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(RESEARCH ARTICLE)

Profile of microorganisms isolated from vaginal secretions of women attending gynecological consultations at the University Clinics of Kinshasa, the Chinese-Congolese Friendship Hospital and the General Reference Hospital of Kinshasa

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Abstract

Aims: The aim of this study was to perform microbiological profiling on vaginal secretions of women who came for consultation and whose diagnosis led to the isolation of germs in the vaginal cavity.

Methodology: This is a retrospective descriptive study of data on microbiological examination performed on women who came for gynecological consultation during the period from January 2012 to December 2016, a period of 5 years in the hospitals of the university clinics of Kinshasa, the Sino-Congolese friendship hospital and the general hospital of Kinshasa. The Kruskal-Wallis test was used to determine the similarity between the variables sought and the significance level was 0.05.

Results: During the period from January 1, 2012 to December 31, 2016, a total of 24 different species were isolated from the vaginal cavities of women who came for gynecological consultations in the three hospitals mentioned above. It appears from this study that Escherichia coli was the species with a very high frequency in the three hospitals; namely the University Clinics of Kinshasa (47.4%), the Chinese-Congolese Friendship Hospital (37.1%) and the General Hospital of Kinshasa (10.1%), followed by species of the genus Klebsiella (*Klebsiella pneumoniae*, *Klebsiella oxytoca*), *Staphylococcus aureus*, *candida albicans*, etc.

Conclusion: The most represented germs were *Escherichia coli*, *Klebsiella pneumoniae*, *Klebsiella oxytoca*), *Staphylococcus aureus* and *candida albicans*. Women's health education regarding these infections needs to be strengthened.

Keywords: Vaginal infections; Vaginal secretions; Microbiome; Microflora; Sterility

1. Introduction

The microbiological profile of the vaginal flora is an indicator of a woman's good health (Chee et *al*., 2020). The vaginal microflora represents 9% of the human microflora, its composition varies from one site to another and favors site-specific conditions, notably the genus Lactobacillus which acidifies the genital tract (Tamaiuolo et *al*., 2020).

This microflora participates on the one hand in the maintenance of sexual health and reproduction, since it seems that it is involved in female fertility and prevents unfavorable consequences during pregnancy, including miscarriages and

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premature births; on the other hand, it prevents the installation of pathogens (Moosa et *al*., 2020). The balance of this microflora is fragile, many factors can alter its composition, lifestyle, excessive use of antibiotics and slow recolonization promote dysbiosis and increase the risk of vaginal infections (Chee et *al*., 2020 ; Coundray and Madhivanon, 2020 ; Moosa et *al*., 2020). These infections represent a public health problem due to their high frequency worldwide as well as the complications and sequelae they cause (Aouag and Gheraf, 2016). These infections are involved in the dysfunction of the female reproductive system with multiple consequences such as infertility and late pregnancy failure (Nadin, 2022). According to Reid (2002), Bohbot (2008) and, Bohbot and Lepargneur (2011) cited by Kabena et al., (2014), one billion women are affected by genital or urinary tract infections each year (Kabena et *al*., 2014). According to WHO (2015), nearly one million people, every day, contract sexually transmitted infections (WHO, 2015). They affected 58.3% of women in South Africa; 30.3% in Zimbabwe; 14.2% in Nigeria (Coundray and Madhivanon, 2020); and according to the WHO 2020 report, 9 germs are involved in most sexually transmitted infections (WHO, 2020). Despite this, studies on the microbiological profiles of genital infections in women show that opportunistic pathogens are often involved in the development of these infections (Sanou et *al*., 2017; Cazanave and De Barbeyrae, 2019; Sigha et al., 2016). In the Democratic Republic of Congo, few studies have addressed this topic; and this work is devoted essentially to establishing a microbiological profiling of women who came for consultation whose diagnosis led to the isolation of germs from the vaginal cavity.

2. Methodology

2.1. Study framework

Our study was conducted in the gynecology departments of the general referral hospital of Kinshasa, the university clinics of Kinshasa, and the Chinese-Congolese friendship hospital.

2.2. Description of the study framework

2.2.1. Kinshasa General Referral Hospital (ex. Maman Yemo)

The General Hospital of Reference of Kinshasa is a public health care center, located in the commune of Gombe, on the Avenue de l'Hôpital (4°18'33'' south and 15°18'21'') in Kinshasa in the Democratic Republic of Congo, with more than 2,250 employees. It is the largest public hospital in the Democratic Republic of Congo and this hospital institution participates in the training of medical and nursing students. Several service organized are : the radiology service, the orthopedic apparatus service, the technical service, yhe University guard service and morguebservice.

