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Bacteriological and antibiotic resistance profile of germs isolated from pyocultures at the Biomedical Laboratory of the China-Guinea Friendship Hospital of Kipé in Conakry (Guinea)

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Abstract:

Introduction: The rapid evolution of bacterial multi-resistance to antibiotics is a worrying phenomenon worldwide and particularly in Africa.

Objective: To describe the bacteriological and antibiotic-resistance profile of organisms isolated from pyocultures at the China–Guinea Friendship Hospital in Conakry (HASIGUI).

Methods: Retrospective study conducted at the HASIGUI Biomedical Laboratory from 15 June 2017 to 22 December 2021. A total of 432 pus samples were analyzed. Bacterial identification and antibiograms were performed using Vitek 2 Compact, API strips, and broth microdilution (bioMérieux, France).

Results: Males predominated (sex ratio M/F = 2.04), and the majority belonged to the 0–20 year age group. Students were the most represented profession. Of 432 pyocultures, 291 (67 %) were positive. The most frequent species were *Staphylococcus aureus* (15.8%), *S. xylosus* (6.5%), *S. lentus* (4.8%), and *Escherichia coli* (4.5%). Highest susceptibilities were observed for linezolid (82.5%), imipenem (71.5%), clindamycin (67.3%), fosfomycin (63.0%), levofloxacin (59.6%), and ciprofloxacin (52.7%). Conversely, resistance rates were highest for benzylpenicillin (94.1%), cephalins (90.5%), cefixime (86.3%), cefuroxime (83.7%), ampicillin (77.2%), cefotaxime (73.9%), nalidixic acid (72.8%), and cotrimoxazole (60.8**Conclusion:** These findings reveal widespread multi-resistance among bacteria isolated from pyocultures, underscoring the need for antibiotic therapy guided by antibiogram results.

Keywords: Antibiotics; Bacteria; Resistance; Pyocultures; Conakry.

Introduction

Bacterial world has never ceased to amaze the scientific world, by its constant evolution, and its resistance to the medical progress made by researchers trying to find a solution, a miracle cure. In 1860, Louis Pasteur was the first to discover that it is microorganisms, and not the air, that are responsible for fermentation, and that they can be destroyed in different ways, but it was in 1929 that Flemming discovered penicillin and H. Florey and E Chain developed its industrial production [1]. The discovery of antibiotics gave rise to the hope that it would one day be possible to curb all infectious diseases. The phenomenon of bacterial resistance to antibiotics has put an end to this "fatal illusion". The widespread use of antibiotics generates the emergence of bacterial strains resistant to existing drugs: this is the other side of the coin. Today, bacterial resistance to antibiotics is a

serious global public health problem that is progressing very rapidly. The post-antibiotic era of the 21st century is predicted by the World Health Organization (WHO) [2].

Despite its mobilization, the number of victims (mortality, morbidity) continues to increase, with increasingly pessimistic forecasts. It predicts that in 2050, antibiotic-resistant infectious diseases will be the leading cause of death by disease. This would mean more than 10 million deaths per year worldwide compared to 700,000 currently, i.e. more than cancer [3]. Bacterial resistance is retained when an antibiotic loses its ability to kill or effectively inhibit bacterial growth. In other words, bacteria continue to multiply in the presence of therapeutic concentrations of antibiotics [4].

Indeed, after the publication of its first report in April 2014 on bacterial resistance, the World Health Organization (WHO) warned of a "serious threat to public health", pointing out the ineffectiveness of antibiotics against certain bacteria. According to the organization, this "is no longer a forecast, but a reality in every region of the world" [5].

In France, the overall consumption of antibiotics in 2019 was 22.2 defined daily doses (DDD) per 1000 inhabitants per day. Among them, beta-lactams represent 58.4%, followed by tetracyclines (12.4%) and macrolides (12.3%) [6].

In Guinea, multi-resistance to antibiotics is becoming a worrying phenomenon among pathogenic and emerging pathogenic bacteria, a study carried out in October 2019 by Makanera et al. at the biomedical laboratory of the Sino-Guinean Friendship Hospital in Kipé on isolated strains of Sphingomonas paucimobilis showed that these species were resistant to ampicillin, the combination of amoxicillin and clavulanic acid, ticarcillin, the combination of piperacillin and tazobactam, ceftazidine and imipenem [7].

A study carried out on non-fermenting bacteria in Conakry at HASIGUI was reported by Makanéra et al. [8]. These authors showed that non fermenting bacteria like *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, *Sphingomonas paucimobilis* were resistance to several families of antibiotics including beta-lactams, quinolones and fluroquinolones, sulfonamides [8]. The high risk of emergence of resistant bacteria in a context of illicit sale of medicines and abusive and anarchic use of antibiotics are reasons that motivated the choice of this theme entitled "Bacteriological profile and antibiotic resistance of germs isolated from pyocultures at the Biomedical Laboratory of the China-Guinea Friendship Hospital of Kipé in Conakry (Guinea)". The aim of the present study was to describe the bacteriological and antibiotic resistance profile of germs isolated from pyocultures.

Methods

These were data on bacterial strains isolated in the laboratory from samples taken of suppurations in patients from the various departments of HASIGUI but also from other health structures in the capital Conakry (Hospitals, clinics, Communal Medical Centers (CMC), etc., received for bacteriological examinations.

