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Asymptomatic Bacteriuria in Kisangani Gestational Women: Prevalence and Germs Involved

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

Introduction: Urinary tract infection is a real public health problem. Asymptomatic bacteriuria, when not detected and treated, turns into pyelonephritis in 30 to 40% of cases, leading to both maternal and fetal complications, which would explain its high morbidity during pregnancy, especially in developing countries. Our objective is to determine the prevalence of asymptomatic bacteriuria and to identify the germs involved in Kisangani.
Methods: This is a descriptive, prospective, multi-site study conducted among 424 pregnant women in four health facilities in the city of Kisangani, all aged 14 to 45 years, received and followed in prenatal consultations from November 25, 2019 to June 25, 2020 and having given written informed consent to participate in the study. Cytobacteriological examination of urine was performed after collection of mid-morning urine in the laboratory of the University Clinics of Kisangani. The data collected were compiled using the Excel spreadsheet program (Microsoft, CDC, 2010) and then imported for analysis using the Epi Info software© 7.2.2.6 in its Stat Cal function.
Results: The prevalence of asymptomatic bacteriuria was 45.75%. Pregnant women between 20 and 34 years old had the most asymptomatic bacteriuria with 72.68%, pauci pares in 48.97% and in their second trimester of pregnancy in 61.34% of cases. 86.08% lived in a union, 60.82% were

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unemployed, 65.98% had secondary education, 50% had a low socioeconomic level and 48.97% had a history of cervico-vaginal infection. *Escherichia coli* and *Staphylococcus aureus* were the most frequently encountered germs.
Conclusion: Asymptomatic bacteriuria is a reality among pregnant women in Kisangani. *Escherichia coli* and *Staphylococcus aureus* are the most frequently encountered germs; screening and management on the basis of culture and antibiogram results are essential for maternal-fetal well-being.

Keywords: Asymptomatic bacteriuria; prevalence; pregnant women; germs; Kisangani.

1. INTRODUCTION

Urinary tract infection is a major public health problem. It is the second most common infectious disease in humans after respiratory diseases. It is one of the most common infections affecting about 100 million people worldwide, especially pregnant women [1,2]. According to the World Health Organization (WHO), *Escherichia coli* urinary tract infections are by far the most common infection in the hospital and community [3].

Urinary tract infection is the most frequent medical complication during pregnancy. It can be symptomatic and be marked by evocative clinical manifestations, or asymptomatic and where only urinary bacteriology can provide information on the diagnosis.
Asymptomatic bacteriuria is the presence of 10^5 bacteria/ml or more in the midstream urine without any physical symptoms such as dysuria, urinary frequency, burning and back pain [4].

Pregnant women have a high risk of developing a urinary tract infection due to anatomical changes, including direct compression of the urinary tract by the pregnant uterus, particularly on the right side (by dextro-rotation of the uterus). Physiological dilatation of the pyelo-caliceal cavities begins in the first trimester and increases progressively until the third trimester. As the uterus develops, the bladder takes on a more abdominal than pelvic position causing dysuria while the stretching of the ureters favors vesico-ureteral reflux and hormonal changes including progesterone which has a muscle relaxant action favoring ureteral stasis and increased bladder capacity. There are also changes in the physico-chemical properties of urine, the bactericidal acidity of urine could be decreased by the dilution of urine and the increase of its PH. Physiological immunodepression also favors the presence of bacteria in the urinary tract as well as contamination of the short urethra by gastrointestinal and perineal bacteria [1].

Asymptomatic bacteriuria may be associated with intrauterine growth retardation and premature delivery. Untreated, approximately 30-40% of these pregnant women develop pyelonephritis [5], which explains the high morbidity associated with asymptomatic bacteriuria during pregnancy, especially in developing African and Asian countries [6,7].

In view of the above, we wondered what were the prevalence and associated factors in pregnant women with asymptomatic bacteriuria in Kisangani?

