired pneumonia episodes, coagulase-negative Staphylococcus Spp. Specially in ICU-acquired bloodstream infections and *Escherichia coli* especially in ICU-acquired urinary tract infections [14].

Moreover, in contrast of our study Funda Yetkin et al. stated that the most frequently detected organisms in ICU were *Acinetobacter spp.*, followed by *P. aeruginosa*, *E. coli*, *K. pneumoniae* and *Candida spp.* [15]. Furthermore, Carlos Junior et al. reported that the most frequently isolated bacteria were *Enterobacteriaceae* followed by *P. aeruginosa* and *S. aureus*, similar to our study [16].

Additionally, in contrast to our study, Sugata Dasgupta et al., Sanwar M. Mitharwal, et al. and Keshni Naidu et al. reported that Gram-negative bacteria were more common in ICU than Gram-positive bacteria. Sugata Dasgupta et al. [17] reported that Gram-negative *Enterobacteriaceae*

were the most frequently isolated pathogens closely followed by *Pseudomonas* species. Sanwar M. Mitharwal, et al. [18] reported that *A. calcoaceticus-baumannii* complex, *P. aeruginosa*, and *K. pneumoniae* were the most common microorganisms. Keshni Naidu et al. [19] stated that Gram-negative bacteria were the most common pathogens isolated, especially *K. pneumoniae* (extended-spectrum β -Lactamase-producing), *Acinetobacter* and *Pseudomonas* species.

The most commonly prescribed antibiotics in the inpatient were metronidazole, cefuroxime, azithromycin and amoxicillin/clavulanic acid all as a tablet. But as injection the commonly prescribed was ceftriaxone. It is important to follow guidelines to prescribe antibiotics appropriately, additionally it is important to know the bacterial resistance rates.

5. CONCLUSION

We found a difference in the prevalence of bacteria in the ICU compared to other studies. The predominant bacteria in ICU were *Staphylococcus aureus* followed by *Pseudomonas aeruginosa* and *Escherichia coli*. The present data could help physicians to know the causative organisms and to administer the most suitable antibiotics for treatment of nosocomial infections in Alkharj area after knowing the susceptibility rate of bacteria to different antibiotics. More efforts are needed to increase the awareness of health care professional regarding infections in the ICU and it is important to implement the suitable preventive measures to reduce the occurrence of infection in critically ill patients.

CONSENT

As per international standard or university standard written patient consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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