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Original Research Article

Etiology of nosocomial infections in two general referral hospitals: CBCA-Virunga and Charité Maternelle de Goma, Democratic Republic of Congo

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ABSTRACT

Background: Nosocomial infections are a major cause of hospital morbidity and mortality. They usually occur during or after medical care. This study aims to identify the main etiologies of nosocomial infections in two general referral hospitals in Goma.
Methods: We conducted a microbiological study, of which 350 samples were analyzed in patients hospitalized for more than 48 hours with signs suggestive of IN these two hospitals, from February 15 to June 24, 2025. Data were collected using a standardized survey questionnaire. To identify the microorganisms involved, the biological parameters from blood culture and cytobacteriological examinations of urine and secretions taken from the surgical sites were carried out in two public health laboratories in Goma, namely Ami-Labo and La Reference.
Results: Among the 350 samples analyzed, 106 germs were isolated, including 98 bacteria and 8 yeasts. The main microorganisms identified were *E. coli*, *S. typhi*, *S. aureus*, *K. pneumoniae*, *P. aeruginosa*, *A. baumannii* and *C. albicans*. UTIs were the most common, followed by respiratory infections and surgical site infections. These isolated bacteria showed multi-resistance to commonly used antibiotics.
Conclusions: The analysis of the germs responsible for these infections revealed six main types of bacterial germs and one type of fungal germ. These bacteria are most often multi-resistant to common antibiotics.

Keywords: Etiologies, Nosocomial infections, Multi-resistant germs

INTRODUCTION

Nosocomial infections are a real public health problem in the world. Their epidemiological surveillance has become, over the last few decades, an essential element of any hospital infection prevention and control programme.[1]

Epidemiological surveillance allows the identification of patients likely to develop a nosocomial infection and the risk sectors resulting either from the nursing staff or from the patient's hospitalization conditions. In addition, it makes it possible to detect important changes in the patient in time and provide information on practical criteria, such as the use of long-term antibiotics, the duration of the catheter and the bladder catheter in the patient's body. In addition, surveillance has shown its effectiveness in reducing nosocomial infections in health facilities.[2]

Prevalence studies remain, despite their limitations, the simplest way to choose in the context of this surveillance to determine the extent of nosocomial infections when resources are limited. Indeed, these studies are inexpensive, easy to carry out and require few human or technical resources. National prevalence studies on nosocomial infections have been carried out in many European and African countries and have helped to define priorities for interventions.

The WHO states that a delay of at least 48 hours after the patient's admission to hospital (or a delay longer than the incubation period when known) is commonly accepted to distinguish a nosocomial acquisition infection from a community infection.[4]

In France, the prevalence in 2022 was estimated at between 6 and 9%. Nosocomial infections were one of the ten leading causes of death, and between 20 and 30% are considered preventable by simple and effective prevention methods. In 1988, a committee for the control of nosocomial infections (CLIN) was created in each hospital. It ensures the epidemiological surveillance of these infections, writes recommendations to the management committee, trains staff, validates care protocols and participates in the control of antibiotic prescription.[5]

In Africa, the highest prevalence rate in 2022 is estimated to be between 10 and 50% with an average of 30%. Prevalence of nosocomial infections, especially in developing countries, has long been neglected. Today, risk of nosocomial infection in these countries is underestimated; even if the prevalence of these infections is higher than in developed countries, awareness of reality of this phenomenon, in context of improved quality of care, is not yet a real health priority for these countries.[6]

In the Democratic Republic of Congo, the prevalence of nosocomial infections in 2022 varies between 22.3 and 24.8% considering the university clinics of Lubumbashi and the university hospital center of Kinshasa (mother Yemo general hospital) compared to other black African countries such as Benin 10%, Senegal 10.9% or Cameroon 12%.[7]

In Goma, particularly at the HGR CBCA-Virunga and Charité Maternelle, the absence of a bacteriology department within these hospitals is a major handicap for the diagnosis of the germs responsible for nosocomial infections; clinicians are often forced to resort to public health laboratories at a very high cost to patients for bacteriological examinations.[8]

METHODS

Setting, type of study and period

This is a microbiological study, with prospective collection, based on the analysis of samples taken from patients suspected of nosocomial infections hospitalized in the departments of: intensive care, surgery, neonatology, internal medicine and gyneco-obstetrics from February 15 to June 24, 2025. These samples were taken by two laboratory technicians and were analyzed at the bacteriological laboratory of public health, Ami-Labo and The Reference.