2. METHODS

This was a descriptive cross-sectional study that took place from November 25, 2019 to June 25, 2020 in four health facilities in the city of Kisangani, capital of the province of TSHOPO, namely the Reference Health Center (CSR) of MATETE, the CSR Prince ALWALEED, the General Reference Hospital Makiso/Kisangani as well as the University Clinics of Kisangani. The data collection was prospective. Our study population consisted of all pregnant women who were seen and followed up during prenatal consultations in one of the facilities used for the study from the 1st to the 3rd trimester of pregnancy. Pregnant women were selected for the study if they met the following inclusion criteria: absence of clinical manifestations of urinary tract infection; no antibiotic therapy within 2 weeks prior to urine sampling for bacteriological analysis; urine sample collection and storage according to standards; informed consent to participate in the study. Four hundred and twenty-four were selected for analysis, of which 194 pregnant women were positive for asymptomatic bacteriuria.

The urine samples were analyzed at the laboratory of the University Clinics of Kisangani.

In fact, in the morning, after waking up, after water restriction and rinsing of the vulva with clean water and soap and then drying, the pregnant woman emitted a first jet of urine which was not collected in order to eliminate the saprophytic germs. A second stream of urine was collected in a sterile bottle and sent to the laboratory within one hour of collection, where the culture was performed directly.

On the first day, the urine samples were inoculated, then Gram staining was performed. Then, the samples were put on two culture media, including Chapman and Mac Conkey, which were used for the identification of germs such as enterobacteria or staphylococci.

On day 2, the reading was taken and colonies with 10^5 elements or more per milliliter of urine were considered positive.

Biochemical identification was performed where pure colonies on Mac Conkey were transferred to Le Minor's gallery to determine their biochemical characteristics. This gallery is composed of 3 tubes containing the following media.

- The medium of Kligler Hajna which informs on the following biochemical characters, namely the fermentation of glucose which can be read on the pellet. This reaction is said to be positive if the medium which was red at the beginning becomes yellow. The fermentation of lactose which can be read on the slope. It is said to be positive if the medium which was red at the beginning becomes yellow. The production of hydrogen sulphide which results in the blackening of the medium. The production of gas is characterized either by the presence of air bubbles in the medium or by its fragmentation, or by the rise of this one.
- Simmons' Citrate medium: if the bacteria use citrate as a carbon source, the medium that is green at the beginning will turn blue.
- The MIL environment (Mobility-Indole-LDC):

The mobility of the bacteria is reflected in the turbidity of the medium;

The indole reaction was sought by adding two or three drops of Kovac's reagent to the medium. This reaction was said to be positive when the halo formed on the surface of the medium was red and negative when this halo remained yellowish.

Note that the initial color of the Mil medium is purple and the non-turn of the medium before the addition of Kovac's reflects a positive result, and its turn to yellow a negative result.

When Mac Conkey was negative because of the presence of Gram+ bacteria, catalase was tested.
The principle is that some aero-anaerobic bacteria possess catalase which is an enzyme that breaks down hydrogen peroxide into oxygen and water. When the bacteria is catalase positive, i.e. has the enzyme catalase, the mixture with the peroxide releases oxygen by the immediate appearance of air bubbles in the form of foam.

When nothing was observed, the bacteria did not possess the enzyme.

This allowed us to identify the Staphylococcus in case of catalase +.

On day 3, the MSA. The selectivity of this medium is based on the presence of sodium chloride which inhibits most Gram+ and Gram- bacteria.

The differentiation of Staphylococci was based on their ability to ferment or not mannitol. If fermentation occurs, it induces an acidification which leads to a yellow coloration of the medium in the presence of phenol red (pH indicator).

We also had the DNase test. Some bacteria have Deoxyribonuclease which is an enzyme that hydrolyzes the deoxyribonucleic acid present in the medium. The result was positive when there was a clear halo around the bacterial growth streak.

If there was no clear halo, the result was negative.

