



## A bacteriological study of septicemia in Hilla city

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### Article History:

Received on: 17.09.2019

Revised on: 24.09.2019

Accepted on: 09.10.2019

### Keywords:

septicemia,  
Hilla general hospital,  
bacterial,  
Staphylococcus

### ABSTRACT

Septicemia is a serious bloodstream infection; it can quickly become life-threatening. The current study aimed to isolate and identify the causative agents of septicemia cases with reference to the antibiogram test. 52 blood samples were collected from a number of incomings and those who lie in Hilla general hospital. After incubation and culturing on suitable media, 30 samples gave growth of one or two species of bacteria. A total of 33 bacterial isolates were obtained, most of them (16 isolates) were belong to coagulase-negative *Staphylococcus* spp., followed by *E. coli* (6 isolates), *Pseudomonas* sp. (5 isolates), *Streptococcus* sp. (2 isolates), and one isolate for each of *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Acinetobacter* sp., and *Listeria monocytogenes*. When antibiotics sensitivity test was accomplished, most *Staphylococcus* spp. were sensitive for daptomycin and had high resistance to both of vancomycin and clindamycin, whereas *Staphylococcus aureus* was sensitive for most the used antibiotics. Half of *E. coli* isolates were sensitive, while the second half were resistant to the used antibiotics. Imipenem inhibited the growth of all *Pseudomonas* isolates, whereas 80% of them were resistant to amikacin. The epidemiology of bacteremia is altering with the aging of the population, shifts in healthcare, and progress in medicine, such as increased use of immunosuppressive treatment, intravascular devices, and invasive procedures.

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ISSN: 0975-7538

DOI: <https://doi.org/10.26452/ijrps.v11i1.1878>

Production and Hosted by

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### INTRODUCTION

Bacteremia is existence of viable bacteria in blood which is normally free of bacteria (Ochei and Kolhatkar, 2000). It can happened in daily actions, like tooth brushing and some secondary medical processes, such as dental work (Forner *et al.*, 2006)

or by applying catheters and other foreign material to arteries and veins, including injection of drugs, and also during infections (Sligl *et al.*, 2006). In the first state, it is a temporary and clinically benign status, where the host immune system ejects bacteria from blood. However, when immune mechanisms fail, or in the presence of anatomic trauma, turbulent cardiac blood flow, or foreign article, bacteremia may cause infection and sepsis. Bloodstream infection results due to imbalances in the complex interplay between the invading microorganism, and the host defense mechanisms (Christaki and Giamarellos-Bourboulis, 2014). Bacteremia differ from sepsis which is host response to microbial pathogens that causes significant rate of morbidity and mortality (Singer *et al.*, 2016; Fan *et al.*, 2016). Most patients with bacteremia achieve the criteria for sepsis. Infection that be discovered within the first 48 hours of hospitalization is defined as a community-acquired infection, whereas infec-

tion that occurs later during lying in hospital is known as hospital-acquired infection (Christaki and Giamarellos-Bourboulis, 2014; Siegman-Igra *et al.*, 2002). The epidemiology of bacteremia is altering with the aging of the population, shifts in health-care, and progress in medicine, such as increased use of immunosuppressive treatment, intravascular devices, and invasive procedures (Nielsen, 2015). Dominant microorganisms in bacteremia alter greatly according to a geographic place, age, and sex of patients, and kind of bacteremia (Kirn and Weinstein, 2013; Moon *et al.*, 2014).