2.2.2. The University Clinics of Kinshasa

The university clinics of Kinshasa are integrated into the University of Kinshasa, which is located at least 20 km from the city center, on Mont-Amba, in the commune of Lemba. The main entrances are: Avenue de l'Université and Avenue de Foire at Rond-point Ngaba.

Several Departments are organized there ; namely : the medical-surgical Department, the Department of surgey, the Department of gyneco-obstetrics, the Department of Pediatrics the Department of anesthesia and intensive care, the Department of clinical Biology and medical, the Department of Physiotherapy and the Department of Pharmacy.

The services organized are: the Radiology Service, the Orthopedic Apparatus Service, the Technical Service, the University Guard Service and the Morgue Service.

2.2.3. Sino-Congolese Friendship Hospital

The Sino-Congolese Friendship Hospital is located in the commune of N'djili, Kimbuta Avenue, district 7, not far from the parish of Saint Teresa, at the following geographical coordinates: 4°24'12'' South and 15°22'27'' East).

The organized services are: Pediatrics, gyneco-obstetrics, internal medicine and surgery.

2.3. Types and period of study

This is a retrospective descriptive study of data on microbiological examination performed on women who came for gynecological consultation during the period from January 2012 to December 2016, a period of 5 years.

2.4. Study population

The study population consisted of all patients who were seen in the gynecology department in the three hospitals and who were referred for microbiological examinations.

2.5. Sampling

2.5.1. Inclusion criteria

All patients seen in consultation for a gynecological problem were included in this study.

2.5.2. Exclusion criteria

We're not included in our study, all patients who came to consultation before January 1, 2012 and after Decembre 31, 2016.

2.5.3. Data collection

The data were collected from the gynecological consultation data, all reported on an individual survey form previously established.

2.6. Variables studied

- microorganisms isolated and
- year of isolation

2.7. Data analysis

Data were entered and analyzed on R software. The Kruskal-Wallis test was used with a significance level of $p<0.05$.

2.8. Ethical issues

Confidentiality of the data was ensured by restricted access to the files. The anonymity of the patients was maintained for the disclosure of the results.

3. Results

During the study period from January 01, 2012 to December 31, 2016, we counted 24 species of microorganisms, isolated from women who came to gynecological consultations, mainly those that were conducted for microbiological examinations. The data collected in the register of the analysis laboratory of the Sino-Congolese Friendship Hospital is shown in the table.

It appears from the above 1 that the number of species listed was 14. 89.6% of them belong to the kingdom of bacteria and 10.4% to the kingdom of fungi. Enterobacteriaceae is the most represented family with 71.9% of species, followed by staphylococcaceae (11.5%), saccharomycetaceae (10.4%), streptococcaceae (4.7%), pseudomonadaceae (1.1%) and finally the morganellaceae family (0.4%).

The data collected in the registry of the analysis laboratory of the university clinics of Kinshasa are shown in the table 2.

It appears from this table 2 that on the register of the analysis laboratory of women who came to gynecological consultations at the university clinics, 14 species belonging to the kingdom of Bacteria were identified. It should also be noted that 75% of these species belong to the Enterobacteriaceae family, 21.8% to the Staphylococcaceae, 2.6% to the Pseudomonadaceae and 1% to the Moraxellaceae.

Data collected in the register of the analysis laboratory of the general hospital of Kinshasa (ex. Maman Yemo).

Table 1 Frequency of women coming for gynecological consultation and referred to the microbiology department of the Chinese-Congolese friendship hospital in N'djili, from January 2012 to December 2016