Study population and sample size

The study involved 350 samples analyzed. These samples were randomly selected from any patient who had a systemic inflammatory response syndrome (SIRS) that occurred during the hospital stay within 48 hours or more and after discharge.

Inclusion criteria

All biological samples (blood, urine, pus) that gave a positive bacterial culture from patients hospitalized for at least 48 hours with signs of a nosocomial infection (temperature greater than or equal to 38°C or less than 36°C) that appeared during the hospitalization stay within 48 hours, or after discharge, were included in this study. without the latter being present at admission and for which clinical data are available.

Exclusion criteria

We excluded from the study all samples collected before 48 hours of hospitalization, samples transferred from other hospitals or poorly collected, poorly stored or contaminated. Or negative or contaminated cultures, and lack of clinical data.

Data collection techniques and tools

Data collection was carried out in a prospective and analytical manner. The data were collected using the following tools-Standardized investigation forms completed in any patient hospitalized for more than 48 hours meeting the definition of suspected cases of IN and use of medical records-care sheets and hospitalization records.

Procedure carried out

The following bacteriological examinations were carried out:

Cytobacteriological examination of urine (ECBU)

Background

ECBU is the examination that has been most used to detect a urinary tract infection. This examination was carried out from the collection of fresh urine in the morning with a view to a cytological (RB, WBC, crystals, epithelial cells) and bacteriological study: to isolate gram-negative bacilli, gram-positive bacilli, cocci and also to

count germs. This is the only method that allowed us to identify exactly the microorganisms that colonized the urine.

Indications of ECBU

Was indicated for: confirmation of the diagnosis of a urinary tract infection or pyelonephritis. Also provided systematic monitoring for people at risk on urinary catheters or diabetics with urinary pruritus, or to adjust treatment after antibiotic susceptibility testing.

Equipment used

Collection equipment

Urinary catheter, dry sterile tubes, 10 ml syringes, tourniquet, bottle of alcohol, sterile gloves, pair of sterile scissors.

Laboratory analysis equipment

Slide slides, slides for direct examination, optical microscope, dyes (gentian violet, fuchsin and lugol), immersion oil, a Bunsen burner, 90° alcohol, a platinum handle, sterile pasteur pipettes, sterile petrie tubes and dishes, culture media (ordinary agar, nutrient agar), incubator.

Conditions for sampling

Verification of the patient's identity and collection of clinical information on the annexed form which included the methods and time of urine collection, the clinical signs, the socio-demographic characteristics of the patient (elderly, infant or pregnant woman, etc.), whether or not to take self-medication with the antibiotic and for how many days. Hand hygiene/non-sterile single-use gloves. Intimate cleansing with soap then rinsing or use of an antiseptic (Povidone) or an antiseptic wipe provided for the examination: cleaning of the vulvar area in women from the front and back to avoid fecal contamination of the meatus in men and the pubic area for infants. Using a sterile vial to collect urine, carrying out the examination after explaining the working conditions to the patient: Technique itself-Eliminate the first stream of urine, collect at least 20 ml of urine, do not touch the edges of the bottle, seal the bottle tightly after filling and identification of the vial/tube, time and date. Waste disposal, and removal of gloves, hand hygiene with soap and water or hydroalcoholic rub and transfer of the specimen to the laboratory

Retention of the sample

The sample was kept in the original vial, at room temperature for less than 2 hours. The sample kept in the refrigerator was kept for 24 hours at 4°C. If it was put in a borated tube, it was kept for up to 48 hours at room temperature.