## MATERIALS AND METHODS

52 blood specimens were collected from incoming patients and those who lie in Hilla surgical hospital with a volume of 2-3 ml for each specimen, they were put in bottles containing brain- heart infusion broth (Himedia, India) and incubated at 37°C for 5-10 days. Samples were cultured after 24 h. and in the fourth and fifth days of incubation on blood agar; MacConkey agar; and chocolate agar for 24-48 h. at 37°C. The isolated bacterial species were identified according to macro and micro characters, in addition to biochemical tests like IMVIC set and catalase test (Forbes *et al.*, 2007). Antibiotics susceptibility test was conducted by a well diffusion assay according to the Kirby-Bauer method. The following antibiotics were used: amikacin; amoxicillin-clavulanic acid; azithromycin; aztreonam; cefotaxime; ceftriaxone; chloramphenicol; ciprofloxacin; clindamycin; daptomycin; erythromycin; imipenem; tetracyclin; and vancomycin. Diameters of inhibition zones were measured and bacterial isolates were assorted as sensitive; intermediate; or resistant (CLSI, 2013).

## RESULTS AND DISCUSSION

Out of 52 blood samples, 22 samples (i.e., 42.30% of total samples) did not give growth of any bacterial species, while the rest 30 samples (57.69%) recorded growth of one or more of bacterial species. Where three samples yielded common growth of two bacterial species, one of them was for *Pseudomonas* sp. with *Staphylococcus* sp., the other was for *Pseudomonas* sp. with *E. coli*, whereas the third one has given the growth of *Staphylococcus* sp. together with *Streptococcus pneumoniae*. The other samples have given the growth of only one bacterial species. A total of 33 bacterial isolates were recorded, most of them (16 isolates) were belonged to *Staphylococcus* spp., followed by *E. coli* (6 isolates), then *Pseudomonas* sp. (5 isolates), *Streptococcus* sp. (2 isolates), and one isolate for each of *Staphylococcus aureus*, *Streptococcus*

*pneumoniae*, *Acinetobacter* sp., and *Listeria monocytogenes*. Accordingly, the majority of bacteremia cases (66.66%) caused by Gram-positive bacteria.

Daptomycin antibiotic had good antibacterial activity against most the isolates of staphylococci, where 14 isolates of which (i.e., 93.33%) were sensitive (Table 1). It was followed by chloramphenicol and ciprofloxacin, with percent of 68.75% and 56.25%, respectively. The percentage of isolates that were sensitive to clindamycin and vancomycin was only 6.25%, that is mean most of the staphylococci isolates were resistant to these two antibiotics.

The single *S. aureus* isolate was sensitive for five out of seven antibiotics, except of ciprofloxacin and clindamycin. All streptococci isolates, of which *S. pneumoniae*, were sensitive to tetracycline, while they were resistant to daptomycin. 50% of *E. coli* isolates were resistant and the other 50% were sensitive to the same antibiotic, except for chloramphenicol, where only one isolate was resistant. The five isolates of *Pseudomonas* sp. were sensitive for imipenem, whereas four of them (80%) were resistant to amikacin and 60% resistant to both of clindamycin and ciprofloxacin. *Acinetobacter* sp. isolate was resistant to most of the used antibiotics, except of amikacin and imipenem. Also, *Listeria monocytogenes* isolate was had high resistance to antibiotics.

Coagulase-negative staphylococci (CoNS) was the most prevalent bacteria among patients. The dominance of CoNS with high resistance to antibiotics and disinfectants in addition to its ability to produce biofilm has been increased markedly with the development of medicine, especially the increasable usage of antibiotics and using of foreign instruments like catheters. Multiple resistant strains of *S. epidermidis*, and *S. haemolyticus* have been recorded in neonates ICU; they had the ability to produce biofilms and were responsible for infections in premature babies (Foka *et al.*, 2006). *S. epidermidis* group consider a widespread cause of septicemia associated with health-care (Sievert *et al.*, 2009).

On the other hand, *S. aureus* isolate was sensitive for most of the antibiotics except of ciprofloxacin and clindamycin. A somewhat similar result was found by (Ansari *et al.*, 2012), where most *S. aureus* isolates were sensitive to the used antibiotics.

*S. aureus* is a popular cause of both community-acquired and hospital-acquired bacteremia and infection may be progressed to many of the complications that it is difficult to be diagnosed early. The mortality rate among patients with SAB can reach to 10-30% (Hal *et al.*, 2012).

