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Bacteriological Profile and Antimicrobial Sensitivity Pattern of Blood Culture Isolates among Septicemia Suspected Patients in the University Teaching Hospital (UTH) Yaoundé, Cameroon

Jude Tsafack Zefack[1, 2], Ngwa Fabrice Ambe[#2, 3], Tanyi Pride Bobga[#2, 3, 4], Ateh Stanislas Ketum[5, 6], Derick Ngwa Awambeng[4, 7], Chi Nicsen Kelly[8], Zuo Beltus Fuh[2], Mafany Efange Henry Velinge[2], Mentoh Ajem Abungwi[9], Benjamin Pokam Thumamo[2]

[1]Department of Natural Sciences, University of Applied Sciences Bonn-Rhein-Sieg, Rheinbach, Germany
[2]Department of Medical Laboratory Sciences, Faculty Health Sciences, University of Buea, Buea, Cameroon
[3]Department of Microbiology and Parasitology, Faculty of Science, University of Buea, Buea, Cameroon
[4]ST Louis Institute of Medical Studies, Douala, Cameroon
[5]Department of Medicine, Faculty Health Sciences, University of Buea, Buea, Cameroon
[6]Reach Out, Buea, Cameroon
[7]Subdivisional Hospital Idebatu, Bakassi, Cameroon
[8]Pan Africa Malaria Genetic and Epidemiology Network (PAMGEN) Malaria Project, University of Buea, Buea, Cameroon
[9]Department of Pharmacy, Faculty of Medicine and Pharmaceutical Sciences, University of Douala, Douala, Cameroon

ABSTRACT

BACKGROUND: Septicemia constitutes a significant public health problem and it is an important cause of morbidity and mortality in hospitalized patients especially in children and neonates in developing countries, where identification of the germ and treatment is usually unsatisfactory.

AIM: The aim of this study was to assess the prevalence of bacterial isolates and antimicrobial susceptibility patterns among septicemia suspected patients in the University teaching Hospital (UTH) Yaoundé.

MATERIALS AND METHODS: This was a hospital based cross sectional study that was carried out for a period of 4 months among septicemia suspected hospitalized patients in the University Teaching Hospital (UTH) Yaoundé. Standard procedure was followed for blood sample collection, isolation, identifications and antimicrobial susceptibility testing. The data were analyzed by using EPI info and SPSS.

RESULTS: Out of 255 blood culture results, 65 (25.5%) had septicemia. The predominant bacteria isolated from blood culture were Coagulase negative *staphylococci* 42 (64.6%), followed by *Klebiesella* spp 8 (12.3%), *E. coli* 7(10.8%), *Acinetobacter spp* 4 (6.2%) and *Streptococcus* spp. 2 (3.1%) *S. aureus* 1 (1.5%) and *Enterobacter* spp 1 (1.5%). The Gram positive and Gram negative bacteria constituted 45(69.2%) and 20(30.8%) of the culture isolates respectively. Children between the ages of 0 -15 years constituted the greatest percentage of infected subjects (28.4%) (P >0.05). The highest incidence of septicemia were from pediatric ward 25 (30.9%) and neonatal ward 24 (26.1%). There was a significant association between septicemia and the body temperature of the patient (P = 0.0272). Our finding, indicates that Gram negative bacteria exhibited a greater level of antimicrobial resistance (12.5%–87.5%) than Gram positive bacteria (2.4% – 50%) to various antibacterial agents used in the study.

CONCLUSION: The consequences of using an ineffective drug in severe bacterial infections could be disastrous as this can complicate management and increase morbidity and mortality

KEYWORDS: *Septicemia, Antimicrobial Sensitivity, Cameroon, Blood Culture*

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 # Corresponding Authors

1. Ngwa Fabrice Ambe
Email: ngwafabrice12@gmail.com
Tel: 00237673565456

2. Tanyi Pride Bobga
Email: bobgatanyi@yahoo.com,
Tel: 00237670579138

BACKGROUND

Septicemia is a systemic illness caused by microbial invasion of normally sterile parts(blood) of the body. This is dangerous because the bacteria and their toxins can be carried through the bloodstream to the entire body. Septicemia can quickly become life-threatening and must be treated and if it is left untreated, septicemia can progress to sepsis [1]. Septicemia remains one of the most important causes of morbidity and mortality throughout the world. Approximately 200,000 cases of bacteria occur annually with mortality rates ranging from 20-50% worldwide [2]. Septicemia accounts for 10-20% of all nosocomial infections and is the eighth leading cause of mortality, in the United States some 17% of these infections result in death [3]. In sub Saharan countries including Cameroon, septicemia is an important cause of illness and death in children, the mortality rate approaches 53% which makes it a significant health problem in developing countries [4]. A study by Kamga et al.;2010, revealed 28.3% prevalence of septicemia in the university teaching Hospital (UTH) Yaoundé Cameroon[5]. Septicemia is very common in the pediatric age group and these are one of the common causes of morbidity and mortality in neonates and children. The rate of blood stream infections in children is about 20–50% in developing countries [6, 7]. More recently, parenteral nutrition products have been implicated in septicemia in neonates [8]. Septicemia occurs in 1.3% to 26.2% of patients with central venous catheters used to administer parenteral nutrition [9]. Higher rates are found across the world, particularly in high-risk groups – e.g., intravenous drug users [10].Also, a variety of microorganisms have been found to colonize Central Venous Catheters (CVCs) and lead to infections in patients undergoing hemodialysis [11,12].