Culturing and antibiotic susceptibility testing

Urine seeding

Using a calibrated loop, a drop of urine was inoculated on a nutrient agar to see well-isolated colonies. The reading was done after 24 hours of incubation or even 48 hours at 37^0C.

Enumeration of microorganisms

The quantitative analysis of bacteriuria was carried out either by dilution of the urine or by the calibrated loop technique or by the submerged slide method. A culture medium is inoculated from the homogenized urine. If germs are known, culture lasts between 24 and 48 hours in order to quantify the bacteria and count the microorganisms.

The antibiogram is carried out by choosing the molecules to be tested. It results from a compromise between the expected spectrum of sensitivity and the delivery of the antibiotic at the site of infection. It is also necessary to know the antibiotics used in urinary tract infection; this allows you to compose the best antibiogram.

Blood culture

Definition

This bacteriological examination consists of the collection and culture of blood samples in an environment specifically designed to promote the growth of bacteria.

The goal of this procedure was to detect the presence of bacteria in the blood, identify them, and evaluate the effectiveness and specificity of antibiotics using a technique called antibiotic susceptibility testing. The examination was carried out at the time of febrile peaks and repeated 3 times at 1-hour intervals.

Material

Three types of vials, each adapted to a specific type of bacteria. One bottle for aerobic germs, the other bottle for anaerobic germs and other bottles for other analyses. Slides and slides for direct examination, an optical microscope, dyes (gentian violet, fuchsin and lugol), immersion oil, a Bunsen burner, 90° alcohol, a platinum handle, sterile Pasteur pipettes, sterile petrie tubes and dishes.

Other materials used

In addition, we used: antibiotic discs, physiological water and distilled water for the preparation of germs, paraffin oil, an oven for incubating cultures, result sheets, the survey sheet, a ruler graduated in centimeters, a marker, antibiotic sheets.

Culture media

Heart-brain broth, Columbia agar with sheep's blood (5%), nalidixic acid and colistin, and Drigalski's lactosis agar.

Indications

This examination is indicated for any patient hospitalized for more than 48 hours who has become febrile when he or she did not have a clinical focus and if he or she has a catheter, a probe or a pacemaker.

In case of sepsis or septic shock, localized infection (meningitis, pneumonia, endocarditis, arthritis, pyelonephritis, fever during drug use, etc.).

Blood culture technique

The pre-analytical phase: good blood sampling practices for blood culture

Before the collection

Visual identification of the filling level of the vials: Visually identify the fill level (10 mL) of the aerobic (green) and anaerobic (orange) adult vials. Note: the visual cue is not present on the paediatric vials (yellow): optimal volume: 4 mL, which corresponds to a graduation.

Quality control

Check the expiration date of the bottles on the label. Check the color of the pad: if gray/green: OK, if yellow: do not use.

Organization

If several samples: blood culture vials and blood collection tubes (EDTA tube, citrated tube, etc.), always start with the blood culture vials and fill the tubes after the vials. Check the necessary equipment: Number of vials (4 to 6 or 2 to 3 pairs) and start with the aerobic vials and then the anaerobic vials. Number the first aerobic vial that will be collected. Pump body and finned needle (epicranial).

Fill the vials to the mark noted on the label with 2 or 3 pairs.

Removal

Hand hygiene and disinfection of the vials:Washing the sampler's hands with soap and water and then rubbing with hydro-alcoholic alcohol. Remove the capsule from the vials and disinfect the cap (with 70° alcohol or alcoholic betadine).

Antisepsis of the patient's skin (according to the protocol validated by the laboratory): Use alcoholic Betadine. Some protocols require 2 successive applications of the antiseptic with drying between each step. E.g. antisepsis in 5 stages: debridement (1), drying (2), rinsing (3), disinfection (4), air drying (5).

Venipuncture at the elbow-Perform the puncture using the sampling device: epicranial and pump body. Start with the aerobic bottle (air without tubing) then the anaerobic bottle and respect the filling volume (10 mL per bottle). All vials (4 or 6 vials) are collected at one time unless endocarditis is suspected.