Type and Period of Study:

This was a retrospective descriptive study over a period of 4 years, from June 15, 2017 to December 22, 2021 with data collection, carried out at the bacteriology unit of the biomedical analysis laboratory of the Sino-Guinean Friendship Hospital Kipé/Conakry over a study period from January 20 to July 20, 2022 (6 months).

Procedures

Cytobacteriological examinations were performed fresh by observation under a light microscope (Microscope XS-213, Nanjing BW Optics Co., Ltd., Jiangsu, China) followed by Gram staining of the slides examined. A kit for staining bacteria by the Gram-Hücker method (RAL Diagnostics, Martillac, France) was used. The sample was then cultured on different agar media: Columbia agar with sheep blood 5% (Liofilchem, Roseto DA, Italy), nutrient agar (Liofilchem, Roseto DA, Italy), Chapmann (bioMérieux, Marcy l'Etoile, France) and CLED (Biomérieux, Marcy l'Etoile, France). Incubation was carried out for 18-24 hours in the GRP 9080 oven (Sumsung Laboratory Instrument CO., Ltd, Shanghai, China). Uniform bacterial colonies isolated from the cultures were stained by the Gram method in order to verify their purity, a key step preceding analyzes with the Vitek 2 Compact 15 automated system (Biomérieux, Marcy Etoile, France). Bacterial identification, antibiograms and determination of minimum inhibitory concentrations (MIC) were carried out using the Vitek 2 compact 15 automated system (Biomérieux, Marcy Etoile, France). For Vitek2 system, the Vitek 2 GP and Vitek2 GN were used for bacterial identification, and the Vitek 2 GP67, Vitek 2 AST-N 233, Vitek2 AST N05 cards were used for the antibiograms and the determination of the minimum inhibitory concentrations (MIC) expressed in µg / ml, with the Vitek 2 Compact 15 automaton (bio-Mérieux France). The Advanced Expert System (AES) software enabled the detection of antibiotic resistance phenotypes using the Vitek2 Compact 15. We used again the API system for identification and antibiograms: (API 20 E and API 20 NE galleries for identification and API ATB gallery for antibiograms bioMérieux).

Results

Out of a total of 432 pus samples collected and cultured at the biomedical laboratory of the Sino-Guinean Friendship Hospital, 291 pus samples were found to be positive, i.e. 67.36% after culture, compared to 141 pus samples that were found to be negative, i.e. 32.64%. Thus, the rest of the work concerned the 291 positive cultures. Gram staining showed that among the 291 positive cultures, 5.07% were Gram-positive bacteria versus 41.92% which represented Gram-negative bacteria.The male gender was predominant (67.13%) compared to the

female gender (32.7%). The distribution of patients according to origin (Table 1) showed that the majority of patients were residents of the different communes of the city of Conakry (74.91% = 218/291) against 25.08% (73/291) whose origin was outside Conakry. However, according to the communes, Table 1 shows that the patients came mainly from the commune of Ratoma with 29.92% (90/291), followed by the commune of Matoto with 18.30% (59/291), from Matam 12.70% (35/291). The communes of Dixinn and Kaloum were the least represented with respectively 7.90% (19/291) and 4.60% (15/291).

Table 1: Distribution of sample provenances

Provenance	**Number**	**Frequency (%)**
Ratoma	90	29.92
Outside Conakry	73	25.08
Matoto	59	20.27
Matam	35	12.02
Dixinn	19	6.52
Kaloum	15	5.15
Total	**291**	**100.00**

Table 2: Distribution of age groups among pyoculture isolates

Age group	**Frequency (%)**
0–20 years	41.44
21–40 years	27.31
41–60 years	17.13
$\geq$ 61 years	14.12
Mean age = 30.07 years (n = 291); range: 13 days–93 years	

Table 4: Distribution of isolated strains according to hospital departments

Department	**Number**	**Percentage (%)**
External services	131	45.01
Traumatology	85	29.20
Neurosurgery	33	11.34
Visceral surgery	18	6.18
Cardiology	9	3.09
Emergencies	7	2.40
Neurology	5	1.71
Intensive care services	2	0.68
Rééducation / Acupuncture	1	0.34
Total	**291**	**100.00**

Table 5: Distribution of bacterial isolates according to pus color

Color	**Number**	**Percentage (%)**
Whitish	22	6.9
Brownish	45	12.5
Hematic	144	50.7
Yellowish	80	29.9
Total	**291**	**100.00**

Table 6: Frequency of species in the *Micrococcaceae* family among the 291 pyoculture isolates

Micrococcaceae family	**Number**	**Percentage (%)**
Staphylococcus genus (n=106; 36.42%)		
Staphylococcus aureus	46	15.81
Staphylococcus xylosus	19	6.53
Staphylococcus lentus	14	4.81
Staphylococcus sciurus	8	2.74
Staphylococcus intermedius	4	1.37
Staphylococcus epidermidis	3	1.03
Staphylococcus hominis spp. hominis	2	0.69
Staphylococcus warneri	2	0.69
Staphylococcus capitis	2	0.69
Staphylococcus cohni spp. urealyticus	1	0.34
Staphylococcus gallinarum	1	0.34
Staphylococcus haemolyticus	1	0.34
Staphylococcus hominis	1	0.34
Staphylococcus pseudintermedius	1	0.34
Staphylococcus schleiferi	1	0.34
Micrococcus genus (n=5)		
Micrococcus luteus/lytae	5	1.71
Kocuria genus (n=8)		
Kocuria varians	3	1.03
Kocuria rosea	2	1.03
Kocuria kristinae	2	0.68
Kocuria rhizophila	1	0.34

