Original Research Article

The Prevalence of *Serratia*, *Stenotrophomonas*, *Citrobacter* and *Morganilla* Pathogens among Patients with Infectious Diseases at a Governmental Hospital in Riyadh Region

ABSTRACT

Aim: The present study aimed to explore the prevalence of *Serratia*, *Stenotrophomonas*, *Citrobacter* and *Morganilla* pathogens among patients with infectious diseases at a governmental hospital in Riyadh Region.

Methodology: This study was conducted in a governmental hospital in Riyadh region. Data were collected from the bacterial cultures results that was prepared the laboratory department in the hospital.

Results: In the 3 years, the total number of gram negative isolates was 2135. *Citrobacter* bacteria represented 2.25%, *Morganilla* represented 1.97%, *Stenotrophomonas* represented 1.64%, and *Serratia* represented 1.59% of the gram negative isolates.

Conclusion: The present study showed that the rate of *Serratia*, *Stenotrophomonas*, *Citrobacter*, or *Morganilla* was low. More studies are needed to know the prevalence of these 4 bacteria and to explore the bacterial resistance rate to the available antibiotics.

KEYWORDS: *Citrobacter*, Gram-negative bacteria, *Morganilla*, Prevalence, *Serratia*, *Stenotrophomonas*.

INTRODUCTION

Bacteria are living things that have one cell only. They look like rods, balls, or spirals under a microscope. Most types of bacteria don't cause a disease but infectious bacteria reproduce quickly in the body and cause infections [1]. Once an individual is infected, clinically apparent disease may or may not be seen,

and in some patients the bacterial infection leads to a clinically significant disease [2]. Troeger et al reported that bacterial diseases remain a major cause of mortality and morbidity globally [3].

Gram-negative bacteria cause numerous infections including blood stream infections, pneumonia, wound or surgical site infections, as well as meningitis in healthcare settings [4]. These infections include those caused by *Acinetobacter*, *Klebsiella*, *Escherichia coli*, and *Pseudomonas aeruginosa*, as well as numerous other less common bacteria [5].

Serratia species are gram-negative bacilli of the Enterobacteriaceae group of bacteria. They are not a commonly found in healthy human fecal flora, in the early part of the 20th century, *Serratia marcescens* was considered a nonpathogenic organism and was used in medical experiments and as a biological warfare test agent [6]. Nonetheless, since the mid-1970s, *Serratia* species have been recognized to cause several infections [7] and in some infections, *Serratia* species were multidrug resistant and complicate the treatment decisions [7].

Stenotrophomonas maltophilia is a ubiquitous, non-fermentative, aerobic, gram-negative bacillus that is closely related to the *Pseudomonas* species [8]. *Stenotrophomonas maltophilia* infections have been associated with high mortality and morbidity rates in severely immunocompromised and debilitated individuals, particularly among hospitalized patients [9]

Citrobacter species are straight, facultative anaerobic, Gram-negative bacilli and are typically motile by means of peritrichous flagellae. They are usually found in water, food, soil, and the intestinal tracts of animals and humans [10] several *Citrobacter* infections are nosocomial infections; however, they can also be community acquired [10].

Morganella morganii is a gram-negative rod that is frequently found in the environment and in the intestinal tracts of humans, mammals, and reptiles as normal flora. Despite wide distribution of *Morganella morganii*, it is an infrequent cause of community-acquired infection and is most often encountered in postoperative and in nosocomial settings [11].

There are several studies about the prevalence of gram negative bacteria in general but most of these studies explore the prevalence of the bacteria that cause infections common *such as Klebsiella*,

Escherichia coli, and *Pseudomonas aeruginosa.* The present study aimed to explore the prevalence of *Serratia*, *Stenotrophomonas*, *Citrobacter* and *Morganilla* pathogens among patients with infectious diseases at a governmental hospital in Riyadh Region.

METHODOLOGY

This study was conducted in a governmental hospital in Riyadh region. Data were collected from the bacterial cultures results that was prepared the laboratory department in the hospital. All of the gram-negative bacteria samples were collected and processed from patients in accordance with standard protocols.

All of the gram negative bacterial isolates that were collected in the hospital from urine, blood, and other samples during the study period from the beginning of 2015 to the end of 2017 were included. Gram positive isolates, isolates of other organisms and the isolates that were collected before 2015 or after 2017, were excluded from the study.

The descriptive data were represented by numbers and percentages. This study was approved by the IRB committee.

RESULTS and DISCUSSION

In 2015, the total number of gram negative isolates were 734 isolates. *Morganilla* represented 2.32% of the gram negative bacterial isolates, *Citrobacter* represented 2.32%, *Stenotrophomonas* represented 1.09%, and *Serratia* represented 1.63%. Table 1 shows the prevalence of *Serratia*, *Stenotrophomonas*, *Citrobacter* and *Morganilla* pathogens in 2015.

Table 1. The prevalence of *Serratia*, *Stenotrophomonas*, *Citrobacter* and *Morganilla* in 2015.