Recommendations for suspected endocarditis: samples (3 pairs) spaced at least one hour apart and spread over 24 hours.

Special case of catheter sampling

Direct suction at the catheter and at the same time taking a sample around the catheter (periphery). It is important to note the sampling site, which makes it possible to know the origin of pathological bacteremia according to the time of positivity of the blood cultures. If + for the catheter first before the peripheral sample, the bacteremia comes from the catheter.

Quality indicator and cause of non-compliance: → If the vial is overfilled: risk of false positive. → If the vial is not sufficiently filled: risk of false negative.

After the collection-Dispose of the sampling device in a waste disposal container and labelling of vials: If the label positioning is not correct, the volume measurement cannot be carried out by the PLC. Volume measurement is not available for pediatric vials. Do not write on the bottom of the bottle.

Only one area is allowed for vial labeling: Store the vials at room temperature and transport the vials to the laboratory as quickly as possible (maximum 2 hours).

Reading

How to interpret a blood culture?

In addition to the germ sought, the factors to be taken into account are: the time to positivity and the number of positive tubes.

A blood culture that becomes positive after 48 hours of incubation argues in favor of contamination. The presence of the same germ in several samples is in favor of an infection. The type of microorganisms often encountered in blood culture are: Facultative aerobic and anaerobic.

At least 2 to 3 cultures should be carried out per 24 hours spaced 15 to 30 minutes apart at different sites.

Statistical analysis

All data was encoded on the Excel file. The analyses were carried out using SPSS software version 20.0 (IBM, Chicago, USA). Descriptive analyses were performed by calculating proportions and percentages for categorical variables and calculating means and their standard deviations for numerical variables.

Bivariate analyses made it possible to compare the percentages for the categorical variables using Pearson's chi-square test or Fischer's exact test according to their conditions of validity. To control for confounders, multivariate analysis using the logistic regression method was performed. To do this, only variables with an association were included in the logistic regression analysis. The significance level was 0.05%.

Variables studied

The data collected focused on: The work protocol and bacteriological analyses.

We developed an identification sheet including the sociodemographic characteristics of the patients (age, sex, marital status, medical parameters with regard to the date of admission to the hospital, the appearance of signs of infection and its evolution (fever with temperature >38°C), hypothermia (temperature <36°C), in whom the following examinations were requested: cytobacteriological urine examinations (ECBU), taking into account their hospital stay and the antibiotic therapy administered, the length of stay of the catheter or catheter in the patient's body, allowed us to identify the germs responsible for nosocomial infection in these two hospitals at the end of the study.

RESULTS

A total of 350 biological samples were analyzed in the laboratory during the study period. Of these samples, 106 germs were isolated, for an overall isolation rate of 30.3%. These germs consisted of 98 bacteria (92.4%) and 8 yeasts (7.6%).

Table 1: Types of microbiological samples taken from respondents.

Samples	Workforce	Percentage (%)
ECBU	207	59
HEMOCULIDE	69	19.7
Secretion sampling (wounds and catheters)	74	21.1
Total	350	100

The microbiological samples taken were diversified according to the suspected sites of infection. ECBU, blood cultures, wound secretion and catheter samples were performed. In this study, the ECBU was the most frequently performed sample (207 samples (59%), indicating a strong clinical suspicion of urinary tract infections in hospitalized patients (Table 1).

The results show a clear predominance of bacteria, which accounted for 92.4% of the isolated germs, compared to yeast (4.7%) (Figure 1).

Gram-negative Enterobacteriaceae were the most frequently isolated germs, accounting for 39.6% of all isolates. They were dominated by *E. coli* (16.9%) and *S. typhi* (14.1%). Non-fermenting Gram-negative bacilli accounted for 31.3%, mainly *P. aeruginosa* (11.2%) and *A. baumannii* (12.2%) (Table 2).

Gram-positive cocci accounted for 24.5% of the germs isolated, dominated by *S. aureus* (13.2%). Yeasts, exclusively represented by *C. albicans*, constituted 4.7% of the isolates (Table 3).

Table 2: Distribution of isolated germs responsible for IN at the HGR CBCA-Virunga and maternal charity.

