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(RESEARCH ARTICLE)

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Bacteriological profile and antibiotic sensitivity of germs isolated from blood cultures at the China-Guinea Friendship Hospital of Kipé in Conakry

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Abstract

Introduction: Bacteremia constitutes a major public health problem worldwide, especially when associated with multidrug resistant bacteria. Objective: To determine the bacteriological profile and antibiotic resistance of bacteria isolated from blood cultures at the China-Guinea Friendship Hospital of Kipé in Conakry. **Methods:** This retrospective study, carried out from January 12 to December 22, 2021. Blood cultures were taken using the Bact/Arlet machine (biomereux, France). Bacterial identification and antibiograms were carried out using the Vitek2 Compact automated system and the API system (bioMérieux, France). **Results**: Out of a total of eighty (80) blood cultures, forty-five (45) were positive, with a rate of 56.25%. The most represented age group was 31-40 years old with an average age of 36.92±10 years. Gram-positive bacteria were associated with 82.23% of bacteremias, 17.77% for Gram-negative bacteria. The most frequent species were: *Escherichia coli* (22.23%), *Staphylococcus xyloxus* (16.23%), *Staphylococcus haemolyticus* (13.51%), *Staphylococcus aureus* (13.51%), *Staphylococcus hominis* (10.81%). A high frequency of resistance of *Enterobacteriaceae* has been observed towards azetreonam, ceftazidime, gentamicin and tobramycin. On the other hand, the majority of strains were sensitive to imipenem, meropenem and amikacin. Gram-positive bacteria including *Staphylococcus xyloxus*, strains of *Staphylococcus haemolyticus* and those of *Staphylococcus aureus* were resistant to penicillin, Oxacillin, Oxacillin COAG and cefoxtin but sensitive to levofloxacin, nitrofurantoin and linezolid. **Conclusion:** These results show that Gram-positive bacteria were more frequently associated with bacteremia, although *Escherichia coli* was in the majority. Finally, a high frequency of multi-antibiotic resistant strains was observed, thus requiring antibiotic therapy based on the results of antibiograms.

Keywords: Blood culture; Bacteremia; Antibiotics; Resistance; Kipé; Conakry

1. Introduction

Blood culture is a laboratory technique whose aim is to demonstrate the presence or absence of microorganisms (bacteria and yeasts in the blood) and possibly study their sensitivity to different antibiotics depending on the case [1]. It is a crucial element in the diagnosis, prognosis and treatment of many severe infections, accompanied by bacterial passage into the blood [2]. Bacteremia are serious conditions, responsible for significant morbidity and mortality throughout the world, and are among the most common Healthcare Associated Infections (HAIs) [3]. The mortality rate attributed to them is high, but their clinical importance is often underestimated in sub-Saharan Africa where the

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majority of fevers are associated with malaria [4,5]. The epidemiological situation of bacteremia has evolved considerably over the last decades:

Indeed, a study carried out on bacteremia in 2002 in Geneva, in Europe, showed that the most frequent pathogenic germs were *Escherichia coli* (*E. coli* (22%)), *Staphylococcus aureus* (*S. aureus* (21%)), coagulase-negative staphylococci (10%), *Streptococcus pneumoniae* (*S. pneumoniae* (7%)) and *Candida albicans* (*C. albicans* (6%)) [6] .

Also in Africa, a study carried out in 2018 in Tunisia showed that the bacterial species most frequently isolated during bacteremia were *Acinetobacter baumannii* (20%) and *Pseudomonas aeruginosa* (16.8%) followed by *Staphylococcus aureus* (7, 5 %). The resistance rate was high with 71% of Pseudomonas aeruginosa strains resistant to ceftazidine.

Colimycin remained the only antibiotic regularly active (98%) against strains of *Acinetobacter baumannii* [7].

This global context of increasing resistance to antibiotics associated with the scarcity of previous studies in Guinea on the sensitivity to antibiotics of bacteria isolated from blood cultures motivated the presentstudy. The aim of this study was to determine the bacteriological profile and antibiotic sensitivity of germs isolated from blood cultures in the biomedical laboratory of the China-Guinea Friendship Hospital of Kipe in Conakry.

2. Material and methods

Study environment was commune of Ratoma. The commune of Ratoma is located in the northwest of the Kaloum peninsula with an area of 62 km^2 and is limited to the north by the Atlantic Ocean, to the south by the commune of Dixinn and Matam, to the west the ocean Atlantic and to the East by the commune of Matoto and the prefecture of Dubréka. The population of the commune of Ratoma is estimated according to the Central Census Office of the National Institute of Statistics at 738,149 inhabitants, including 365,796 (49.56%) women (2017 Census). The China-Guinea Friendship Hospital (HASIGUI), located in the City of Doctors in the Kipé district in the Commune of Ratoma, was inaugurated in April 2011.

This was a retrospective study of descriptive type with data collection, carried out at the bacteriology unit of the biomedical analysis laboratory of the China-Guinea Friendship Hospital Kipé/Conakry over a period of 12 months, (from January 12 to December 22, 2021).

Blood cultures were done with the Bact/Arlet automated system (bioMerieux, France). Our strains were identified using the Vitek 2 Compact 15 machine and the API 20 galleries. The antibiograms were also carried out using the Vitek 2 Compact 15 machine and the ATB Api galleries.

3. Results

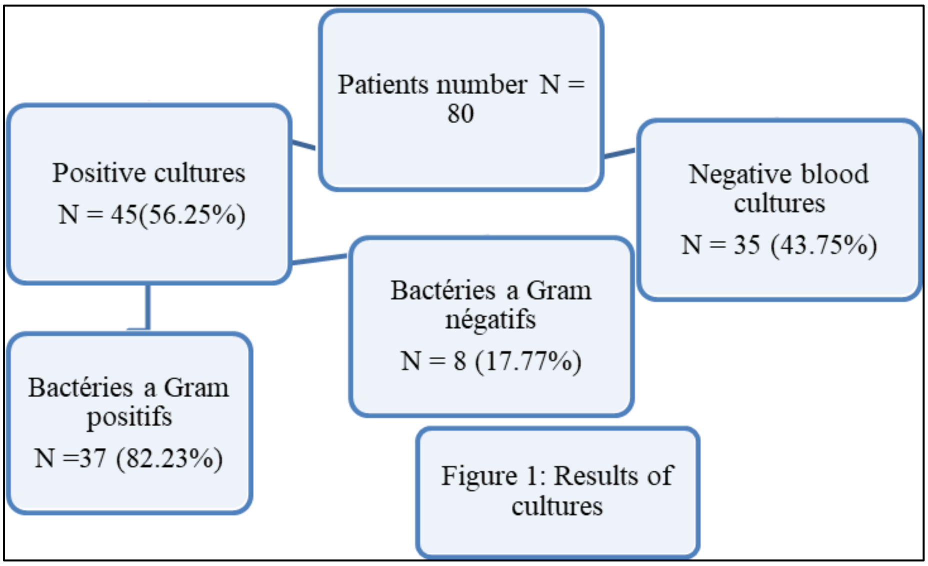
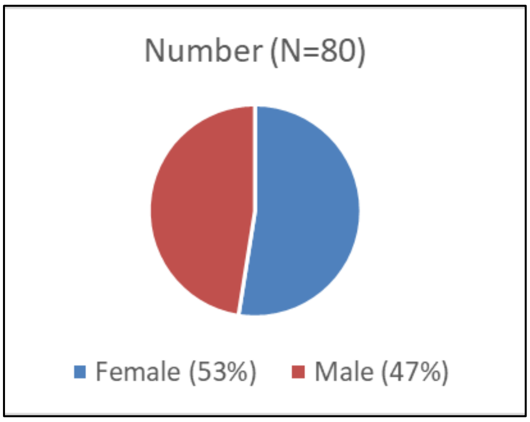