In many studies a wide range of bacteria has been described in febrile patients including Gram negative bacteria such as *Escherichia coli, Pseudomonas aeroginosa, Klebsiella species, Neisseria meningitidis, Haemophilus influenzae*, and Gram positive such as Coagulase negative *staphylococci* (CONS) bacteria, *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Streptococcus pyogenes, Streptococcus agalactiae*, and *Enterococcus faecium*[13].

Bacterial pathogens isolated from septicemia are a leading cause of significant patient morbidity and mortality. The impact of specific etiologic agents on septicemia patient outcome are tremendous; septicemia increases the mortality rate, prolongs patient stay in an intensive care unit and in the hospital, and leads to increased health care costs [14,15].

The diagnosis of these infections can be confirmed by blood culture, which is routinely available in few hospitals in developing countries [16]. The timely and appropriate use of antibiotics is currently the only way to treat septicemia. However, many bacterial pathogens have become resistant to antibiotic regimens and hence a serious public health concern with economic and social implications throughout the world. Antibiotics resistance is a growing problem in developing countries such as Cameroon. In Cameroon the unregulated over-the-counter sale of these antimicrobials, mainly for self-treatment of suspected infection in humans, and to a lesser extent for use in animals without prescription, would inevitably lead to emergence and rapid dissemination of resistance [5, 17]. Many studies have found that inadequate empirical therapy of septicemia infections is associated with adverse outcomes, including increased mortality and increased drug resistance emergence [18,19].

Septicemia constitutes a significant public health problem and it is an important cause of morbidity and mortality in most healthcare setting particularly in hospitalized patients [20]. However, there are only a few studies conducted in Cameroon due to the declining health infrastructure, which have studied the organisms involved in septicemia and their antibiotic susceptibility pattern. Therefore, we conducted this study to determine the common bacterial agents associated with septicemia and their antimicrobial susceptibility patterns in septicemia suspected hospitalized patients attending the University Teaching Hospital (UTH) Yaoundé Cameroon.

METHODOLOGY

Study Area

This study was conducted in the University Teaching Hospital Yaoundé, which is located in the Yaoundé six sub division in the Centre region of Cameroon between January to April 2018. All laboratory analysis were routinely processed in the bacteriology Laboratory of the hospital.

Study Design

This study was a hospital based cross sectional study. At enrollment an informed consent was obtained and each study participant was asked to complete a questionnaire which consisted of sociodemographic (name, age, sex) ward, date and time, body temperature of collection of sample and personal details, history of present illness, clinical signs and symptoms, and so forth.

Sample Size

A sample size of 311 participants was calculated from the formula:

$$N = \frac{Z^2 X\, P\,(1-P)}{d^2} = \frac{(1.96)^2 \times 0.283(1-0.283)}{(0.05^2)} = 311 \text{ participants}$$

Where, N= required sample size, Z= confidence interval (95%) i.e. 1.96, P= pre-estimated prevalence (28.3%)) obtained from a similar study carried out by Kamga*et al* in 2010 in the University Teaching Hospital (UTH) Yaoundé, Cameroon. d= error margin (5%).

Sample size attained was 255 participants

Study Population

The study included all septicemia suspected hospitalized patients attending the University teaching hospital (UTH) Yaoundé who had been prescribed a blood culture test.

Inclusion Criteria

Individuals included in the study were septicemia suspected hospitalized patients of all age groups who were requested a blood culture.

Exclusion Criteria

Those who were already on antibiotics were excluded from the study.

Ethical Consideration

Authorization to conduct the study was obtained from the Faculty of Health sciences University of Buea, Also, administrative authorization was obtained from the

University Teaching Hospital (UTH) Yaoundé. Participants or guardians were given a consent form or assent form respectively, to fill as an initial step in the participation process after the study purpose had been well explained to them. Participants were informed of their full autonomy over their participation in the study and the freedom to withdraw at any time if they so desire. Ethical review and clearance was gotten from the Institutional review board (IRB/FHS UB).