Isolated germs	Workforce	N (%)
Gram-negative bacteria		
Enterobacteriaceae	42	39.6
S. typhi	15	16.9
E. coli	18	14.1
K. pneumoniae	6	5.6
Enterobacter Spp.	3	5.6
Non-fermenting non-enterobacterial NGBs	33	31.3
Proteus Spp.	6	5.6
P. aeruginosa	12	11.2
A. baumannii	13	12.2
S. maltophilia	2	
Gram-positive cocci	26	24.5
S. aureus	14	13.2
Coagulase-negative *Staphylococcus*	4	3.7
E. faecalis	8	7.5
Yeasts	5	4.7
C. albicans	5	4.7
Total	106	100

Table 3: Types of nosocomial infections observed in these two hospitals.

Infections	Work force	Percentage (%)
Urinary tract infections	66	46.1
Surgical site infections	22	16.1
Bacteremia, sepsis	18	13.2
Respiratory infections	26	23.5
Skin infections	4	3.1
Total	136	100

Table 4: Types of germs isolated from urinary catheter patients in these two hospitals.

Bacteria/yeasts	Work force	Percentage (%)
Enterobacteriaceae		
E. coli	16	37.2
K. pneumonia	2	4.6
E. cloacae	4	9.2
Non-fermenting Gram-negative bacilli		
P. aeruginosa	5	11.6
S. typhi	7	16.2
Gram-positive cocci (CGP)		
E. faecium	2	4.6
Coagulase-negative *Staphylococcus*	1	2.3
Yeasts		
C. albicans	6	13.9
Total	43	100

Table 5: Types of germs isolated from patients with venous catheters in these two hospitals.

Variables	Workforce	N (%)
Gram-positive bacteria		
S. aureus	10	15.8
Coagulase-negative Staphyloccocus	4	6.3
Enteroccocus spps.	2	3.1
Non-fermenting NGB		
E. coli	13	20.6
S. typhi	14	22.2
K. pneumoniae	7	11.1
P. aeruginosa	6	9.5
A. baumannii	3	4.7
Mushrooms		
Candida albicans	4	6.3
Total	63	100

Urinary tract infections were the most common with 66 cases (46.1%), followed by respiratory infections (26 cases; 23.5%). Surgical site infections accounted for 16.1%, while bloodstream infections and sepsis accounted for 13.2%. Skin infections were less common (3.1%) (Table 4).

In patients with urinary catheters, 43 germs were isolated. Gram-negative bacilli were in the majority. *E. coli* was the most isolated germ (37.2%), followed by *S. typhi* (16.2%) and *P. aeruginosa* (11.6%). *C. albicans* yeast accounted for 13.9% of the isolates (Table 5).

In patients with venous catheters, 63 germs have been identified. Gram-negative bacilli dominated, with a high frequency of *S. typhi* (22.2%) and *E. coli* (20.6%). Among Gram-positive cocci, *S. aureus* was the most common (15.8%). *C. albicans* accounted for 6.3% of isolates (Table 6).

Of the 106 germs isolated, a significant proportion had multi-resistance to antibiotics. Gram-negative bacteria made up the majority, dominated by *E. coli* (22.6%), *S. typhi* (16.9%) and *K. pneumoniae* (11.3%). Among the non-fermenting bacilli, *P. aeruginosa* (13.2%) and *A. baumannii* (5.6%) were frequently isolated (Table 7).

The 24 strains of *E. coli* tested showed a high sensitivity to carbapenems, cefepime and ceftriaxone (100%). In contrast, high resistance was observed to amoxicillin (68%), cotrimoxazole (89%) and gentamicin (85%). Nitrofurantoin and ciprofloxacin showed good activity with sensitivity levels of 83% and 80%, respectively (Table 8).

Table 6: Distribution of multidrug-resistant bacteria responsible for nosocomial infections in these 2 hospitals.

