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Prevalence of Bacterial Pathogens Isolated in 2018 from Patients in a Military Hospital

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Author's contribution

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

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ABSTRACT

Aim: The aim of the present study was to describe the prevalence of bacterial pathogens isolated from patients in a military hospital in Alkharj.
Methodology: This was a retrospective study conducted to describe the prevalence of bacterial pathogens in 2018. Clinical culture results were collected from laboratory in a military hospital from 01-01-2018 to31-12-2018.
Results: The most common bacteria were *Escherichia coli* bacteria followed by *Pseudomonas aeruginosa*. Gram negative bacteria were collected mainly by urine culture while gram positive bacteria were collected mainly from wound/pus/skin cultures.
Conclusion: In general, from this study it can be concluded that the rate of bacterial infections is high. It is important to follow the healthcare professional recommendations such as hand washing and other measures to prevent the occurrence of infections. Moreover, health care professional should know the causative bacteria to give the appropriate treatment.

Keywords: Prevalence; bacterial isolates; gram positive; gram negative; bacterial culture.

1. INTRODUCTION

Infectious diseases are caused by many microorganisms such as viruses, bacteria, fungi or parasites; these infections can be spread from one person to another either directly or indirectly such as when an individual with the bacterium or virus kisses, touches, or coughs or sneezes on

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someone who isn't infected [1]. Infectious diseases can cause several different symptoms. Some can be life-threatening while others are mild and the patient may not even notice symptoms [2].

Bacteria are one of the organisms that cause infections. They are prokaryotic organisms whose cells lack a nucleus. Usually bacterial cells range from 0.5 to 5.0 μm in length and 0.2 to 2 μm in diameter [3]. Bacterial genetics are subtly different from eukaryotic genetics.

For several bacterial infections, the host immune system successfully eliminates the attacking bacteria and as a result the infection resolves. However, in some infections, bacteria evade the host immune system and persist within the host. Several infections are clinically asympto-matic, but some infections are associated with clinically apparent symptoms [4].

Hospitalized patients are at higher risk of infections than others especially, for immune compromised patients [5]. Nosocomial infections cause significant morbidity and mortality, increase the period of hospitalization and increase direct patient care costs [6]. These infections are common complications affecting hospitalized patients, mainly in the intensive care units where outbreaks repeatedly originate [7,8]. Pneumonia, urinary tract infection and primary bloodstream infection account for the majority of nosocomial infections [9].

Almost every pathogen could result in infection for the hospitalized patients, but only limited number of these organisms is mainly responsible for most of the nosocomial infection. Among them gram positive *Staphylococcus* aureus, gram positive *Enterococci*, gram negative *Escherichia coli* and Gram-negative *Pseudomonas aeruginosa* takes the leading [10]. Mario et al reported that *Pseudomonas* spp and *Escherichia coli* were the most prevalent gram negative bacteria [11,12]. Moreover, Mario reported that *Staphylococcus aureus* was the most prevalence gram positive bacteria, many of these bacteria are nor resistance to antibiotics [13,14].

Bacterial cultures and isolations can make definitive diagnosis [15], they help the prescribers in better diagnosis of the infections and in choosing the appropriate antibiotics to treat these infections. The objective of the present study was to describe the prevalence of bacterial pathogens isolated from patients in a military hospital in Alkharj.

2. MATERIALS AND METHODS

This was a retrospective study conducted to describe the prevalence of bacterial pathogens in 2018. Clinical culture results were collected from laboratory in a military hospital in Alkharj – Saudi Arabiafor all blood, urine, pus, throat and other culture reports obtained from 01-01-2018 to 31-12-2018. This military hospital provides medical services to military personnel and their families in Al Kharj which is a city in Al Kharj Governorate in central Saudi Arabia. Al Kharj is 77 km south of Riyadh.

The consultant microbiologists in the hospital helped me in collecting the bacterial culture results during 2018 after the IRB committee in the hospital approved the study.

Inclusion criteria include all bacterial specimens in 2018. Exclusion criteria include the bacterial specimen before or after 2018 and fungi culture reports. All isolates (even replicates) were included.

Different tests were done such as gram stain test using crystal violet dye and safran in dye to differentiate between gram positive and gram negative bacteria. After that other tests may be performed to further differentiate bacteria such as using MacConkey agar plates and coagulase test.

Results are presented in tablesas absolute numbers (n) and the percentage values (%). The data include the number and percentage of the causative organisms, the number of gram positive and gram-negative bacteria and the type of specimens.

This study is approved by the IRB ethical committee in the military hospital with letter number 4101728.

3. RESULTS

The most common bacteria were *Escherichia coli* bacteria (32.83%) followed by *Pseudomonas aeruginosa* (14.13%). The number and percentage of causative organisms in 2018 are shown in Table 1.