Blood culture and antibacterial sensitivity

Using aseptic technique about 10 ml (adults) or 5ml (children) of blood was obtained after cleaning the venous site with 70% alcohol and subsequently by 10% povidone iodine solution. The blood was then inoculated directly into the diphasic blood culture bottle after having first disinfected the top of the blood culture bottle with an alcohol swab. The blood culture bottle was then gently rotated to mix the blood and culture medium, the blood culture bottle was labeled and incubated at 37 ˚C. Our cultures were incubated for up to seven days before reporting as negative. After 24 hours of incubation (day 1) the bottle was checked for any growth in the Hemoline Diphasic bottle which was detected by a change in the color of the broth and agar of the media, hemolysis, clot or gas production. The same process continued as above for three days if there was no growth, after 72 hours of incubation, a systematic re-inoculation was performed on Blood and Chocolate + polyvitex agar and incubated anaerobically in a candle jar at 37 ˚C for 24 hours. In case there was no growth, the content of the bottle was gently mixed and further incubated for more 24 hours and observed the following day (day 2) for any growth. On the seventh day if there was still no growth on the bottle, another systematic re-inoculation was done on Blood and Chocolate + Polyvitex and incubated at 37 ˚C for 24 hours. The plates were examined the following day and if there was still no growth it is reported as "sterile blood culture". However, if only after 24 hours of incubation (or before the normal seven days limit for incubation) there was a growth in the culture bottle, Gram staining was done using both the broth and the colonies on the slope. The gram stain reaction of the bacteria guided on which medium to be used for subculture. Gram positive cocci were inoculated onto Manitol salt agar (Chapman agar), chocolate plus polyvitex and blood agar. The manitol salt agar plates were incubated aerobically while chocolate agar and blood agar were incubated in microaerophilic atmosphere (5–10% CO2) using a candle jar. Gram-negative bacilli were subculture on EosineMethylen Blue (EMB) and incubate aerobically at 37°c for 24 hrs. Identification of culture isolates were done according to standard bacteriological techniques and their characteristic appearance on their respective media, Gram smear technique, hemolytic activity on sheep blood, rapid bench tests such as catalase, coagulase and optochin tests for Gram positive bacteria were used.SLIDEX Strepto PLUS® reagent was used for Lancefied grouping of Streptococci. In case of Gram negative bacteria, oxidase test was performed to distinguish between the *enterobacteria* (oxidase negative) from other Gram negative non-fermenting bacilli (oxidase positive); Api20E was used following the manufacturer's instructions for the identification of *Enterobactericeae*. Finally, the Kirby-Bauer diffusion method was used to test the susceptibility of the isolates on Muller-Hinton agar according to procedures of Clinical Laboratory Standard Institute (CLSI 2010) [21]. Antibiogram for *Streptococcus* species was done on blood agar. For *Staphylococcus* spp antibiotics disc tested included; Amoxcillin /Clavulanic acid (30g), gentamycin (10µg), cefoxitime (30µg), cotrimoxazole (1.25/23.7µg), vancomycin (30µg), erythromycin (15µg), lincomycin (15µg), tetracycline (30µg), oxacillin(5µg), Tobramycine (10g), pristinamycine (15g), fusidicacid (10g) and Cefoxitime (30µg). For *Streptococcus* spp antibiotics disc tested included: gentamycin (500µg), streptomycin (500µg), cefoxitime (30µg),vancomycin (5µg), erythromycin (15µg), lincomycin (15µg), tetracycline (30µg), oxacillin (1µg), imipenem (10µg), Cefepime (30µg), ciprofloxacin (5g), ampicillin (10g), chloramphenicol (30g) and Cefotaxime (30µg). F*or Enterobacteria* spp antibiotics disc tested included: gentamycin (10µg), cefoxitime,(30µg), cotrimoxazole (1.25/23.7µg), levofloxacin (5µg), imipeneme (10µg), ceftazidime (10µg), aztreonam (30µg), Cefalotine (30µg), Cefixime (5µg), Cefuroxime (30µg), Cefotaxime (5µg), eftriaxone (30µg), Ceftazidine (10µg), Aztreonam (30µg), Amikacin (30µg), Netilmicin (10µg), Nalidixic acid (30µg), Norfloxacin (10µg), Ciprofloxacin (5µg) and Cefoxitime (30µg). In our study the following quality control measures were done; Sample collection was done under aseptic conditions and preparation of culture plates was done following all the manufacturers procedure, a sterility and fertility test was done on them before used. The reference strains used as control for disc diffusion testing and BACTEC PEDS Plus/F culture media were S. aureus (ATCC-25923), P. aeruginosa (ATCC-27853), E. coli (ATCC-25922), Haemophilus influenzae (ATCC-49247).

Data Analysis

Data were recorded on register forms and entered in a Microsoft Excel database in a secure computer and analysis was done with SPSS version 20 and EPI info version 7.Data were statistically described in terms of frequencies and percentages. The Chi Square test was used to compare two categorical variables and a *P* value less than 0.05 was considered statistically significant at 95% confidence interval.

RESULTS

Sociodemographic characteristics

Two hundred and fifty five (255) septicemias suspected patient's blood cultures were processed routinely from January 1st, 2018 to April 30th, 2018. Of these patients 132 (51.8%) were males and 123 (48.2%) were females. The age range was between 1day to 82years with majority of the patients176 (69.0%) between 0 – 15 years of age **[Figure 1].**

The overall prevalence of bacteria isolated from blood culture of bacteremia suspected patients were 65 (25.5%). 37 (56.9%) of the positive cultures were from males and 28 (43.1%) were from females. All the infections were due to single organism. The predominant bacteria isolated from blood culture were Coagulase negative *Staphylococcus (CONS)* 42 (64.6%), followed by *klebiesella spp.* 8 (12.3%) and *Escherichia coli* 7 (10.8%)**[Figure 2].** The Gram positive bacteria constituted 45 (69.2%) while the Gram bacteria constituted 20 (30.8%).