Figure 1 Patient flow diagram

Table 1 Distribution of blood cultures according to age groups (years)

Age groups (years)	Number	Percentage
1-10	14	17.5
11-20	9	11.25
21-30	4	5
31-40	22	27.5
41-50	12	15
≥ 51 Total	19 80	23.75 100



Sex-ratio H/F= 0,90

Figure 2 Distribution of blood cultures according to sex

Table 2 Distribution of blood cultures according to sex, origin, services of origin

Sex, Provenance, Departments	Frequence	Percentage
SEX		
Female	42	53
Male	38	47
PROVENANCE		
Outside of Conakry	28	35
Matoto	20	25
Ratoma	15	18.75
Dixinn	6	7.5
Kaloum	11	13.75
DEPARTMENTS		
External services	59	73.75
Neurochirurgery	6	7.5
Intensive care	5	6.25
Emergency	3	3.75

Neurology	2	2.5
Cardiology	2	2.5
Traumatology	1	1.25
Kinesitherapy/Acupuncture	1	1.25
Visceral surgery	1	1.25

(Sex ratio M/F= 0.90)

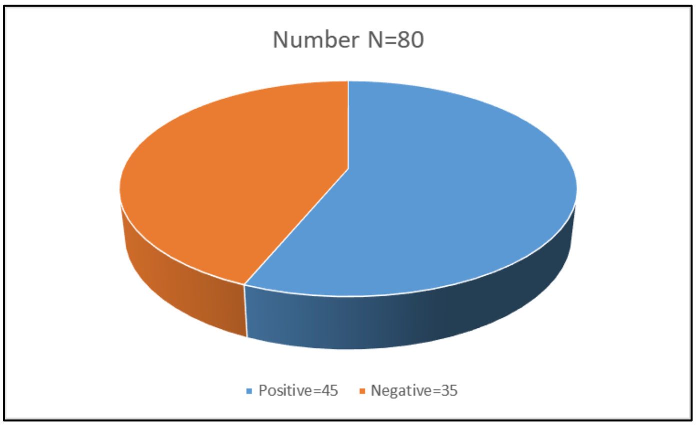


Figure 3 Frequency of blood cultures positivity

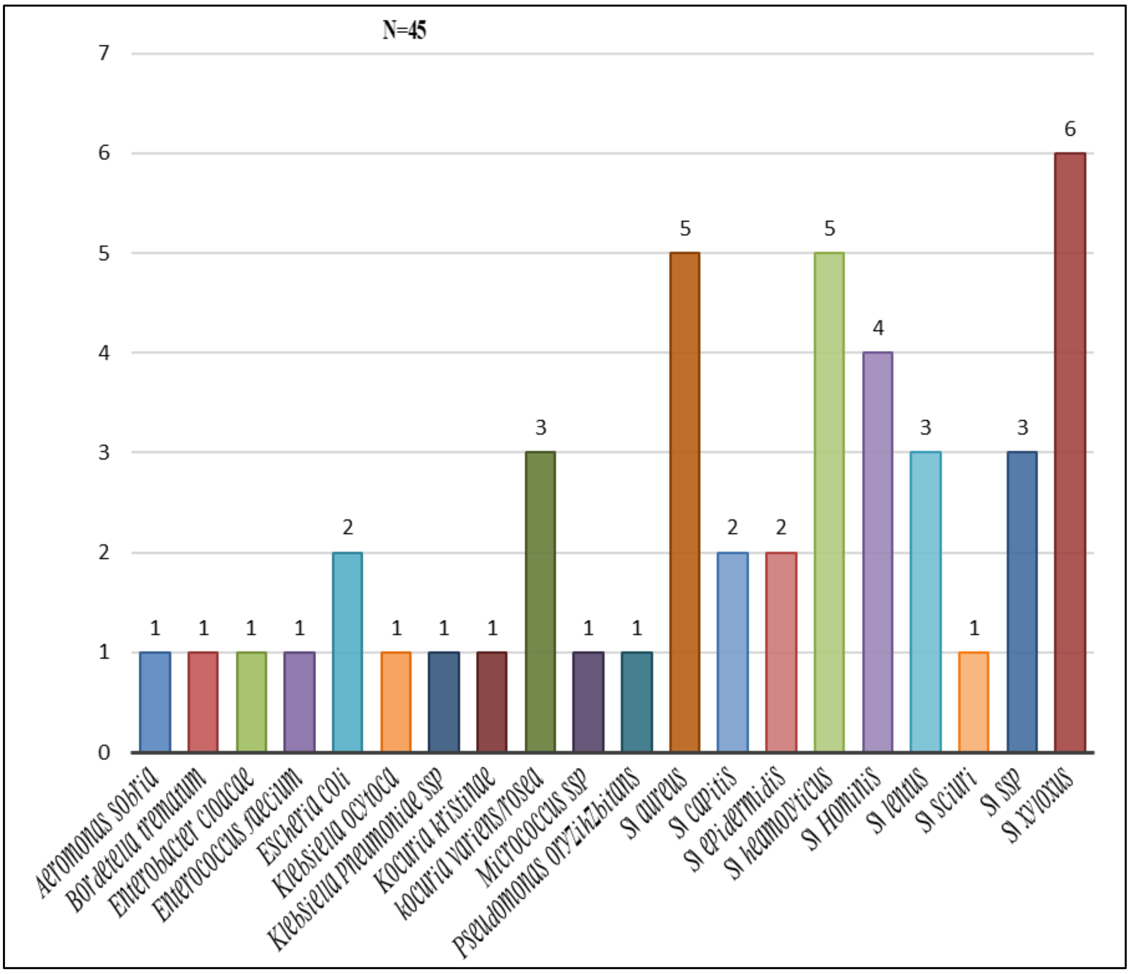


Figure 4 Distribution of blood cultures according to the bacterial strains isolated