Table 7: Frequencies of different species of *Enterobacteriaceae* among the 291 pyoculture isolates

Enterobacteria species	**Number**	**Percentage (%)**
Enterobacteriaceae (n = 128)		
Escherichia coli	13	4.47
Klebsiella pneumoniae spp pneumoniae	11	3.78
Serratia liquefaciens	10	3.44
Proteus mirabilis	09	3.1
Enterobacter cloacae	08	2.75
Enterobacter aerogenes	06	2.06
Enterobacter sakazakii	06	2.06
Salmonella enterica ser. Typhimurium	0	2.72
Salmonella enterica spp enterica	06	2.06
Citrobacter freundii	04	1.37
Raoultella ornithinolytica	04	1.37
Serratia marcescens	04	1.37
Citrobacter koseri	03	1.03
Enterobacter cloacae spp cloacae	03	1.03
Providencia stuarti	03	1.03
Serratia odorifera	03	1.03
Enterobacter cloacae complex	02	0.69
Enterobacter cloacae spp dissolvens	02	0.69
Morganella morganii spp morganii	02	0.69
Pantoea spp	02	0.69
Yersinia enterocolitica	02	0.69
Raoultela planticola	02	0.69
Enterococcus faecalis	01	0.34
Enterococcus gallinarum	01	0.34
Hafnia alvei 1	01	0.34
Klebsiella oxytoca	01	0.34
Klebsiella pneumonae	01	0.34
Klebsiella pneumoniae spp ozaenae	01	0.34
Kluyvera spp	01	0.34
Proteus vulgaris	01	0.34
Provindencia stuarti	01	0.34
Enterobacter amnigenus 2	01	0.34
Raoultela terragina	01	0.34
Salmonella choleraesuis	01	0.34
Salmonella enterica spp arizonae	01	0.34
Salmonella enterica ser. Enteritidis	01	0.34
Serratia fonticola	01	0.34

Table 8: Frequency of non-fermentative Gram-negative bacilli among the 291 bacterial strains isolated from pyocultures (n = 42)

Bacterial species	**Number**	**Percentage (%)**
Non-fermentative bacteria (n = 42; 14.08%)		
Pseudomonas aeruginosa	10	3.44
Pseudomonas luteola	07	2.41
Pseudomonas fluorescens	06	2.06
Sphingomonas paucimobilis	04	1.37
Aeromonas hydrophila/caviae/sobriae	03	1.03
Bulkholderia cepacia	03	1.03
Sternotrophomonas maltophilia	02	0.69
Acinetobacter baumanii complex	02	0.69
Achromobacter denitrificans	01	0.34
Aeromonas hydrophila/caviae	01	0.34
Chromobacterium violaceum	01	0.34
Pseudomonas stutzeri	01	0.34
Rhizobium radiobacter	01	0.34
Vibrio fluvialis	01	0.34

Table 9: Frequency of species belonging to *Streptococcaceae* among the 291 bacterial strains isolated from smear cultures (n = 2)

***Streptococcus* genus**	**Number**	**Percentage (%)**
Total *Streptococcus* species: 02 = 0.68		
Streptococcus thorraltensis	01	0.34
Streptococcus uberis	01	0.34

Table 10: Overall sensitivity to antibiotics of the different bacterial strains isolated from pyocultures (N = 291)

Antibiotics	**Sensitive N (%)**	**Intermediate N (%)**	**Resistant N (%)**	**Total**
Amoxicillin	08(38.1)	00(0.00)	13(61.90)	**21**
Amoxicillin/Clavulanic acid	48(34.29)	09(6.43)	83(59.28)	**140**
Ampicillin	18(22.29)	01(0.54)	142(77.17)	**184**
Fusidic acid	41(66.12)	01(1.63)	20(32.25)	**62**
Nalidixic acid	34(25.00)	03(2.2)	99(72.8)	**136**
Benzylpénicillin	04(06.00)	02(04.00)	96(94,11)	**102**
Cephalotin	12-(8.16)	02(1.37)	133(90.47)	**147**
Cefixime	11(13.71)	00(0.00)	69(86.29)	**80**
Cefixitim32	33(42.31)	01(1.28)	44-(56.41)	**78**
Cefoxitine	66(31.13)	02(0.95)	144(67,92)	**212**
Cefotaxime	39(23.64)	04(2.42)	122(73.94)	**165**
Ciprofloxacin	109(52.66)	22(10.63)	76(36,71)	**207**
Cefotixine Screen	09(31.03)	01(03.45)	19(65.52)	**29**
Clindamycin	62(67.27)	03(01.1)	31(31.63)	**98**
Ceftazidime	44(25.88)	25(14.71)	101(59.41)	**170**
Cefepime	29(24.79)	18(15.38)	70(59.83)	**117**
Trimethoprime/Sulfamethoxazole	76(34.23)	11(04.95%)	135(60.81)	**222**
Cefuroxime	14(14.29)	02(02.04)	82(83.67)	**98**
Erythromycin	49(51.04)	02(2.08)	45(46.88)	**96**
Fosfomycin	80(62.99)	08(06.30)	39(30.71)	**127**
Gentamicin	133(48.72)	09(03.30)	131(47.98)	**273**
Imipenem	118(71.51)	07(04.25)	40(24.24%)	**165**
Kanamycin	34(55.74)	00(0.00)	27(44.26)	**61**
Levofloxacine	127(59.62)	18(03.76)	78(36.62)	**213**
Linezolide	80(82.47)	01(01.04)	16(16.49)	**97**