In the current study, all streptococci, including *S.*

**Table 1: Species of isolated bacteria and the number of resistant isolates**

No.	Antibiotics	<i>Staphylo. S. spp.</i>	<i>S. aureus</i>	<i>Streptoc. S. sp.</i>	<i>S. pneumo-niae</i>	<i>E. coli</i>	<i>Pseudomon. sp.</i>	<i>Acinetobac. sp.</i>	<i>Listeria monocy-togenes</i>
1	Amikacin	4	0			3	4	0	1
2	Azithromycin			1	1				
3	Aztreonam						2		1
4	Amoxicillin-clavulanic acid					3			
5	Chloramphenicol		0			1			
6	Clindamycin	10	1			3	3		1
7	Ceftriaxone			1	1			1	
8	Cefotaxime					3			
9	Ciprofloxacin	4	1			3	3		1
10	Daptomycin	2		2	1				
11	Erythromycin	9	0					1	
12	Imipenem					3	0	0	1
13	Tetracyclin		0	0	0			1	
14	Vancomycin	15	0						

pneumonia, were sensitive to tetracycline, whereas they revealed resistance to daptomycin. Viridans streptococci are normal flora in the mouth; they can cause transient bacteremia after eating; teeth brushing, or flossing. It was found that the main route for the entrance of group A streptococci is skin and soft tissues (Morales *et al.*, 2006).

Half of *E. coli* isolates were sensitive, whereas the other half were resistant to the same antibiotic. In a study conducted by Ansari and others, 47% of *E. coli* isolates were sensitive to ciprofloxacin (Ansari *et al.*, 2012). It was found that *E. coli* represents half of the pathogens isolated from community-acquired bacteremia patients (Moon *et al.*, 2014).

All the five isolates of *Pseudomonas* were sensitive to imipenem, whereas four of them (80%) were resistant to amikacin and 60% were resistant to both of clindamycin and ciprofloxacin. In a previous study (Ewaid *et al.*, 2020), *Pseudomonas* had been isolated from 13% of blood specimens taken after oral surgical procedures (Ansari *et al.*, 2012). Bacteremia resultant of *Pseudomonas* may not be recognized from that caused by other Gram-negative bacteria, so patients infected with *Pseudomonas* may have inactive antibiotics, in addition, delay in starting efficient antibacterial therapy was associated with higher mortality with a rate reached to 39% (Kang *et al.*, 2003).

*Acinetobacter sp.* was isolated from only one blood sample and it was resistant to most of the

used antibiotics except of amikacin and imipenem. This Gram-negative bacteria that belong to the Moraxellaceae family found in soils, waters, and even in hospitals where it causes serious infections in immunocompromised individuals. At least 25% of healthy persons are carrying this bacteria on their skins with no harm, but in hospitals, some strains may cause infections such as pneumonia or bacteremia (Doughari *et al.*, 2011). The main sources for infection with *Acinetobacter* in a hospital are hands of hospital staff, respiratory therapy supply; foods; tap water; infusion pumps; and others (Manchanda *et al.*, 2010; Ewaid and Abed, 2017).

One isolate of *Listeria monocytogenes* had isolated in this study; *Listeria* is Gram-positive bacteria found in environments like waters and foods. *L. monocytogenes* species cause a number of infections of which meningitis, meningoencephalitis, or bacteremia in immunosuppressed patients, pregnant, neonates, and elderly people (Saavedra *et al.*, 2012; Ewaid *et al.*, 2019b,a).

## CONCLUSIONS

When antibiotics sensitivity test was accomplished, most *Staphylococcus spp.* were sensitive for daptomycin and had high resistance to both of vancomycin and clindamycin, whereas *Staphylococcus aureus* was sensitive for most the used antibiotics. Half of *E. coli* isolates were sensitive, while the second half were resistant to the used antibiotics. Imipenem

inhibited the growth of all *Pseudomonas* isolates, whereas 80% of them were resistant to amikacin.

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