Table 3 Distribution of positive blood cultures according to the families of bacteria isolated

Bacterial families	Number	Pourcentage (%)
Micrococcaceae	37	80.00
Enterobacteriaceae	5	13.34
Pseudomonadaceae	1	2.22
Aeromonadaceae	1	2.22
Alcaligenaceae	1	2.22
Total	45	100

Table 4 Distribution of isolated bacterial strains according to Gram staining results

GRAM	Bacterial isolates	Number	Percentage (%)
GRAM POSITIF	*Staphylococcus xyloxus*	6	13.34
	Staphylococcus haemolyticus	5	11.5
	Staphylococcus aureus	5	11.5
	Staphylococcus hominis	4	8.89
	Staphylococcus ssp	3	6.67
	Staphylococcus lentus	3	6.67
	Kocuria variens/rosea	3	6.67
	Staphylococcus. epidermidis	2	4.46
	Staphylococcus. capitis	2	4.46
	Kocuria kristinae	1	2.22
	Micrococcus ssp	1	2.22
	Staphylococcus. sciuri	1	2.22
	Enterococcus faecium	1	2.22
GRAM NEGATIF	*Escherichia coli*	2	4.46
	Enterobacter cloacae	1	2.22
	Klebsiella pneumoniae ssp	1	2.22
	Klebsiella ocytoca	1	2.22
	Bordetella trematum	1	2.22
	Aeromonas sobria	1	2.22
	Pseudomonas oryzihabitans	1	2.22
	TOTALE	45	100

Table 5 Overall antibiotic susceptibility profiles of all isolated bacterial species

Antibiotics tested	**Sensitive**	**Intermediate**	**Resistant (%)**	**Total**
Amoxicillin/Clavulanic Acid	6 (75.00)	0	2 (25.00)	8
Ampicillin	6 (66.70)	0	3(33.33)	9
Benzylpenicillin	33 (94.29)	0	2(5.71)	35
Oxacillin COAG	30 (96.78)	0	1 (3.22)	31
Oxacillin	31 (91.17)	0	3(8.82)	34
Ticarcillin	8(80.00)	0	2(20.00)	10
Ticarcillin/Clavulanic Acid	2(100)	0	0	2
Piperacillin	2(100)	0	0	2
Piperacillin/Tazobactam	2(100)	0	0	2
Imipenem	6(60.00)	1 (10.00)	03(30.00)	10
Ertapenem	2(100)	0	0	2
Meropenem	5(83.33)	0	01(16.66)	6
Azetreonam	7(100)	0	0	7
céfalotine	4(66.66)	0	2(33.33)	6
Cefazoline	3 (60.00)	0	2(40.00)	5
Cefotixine	32 (96.97)	0	1(3.03)	33
Céfotaxime	6 (75.00)	0	2 (25.00)	8
Cefixitine Screen	29(93.55)	0	2(6,45%)	31
Cefuroxim	4(66.67)	0	2(33.33)	6
Cefoxitin32	3(50.00)	0	3(50.00)	6
Cefepime	5(62.5)	0	3(37.50)	8
Ceftazidime	06(100)	0	0	6
Cefoperazone/Sulbactam	1(25.00)	1(25.00)	2(50.00)	4
Fosfomycin	25(73.52)	1(2.96)	8(23.52)	34
Teicoplanin	12(41.37)	1(6.89)	15(51.72)	28
Table 5 Overall antibiotic susceptibility profiles of all isolated bacterial species (continued)				
Antibiotics tested	Sensitive	Intermediate	Resistant	Total
Vancomycin	22(63.86)	0	13(37.14)	35
Amikacin	2(20.00)	0	8(80.00)	10
Gentamicin	30(69.77)	3(6.97)	10(23.25)	43
Tobramycin	32(84.21)	2(5.26)	4(10.53)	38
Kanamycin	24(77.42)	0	7(22.58)	31
Erythromycin	27(75.14)	2(5.71)	6(17.14)	35
Clindamycin	21(61,76)	0	13(38.23)	44
Lincomycin	17(56.66)	0	13(43.33)	30

Pristinamycin	15(48.39)	1(3.22)	15(48.39)	31
Quinupristin/Dalfopristin	13(38.23)	3(8.82)	18(52.94)	34
Tetracycline	33(89.19)	1(2.70)	3(8.11)	37
Minocycline	13(4.33)	1(3.33)	17(56.66)	31
Tigecylin	18(60.00)	0	12(40.00)	30
Fusidic Acid	0	0	04(100)	4
Nalidixic Acid	05(100)	0	0	5
Nalidixic Acid CLSI	2(100)	0	0	2
NalixidicAcid CA-SFM	2(100)	0	0	2
Linezolid	21(60)	0	14(40.00)	35
Norfloxacin	1(50.00)	0	1(50.00)	2
Ciprofloxacin	7(53.84)	1(7.69)	5(38.46)	13
Ofloxacin	22(59.46)	1(2.70)	14(37.83)	37
Levofloxacin	25(59.52)	1(2.39)	16(38.09)	42
Moxifloxacin	2(50.00)	1(25.00)	01(25.00)	4
Trimethprim/Sulfamethoxazole	32(80.00)	1(2.50)	7(17.50)	40
Nitrofurantoine	14(35.00)	1(2.50)	25(62.50)	40
Rifampicin	29(80.55)	1(2.79)	6(16.66)	36
Colostin	2(100)	0	0	2

Table 6 Profile of sensitivity of Enterobacteria to the antibiotics tested

Antibiotics tested	Sensitive	Intermediate	Resistant	Total
Amoxicillin/Acide Clavulanic Acid	1(25.00)	0	3(75.00)	4
Ampicillin	1(25.00)	0	3(75.00)	4
Ticarcillin	1(20.00)	0	4(80.00)	5
Ticarcillin/Clavulanic Acid	0	0	1(100)	1
Piperacillin	1(20.00)	0	4(80.00)	5
Piperacillin/Tazobactam	2(50.00)	1	2(50.00)	4
Imipenem	2(40.00)	1(20.00)	2(40.00)	5
Meropenem	3(75.00)	0	1(25.00)	4
Ertapenem	0	0	1(100)	1
Azetreonam	0	0	4(100)	4
Cefalotin	1(33.33)	0	2(66.66)	3
Cefazolin	1(33.33)	0	2(66.66)	3
Cefotixin	0	0	2(100)	2
Cefoxitin 32	1(25.00)	0	3(75.00)	4
Cefotaxime	1(25.00)	0	3(75.00)	4