Table 1. Frequency of isolation of strains according to bacterial species

Organism	Number in 2018	Percentage
Escherichia coli	244	32.84
Enterobacter aerogenes	5	0.67
Enterobacter cloacae	20	2.69
HaemophillusSpp	4	0.53
Klebsiella pneumonia	78	10.50
Citrobacterfreundii	1	0.13
CitrobacterKoseri	3	0.40
Serratia marcescens	10	1.35
Proteus mirabillis	17	2.29
Providenciastuartii	4	0.53
Morganellamorganii	3	0.40
Citrobacteryoungea	1	0.13
Pseudomonas fluorescens	1	0.13
Salmonella	11	1.48
Pseudomonas aeruginosa	105	14.13
Acinetobacterbaumannii	51	6.86
Brucella	5	0.67
Staphylococcus aureus	93	12.52
Coagulase-negative staphylococci	33	4.44
Group A streptococcus	7	0.94
Group B Streptococcus	30	4.04
Enterococcus faecalis	17	2.29
Total	743	100

Table 2. Distribution of bacterial strains according to Gram stain

Bacteria classification	Number in 2018	Percentage
Gram-negative	563	75.77
Gram-positive	180	24.22
Total	743	100

Table 3. Distribution of bacterial strains according to the nature of samples

	Urine	Wound/Pus /Skin	Upper respiratory	lower respiratory	blood	Catheter	Stool	Total
Gram-negative	296	136	30	59	31	1	10	563
Gram-positive	12	104	3	13	45	3	0	180
Total	308	240	33	72	76	4	10	743

The majority of infections were caused by gram negative bacteria (75.77%). Table 2 shows the number and percentage of causative gram negative and gram-positive bacteria.

Gram negative bacteria were collected mainly by urine culture (52.57%).Gram positive bacteria were collected mainly from wound/pus/skin cultures (57.77%). The number of different types of specimens collected in 2018 is shown in Table 3.

The most commonly prescribed antibiotics in the hospital were Amoxicillin/clavulanic acid, amoxicillin, cefuroxime, metronidazole and ciprofloxacin.

4. DISCUSSION

The majority of infections were caused by gram negative bacteria (75.77%) that were mainly collected by urine culture (52.57%) followed by Wound/Pus/Skin (24.15%). The most common gram positive and gram-negativebacteria were *Escherichia coli followed by Pseudomonas aeruginosa, Staphylococcus aureus and Klebsiella pneumonia*, these 4 bacteria formed about 79% of the bacterial isolates.

Out of 240 Wound/Pus/Skin specimens, 56.66% were for gram negative bacteria. Similarly, Aynalem Mohammed et al reported that for the

bacterial isolates of wound infections, 57% of the isolates were gram-negative and 43% were gram-positive [16].

Gram positive bacteria form only 24.22% of the total isolates; these bacteria were mainly collected by Wound/Pus/Skin specimens (57.77%). The most common gram-positive bacteria were *Staphylococcus* aureus (12.51% of the total isolates) followed by *Coagulase-negative staphylococci* (4.44% of the total isolates).

Atif H. Asghar studied the frequency of gram-positive bacteria in Makkah hospitals and similar to the result of the present study he stated that *Staphylococcus aureus* was the most common cause of wound infection and accounted for more than half of the clinical isolates [17]. Márió Gajdács and Edit Urbán reported that among bacteria cultures isolated from vaginal samples, 91.4% of samples include S. aureus [18].

About 96% of the isolates collected by urine were for gram negative bacteria specially *Escherichia coli* and this is rational because *Escherichia coli* bacteria were the most common pathogen that cause urinary tract infections as reported by Martin Odoki et al who studies the prevalence of bacterial urinary tract infections in in Bushenyi District in Uganda and reported that *Escherichia coli* was the most prevalent bacterial uropathogen (41.9%) [19].

In contrast to our study, Ovidiu Zlatian studied the hospitalized patients with severe invasive infections and reported that Staphylococcus aureus is the most common isolates (37.06%) and that *Escherichia coli* were detected by only 7.06% of the isolates [20].

The majority of the isolates of gram negative bacteria were collected from urine, wound and lower respiratory tract. Gram positive bacteria were collected from Wound and blood. This result is rational, because *Escherichia coli* (a gram negative bacteria) is the most common bacteria that cause urinary tract infections. Moreover, *Staphylococcus aureus (a gram positive bacteria) is the most common cause of infections in wounds and on the skin.*

The most commonly prescribed antibiotics in the hospital were amoxicillin/clavulanic acid, amoxicillin, cefuroxime, metronidazole and ciprofloxacin. These antibiotics are effective in treating a broad spectrum of bacteria but it is important to know the resistance rate for these antibiotics.

5. CONCLUSION

In general, from this study it can be concluded that the rate of bacterial infections is high especially the infections caused by *Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus and Klebsiella pneumonia*. It is important to follow the healthcare professional recommendations such as hand washing and other measures to prevent the occurrence of infections. Health care professional should know the causative bacteria to give the appropriate treatment. Many interventions such as lectures and brochures should be conducted to increase the awareness regarding infections and antibiotic for the public and for the health care professionals.

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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