Table 11: Overall sensitivity to antibiotics of the different bacterial strains isolated from pyocultures (continued)

Antibiotics	**Sensitive N (%)**	**Intermediate N (%)**	**Resistant N (%)**	**Total**
Lincomycin	32 (52.46)	03 (0.92)	26 (46.62)	**61**
Moxifloxacin	36 (83.72)	02 (04.65)	05 (11.63)	**43**
Meropenem	62 (63.27)	06 (06.12)	30 (30.61)	**98**
Minocycline	46 (73.02)	03 (4.76)	14 (22.22)	**63**
Nitrofurantoine	119 (61.10)	17 (07.59)	62 (31.31)	**198**
Ofloxacin	108 (48.00)	04 (01.78)	113 (50.22)	**225**
Oxacillin	39 (38.61)	03 (02.97)	59 (58.42)	**101**
Oxacilline CO	20 (43.47)	02 (04.36)	24 (52.17)	**46**
Pipéracillin	105 (65.22)	21 (13.04)	35 (21.74)	**161**
Pristamicin	43 (72.88)	04 (06.78)	12 (20.34)	**59**
Rifampicin	54 (54.00)	04 (04.00)	42 (42.00)	**100**
Ticarcilline	30 (18.87)	04 (02.51)	125 (78.62)	**159**
Tetracycline	46 (24.34)	02 (01.06)	141 (74.60)	**189**
Tigecyclin	44 (97.78)	00 (09.00)	01 (02.22)	**45**
Teicoplanin	53 (79.10)	06 (08.96)	08 (11.94)	**67**
Tobramycin	95 (41.67)	09 (03.95)	124 (54.38)	**228**
Vancomycine	74 (73.27)	05 (04.95)	22 (21.78)	**101**
Quinupristine/Dalfopristine	63 (73.26)	05 (05.81)	18 (20.93)	**86**
Amikacine	104 (60.82)	07 (04.09)	60 (35.09)	**171**
Ertapénème	32 (76.19)	01 (02.38)	09 (21.43)	**42**

Table 12: Antibiotic susceptibility of the species *Staphylococcus aureus* isolated from pus

Antibiotic	**Sensitive N (%)**	**Intermediate N (%)**	**Resistant N (%)**	**Total**
Fusidic acid	16 (94,12)	00 (0.00)	01 (05.88)	17
Benzylpénicillin	00 (0.00)	00 (0.00)	29 (100)	29
Cefoxitine	05 (41.67)	00 (0.00)	07 (58.33)	12
Ciprofloxacine	23 (82.14)	01 (03,57)	04 (14.29)	28
Clindamycin	34 (80.95)	00 (0.00)	07 (19.05)	42
Erythromycine	27 (69.23)	00 (0.00)	12 (30.77)	39
Fosfomycine	13 (100)	00 (0.00)	00 (0.00)	13
Gentamicin	36 (81.82)	02 (04.54)	06 (13.64)	44
Levofloxacine	35 (79.54)	04 (09.10)	05 (11.36)	44
Linezolide	37 (94.87)	00 (0,00%)	02 (5.13%)	39
Lincomycin	09 (69.23)	00 (0.00)	04 (30.77)	13
Moxifloxacin	28 (100)	00 (0,00)	00 (0.00)	28
Minocycline	13 (92.86)	00 (0,00)	01 (07.2)	14
Nitrofurantoine	40 (97.56)	00 (0.00)	01 (02.44)	41
Ofloxacin	10 (58.82)	00 (0.00)	07 (41.18)	17
Oxacillin	17 (42.5)	00 (0.00%)	23 (57.50)	40
Penicillin	01 (07.69)	00 (0.00)	12 (92.30)	13
Pristamicin	09 (75.00)	01 (08.33)	02 (16.67)	12

Table 13: Antibiotic susceptibility of the species *Rifamycin*-resistant isolates

Antibiotic	**Sensitive N (%)**	**Intermediate N (%)**	**Resistant N (%)**	**Total**
Rifamycin	32 (78.05)	02 (04.88)	07 (17.07)	41

Table 14: Continued antibiotic susceptibility of Gram-positive cocci isolates

Antibiotic	**Sensitive N (%)**	**Intermediate N (%)**	**Resistant N (%)**	**Total**
Tetracycline	21 (51.22)	00 (0.00)	20 (48.78)	41
Tigecycline	30 (100.00)	00 (0.00)	00 (0.00)	30
Teicoplanin	18 (90.00)	00 (0.00)	02 (10.00)	20
Trimethoprim/Sulfamethoxazole	25 (59.52)	00 (0.00)	17 (54.84)	42
Tobramycin	12 (57.14)	00 (0.00)	09 (42.86)	21
Vancomycin	32 (76.19)	02 (04.76)	08 (19.05)	42
Quinupristin/Dalfopristin	31 (93.94)	02 (06.06)	00 (0.00)	33

Table 15: Antibiotic susceptibility of *Staphylococcus xylosus* isolated from pus