Cefuroxime	0	0	3(100)	3
Cefixim	1(33.33)	0	2(66.66)	3
Cefepim	2(50.00)	0	2(50.00)	4
Ceftazidime	0	0	5(100%)	5
Cefoperazone/Sulbactam	1(50.00)	1(50.00)	0	2
Amikacin	4(80.00)	0	1(20.00)	5
Gentamycin	1(25.00)	0	3(75.00)	4
Tobramycin	0	0	3(100)	3
Tétracyclin	0	0	1(100)	1
Nalidixic Acid	0	0	4(100)	4

Table 6 Profile of sensitivity of Enterobacteria to the antibiotics tested (continued)

Antibiotics tested	**Sensitive**	**Intermediate**	**Resistant**	**Total**
Ciprofloxacin	1(20.00)	1(20.00)	3(60.00)	5
Ofloxacin	2(50.00)	0	2(50.00)	4
Levofloxacin	2(50.00)	0	2(50.00)	4
Trimethprim/Sulfamethoxazole	0	0	2(100)	2
Nitrofurantoine	0	0	2(100)	2
Rifampicin	0	0	1(100)	1
Colostin	0	0	1(100)	1

Table 7 Susceptibility profile of non-fermentative Gram-negative bacteria (*Pseudomonas oryzihabitans* and *Aeromonas* sobria) to the antibiotics tested

Antibiotics tested	**Sensitve**	**Intermediate**	**Resistant**	**Total**
Amoxicillin/ Clavulanic Acid	1(100)	0	0	1
Ampicillin	1(100)	0	0	1
Penicillin	0	0	1(100)	1
Oxacillin	0	0	1(100)	1
Ticarcillin	1(50.00)	0	1(50.00)	2
Ticarcillin/Clavulanic Acid	0	0	1(100)	1
Piperacillin	1(50.00)	0	1(50.00)	1
Piperacillin/Tazobactam	2(100)	0	0	2
Imipenem	2(100)	0	0	2
Meropenem	2(100)	0	0	2
Aztronam	0	0	2(100)	2
Cefepime	1(50.00)	0	1(50.00)	2
Céfixime	1(100)	0	0	1
Cefotaxim	1(100)	0	0	1

Cefoxitine	0	0	1(100)	1
Cefalotin	1(100)	0	0	1
cefazolin	1(100)	0	0	1
Cefuroxime	1(100)	0	0	1
Ceftazidime	2(100)	0	0	2
Cefoxitine 32	1(100)	0	0	1
Céfoxitin Screen	0	0	1(100)	1
Cefoperazone/Sulbactam	1(100)	0	0	1
Fosfomycin	0	0	(100)	1
Vancomycin	0	0	1(100)	1

Table 7 Susceptibility profile of non-fermentative Gram-negative bacteria (*Pseudomonas oryzihabitans* and *Aeromonas* sobria)to the antibiotics tested (continued)

Antibiotics tested	**Sensitive**	**Intermediate**	**Resistant**	**Total**
Amikacin	2(100)	0	0	2
Gentamycin	2(100)	0	0	2
Tobramycin	0	0	2(100)	2
Kanamycin	1(100)	0	0	1
Erythromycin	0	0	1(100)	1
Clindamycin	0	0	1(100)	1
Lincomycin	0	0	1(100)	1
Pristinamycin	0	0	1(100)	1
Quinupristin/Dalfopristin	0	0	1(100)	1
Tetracycline	0	0	1(100)	1
Minocycline	1(100)	0	0	1
Fusidic Acid	0	0	1(100)	1
Linezolide	0	0	1(100)	1
ciprofloxacin	2(100)	0	0	2
Ofloxacin	1(100)	0	0	1
Levofloxacin	2(100)	0	0	2
Trimethprim/Sulfamethoxazole	1(100)	0	1(100)	2
Nitrofurantoine	1(50.00)	0	1(50.00)	2
Rifampicin	0	0	1(100)	1
Colostin	0	0	1(100)	1

Table 8 Susceptibility profile of Gram-positive cocci to the antibiotics tested

antibiotics tested	**Sensitive**	**Intermediate**	**Resistant**	**Total**
Ampicillin	1(25.00)	0	3(75.00)	4

Benzylpénicillin	1(3.12)	0	31(96.87)	32
Amoxicillin/Clavulanic Acid	0	0	3(100)	3
Oxacillin COAG	1(3.33)	0	29(96.66)	30
Oxacillin	2(6.66)	0	28(93.33)	30
Ticarcillin	0	0	3(100)	3
Piperacillin	0	0	2 (100)	2
Pieracillin/Tazobactam	0	0	2 (100)	2
Imipenem	2 (66.66)	0	1(33.33)	3
Ertapenem	0	0	1(100)	1
Aztreonam	0	0	1(100)	1
Cefotixin	1(3.22)	0	30(96.77)	31
Céfalotine	0	0	2 (100)	2
cefazoline	0	0	1(100)	1
cefixime	0	0	2(100)	2
Cefepime	0	0	2(100)	2
cefuroxime	1(50.00)	0	1(50.00)	2
Céfotaxime	0	0	3(100)	3
Céfixitine Screen	2(7.14)	0	26(92.85)	28
Cefoperazone+Sulbactame	0	0	1(100)	1
Ceftazidime	0	0	2(100)	2
Amikacine	2(66.66)	0	1(33.33)	3
Fosfomycine	9(28.12)	1(3.13)	22(68.75)	32
Teicoplanine	15(53.57)	2(7.14)	11(39.28)	28

Table 8 Susceptibility profile of Gram-positive cocci to the antibiotics tested (continued)

Antibiotics tested	Sensive	Intermediate	Resistant	Total
Vancomycin	23(69.69)	0	10(30,30)	33
Gentamycin	7(21.21)	3(9.09)	26(78.78)	33
Tobramycin	4(13.33)	2(6.66)	26(86.66)	30
Kanamycin	5(17.24)	0	24(82.75)	29
Erythromycin	6(19.35)	2(6.45)	25(80.64)	31
Clindamycin	13(41.93)	0	18(58.06)	31
Lincomycin	14(46.66)	0	16(53,33)	30
Pristinamycin	15(51,72)	1	13(44.83)	29
Quinupristin/Dalfopristin	18(54.54)	3(9.09)	12(36.36)	33
Tetracyclin	4(11.76)	1(2.94)	29(85.29)	34
Nalidixic Acid	0	0	3(100)	3
Nalidixidic Acid CLSI	0	0	2(100)	2
Minocyclin	16(55.17)	1(3,44)	12(41.38)	29