In this study the predominant bacteria by age class were CONS 35 (19.9%), followed by *Klebiesella spp.* 4(2.3%), *Acinetobacter spp*. 4(2.3%), *E. coli* 3 (1.7%), *Streptococcus spp.* 2 (1.1%), *Staphylococcus aureus* 1 (0.6%) and *Acinetobacter spp.* 1 (0.6%) in patients of age between 0 – 15 years.

In our study, most of the sepsis patients were males 37(56.9%), however, there was no statistical significant difference between the genders and septicemia (X^2 = 0.3359,P = 0.1699). We observed that the spectrum of septicemia varies with the age of patients. Twenty eight point four percent (28.4%) of septicemia was found in those ages between 0- 15 years which has the highest proportion of sepsis patients. But however, there was no statistical significant difference between age of patient and Blood Stream Infection (BSI) (X^2 = 9.0217, P = 0.1082)**[Table 1]**. Also, 25(30.9%) and 24(26.1%) of bacteria were isolated from patients hospitalized in the pediatric and neonatal wards respectively while the remaining percent were from those hospitalized in the other wards. However, there was no significant association between the ward in which a patient was admitted with the blood culture result (X^2 = 6.5657 and P = 0.3629) **[Table 2].**

Variation of septicemia with temperature

In our study, most of the septicemia suspected patients tested i.e. 152 (72.7%) had temperatures between 37.1- 40 degree Celsius. There was therefore a significant association between septicemia and the body temperature of the patient (X^2 = 7.2068 and P = 0.0272) **[Table 3].**

Antibiotic susceptibility patterns

Sensitivity pattern

The antimicrobial sensitivity levels for the Gram-negative organisms, causing blood stream infections ranged from 25% to 100%. *Klebsiella* spp were sensitive to fosfomycine (100 %), levofloxacin/gentamycin (75% each), and chloramphenicol/aztreonam (62.5%). *E. coli* were sensitive to fosfomycin/chloramphenicol/aztreonam/imipenem (50% each), levofloxacin (37.5%) and cefepime (25 %). *Acinetobacter*spp. were sensitive to levofloxacin (75 %), gentamycin (50 %) and imipinem/fosfomycine (25 %5). The range of sensitivity for the Gram positive bacteria were from 30.9 % to 100%. *CONS* isolates were sensitive to pristinamyci'n (69 %), vancomycin (59.5 %), minocycline (52.4) and lincomycine (50%) **[Table 4].**

Resistance pattern

Antimicrobial resistance levels for the Gram-negative organisms, causing blood stream infections were ranging from 12.5 to 100%. *Klebsiell a*spp were resistant to amoxicillin (87.5%), cefepim /cefalotin (62.5% each) and cotrimoxazole (50%). *E. coli* were resistant to cefepim/ amox+clavulanic acid/ chloramphenicol (42.9% each) and cefoxitin/amoxicillin/ cotrimoxazole (28.6 % each). *Acinetobacter*spp. were resistant to cefalotin (75%), Amox+ clavulanic acid (50 %). The range of resistance for Gram positive bacteria were from 2.4% – 100 %. *CONS* isolated were resistant to tetracycline (50 %), cefoxitin (38.1 %), erythromycin/ amox+clavulanic acid (30.9 % each) and cotrimoxazole (37.5 %). One hundred percent (100 %) of *S. aureus* isolates were resistant to fusidic acid, co-trimoxazole, tetracyclin, chloramphenicol and erythromycin **[Table 5]**.

DISCUSSION

The result of this study demonstrated the profile of microbial isolates causing septicemia and their susceptibility pattern to most commonly used antimicrobial agents. The rate (25.5 %) of bacteria isolation in the blood culture of septicemia suspected patients in this study was in line with what had been previously reported in Gondar, Ethiopia (24.2%) though slightly higher [22]. However, this finding was relatively lower than studies done in Yaoundé, Cameroon (28.3%) and Zimbabwe (37.1%) [5, 23]. On the other hand, our finding was higher than other studies done in Gondar, Ethiopia (18.2 %), Nigeria (18.2 %) and Iran (4.1%) [24 -26]. The varying proportions may be due to the different methodology used and the area of study, because of the regional variation known to occur.