N°	Isolated microorganisms	Reign	Family	Gram staining	2012	2013	2014	2015	2016	Total	Frequency (%)
1	*Candida albicans*	Fungi	Saccharomycetaceae	-	6	6	6	7	4	29	10.4
2	*Citrobacter diversus*	Bacteria	Enterobacteriaceae	Negative	5	2	3	4	2	16	5.7
3	*Escherichia coli*	Bacteria	Enterobacteriaceae	Negative	24	19	21	27	12	103	37
4	*Enterobacter clocaea*	Bacteria	Enterobacteriaceae	Negative	2	2	3	3	2	12	4.3
5	*Enterobacter diversus*	Bacteria	Enterobacteriaceae	Negative	1	-	1	1	-	3	1.1
6	*Klebsiella oxytoca*	Bacteria	Enterobacteriaceae	Negative	13	6	7	7	4	37	13.3
7	*Klebsiella ozaena*	Bacteria	Enterobacteriaceae	Negative	4	2	1	1	1	9	3.2
8	*Proteus mirabilus*	Bacteria	Enterobacteriaceae	Negative	1	2	1	1	2	7	2.5
9	*Proteus vulgaris*	Bacteria	Enterobacteriaceae	Negative	2	2	4	4	1	13	4.6
10	*Pseudomonas aeruginosa*	Bacteria	Pseudomonadaceae	Negative	1	-	1	1	-	3	1.1
11	*Providentia retgerii*	Bacteria	Morganellaceae	Negative	1	-	-	-	-	1	0.4
12	*Staphylococcus aureus*	Bacteria	Staphylococcaceae	Negative	7	3	5	5	1	21	7.5
13	*Staphylococcus epidermidis*	Bacteria	Staphylococcaceae	Negative	5	1	2	2	1	11	3.9
14	*Streptococcus agalactie*	Bacteria	Streptococcaceae	Positive	6	2	3	2	-	13	4.6
Total					78	47	58	65	30	278	100

Table 2 Frequencies of women coming for gynecological consultation and referred to the microbiology service at the university clinics of Kinshasa from January 01, 2012 to December 31, 2016

N°	Isolated microorganisms	Reign	Family	Gram staining	2012	2013	2014	2015	2016	Total	Frequency (%)
1	*Acinetobacter sp.*	Bacteria	Moraxellaceae	Negative	1	1	-	-	-	2	1.0
2	*Citrobacter diversus*	Bacteria	Enterobacteriaceae	Negative	5	-	-	-	-	5	2.6
3	*Citrobacter freundii*	Bacteria	Enterobacteriaceae	Negative	5	-	-	-	-	5	2.6
4	*Escherichia coli*	Bacteria	Enterobacteriaceae	Negative	52	6	10	12	11	91	47.4
5	*Enterobacter sp*	Bacteria	Enterobacteriaceae	Negative	4	1	1	1	-	7	3.6
6	*Klebsiella oxytoca*	Bacteria	Enterobacteriaceae	Negative	2	1	-	1	-	4	2.1
7	*Klebsiella ozaenae*	Bacteria	Enterobacteriaceae	Negative	2	-	-	-	-	2	1.0
8	*Klebsiella pneumonia*	Bacteria	enterobacteriaceae	Negative	12	10	2	5	-	29	15.1
9	*Proteus mirabilis*	Bacteria	Enterobacteriaceae	Negative	-	-	-	-	1	1	0.5
10	*Pseudomonas aeroginosa*	Bacteria	Pseudomonadaceae	Negative	1	-	-	-	2	3	1.6
11	*Pseudomonas maltophilia*	Bacteria	Pseudomonadaceae	Negative	2	-	-	-	-	2	1.0

12	*Staphylococcus aureus*	Bacteria	Staphylococcaceae	Positive	14	2	2	1	2	21	10.9
13	*Staphylococcus epidermidis*	Bacteria	Staphylococcaceae	Positive	3	-	1	-	-	4	2.1
14	*Staphylococcus saprophyticus*	Bacteria	Staphylococcaceae	Positive	13	2	1	-	-	16	8.3
Total					116	23	17	20	16	192	100

Table 3 Frequencies of women who came for gynecological consultations and were referred to the microbiology department at the general hospital of kinshasa (ex. Maman Yemo) from January 2012 to December 2016