Tigecylin	1(100)	0	0	1
Fusidic Acid	12(41.37%)	0	17(58.60)	29
Linezolid	20(57.15)	0	15(42.85)	35
Norfloxacin	1(50.00)	0	1(50.00)	2
Ofloxacin	11(36.67)	1(3,33)	18(60.00)	30
Levofloxacin	12(34.28)	1(2.85)	22(62.86)	35
Moxifloxacin	1(33.33)	1(33.33)	1(33.33)	3
Ciprofloxacin	2(33.33)	0	4(66.66)	6
Trimethprim/Sulfamethaxole	6(19.35)	1(3.22)	24(77.42)	31
Nitrofurantoine	24(66.66)	2(5.55)	10(27.77)	36
Rifampicin	6(18.18)	1(3.03)	26(78.78)	33

Table 9 *Escherichia coli* sensitivity profile to the antibiotics tested

Antibiotics tested	Sensitive	Intermediate	Resistant	Total
Amoxicillin/Clavulanic Acid	1(100)	0	0	1
Ampicillin	1(100)	0	0	1
Ticarcillin	1(50.00)	0	1(50.00)	2
Ticarcilline/Clavulanic Acid	0	0	1(100)	1
Piperacillin	1(50.00)	0	1(50.00)	2
Piperacillin/Tazobactam	1(50.00)	0	1(50.00)	2
Imipenem	2(100)	0	0	2
Meropenem	2(100)	0	0	2
Azetreonam	0	0	2(100)	2
Cefalotin	1(100)	0	0	1
cefazolin	1(100)	0	0	1
Cefotixin	0	0	1(100)	1
Cefoxitin 32	1(100)	0	0	1
Cefotaxim	1(100)	0	0	1
Cefuroxime	0	0	1(100)	1
Cefixime	1(100)	0	0	1
Cefepime	1(50.00)	0	1(50.00)	2
Ceftazidime	0	0	2(100)	2
Amikacin	2(100)	0	0	2
Gentamycin	0	0	2(100)	2
Tobramycin	0	0	2(100)	2
Tetracyclin	0	0	1(100)	1
Nalidixic Acid	0	0	1(100)	1

Table 9 *Escherichia coli* sensitivity profile to the antibiotics tested (continued**)**				
Antibiotics tested	**Sensitive**	**Intermediate**	**Resistant**	**Total**
Ciprofloxacin	0	0	2(100)	2
Ofloxacin	1(100)	0	0	1
Levofloxacin	1(50.00)	0	1(50.00)	2
Trimethprim/Sulfamethoxazole	0	0	1(100)	1
Nitrofurantoine	0	0	1(100)	1
Rifampicin	0	0	1(100)	1
Colostin	0	0	1(100)	1

Table 10 Susceptibility profile of the species *Staphylococcus xylosus* to the antibiotics tested

Antibiotics tested	**Sensitive**	**Intermediate**	**Resistant**	**Total**
Pénicillin	0	0	6(100)	6
Oxacillin COAG	1(20.00)	0	4(80.00)	5
Oxacillin	0	0	4(100)	4
Cefotixin	0	0	5(100)	5
Céfixitin Screen	0	0	6(100)	6
Fosfomycine	2(33.33)	0	4(66.66)	6
Teicoplanin	4(66.66)	0	2(33.33)	6
Vancomycin	4(66.66)	0	2(33.33)	6
Gentamycin	1(20%)	0	5(80.00)	6
Tobramycin	1(16.66)	0	5(83.33)	6
Kanamycin	1(16.66)	0	5(83.33)	6
Erythromycin	2(33.33)	0	3(60.00)	5
Clindamycin	2(33.33)	0	4(66,66%)	6
Lincomycin	2(33.33)	0	4(66,66)	6
Pristinamycin	4(66.66)	0	2(33.33)	6
Quinupristin/Dalfopristin	4(66.66)	0	2(33.33)	6
Tetracycline	1(16.66)	1(16.66)	4(66.66)	6
Minocycline	3(50.00)	1(16.66)	2(33.33)	6
Acide Fusidique	2(40.00)	0	4(66.66)	6
Linezolide	3(60.00)	0	2(40.00)	5
Ofloxacine	3(50.00)	0	3(50.00)	6
Lévofloxacine	3(50.00)	0	3(50.00)	6
Trimethoprim/Sulfamethoxazole	3(50.00)	0	3(50.00)	6
Nitrofurantoine	5(83.33)	0	1(16.66)	6
Rifampicin	2(33.33)	0	4(66.66)	6

Table 11 Susceptibility profile of the species *Staphylococcus haemolyticus* to the antibiotics tested

Antibiotics tested	Sensitive N(%)	Intermediate N(%)	Resistant N(%)	Total
Penicillin	1(20)	0	4(80)	5
Oxacillin COAG	0	0	4(100)	4
Oxacillin	0	0	5(100)	5
Céfotixin	0	0	4(100)	4
Céfixitin Screen	0	0	4(100)	4
Fosfomycin	0	0	4(100)	4
Teicoplanin	2(50)	2(50)	0	4
Vancomycin	5(100)	0	0	5
Gentamycin	0	1(20)	4(80)	5
Tobramycin	0	0	4(100)	4
Kanamycin	0	0	4(100)	4
Erythromycin	0	2(40)	3(60)	5
Clindamycin	4(80)	0	1(20)	5
Lincomycin	3(75)	0	1(25)	4
Pristinamycin	4(100)	0	0	4
Quinupristin/Dalfopristin	5(100)	0	0	5
Tetracycline	0	0	4(100)	4
Minocycline	3(75.00)	0	1(25.00)	4
Tigecylin	1(100)	0	0	1
Fusidic Acid	2(50.00)	0	2(50.00)	4
Linezolid	5(100)	0	0	5
Ofloxacin	0	0	4(100)	4
Levofloxacin	0	1(20)	4(80.00)	5
Moxifloxacin	0	1(100)	0	1
Ciprofloxacin	0	0	1(100)	1
Trimethprim/Sulfamethoxazole	0	0	5(100)	5
Nitrofurantoine	4(80.00)	0	1(20.00)	5
Rifampicin	0	0	5(100)	5

Table 12 Susceptibility profile of *Staphylococcus aureus* species to the antibiotics tested

Antibiotics tested	Sensitive N(%)	Intermediate N(%)	Resistant N(%)	Total
Penicillin	0	0	5(100)	5
Oxacillin COAG	0	0	5(100)	5
Oxacillin	1(25.00)	0	3(75.00)	4