The range of microorganisms that invade the bloodstream has been systematically studied by several researchers. In our study, 69.2 % of infections were caused by Gram-positive and 30.8 % by Gram-negative bacteria. Several studies in different countries; Yaoundé Cameroon (56.2 % and 43.8 %), Gondar Ethiopia (69% and 31%), Jimma Ethiopia, (60.9% and 39.1%), Gondar Ethiopia (70.2% and 29.8%), Zimbabwe (71.9% and 28.1%) Addis Ababa Ethiopia (62.6% and 37.4%), have shown marginally higher prevalence of Gram-positive and lower prevalence of Gram-negative organisms, respectively [5, 22-26]. On the contrary, Gram-negative bacteria have been reported as the commonest cause of bacteremia in hospitalized febrile patients in developing countries in studies conducted in Nigeria (69.3% and 30.7%), Saudi Arabia (62.2% and 33.8%), Tanzania (69.7% and 30.3%) [27, 28, 29]. The possible explanation for the difference could be the difference in blood culture system, geographical location, the study design, epidemiological difference of the etiological agents, nature of patient population and seasonal variation.

In our study, CONS, *Klebsiella* spp., *E. coli*, *Acinetobacter* spp., *Streptococcus spp.*, *S. aureus*, and *Enterobacter* spp. were the seven most common bacterial pathogens causing septicemia. Similar observations have been made in cases of bacteremia in different countries, however, the proportion and predominance of the organisms varied [5, 22-24, 30,31, 32, 33].

The predominant etiological agents in our study were Gram positive organisms. It conforms to other studies [5, 22-24]. Coagulase negative *staphylococci* (CONS) were the most commonly isolated bacteria and this has also been found in other studies [5, 22-24]. The role of CONS in bacteremia is divisive. Until the 1970's, CONS were mainly recognized as a contaminant. Since then, several studies have reported increasing incidence of infections due to CONS [34,35,36].

Our study revealed that CONS 42(64.6%) was the predominant bacteria isolated. However, our finding was much higher than what was obtained in other studies in Yaoundé Cameroon (26.4 %), Gondar Ethiopia (42.3 %), Addis Ababa Ethiopia (43.3 %), Zimbabwe (42.9 %), Jimma Ethiopia (26.1%), and Gondar Ethiopia (33.3%) [5,22-24, 36]. However, this finding is contrary to a study done in Tanzania, the predominant bacteria are *Salmonella* spp. followed by *E. coli* [30].Furthermore, In the case of Gram negative bacteria, *Klebsiella spp*. (12.3%) was the predominant bacteria followed by *E. coli (*10.8 %) in this study. This finding is comparable to other studies done in Gondar Ethiopia [24] where, isolation rate of *Klebsiella* spp. and *E. coli* were (12.7 %) and (7.0 %) respectively. However, our results were different from what was obtained in Yaoundé Cameroon [5] and Addis Ababa Ethiopia [75] where, isolation rate of *Klebsiella* spp. and *E. coli* were (6.4 % & 9.7%) and (5.5 % & 8.1%) respectively. In addition to

that, we did not isolate *Haemophilus influenzae* like other studies in Cameroon and Ethiopia [5,22-24,36].

This study revealed all cases of septicemia to be cause by a single microorganism that was isolated. This observation is in agreement with earlier studies [5, 22, 37]. On the contrary, septicemia of polymicrobial etiology was found in other studies [69, 83]. However, most clinical bacteriologists failed to report polymicrobial sepsis because of misconception of contamination, ignorance of its significance or disregard for the second organism in an already positive culture [38]. But there is a need to correlate the occurrence of polymicrobial sepsis with clinical outcome in septicemia. A patient already infected with one microbe may have acquired the second one from the hospital environment or both the bacteria could be nosocomial in origin [39].

Our study showed that septicemia was relatively higher in those age 0-15 years (28.4 %) than other age groups. This study has established that the disease affects all age groups but it was more noticeable in neonates and children between 0-15 years than adults [Table 4]. This finding is supported by other studies [5, 24, 68, 39]. There was no significant association between age of patient and septicemia (X^2 = 9.0217 and P = 0.1082) in this study. This was contrary to a study done in Gondar Ethiopia which recorded a significant association between age of the patient and septicemia [24].

In addition to that, our study revealed that septicemia was more in patients in the pediatric ward 25 (30.9%) and neonatal ward 24 (26.1%) than any other hospital ward. The higher occurrence of septicemia in neonates and pediatrics age between 0-15 years has been reported from different studies [22, 33]. The high occurrence of septicemia in neonates in the University Teaching Hospital Yaoundé may probably be attributed to their low immune response, socio-economic status of their parents, poor hygiene practices and bottle feeding [39].There was no statistically significant difference between gender variation and septicemia (X^2 = 0.9297 and P = 0.3349) in this study. This study showed that males were more affected than females by septicemia. This finding was similar to what had been previously reported by various authors [22, 39].A study of in vitro antimicrobial susceptibility profile of the etiological agents of septicemia has revealed that there is a growing emergence of multi-drug resistant microbes. Fifty percent (50%) of *CONS* isolated were resistant to tetracycline. The only *S. aureus* isolated had a one hundred percent (100 %) resistance to fusidic acid, co-trimoxazole, tetracycline, chloramphenicol and erythromycin. The consequences of using an ineffective drug in severe bacterial infections could be disastrous as this can complicate management and increase morbidity and mortality [22-26]. In our study, Gram negative bacteria *Klebsiella spp*. showed highest resistance to amoxicillin (87.5 %) and cefepime (62.5 %).