Gram negative bacteria	Number	%
Morganilla	17/734	2.32%
Citrobacter	17/734	2.32%
Stenotrophomonas	8/734	1.09%
Serratia	12/734	1.63%

Table 2 shows the prevalence of *Serratia*, *Stenotrophomonas*, *Citrobacter* and *Morganilla* pathogens in 2016. Out of the 760 gram negative isolates, *Morganilla* represented 2.50% of the gram negative bacterial isolates, *Citrobacter* represented 2.76%, *Stenotrophomonas* represented 0.79%, and *Serratia* represented1.45%.

Table 2. The prevalence of *Serratia*, *Stenotrophomonas*, *Citrobacter* and *Morganilla* in 2016.

Gram negative bacteria	Number	%
Morganilla	19/760	2.50%
Citrobacter	21/760	2.76%
Stenotrophomonas	6/760	0.79%
Serratia	11/760	1.45%

In 2017, the total number of gram negative isolates were 641 isolates. *Morganilla* represented 0.94% of the gram negative bacterial isolates, *Citrobacter* represented 1.56%, *Stenotrophomonas* represented 3.28%, and *Serratia* represented 1.72%. Table 3 shows the prevalence of *Serratia*, *Stenotrophomonas*, *Citrobacter* and *Morganilla* pathogens in 2017.

Table 3. The prevalence of *Serratia*, *Stenotrophomonas*, *Citrobacter* and *Morganilla* in 2017.

Gram negative bacteria	Number	%
Morganilla	6/641	0.94%
Citrobacter	10/641	1.56%
Stenotrophomonas	21/641	3.28%
Serratia	11/641	1.72%

Table 4 shows the prevalence of *Serratia*, *Stenotrophomonas*, *Citrobacter* and *Morganilla* in the 3 years. In the 3 years, the total number of gram negative isolates was 2135. *Citrobacter* bacteria represented 2.25%, *Morganilla* represented 1.97%, *Stenotrophomonas* represented 1.64%, and *Serratia* represented 1.59% of the gram negative isolates.

Table 4. The prevalence of *Serratia*, *Stenotrophomonas*, *Citrobacter* and *Morganilla* in the 3 years.

Gram negative bacteria	Number	%
Morganilla	42/2135	1.97
Citrobacter	48/2135	2.25%
Stenotrophomonas	35/2135	1.64%
Serratia	34/2135	1.59%

The present study showed that only 7.45% of the gram negative bacterial isolates were caused by *Serratia*, *Stenotrophomonas*, *Citrobacter*, or *Morganilla. A*hmed reported that the most prevalent gram negative bacteria in a Public Hospital *were Escherichia coli, Pseudomonas aeruginosa, Klebsiella pneumonia, and Acinetobacter baumannii [12].* Ahmed et al stated that the most common gram negative bacteria that caused infections in Al-Kharj city was *Escherichia coli, Pseudomonas aeruginosa,* and *Klebsiella pneumonia [13].* Other study found that the most common gram negative bacteria were *Escherichia coli* and by *Pseudomonas aeruginosa* [14].

Neuhauser et al found that among gram negative bacilli in US intensive care units, *Pseudomonas aeruginosa* was the most frequently isolated organism (23%) followed by *Enterobacter* species (14.0%) and that *Serratia marcescens* bacteria represent 5.4%, *Stenotrophomonas maltophilia* bacteria represent 4.3%, *Citrobacter* species represent 2.9%, and *Morganella morganii* bacteria represent 0.9% of the gram negative bacteria [15]. Patil et al state that *Morganella morganii* commonly implicated in urinary tract infections and pyogenic infections, but rarely causes central nervous system infections especially brain abscess [16]. Jones et al found that 0.8% of gram negative infection was caused by *Citrobacter* spp [17]. Other studies showed that *Citrobacter* spp. might account for 3 – 6% of all *Enterobacteriaceae* causing nosocomial infection [18,19]. Ahmed showed that among the bacterial pathogens that were isolated from patients in a military hospital in 2018, Citrobacter represented 0.53% of all bacterial isolates (the rate was calculated based on the total bacterial isolates that means both gram positive and negative), *Morganella represented* 0.40% of all bacterial isolates, *Serratia represented* 1.35 % of all bacterial isolates, and there were no infections caused by *Stenotrophomonas* bacteria (0%) [14].

The main limitation if the present study was that the available data included the percentage of different bacteria but didn't contain information about the type of the infections.

CONCLUSION

The present study showed that only 7.45% of the infections that were caused by gram negative bacteria were caused by Serratia, Stenotrophomonas, Citrobacter, or Morganilla but some of these infections could be caused by bacteria that are resistant to the available antibiotics that may lead to severe consequences. More studies are needed to know the prevalence of these 4 bacteria and the prevalence of other bacteria. Moreover, more studies are needed to explore the bacterial resistance rate to the available antibiotics.

ACKNOWLEDGMENT

" This Publication was supported by the Deanship of Scientific Research at Prince Sattam bin Abdulaziz University"

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