Cefoxitin	1(20.00)	0	4(80.00)	5
Cefoxitin Screen	1(20.00)	0	4(80.00)	5
Fosfomycin	2(40.00)	0	3(60.00)	5
Teicoplanin	4(80.00)	0	1(20.00)	5
Vancomycin	5(100)	0	0	5
Gentamycin	2(40.00)	0	3(60.00)	5
Tobramycin	1(20.00)	0	4(80.00)	5
Kanamycin	1(20.00)	0	4(80.00)	5
Erythromycin	2(40.00)	0	3(60.00)	5
Clindamycin	3(60.00)	0	2(40.00)	5
Lincomycin	3(75.00)	0	1(25.00)	4
Pristinamycine	3(60.00)	0	2(40.00)	5
Quinupristin/Dalfopristin	3(60.00)	0	2(40.00)	5
Tetracycline	1(20.00)	0	4(80.00)	5
Minocycline	3(60.00)	0	2(40.00)	5
Fusidic Acid	4(80.00)	0	1(20.00)	5
Linezolid	4(80.00)	0	1(20.00)	5
Ofloxacin	4(80.00)	0	1(20.00)	5
Levofloxacin	4(80.00)	0	1(20.00)	5
Trimethoprim/Sulfamethoxazole	1(20.00)	0	4(80.00)	5
Nitrofurantoine	4(80.00)	0	1(20.00)	5
Rifampicin	1(20.00)	0	4(80.00)	5

Table 13 Susceptibility profile of the species *Staphylococcus hominis* to the antibiotics tested

Antibiotics tested	**Sensitive N(%)**	**Intermediate N(%)**	**Resistant N(%)**	**Total**
Penicillin	0	0	4(100)	4
Oxacillin COAG	0	0	3(100)	3
Oxacillin	0	0	3(100)	3
Céfoxitin	0	0	4(100)	4
Cefoxitin Screen	0	0	4(100)	4
Fosfomycin	0	0	4(100)	4
Teicoplanin	3(100)	0	0	3
Vancomycin	3(75.00)	0	1(25.00)	4
Gentamycin	1(25.00)	0	3(75.00)	4
Tobramycin	0	0	4(100)	4
Kanamycin	0	0	4(100)	4

Erythromycin	1(25.00)	0	3(75.00)	4
Clindamycin	1(25.00)	0	3(75.00)	4
Lincomycin	3(75.00)	0	1(25.00)	4
Pristinamycin	2(50.00)	0	2(50.00)	4
Quinupristin/Dalfopristin	3(75.00)	1(25.00)	0	4
Tetracycline	0	0	4(100)	4
Minocycline	4(100)	0	0	4
Fusidic Acid	2(66.66)	0	1(33.33)	3
Linezolid	4(100)	0		4
Ofloxacin	1(25.00)	0	3(75.00)	4
Levofloxacin	1(25.00)	0	3(75.00)	4
Trimethprim/Sulfamethoxazole	0	0	4(100)	4
Nitrofurantoine	3(75.00)	1(25.00)	0	4
Rifampicin	1(25.00)	0	3(75.00)	4

4. Discussion

We carried out a retrospective descriptive study lasting 12 months from (January 12 – December 22, 2021) at the HASIGUI biomedical laboratory, this study allowed us to determine the bacteriological profile and sensitivity of the antibiotics to germs isolated from blood cultures. Blood cultures were taken with the Bact/Arlet automated system (bioMerieux, France). Our strains were identified using the Vitek 2 Compact 15 machine and the API 20 galleries. The antibiograms were also carried out using the Vitek 2 Compact 15 machine and the ATB Api galleries. Several studies have been carried out within the HASGUI laboratory showing multi-resistance on several gram positive and negative germs: Makarena et al [8,9].

4.1. Sociodemographic characteristics

Distribution of the patients according to sex showed that 53% (42/80) came from women and 47% (38/80) were from men (Table2; Figure 2). We note that there is a predominance of the female sex compared to the male sex with a M/F sex ratio of 0.90. Our results are close to those of Doumbia R. [10], who reported in 2019 to the National Institute of Public Health in Bamako a female predominance of 54% of patients with a M/F sex ratio equal to 1.17. On the other hand, our results are different from Boukerouz and Benmehidi (2017) [11], there is a predominance of the male sex (56%) compared to the female sex (44%), with a sex ratio of 0.90. On the other hand, our results were comparable to those reported by Traoré et al in Mali in 2012. Indeed, the male sex represented 56.35% of the patients studied in his work and the sex ratio was equal to 1.29 [12].

The distribution of bacterial isolates according to age showed that the most represented age group was that of 31 to 40 years old with a frequency of (22%), followed by that of 36 to 45 years old (14%). , then that of 1 to 10 years with a frequency of 14% and finally that of 41 to 50 years with a frequency of (12%). The average age was 36.92 ±10 years with extremes of 1 year to 90 years (Table IV). Our results are close to those reported in 2012 by Traoré [12]. This author showed in his study in Mali an average age of 36.29 ± 9.328, with extremes of 19 to 57 years and the age group of 30-39 years was the most represented with a percentage of 51.4%, followed by that of 40-49 years old with a percentage of 29.7% [12].

In 2023, Cissoko Y et al., reported results of a meta-analysis of antibiotic susceptibility of bacteria isolated from blood cultures in Mali from 2000-2020 [13]. These authors reported that, out of 293 studies, 7 met their inclusion criteria. Thesis studies were the most represented (71.43%). All studies were carried out in Bamako and 57.14% of cases concerned children [13].

The distribution of patients according to the China-Guinea Friendship hospital of Kipé in Conakry consultation services showed that out of a total of 80 patients received, 59 of them came from external services, i.e. a frequency of 73.75%, followed by neurosurgery from which they came. 06, i.e. 7.50% of patients, then intensive care with 5 patients i.e. 6.25% plus emergencies with 03 patients equivalent to 3.75% , cardiology and neurology 02 patients each, corresponding to 2.50%, finally the services of visceral surgery, traumatology, physiotherapy with each 01 patient, equivalent to 1.25% (Table 2).

The high frequency of patients coming from the services of other hospitals and health structures in the city of Conakry and the interior of the country is due to the fact that the HASIGUI biomedical laboratory is considered to be one of the best equipped in the country since its opening in 2012 and consequently, the quality of the analysis results is better compared to other laboratories in the country. This observation was made through an external quality assessment of Guinean biomedical laboratories conducted by the One World Accuracy Agency (Canada), which operates globally.