A general overview of the antibiogram of the major bacterial isolates (i.e. CONS, *Klebsiella spp*., *E. coli* and *Acinetobacter spp*.) indicates that Gram negative bacteria exhibited a greater level of antimicrobial resistance ranging between 12.5%– 87.5%) than Gram positive bacteria (2.4% – 50%) to various antibacterial agents employed during the study period. This was similar to other studies done in Nigeria for which Gram negative bacteria had (19.8%-92.3%) and Gram positive (10%-87%) [39] and another in Gondar Ethiopia which had Gram negative bacteria (20%-100% and Gram positive (23.5%-58.8%)[24]. This situation raises serious concern and suggests a very high resistance gene pool perhaps due to gross misuse and inappropriate usage of the antibacterial agents [39].Gentamycin was found to be effective against both Gram positive and Gram negative isolates. Similar findings have been reported in previous studies done in Cameroon and Ethiopia [5, 24].

CONCLUSION

Our study reveals the prevalence of septicemia at the University Teaching Hospital Yaoundé between January and April 2018 was 25.5% and also Coagulase negative *Staphylococcus (CONS)*, *klebsiella spp and E.coli* were the leading cause of septicemia among septicemia suspected hospitalized patients who attended the hospital during this period. Children between 0-15 years registered the highest number of septicemia cases in this study .In general CONS were most sensitive to pristinamycine, vancomycin, minocycline and linomycin while gram negative bacilli were more sensitive to fosfomycin, levofloxacin and gentamycin. We observed decline in susceptibility of these common pathogens (especially Gram-negative bacilli) to common antibiotics, which calls for increase effort to ensure more rational use of drugs. None of the antibiotics used singly showed high sensitivity to all the gram-negative bacteria, so a combination of two or more drugs (such as gentamicin, cefoxitime and ciprofloxacin) is needed to cover the broad range of gram-negative bacilli.

What is already known on this topic?

- This is a high incidence of septicemia in children and neonates

What this study adds

- Majority of the isolates were multidrug resistant. These higher percentages of multi-drug resistant emerged isolates urge us to take infection prevention measures and to conduct other large studies for appropriate empiric antibiotic choice.
- There was a significant association between septicemia and the body temperature of the patient

List of Abbreviations

BSI: Blood Stream Infection, HCAB: Healthcare-associated BSI, HAB: Hospital-acquired BSI, ICU: Intensive Care Unit, CA: Community acquired, HCA: Health care associated, UTH: University Teaching Hospital

Authors' contributions

JTZ, BPT, NFA and TPB conceived and designed the study: JTZ and NFA conducted the study: BPT supervised the study: TPB, MEHV, ZBF, MAA, NFA, DNA, ATK and CNK performed data analysis and interpretation. JTZ, NFA and TPB wrote the first draft of the manuscript and BPT reviewed and corrected the manuscript. All authors approved the final copy

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Conflicts of interests

The authors declare no competing interest.

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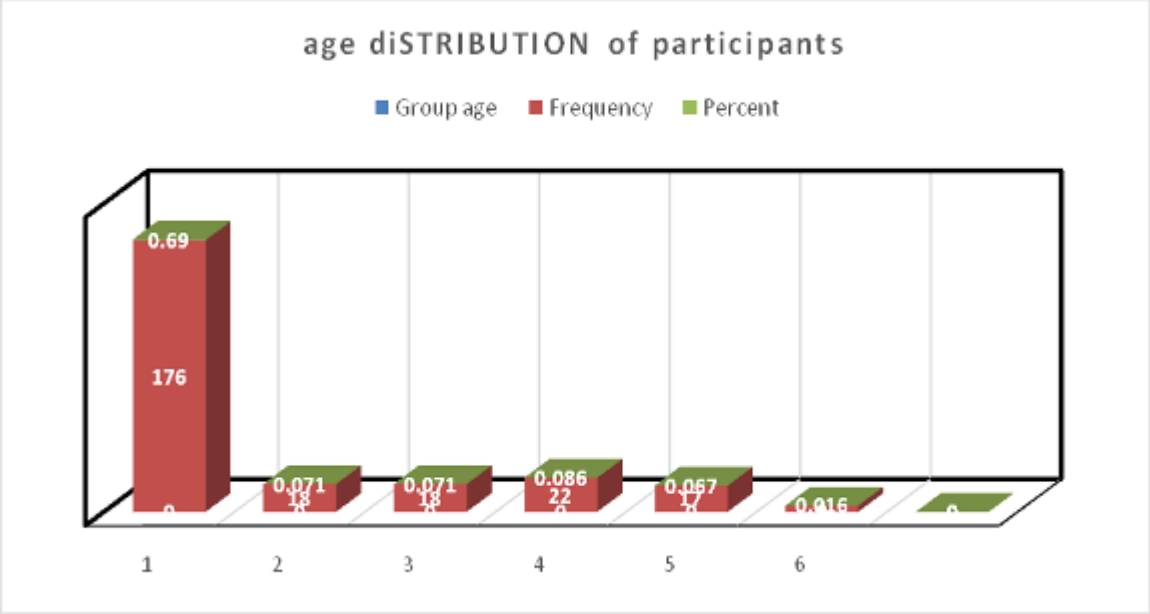