Antibiotics	**Sensitive**	**Intermediate**	**Resistant**	**Total**
Fusidic acid	11 (73.33)	00 (0.00)	04 (26.67)	15
Cefotixin	06 (35.29)	00 (0.00)	11 (64.71)	17
Cefotixin Screen	04 (50.00)	00 (0.00)	04 (50.00)	08
Clindamycin	09 (52.94)	01 (05.88)	07 (41.18)	17
Trimethoprim/Sulfamethoxazole	10 (58.82)	01 (05.88)	06 (35.30)	17
Erythromycin	06 (37.50)	00 (0.00)	10 (62.5)	16
Fosfomycin	12 (66.67)	00 (0.00)	06 (33.33)	18
Gentamicin	10 (55.55)	00 (0.00)	08 (44.45)	18
Kanamycin	05 (35.71)	00 (0.00)	09 (64.29)	14
Levofloxacin	13 (76.47)	00 (0.00)	04 (23.53)	17
Linezolide	13 (81.25)	00 (0.00)	03 (18.75)	16
Lincomycin	09 (52.94)	00 (0.00)	08 (47.06)	17
Minocyclin	10 (71.43)	00 (0.00)	04 (28.57)	14
Nitrofurantoine	17 (94.44)	00 (0.00)	01 (05.58)	18
Ofloxacin	13 (72.22)	00 (0.00)	05 (27.78%)	18
Oxacillin	05 (27.78)	00 (0.00%)	13 (72.22)	18
Oxacillin CO	04 (33.33)	00 (0.00)	08 (66.67)	12
Benzylpénicillin	01 (05.88)	00 (0.00%)	16 (94.12)	17
Pristamicine	12 (70.59)	01 (05.88)	04 (23.53)	17
Rifampicin	08 (44.45)	00 (0.00)	10 (55.55)	18
Tetracycline	03 (17.65)	00 (0.00)	14 (82.35)	17

Table 16: Continued antibiotic susceptibility of Gram-positive cocci isolates

Antibiotics	**Sensitive N (%)**	**Intermediate N (%)**	**Resistant N (%)**	**Total**
Teicoplanine	13 (81.25)	01 (03.75)	02 (12.5)	**16**
Tobramycin	09 (60.00)	00 (0.00)	06 (60.00)	**15**
Vancomycin	14 (82.35)	00 (0.00)	03 (17.65)	**17**
Quinupristin/Dalfopristin	10 (58.82)	02 (11.77)	05 (29.41)	**17**

Table 17: Antibiotic susceptibility of the species *Staphylococcus lentus* isolated from pus

Antibiotic	**Sensitive N(%)**	**Intermediate N(%)**	**Resistant N(%)**	**Total**
Fusidic acid	7 (77.8)	0 (0.0)	2 (22.2)	9
Nalidixic acid	0 (0.0)	0 (0.0)	4 (100.0)	4
Cefotixine	5 (38.5)	0 (0.0)	8 (61.5)	13
Trimethoprim/Sulfamethoxazole	7 (63.6)	4 (36.4)	0 (0.0)	11
Cefuroxime	0 (0.0)	1 (25.0)	3 (75.0)	4
Erythromycin	5 (50.0)	2 (20.0)	3 (30.0)	10
Fosfomycin	6 (54.5)	0 (0.0)	5 (45.5)	11
Gentamycin	9 (69.2)	1 (7.7)	3 (23.1)	13
Imipenem	4 (100.0)	0 (0.0)	0 (0.0)	4
Kanamycin	5 (62.5)	0 (0.0)	3 (37.5)	8
Levofloxacin	5 (38.5)	0 (0.0)	8 (61.5)	13
Linezolide	8 (88.9)	0 (0.0)	1 (11.1)	9
Lincomycin	8 (88.9)	1 (11.1)	0 (0.0)	9
Minocycline	7 (77.8)	2 (22.2)	0 (0.0)	9
Nitrofurantoine	7 (63.6)	3 (27.3)	1 (9.1)	11
Ofloxacin	8 (61.5)	0 (0.0)	5 (38.5)	13
Oxacillin	7 (70.0)	0 (0.0)	3 (30.0)	10
Oxacillin CO	3 (42.9)	1 (14.3)	3 (42.9)	7
Penicillin	1 (11.1)	0 (0.0)	8 (88.9)	9
Pristamicin	9 (100.0)	0 (0.0)	0 (0.0)	9
Rifampicin	4 (40.0)	0 (0.0)	6 (60.0)	10

Table 18: Antibiotic sensitivity of isolates from pyocultures

Antibiotic	**Sensitive N(%)**	**Intermediate N(%)**	**Resistant N(%)**	**Total**
Amoxicillin/Clavulanic Acid	5 (55.6)	0 (0.0)	4 (44.4)	9
Ampicillin	0 (0.0)	0 (0.0)	13 (100.0)	13
Nalidixic Acid	1 (10.0)	0 (0.0)	9 (90.0)	10
Cephalotin	0 (0.0)	0 (0.0)	9 (100.0)	9
Cefixime	0 (0.0)	0 (0.0)	9 (100.0)	9
Cefixitim32	6 (85.7)	0 (0.0)	1 (14.3)	7
Cefotixine	8 (100.0)	0 (0.0)	0 (0.0)	8
Cefotaxime	0 (0.0)	0 (0.0)	12 (100.0)	12
Ciprofloxacin	1 (9.1)	2 (18.2)	8 (72.7)	11
Ceftazidime	1 (7.7)	3 (23.1)	9 (69.2)	13
Cefepime	0 (0.0)	5 (41.7)	7 (58.3)	12
Trimethoprim/Sulfamethoxazole	0 (0.0)	0 (0.0)	6 (100.0)	6
Cefuroxime	0 (0.0)	0 (0.0)	11 (100.0)	11
Fosfomycin	9 (100.0)	0 (0.0)	0 (0.0)	9
Gentamycin	3 (23.1)	0 (0.0)	10 (76.9)	13
Imipenem	1 (7.7)	0 (0.0)	12 (92.3)	13
Levofloxacin	3 (25.0)	0 (0.0)	9 (75.0)	12
Meropenem	3 (33.3)	0 (0.0)	6 (66.7)	9
Nitrofurantoin	5 (62.5)	1 (12.5)	2 (25.0)	8
Piperacillin	7 (63.6)	0 (0.0)	4 (36.4)	11
Ticarcillin	0 (0.0)	0 (0.0)	8 (100.0)	8
Tetracycline	0 (0.0)	0 (0.0)	10 (100.0)	10
Tobramycin	5 (38.5)	0 (0.0)	8 (61.5)	13
Amikacin	7 (53.8)	0 (0.0)	6 (46.2)	13