In our study, we had 80 blood culture cases, and the positivity rate recorded was 56.25% (45/80), corresponding to 45 blood cultures (Figure 3). This rate is significantly higher than that recorded at the Benbadis University Hospital Center (CHU) in Constantine by Boukerouaz and Benmehidi (2017)[11], over a period of one year (April 2016 – April 2017). Out of 3408 blood cultures, the positivity rate was 31%. The positivity rate recorded at HASIGUI is high compared to other studies carried out in Morocco at the Ibn Sina Hospital in Rabat (17.2%) (El Mouali, 2012)[14], at the Mohammed VI University Hospital in Marrakech (19.7%) (Soraa et al, 2011)[7], and at the Hassan II University Hospital in Fes (20%) (Mahmoud et al, 2010) [15] and in Mali (19%) by Koné S in 2009 [16].

4.2. Bacteriological profile

Our study focused on 80 blood culture samples. Culture results showed 45 positive blood cultures versus 35 sterile (negative) blood cultures. Among these 45 samples, 20 bacterial species were isolated (Figure 3). The bacteriological profile of all positive blood culture isolates is marked by a predominance of Gram-positive bacteria with a frequency of (82.23%) compared to Gram-negative bacteria (17.77%) (Table 4).

The leader of Gram-positive bacteria according to our study was *Staphylococcus xyloxus* (13.34%), *Staphylococcus haemolyticus* (11.15%), *Staphylococcus aureus* (11.15%), *Staphylococcus hominis* (10.81%), and Gram-negative bacteria (17.77%) with a dominance of *Escherichia coli* (4.46%) followed by *Klebsiella pneumoniae* (2.22%), *Pseudomonas oryzihabitans* (2.22%), The 13 other species isolated were in the minority; in fact, they all represented less than 30% of our study population. These results are similar to those of Koné S, (2009)[16**]**, who reported a predominance of Gram-positive cocci (53.19%) compared to Gram-negative bacilli (39.69%) and those of Boukerouaz and Benmehidi (2017).) [11] where Gram-positive cocci represent (51%) and Gram-negative bacteria (49%) with a dominance of E. coli (19.1%) followed by *Klebsiella* pneumoniae (16.6%).

On the other hand, in Morocco the bacteriological profile was marked by a clear predominance of Gram-negative bacteria (59.63%) compared to Gram-positive bacteria (39.13%) (Elmouali, 2012)[14]. At the Hassan II University Hospital of Fes in Morocco, Mahmoud et al., (2010)[15] reported a predominance of Gram-negative bacilli (77%) compared to Gram-positive cocci. This difference could be linked to the local epidemiology of different regions.

The distribution of blood cultures according to the families of bacteria isolated (Table 4) shows that the *Micrococcaceae* are the most dominant (80%) followed by the enterobacteriaceae with a percentage of (13.34%), and the *Pseudomonadaceae, Aeromonadaceae*, *Alcaligrnaceae* with a lower percentage (2.22%).

Our results are different compared to other studies, other researchers have reported a predominance of *Enterobacteriaceae* followed by *Micrococcaceae* (Elmouali 2012)[14]; Okalla et al, 2014)[17].

Thus the 45 strains isolated in our study were identified using the automated system and their antibiograms were also carried out using the Vitek 2 Compact 15. The results are presented and discussed according to current literature data.

Local, up-to-date epidemiological data on bacterial antibiotic resistance are very important to know because, in addition to guiding first-line antibiotic therapy, they feed national and international antibiotic resistance data banks.

4.3. Antibiotic sensitivity test

4.3.1. Gram positive bacteria

The leader of the Gram-negative bacteria according to our study was the strains of *Escherichia coli* (Table 4), they presented resistance to certain antibiotics tested. Thus the strains of *Escherichia coli* were all sensitive to imipenem (100%), meropenem (100%), amikacin (100%). We noticed resistance of E.coli towards ciprofloxacin (100%), azetreonam (100%), ceftazidime (100%), gentamicin (100%), tobramycin (100%) (Table XIII). Our results are different from those of Elmouali (2012) [14] who found sensitivity to imipenem and gentamycin (100%) and resistance to amoxicillin (77.7%), trimethoprim/Sulfamethoxazole (43.48%), cefotaxime (15%). The rate of resistance of *Escherichia coli* to antibiotics has experienced worrying growth in recent years. It is established that the resistance of *E. coli* to antibiotics is correlated with the abusive, ambulatory and uncontrolled use of the latter which contributes to the wide spread of resistance.

During our study, the only one strain of *Klebsiella pneumoniae* ssp isolated were sensitive to gentamycin (100%), Amakacin (100%) and less sensitive to imipenem, however they were resistant to all other antibiotics tested. These results are close to those found in the laboratory of the Benbadis University Hospital of Constantine by Boukerouaz and Benmehidi (2017) who showed 100% resistance to amoxicillin, a resistance rate of 81% to cefotaxime and 60% to ciprofloxacin[11]. The rate of resistance to cephalosporins and quinolones is high compared to the results reported in 2012 by El Mouali for cefotaxime (64%) and ciprofloxacin (23.6%) [14].

There was a rate of resistance to the trimethoprim-sulfamethoxazole combination (100%). This value is high compared to that reported in 2017 by Boukerouaz and Benmehidi (53%) [11] and by El Mouali in 2012 (57.6%) [14].

In our study, the isolated strains of *Klebsiella spp* were sensitive to gentamicin; however, El Mouali [14] and Boukerouaz and Benmehidi [8] reported sensitivity to imipenem.

On the other hand, these results are different from those of Makarena et al., [8] in their study carried out in 2020 in HASIGUI. The majority of strains were sensitive to amikacin (100%%), imipenem (100%), ertapemem (93.42%), ofloxacin (80.26%), cefoxitin (77.63%), ciprofloxacin (75%), the combination amoxicillin/clavulanic acid (72.36%), gentamicin (71.05%) and the piperacillin/tazobactam combination (59.21%). On the other hand, these strains were mainly resistant to cephalotin (71.05%), cefotaxime (57.9%), nalidixic acid (55.25%), and ceftazidime (54%).

In our study, the isolated strains of non-fermenting Gram négative bacteria (*Pseudomonas Oryzihbtans* and *Aeromonas sobria)* were sensitive to Gentamicin, Kanamycin, Minocycline, Ofloxacin, Levofloxacin, Nitrofurantoin at (100%). On the other hand, the strains are resistant to (100%) vis-à-vis penicillin. , oxacillin, Oxacillin COAG , cefoxtin, cefoxtine screen,Kanamycin, fosfomycin, tetracycline, tobramycin, cotrimoxazole, rifampicin ,clindamycin, erythromycin.