KEY: 1=0-15 years, 2=16-30 years, 3= 31-45 years, 4= 46-60 years, 5=61-75 and 6= >75

Figure 1: **Age distribution of septicemia suspected hospitalized cases (participants).**

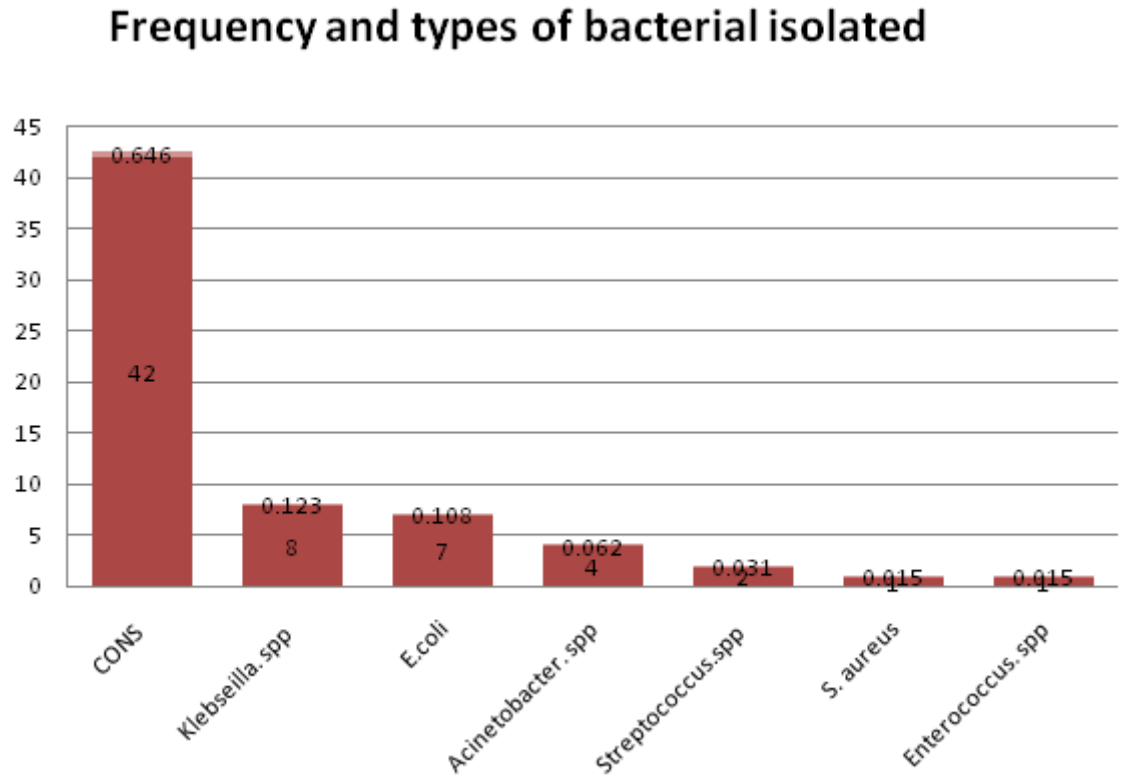

Figure 2: Frequency and types of bacterial isolates from septicemia hospitalized cases.

Table 1: Frequency of bacterial isolated by age class from septicemia hospitalized cases

Age class	CONS n(%)	Klebsiella spp. n(%)	E. coli n(%)	Acinetobacter spp. n(%)	Streptococcus spp. n(%)	S.aureus n(%)	Enterobacter spp. n(%)
0-15 yrs	35(19.9)	4(2.3)	3(1.7)	4(2.3)	2(1.1)	1(0.6)	1(0.6)
16-30 yrs	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
31-45 yrs	2(11.1)	2(11.1)	2(11.1)	0(0.0)	0(0.0)	0(0.00)	0(0.0)
46-60 yrs	3(13.6)	1(4.5)	1(1.5)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
61-75 yrs	2(11.8)	1(5.9)	1(5.9)	0(0.0)	0(0.0)	0(0.0)	0(0.0)

Table 2: Sociodemographic characteristics of septicemia suspected hospitalized cases

Variable	Culture result		Association
Sex of patient	**Positive n(%)**	**Negative n(%)**	**P value andx²**
Male	37(28.0)	95(72.0)	$X^2 = 0.9297$
Female	28(22.8)	95(77.2)	P = 0.3349
Total	65	190	
Age in years 0-15 yrs	50(28.4)	126(71.6)	$X^2 = 9.0217$ P = 0.1082
16-30 yrs	0(00)	18(100.0)	
31- 45 yrs	6(33.3)	12(66.7)	
46-60 yrs	5(22.7)	17(77.3)	
61-75 yrs	4(23.5)	13(76.5)	
> 75 yrs	0(00)	4(100)	
Total	65	190	
Origins(Ward)			
Pediatric	25(30.9)	56(69.1)	$X^2 = 6.5657$ P = 0.3629
Neonatal P	24(26.1)	68(73.9)	
Reanimation	7(17.9)	32(82.1)	
Emergency	4(16.0)	21(84.0)	
Internal medicine	3(23.1)	10(76.9)	
Obstetrics & Gynecology	1(25.0)	3(75.0)	
Surgery	1(100.0)	0(0.0)	
Total	65	190	