Table 19: Antibiotic sensitivity of [species name] isolates from pus

Antibiotic	**Sensitive N(%)**	**Intermediate N(%)**	**Resistant N(%)**	**Total**
Amoxicillin/Clavulanic Acid	5 (45.5)	2 (18.2)	4 (36.3)	11
Ampicillin	0 (0.0)	0 (0.0)	10 (100.0)	10
Nalidixic Acid	6 (75.0)	0 (0.0)	2 (25.0)	8
Cephalotin	1 (10.0)	0 (0.0)	9 (90.0)	10
Cefotixin	8 (80.0)	0 (0.0)	2 (20.0)	10
Cefotaxime	1 (10.0)	0 (0.0)	9 (90.0)	10
Ciprofloxacin	5 (45.5)	2 (18.2)	4 (36.3)	11
Ceftazidime	1 (9.1)	0 (0.0)	10 (90.9)	11
Cefepime	0 (0.0)	0 (0.0)	5 (100.0)	5
Gentamicin	6 (54.5)	0 (0.0)	5 (45.5)	11
Imipenem	10 (90.9)	0 (0.0)	1 (9.1)	11
Nitrofurantoin	1 (11.1)	4 (44.4)	4 (44.4)	9
Ofloxacin	4 (44.4)	0 (0.0)	5 (55.6)	9
Piperacillin	7 (70.0)	0 (0.0)	3 (30.0)	10
Ticarcillin	0 (0.0)	0 (0.0)	10 (100.0)	10
Trimethoprim/Sulfamethoxazole	1 (14.3)	0 (0.0)	6 (85.7)	7
Tobramycin	4 (36.4)	1 (9.1)	6 (54.5)	11
Amikacin	8 (72.7)	1 (9.1)	2 (18.2)	11
Ertapenem	0 (0.0)	0 (0.0)	6 (100.0)	6

Table 20: Antibiotic sensitivity of isolates from pus

Antibiotic	**Sensitive N(%)**	**Intermediate N(%)**	**Resistant N(%)**	**Total**
Amoxicillin/Clavulanic Acid	1 (10.0)	0 (0.0)	9 (90.0)	10
Nalidixic Acid	0 (0.0)	0 (0.0)	9 (100.0)	9
Cephalotin	1 (11.1)	0 (0.0)	8 (88.9)	9
Cefotixine	0 (0.0)	0 (0.0)	9 (100.0)	9
Ciprofloxacin	8 (80.0)	1 (10.0)	1 (10.0)	10
Ceftazidime	4 (44.4)	1 (11.1)	4 (44.4)	9
Gentamicin	8 (88.9)	0 (0.0)	1 (11.1)	9
Imipenem	7 (87.5)	0 (0.0)	1 (12.5)	8
Nitrofurantoin	0 (0.0)	0 (0.0)	6 (100.0)	6
Ofloxacin	8 (80.0)	0 (0.0)	2 (20.0)	10
Piperacillin	6 (66.7)	0 (0.0)	3 (33.3)	9
Ticarcillin	3 (33.3)	0 (0.0)	6 (66.7)	9
Trimethoprim/Sulfamethoxazole	0 (0.0)	0 (0.0)	7 (100.0)	7
Tobramycin	7 (87.5)	0 (0.0)	1 (12.5)	8
Amikacin	7 (87.5)	0 (0.0)	1 (12.5)	8