Makarena et al [18] reported in their studies on *Pseudomonas* carried out in 2019 at the HASIGUI biomedical laboratory that the majority of strains were sensitive to imipenem (93.33%), amikacin (88%), gentamicin (72 %), tobramycin (70.66%), piperacillin/tazobactam (70.66%), ceftazidime (60%), cefotaxime (54.66%), ofloxacin (57.33%) and ciprofloxacin (58.66%). On the other hand, these strains were resistant to ampicillin (89.33%), trimethoprim/sulfamethoxazole (89.33%), nalidixic acid (85.33%), cefalotin (77.33%), ticarcillin (68%), cefoxitin (64%), and nitrofurantoin (57.33%). Cases of multi-drug resistance have been observed with high MICs. Results almost similar to ours. On the other hand, the nitrofurantoin molecules were less active on *Pseudomonas* strains in our study. These authors reported aigain previously that only 37.5% of *Sphingomonas paucimobilis* were sensitive to nitrofurantoine[19].

4.3.2. Gram-positive bacteria

The leader of Gram-positive bacteria according to our study was *Staphylococcus xylosus* (Table 4), all our strains of *Staphylococcus xylosus* presented high resistance to penicillin (100%), cefixitin screen (1000%), gentamicin (80%), Tobramycin (80%), Kanamycin (80%), Oxacillin (80%), and Rifampicin (66.66%), Erythromycin (60%), Ofloxacin (50%), On the other hand we note a sensitivity to Teicoplanin (66.66%), vancomycin (66.66%), pristamycin (60%), nitrofurantoin (60%), Quinupristin/Dalfopristin (66.66%), Linezolid (60%) (Table XIV). Makanera et al. [20] reported in 2025 in study carried out in 2016 at HASIGUI, that the strains of *Staphylococcus xylosus* isolated showed a very high resistance profile in general. Indeed, these strains were resistant to Benzylpeniciline (100%), Erythromycin (100%), Clindamycin (100%), Rifampicin (100%), Quinupristin/Dalfopristin (100%), Linezolid (100%), Vancomycin (100%), Tetracycline (100%). Different results from ours.

-During our study, all our strains of *Staphylococcus haemolyticus* were totally resistant to penicillin, Oxacillin COAG, cefoxtine, fosfomycin, tetracycline, tobramycin, Rifampicin, ofloxacin, levofloxacin, cotrimoxazole (100%), Oxacillin and gentamicin (80%), erythromycin (60%). Total sensitivity to vancomycin, pritamycin, linezolid (100%), clindamycin and nitrofurantoin (80%), lincomycin and minocycline (5%) was noted (Table11).

Pedroso al [21] who in a study carried out in 2018 in Brazil, reported strains of S. haemolyticus totally resistant to Benzylpeniciline and almost completely to Oxacillin (84%) . These strains were also resistant to Clindamycin (78.5%), Norfloxacin (78.5%), Erythromycin (64.2%), Ciprofloxacin (64.2%), Trimethoprim/Sulfamethoxazole (64.2%), and Rifampicin (14.2%). Results almost similar to ours. On the other hand, the mo-In our study, the isolated strains of *Staphylococcus aureus* showed total resistance to penicillin and Oxacillin COAG (100%), cefoxtine, cefoxtine screen, Kanamycin, tetracycline, tobramycin, Rifampicin, levofloxacin, cotrimoxazole (80%) , and Oxacillin (75%) while erythromycin, gentamicin, fosfomycin are resistant to (60%).

All the isolates (100%) were sensitive to vancomycin and the majority (80%), of these isolates were sensitive to fusidic acid, linezolid, ofloxacin, levofloxacin, and nitrofurantoin while 75% of these strains had susceptibility to lincomycin (Table 12).

Our results are similar to those of Koinam FR et al. [22] in 2016 in Burkina Faso. During their study, 92% of their S. aureus strains presented resistance to Penicillin, Oxacillin (80%), Erythromycin (44%). Bachir-Pacha et al [23] also reported in 2014 in Algeria, 100% resistance of their *Staphylococcus aureus* strains to penicillin. Their *Staphylococcus aureus* strains were also resistant to Kanamycin (54%), Oxacillin (48.62%), and Erythromycin (28.44%) molecules of Benzylpeniciline and clindamycin were sensitive in our study.

In our study, *Staphyloccocus hominis* strains showed total resistance to penicillin, oxacillin, Oxacillin COAG cefoxtin, cefoxtin screen, Kanamycin, fosfomycin, tetracycline, tobramycin, cotrimoxazole (100%), levofloxacin, rifampicin, clindamycin , erythromycin, gentamicin are resistant to (75%). All the isolates (100%) were sensitive to teicoplanin, minocyclne, and linezolid while 75% of these strains were susceptible to levofloxacin, nitrofurantoin, lincomycin and Quinupristin/Dalfostatin and 66.66% were susceptile to fusidic acid (66, 66%) (Table 13).

During our study, the isolated strains of *Kocuria varians/Rosea* were all resistant to (100%) Penicillin, Oxacillin COAG, Oxacillin, Cefoxitin, Cefoxitin Screen, Teicoplanin, Vancomycin, Erythromycin, Clindamycin, Lincomycin, Pristinamycin, Quinupristin/Dalfostatin, Tetracycline, Acid Fusidic, Linezolid, Nitrofurantoin, Rifampicin. On the other hand, kanamycin and Fosfomycin were sensitive to (66.66%). Our results are different from those of Makarena et al., [24] who reported in their study carried out in 2019 at the HASIGUI biomedical laboratory that *Kocuria* strains were sensitive to vancomycin, minocycline and teicoplanin.

Two of the three strains were susceptible to linezolid, trimetrhoprim/sulfamethoxazole, latetracycline, quinupristin/dalfopristin, kanamycin, lincomycin, pristinamycin, fusidic acid and fosfomycin. Furthermore, two of the three strains were resistant to gentamicin, erythromycin, rifampicin and penicillin, while intermediate sensitivity was observed to levofloxacin and nitrofurantoin for two strains.

5. Conclusion

This present study carried out in the biomedical Laboratory of China-Guinea Friendship hospital of Guinea in Kipé/Conakry (from January 12 to December 22, 2021), showed that the most frequent bacterial isolates associated to bacteremia were Gram positive cocci belonged to *Staphylococcus* genus, despite the fact that the *Escherichia coli* species was the most represented among the Gram negative bacteria. A high frequency of multi-antibiotic resistant strains has been observed; which requires antibiotic therapy based on the results of an antibiogram in order to avoid the spread of forms of antibiotic resistance. The interest of this study is that it can serve as a basis for reflection for the optimization of empirical treatment of bacteremia in the region. In perspective, a molecular study of antibiotic resistance genes would be necessary in order to be able to identify their nature and their involvement in the propagation of antibiotic resistance forms.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare no conflicts of interest

Author Contributions

All authors contributed to this work.

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