N°	Isolated microorganisms	Reign	Family	Gram staining	2012	2013	2014	2015	2016	Total	Frequency (%)
1	*Candida albicans*	Fungi	Saccharomycetaceae	-	6	9	1	1	7	24	10
2	*Chlamydia*	Bacteria	Chlamydiaceae	-	-	-	1	-	-	1	0.4
3	*Citrobacter diversus*	Bacteria	Enterobacteriaceae	Negative	-	-	-	1	1	2	0.8
4	*Citrobacter freundii*	Bacteria	Enterobacteriaceae	Negative	-	-	-	-	1	1	0.4
5	*Corynebacterie*	Bacteria	Corynebacteriaceae	Positive	3	8	2	-	-	13	5.4
6	*Enterobacter sp.*	Bacteria	Enterobacteriaceae	Negative	-	8	-	-	-	8	3.3
7	*Escherichia coli*	Bacteria	Enterobacteriaceae	Negative	6	18	19	27	5	75	31
8	*Klebsiella oxytoca*	Bacteria	Enterobacteriaceae	Negative	-	1	5	4	3	13	5.4
9	*Klebsiella ozaenae*	Bacteria	Enterobacteriaceae	Negative	-	-	1	-	-	1	0.4
10	*Klebsiella pneumoniae*	Bacteria	Enterobacteriaceae	Negative	-	2	3	2	3	10	4.1
11	*Neisseria gonorrhoeae*	Bacteria	Neisseriaceae	Negative	1	-	1	-	-	2	0.8
12	*Proteus mirabilis*	Bacteria	Enterobacteriaceae	Negative	-	-	-	1	-	1	0.4
13	*Proteus vulgaris*	Bacteria	Enterobacteriaceae	Negative	-	-	1	1	-	2	0.8
14	*Providentia retgerii*	Bacteria	Morganellaceae	Negative	-	-	1	1	-	2	0.8
15	*Pseudomonas aeroginosa*	Bacteria	Pseudomonadaceae	Negative	-	-	-	2	-	2	0.8
16	*Pseudomonas sp.*	Bacteria	Pseudomonadaceae	Negative	1	8	2	-	-	11	4.5
17	*Staphylococcus aureus*	Bacteria	Staphylococcaceae	Positive	4	18	18	24	10	74	30.6
Total					21	72	55	64	30	242	100

Table 3 shows that 17 microbial species were identified at the General Hospital of Kinshasa. 90% of these species belong to the kingdom of Bacteria and 10% to the kingdom of Fungi. 47.3% of these species belong to the Enterobactericeae family, 30.7% to the Staphylococcaceae, 10% to the Saccharomycetaceae, 5.4% to the Pseudomonadaea, 4.5% to the Corynebacteriacea, 0.4% of Morganellaceae and Neisseriaceae, and finally 0.4% of Chlamydiaceae. Statistical analysis of data from these different tables by the Kruskal-Wallis test, at confidence level 2, showed that there was no significant difference (P= 0.05982, thus p>0, 05).

4. Discussion

Our results obtained in different hospitals, differ from those obtained by Hachimi, who worked on the epidemiological and resistance profile of Streptococcus agalactiae, whose isolation of bacterial strains from the vaginal cavity of women

coming to gynecological consultation showed a preponderance of Streptococcus agalactiae (26%), followed by Candida albicans (25%).

A study similar to ours, was conducted by Elmoghazli (2018) at Marraketch on the microbiological profile of vaginal infections over a period of five years, from 2013 to 2017, found the following results: Gardenella vaginalis (33.89%), Streptococci (33.33%), yeasts (6.94%) and Enterobacteriaceae (12.42%). These results differ from ours, where the species Gardenella vaginalis was not isolated during the five years of retrospective studies. It was reported by Nadim, 2022 that, the vaginal flora of a pregnant woman is composed mainly of Lactobacillus, which plays a protective role for the fetus. The high frequency of other types of microorganisms, is an indicator of a probable infection. Therefore, Women should take care of the quality of their environment to prevent complications due to infections.

5. Conclusion

The objective of this study was to profile the microorganisms isolated from vaginal secretions in some hospitals of Kinshasa; namely the University Clinics of Kinshasa, the General Hospital of Kinshasa and the Chinese-Congolese Friendship Hospital from January 2012 to December 2016; that is to say a period of five years.

The study found that:

- *Escherichia coli* is the most frequent species with 47.4%, followed by *Klebsiella pneumoniae* (15.0%), *Staphylococcus aureus* (10.9%), etc. At the Sino-Congolese Friendship Hospital, *E. coli* is the most isolated species, with a frequency of 37.1%, followed by *Klebsiella oxytoca* (13.3%), *Candida albicans* (10.4%), etc. At Kinshasa General Hospital, *E. coli* and *Staphylococcus aureus* are the most isolated species, with a frequency of 30.7% each, followed by Candida albicans (10.0%), etc.

The non-parametric Kruskal-Wallis test performed on the data from each hospital indicated that there was no significant difference ($p>0.05$). These results are an indication that health education in Kinshasa is not well controlled and therefore needs to be strengthened.

Compliance with ethical standards

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Disclosure of conflict of interest

Authors have declared that no competing interests exist.

Statement of informed consent

Informed consent was obtains by the managers of the above-mentioned hospitals on the basis of the forms, whose anonymity was privileged.

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