Table 21: Antibiotic sensitivity of *Serratia liquefaciens* isolates from pus

Antibiotic	Sensitive N(%)	Intermediate N(%)	Resistant N(%)	Total
Amoxicillin	0 (0.0)	0 (0.0)	4 (100.0)	4
Amoxicillin/Clavulanic Acid	0 (0.0)	0 (0.0)	6 (100.0)	6
Ampicillin	0 (0.0)	0 (0.0)	9 (100.0)	9
Nalidixic Acid	0 (0.0)	0 (0.0)	7 (100.0)	7
Cephalotin	0 (0.0)	0 (0.0)	7 (100.0)	7
Cefixime	3 (37.5)	0 (0.0)	5 (62.5)	8
Cefixitim32	1 (14.3)	0 (0.0)	6 (85.7)	7
Cefotixine	3 (33.3)	0 (0.0)	6 (66.7)	9
Cefotaxime	2 (25.0)	0 (0.0)	6 (75.0)	8
Ciprofloxacin	1 (11.1)	0 (0.0)	8 (88.9)	9
Cefepime	1 (12.5)	2 (25.0)	5 (62.5)	8
Trimethoprim/Sulfamethoxazole	1 (14.3)	0 (0.0)	6 (85.7)	7
Cefuroxime	0 (0.0)	0 (0.0)	9 (100.0)	9
Fosfomycin	2 (28.6)	0 (0.0)	5 (71.4)	7
Gentamycine	2 (25.0)	0 (0.0)	6 (75.0)	8
Imipenem	6 (66.7)	0 (0.0)	3 (33.3)	9
Levofloxacin	2 (22.2)	1 (11.1)	6 (66.7)	9
Meropenem	3 (42.9)	0 (0.0)	4 (57.1)	7
Nitrofurantoine	1 (14.3)	0 (0.0)	6 (85.7)	7
Ofloxacin	1 (11.1)	0 (0.0)	8 (88.9)	9
Pipéracillin	6 (75.0)	2 (25.0)	0 (0.0)	8
Ticarcillin	0 (0.0)	0 (0.0)	10 (100.0)	10
Tétracycline	1 (14.3)	0 (0.0)	6 (85.7)	7
Tobramycin	2 (22.2)	0 (0.0)	7 (77.8)	9
Amikacin	3 (30.0)	0 (0.0)	7 (70.0)	10

Discussion

We conducted a retrospective descriptive study over a 4-year period, from June 15, 2017 to December 22, 2021, for a study period from January 20 to July 20, 2022 (6 months). Several shortcomings of this study should be noted. The data were collected from a database and were therefore missing in some cases, particularly patient information (history of infections, hospitalization, or antibiotic therapy).

In our study, the distribution of samples according to age showed that the most represented age group was 0 to 20 years old with a percentage of 41.44%, followed by 21 to 40 years old (27.31%), then 41 to 60 years old with a proportion of 17.13%, and finally 61 years old and over (14.12%). The mean age of the patients was 30.07 years, with a range of 13 days to 93 years. The male sex was predominant (67%). The sex ratio was 2.04 men for every woman. These results are similar to those of Chaouch et al. [9], who, in their 2020 study in Morocco, reported that out of 535 bacterial species, all germs combined, 325 were isolated from men, or 61%, with a sex ratio of 1.5 men for every woman.

The distribution of patients according to the services of origin showed that 53.5% came from the external services of the hospital, our results are comparable to those of Rahma et Sebboua [10]. in 2011 in Algeria, followed by traumatology (24.3%), Neurosurgery (10%) and Visceral Surgery (5.1%). The high frequency of patients from other hospitals and health structures in the city of Conakry and the interior of the country is due to the fact that the biomedical laboratory of HASIGUI was considered one of the best equipped in the country since its opening in 2012 with good services. Also very few bacteriological laboratories in the country were able to identify bacteria and perform antibiograms. Therefore, the quality of the analysis results is better.

This observation was made through an external quality assessment of Guinean biomedical laboratories with the One World Accuracy Agency (Canada), which operates globally.

During our study, out of 432 samples analyzed, 291 (67%) were culture-positive, and 141 (33%) had sterile cultures. These results are similar to those of Rahma et Sebboua [10]. During their study in Algeria in April 2021, the results revealed that 1,107 (67.3%) cultures were positive out of a total of 1,645 samples.

Regarding the overall sensitivity profile of our isolated strains, we found a high resistance to benzylpenicillin (94.11%).

Bacterial identification showed that the Enterobacteriaceae family (Table 8) represented 43.29% (128/291) of the 291 isolated strains, followed by the Micrococcaceae family (Table 7) which represented 36.42% (106/291), while non-fermenting Gram-negative bacilli (Table 9) represented 14.08% (42/291). Finally, the Streptococcaceae family (Table 10) was very weakly represented with 0.68% (2/291).

However, the majority bacterial species was Staphy-

lococcus aureus (15.81%), followed by Staphylococcus xylosus (6.53%=19/291) and *Staphylococcus lentus* (4.81%=14/291). These results are consistent with the results of the Moroccan study [11], other studies worldwide report the predominance of Gram-negative bacteria, particularly *Enterobacteriaceae* [12-14]. On the contrary, in Germany, the presentation of surgical site suppurations to CGP and particularly to staphylococci is more frequent than other bacterial groups [15]. Many other isolated species were in the minority.

Our results are partly close to those reported in Burkina Faso by Ouedraogo et al in 2020 that *Staphylococcus aureus* was the majority species of bacterial strains isolated from their cultures [16] .

The other isolated species were in the minority. Our results were close to those of Gheit et al [1] who in 2011 in Morocco, during their study reported that the species *Staphylococcus aureus* was the majority with an isolation frequency of 16.4%. They also found white Staphylococci (10.2%) and *Escherichia coli* (5%). On the other hand, Roy S and Dhar D reported in their study that out of 2050 pus samples obtained in the Microbiology laboratory from various departments of Silchar Medical College, Silchar (India), 1040 were culture positive and 1010 were sterile [17]. Out of 1040, 439 (42.21%) were *Stapylococcus aureus, Klebsiella* species 165(15.86%), *Pseudomonas* species 159(15.28%), *Proteus pecies* 141(13.55%), *Citrobacter* 98(9.4%), *Escherichia coli* 20(1.9%), *Acinetobacter* 18(1.7%)[17]. .

The study of antibiotic susceptibility only focused on the most frequently isolated species.