Family	Bacteria	Percent (%)
Gram-positive bacteria (these bacteria appear purple after staining with Gram)		
S. aureus	16	15
Gram-negative bacteria (often appear pink after Gram staining)		
E. coli	24	2216
S. typhi	18	1619
K. pneumoniae	12	11.3
Enterobacter Spp.	8	7.6
Non-fermenting BGNs often multi-resistant		
A. baumannii	6	5.6
P. aeruginosa	14	13.2
S. maltophilia	2	1.8
Enterobacter Spp.	6	5.6
Total	106	100

Table 7: Antibiotic susceptibility of 24 strains.

Antibiotics tested	Bacteria-*E. coli*		
	I	R	S
Cefotaxime	0	5%	95%
Amoxi-A Clavulanic	0	57%	43%
Amoxycillin	0	68%	32%
Amikacin	0	68.7%	31.7%
Gentamicin	0	85%	15%
Cefepime	0	0%	100%
Nalidixic acid	0	52%	48%
Ciprofloxacin	0	20%	80%
Carbapenems	0	0%	100%
Norfloxacin	0	0	1
Nitrofurantoin	0	17%	83%
Cotri	0	89%	11%
Azithromycin	0	53%	47%
Ceftriaxone	0	0	100%

All 18 strains of *S. typhi* were highly susceptible to carbapenems (100%), azithromycin (95%) and ceftriaxone (85%). Significant resistance was observed to

cotrimoxazole (90%), amoxicillin (80%) and gentamicin (85%) (Table 9).

Table 8: Antibiotic susceptibility of 18 *S. typhi* strains.

Antibiotics tested	Bacteria-*S. typhi*		
	I	R	S
Amoxicillin	0	80%	10%
Gentamicin	0	85%	15%
Chloramphenicol	0	76%	14%
Azithromycin	0	5%	95%
Norfloxacin	0	20%	80%
Carbapenems	0	0	100%
Ceftriaxone	0	15%	85%
Cotrimoxazol	0	90%	10%
Ceftazidime	0	18.3%	82.7%
Ciprofloxacin	0	18.8%	81.2%
Amikacin	0	23.4%	76.6%

*I: intermediate, R: resistant, S: sensitive

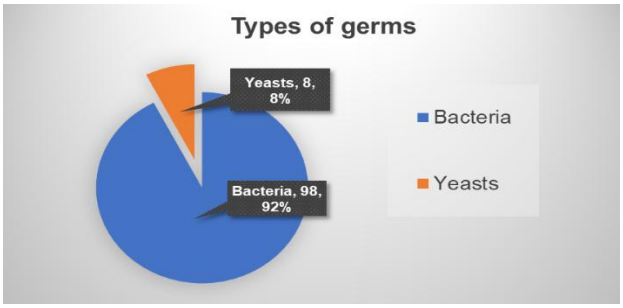

Figure 1: Types of germs isolated at HGR CBCA-Virunga and Maternal Charity.

DISCUSSION

This study dealt with the etiology of nosocomial infections in two referral hospitals, CBCA-Virunga and Charité Maternelle in the city of Goma. The survey covered 350 samples of patients hospitalized from February 15 to June 24, 2025. These samples were analyzed in two public health laboratories in North Kivu, Reference and Ami-Labo in the bacteriology department.

In the search for the causes of nosocomial infections in these hospitals, we isolated 106 strains, including 98 predominantly gram-negative bacterial strains (87%) consisting of Cocci and bacilli and 16 gram-positive strains (13%) consisting only of cocci. In addition, of the 106 bacterial strains, 37 were isolated in intensive care (34.9%), 29 were isolated from patients operated on in surgery, i.e. 27.3%; and 18 in neonatology (16.9%). and 22 strains in other departments (gynaecology and obstetrics and paediatrics) or 22.3%. In addition to this, we also observed a predominance of urinary tract infections (68/106) (64.1% compared to other categories).