Table 3: Variation of septicemia with temperature in septicemia suspected cases

Temperature(°C)	Frequency	Percentage	Cum Percent	X^2 and P value
35 - 37	44	21.1%	21.1%	$X^2 = 7.2068$ P = 0.0272
37.1 - 40	152	72.7%	93.8%	
40.1 – 42	13	6.2%	100.0%	
Total	209	100.0%	100.0%	

Table 4: Sensitivity pattern of bacteria isolated from septicemia suspected hospitalized cases

Bacterial isolates	Antimicrobials												
	PT	VA	MNO	L	CN	P	E	FOS	C	FEP	ATM	LEV	IMP
	N	n	n	n	n	N	n	n	n	n	N	N	n
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
GRAM +VE													
CONS	29	25	22	21	13	00	16	NT	NT	NT	NT	NT	NT
	69.0	59.5	52.4	50	30.9	00	38.1						
S. aureus	0	0	0	0	0	NT	NT	NT	0	NT	NT	NT	NT
	00	00	00	00	00				00				
Streptococcus spp.	1	1	NT	NT	2	2	1	NT	1	NT	NT	1	NT
	50	50			100	100	50		50			50	
GRAM –VE													
Klebsiella spp.	NT	NT	NT	NT	6	NA	NA	8	5	2	5	6	4
					75			100	62.5	25	62.5	75	50
E. coli	NT	NT	NT	NT	4	NA	NA	4	4	2	4	3	4
					50			50	50	25	50	37.5	50
*Acinetobacter*spp.	NT	NT	NT	NT	2	NA	NA	1	0	0	0	3	1
					50			25	00	00	00	75	25
*Enterobacter*spp.	0	0	0	0	0	NA	NA	1	0	0	0	0	0
	00	00	00	00	00			100	00	00	00	00	100

Key:-FA/FC-fusidic acid, SXT/TM- Cotrimoxazole, TET-tetracycline,C-chloramphenicol,CN/CN-gentamycin, CF/KF-Cefalotin, , E- erythromycin,CIP-ciprofloxacin, OX-Oxacilin, FEP-Cefepime,AMX-amoxicillin, FOX-Cefoxitin, AMC-amoicilin+ clavulanic acid, pristinamycin-PT/PR, vancomycin-VA, minocyclin-MNO/MI, penecilin-P, fosfomycin-FOS, aztreonam-ATM/AZT, levofloxacin-LEV, imipenem-IMI/IMP,NA-Not Applicable.

Table 5: Resistance pattern of bacteria isolated from septicemia suspected hospitalized cases

Bacterial isolates	Antimicrobials												
	FA	SXT	TET	C	CN	CF	E	CIP	OX	FEP	AMX	FOX	AMC
	N	N	N	N	n	n	N	n	n	n	N	N	n
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
GRAM +VE													
CONS	11	15	21	NT	8	NT	13	NT	12	NT	1	16	13
	26.2	37.5	50		19.0		30.9		28.6		2.4	38.1	30.9
S. aureus	1	1	1	1	1	00	1	00	00	00	00	00	00
	100	100	100	100	100	00	100	00	00	00	00	00	00
Streptococcus spp.	NT	1	1	1	00	NT	00	NT	1	NT	NT	NT	NT
		50	50	50	00		00		50				
GRAM –VE													
Klebsiella spp.	NT	4	NT	1	1	5	NA	1	NT	5	7	2	3
		50		12.5	12.5	62.5		12.5		62.5	87.5	25	37.5
E. coli	NT	2	NT	3	1	2	NA	1	NT	3	2	2	3
		28.6		42.9	14.3	28.6		14.3		42.9	28.6	28.6	42.9
Acinetobacter spp.	NT	1	NT	1	1	3	NA	00	00	2	00	1	2
		25		25	25	75		00	NT	50	00	25	50
Enterobacter spp.	00	00	00	00	1	1	NA	1		00	00	00	00
	00	00	00	00	100	100		100	00	00	00	00	00

Key:-FA/FC-fusidic acid, SXT/TM- Cotrimoxazole, TET-tetracycline, C-chloramphenicol, CN/CN-gentamycin, CF/KF-Cefalotin, E- erythrom,CIP-ciprofloxacin, OX-Oxacilin, FEP-Cefepime, AMX-amoxicillin, FOX-Cefoxitin, AMC-amoicilin+ clavulanic acid, pristinamycin-PT/PR, vancomycin-VA, minocyclin-MNO/MI, penecilin-P, fosfomycin-FOS, aztreonam-ATM/AZT, levofloxacin-LEV, imipenem-IMI/IMP, NA-Not Applicable.