During our study, all our *Staphylococcus aureus* strains were resistant to benzylpenicillin (92.3%), oxacillin (57.5%), and trimethoprim/sulfamethoxazole. These results are very similar to those obtained by Bachir-PM. et al. [18] in 2014 in Algeria. During their study, they reported resistance of isolated *Staphylococcus aureus* strains to certain antibiotics, particularly benzylpenicillin (100%). Their Staphylococcus aureus strains were also resistant to kanamycin (54%), oxacillin (48.62%), followed by resistance to erythromycin (28.44%).

Koinam [19] et al. In 2016, in Burkina Faso, they also found results similar to ours regarding the antibiotic resistance of their *Staphylococcus aureus* strains. They noted resistance to penicillin (92%); to oxacillin (80%); to erythromycin (44%).

During our study, our isolated *Staphylococcus xylosus* strains showed high resistance to penicillin (94.12%), tetracycline (82.35%), oxacillin (72.22%), tobramycin (60%), trimethoprim/sulfamethoxazole (35.30). Our results are comparable to those reported in 2025 on *Staphylococcus* strains by Makanéra et al. [20] at HASIGUI (Guinea). They reported that strains of *Staphylococcus xylosus*, like ours, had resistance as high as tetracycline (90%), erythromycin (88.89%), fosfomycin (88.89%), lincomycin 87.5%), penicillin (85.71%), oxacillin (75%), trimethoprim/sulfamethoxazole (71.43%).

Our *Staphylococcus lentus* strains isolated in the present study were sensitive to fusidic acid (77.78%), oxacillin (70%), and gentamicin (69.23%). However, they showed resistance to penicillin (88.89%), levofloxacin (61.54%), rifampicin (60%), and tetracycline (66.67%).

Those of *Escherichia coli* were sensitive to Cefixitim32 (85.71%), Cefoxitin and fosfomycin (100%), nitrofurantoin (62.5%), and piperacillin (63.64%). On the other hand, they showed resistance to: ampicillin, cefotaxime, cephalothin, trimethoprim/sulfamethoxazole, ticarcillin and tetracycline (100%), nalidixic acid (90%), imipenem (92.31%), gentamicin (76.92%), ciprofloxacin (72.73%), tobramycin (61.54%). Our results agree with those of Rahma [10] in 2021 in Algeria.

Our *Klebsiella pneumoniae* spp. pneumoniae strains were susceptible to imipenem (90.9%), cefotixin (80%), amikacin (72.7%), and piperacillin (70%). However, they showed resistance to ampicillin, ticarcillin, cefepime, and ertapenem (100%), cephalothin, cefotaxime, and ceftazidine (90%), and trimethoprim/sulfamethoxazole (85.71%).

Pseudomonas aeruginosa strains were susceptible to ciprofloxacin (80%), imipenem (87.5%), gentamicin (88.89%), ofloxacin (80%), and tobramycin (87.5%). While they showed resistance to: nalidixic acid, cephalotixin, nitrofurantoin, trimethoprim/sulfamethoxazole (100%), amoxicillin/clavulanic acid (90%), cephalothin (88.89%).

Serratia liquefaciens strains were sensitive to piperacillin (75%), imipenem (66.67%). However, they showed resistance to: amoxicillin/clavulanic acid, nalidixic acid, cephalothin, amikacin (100%), ciprofloxacin (88.89%), nitrofurantoin (85.71%). The rate of resistance to C3G in our work is higher than that achieved in Morocco [19].

Conclusion

Suppurative infections are caused by pyogenic bacteria. These infections can affect any organ (superficial and/or deep). They are a significant cause of morbidity and mortality.

Our study focused on pus samples from a predominantly male and very young study population, with a majority age range of 0 to 20 years. They were primarily students and resided largely in the urban district of Ratoma. A large number of pus samples were collected from patients from the hospital's outpatient facilities. Of the 432 pus cultures performed, 291 were positive. The most commonly isolated bacteria were in the family of *Enterobacteriaceae*, and the most frequently isolated species was *Staphylococcus aureus*. The antibiotic susceptibility tests revealed high resistance to beta-lactam molecules. They were also highly resistant to some antibiotics in the cyclin and quinolone families. In addition, a high frequency of multidrug-resistant bacteria was observed in different bacterial families.

Conclusion

The results of the present study showed a high proportion of multidrug resistance among pyogenic bacteria. Thus, optimal antibiotic therapy should be based on the results of an antibiogram to prevent the spread of multidrug-resistant bacteria.

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Author Contributions

- **Abdoulaye Makanéra:** Study conception and design; supervision of laboratory work; data interpretation; drafting and final revision of manuscript.
- **Taliby Dos Camara:** Data collection coordination; statistical analysis; writing of the Materials and Methods and Results sections; review of manuscript.
- **Moïse Koi Koivogui:** Laboratory processing of samples; bacterial identification and antibiogram acquisition; data validation.
- **Mariam Condé:** Database management; quality control of data entries; contribution to Discussion writing.
- **Ibrahima Sori Diallo:** Methodological support; critical revision of microbiological procedures; oversight of ethical compliance.
- **Oumar Souaré:** Technical supervision of the Vitek 2 and API systems; interpretation of resistance phenotypes; manuscript editing.
- **Bintou Konaté:** Literature review; preparation of tables and figures; formatting and journal style compliance.

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Conflict of Interest

The authors declare that there are no conflicts of interest associated with this study.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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