E. coli was the leading cause of infections found in most of the samples analysed (22.3%), followed by *S. Typhi* (16.9%), *S. aureus* (15%), *P. aeruginosa* (13.2%) and *K. pneumonia (*11.3%). Compared to the survey carried out by the WHO in 40 countries in Sub-Saharan Africa in 2022, the classification is as follows: 1. *E. coli* (18.3%) of isolates. 2. *S. aureus* (17.2%) of isolates. 3. *Klebsiella Spp.* (17.2%) isolates. 4. *P. aeruginosa* (10.3%) of isolates. *Acinetobacter* Spp. (6.8%) of isolates.[9]

In comparison with the study reported by Raoofi et al in 2024, this one present *E. coli* in first position (18.3%) followed by *S. aureus* (17.3%), *Klebsiella* Spp. (17.2%), *Pseudomonas Spp.* (10.3%) and *Acinetobacter* Spp. (6.8%), we find that the results of these two studies do not mention *Salmonella Typhi*. This can be explained by a combination of factors related to the hospital environment, the insufficient hand hygiene practices of health care staff, and the epidemiological context of endemicity of this infection in Goma.[10]

Indeed, *S. typhi* is a strictly human pathogen transmitted mainly by the fecal-oral route and was found in the bacterial isolates of the samples analyzed. Often due to poor hand hygiene or contamination of water and surfaces, *S. typhi* in the context of Goma can be explained by cross-contamination within hospital wards following poor hand hygiene.

On the other hand, invasive care such as catheters, infusions, or surgical procedures performed with insufficiently sterilized equipment or handled with contaminated hands can promote the introduction of *S. typhi* into the bloodstream or deep tissues of hospitalized patients.

In addition, the high community circulation of typhoid fever in the population of Goma constitutes a permanent human reservoir, which increases the likelihood that asymptomatic carriers (health care staff, visitors or patients) will introduce the bacterium into the hospital environment.

This study, in comparison with the study of Kasonga Ngoya carried out at the University Clinics of Lubumbashi in 2013, presents the etiology of infections associated with care dominated by. *E. coli* (29.7%), *S. aureus* (24.3%) and *P. aeruginosa* (17.5%).[11] This classification shows a nuance with the presence of *S. typhi* which occupies the 2nd place in our classification. That is 16.9%.

Another study by the Congolese Journal of Science and Technology conducted in Kinshasa in 2024 describes bacteria isolated from two facilities in Kinshasa, including the Ngaliema Clinic (aseptic surgery and neonatology room) and the King Baudouin Hospital in Masina, which identified the following germs: *S. aureus* (23.6%), *E. coli* (21.6%), *P. aeruginosa* (16.7%) and *A. baumanni* (11.2%). These isolates come from surgical site and neonatal samples 12.

With any reservations of direct comparison between

previous studies conducted by other researchers in Mbujimayi, Lubumbashi, Kinshasa and other African countries such as Morocco, Mali, Benin and Senegal.[13] Also given the differences in methodological and temporal approaches, our results deviate a little from them due to the presence of *S. typhi* in our classification. These differences mainly concern the setting of our study, the method of sample collection, the number of infectious sites investigated, the techniques used in the collection of the sample and the number of samples analyzed (95% CI) 3.6 [1, 8.92].

Limitations

This study has some limitations. First, it was carried out in only two hospitals in the city of Goma, which limits the generalization of the results to all hospital structures in the region or country. Second, microbiological analyses were performed in external laboratories, which could influence sample processing times. Finally, some selective culture media for the counter-expertise of our results were not available, which allowed us to use a single range of selective media.

CONCLUSION

This study identified the main etiological germs of nosocomial infections in the CBCAVirunga and Charité Maternelle general referral hospitals in the city of Goma. The results show a predominance of Gram-negative bacteria, including *E. coli*, *S. typhi*, *P. aeruginosa,* and *K. pneumoniae.* For Gram-positive bacteria, we recorded the predominance of *S. aureus.* These bacteria are often associated with multidrug resistance. *C. albicans*, a yeast has also been recorded. These results contribute to a better understanding of the microbiological profile of nosocomial infections in the city of Goma and highlight the importance of strengthening prevention, epidemiological surveillance and antibiotic use measures in order to reduce the burden of these infections in health facilities.

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