On the 4th day, the antibiogram was performed. The principle is that when the antibiotic disk is deposited on the surface of the culture medium, the antibiotic diffuses by creating a concentration gradient. The bacteria seeded on this medium came into contact with varying concentrations of antibiotic.

For an antibiotic concentration higher than the minimum inhibitory concentration (MIC), its

growth was stopped. Inhibition was expressed by a circular zone where there was no visible growth (absence of colonies). The diameter of this zone was proportional to the sensitivity of the strain towards this antibiotic.

The reading of the antibiogram is done after incubation, zones of inhibition of variable diameters appear around some discs, the results are compared to the critical values of the antibiogram tables.

- Sensitive: if the inhibition diameter is less than the critical concentration diameter.
- Intermediate: the diameter of inhibition (corresponding to the MIC) greater than the diameter of the critical concentration.
- Resistant: if the inhibition diameter is between the critical concentration diameters [8].

The compilation of the collected data was done through the Excel software spreadsheet (Microsoft, CDC, 2010) and then imported for analysis using the Epi Info software© 7.2.2.6 in its Stat Cal function.

3. RESULTS

From Table 1, it can be seen that the prevalence of asymptomatic bacteriuria was 45.75%.

Table 2 shows that 72.68% of our respondents were between the ages of 20 and 34; 86.08% were in a union; 60.82% were unemployed; 48.97% resided in the commune of Makiso; 65.98% had a secondary education; and 50% were poor.

Table 3 shows that 48.97% of our respondents were pauci pares and 61.34% were in their second trimester of pregnancy; 3.11% had a history of PMR and 48.97% had a history of cervico-vaginal infection.

Escherichia coli was the most frequent germ in 36.08% followed by coagulase positive Staphylococcus in 21.13% of cases.

Table 1. Prevalence of asymptomatic bacteriuria

	N	%	95% CI
Positive culture	194	**45,75**	41,07-50,51
Negative culture	230	54,25	49,49-58,93
Total	424	100	

Table 2. Socio-demographic characteristics

Variables	N	%	95% CI
Age (years)			
<20	27	13,92	9,38-19,60
20-34	141	**72,68**	65,84-78,82
≥35	26	13,40	8,95-19,02
Marital status			
In union	167	**86,08**	80,40-90,62
Single	27	13,92	9,38-19,60
Occupancy			
With employment	54	27,84	21,65-34,71
Unemployed	118	**60,82**	53,58-67,74
Student	22	11,34	7,24-16,66
Level of education			
Without	2	1,03	0,13-3,67
Primary	29	14,95	10,25-20,76
Secondary	128	**65,98**	58,85-72,61
Superior	35	18,04	12,90-24,19
Socio-economic level			
Poorer	6	3,09	1,14-6,61
Poor	97	**50,00**	42,75-57,25
Medium	68	35,05	28,36-42,21
Rich	23	11,86	7,67-17,26

Table 3. Gyneco-obstetrical profile

	N	%	95% CI
Parity			
Nullipare	31	15,98	11,12-21,91
Pauci pare	95	**48,97**	41,74-56,23
Multipare	58	29,90	23,55-36,87
Large multiparous	10	5,15	2,50-9,28
Gestational age			
1er quarter	9	4,64	
2ième quarter	119	**61,34**	
3ième quarter	66	34,02	
RPM			
Yes	6	**3,11**	1,15-6,64
No	188	96,89	93,36-98,85
Cervico-vaginal infection			
Yes	95	**48,97**	41,74-56,23
No	99	51,03	43,77-58,26

Table 4. Germs found in urine culture

Germs	N	%	95% CI
E. coli	70	**36,08**	29,33-43,27
Enterobacter	39	20,10	14,70-26,44
Citrobacter	30	15,46	10,68-21,33
Pseudomonas	17	8,76	5,19-13,66
Klebsiella	10	5,15	2,50-9,28
Providencia	5	2,58	0,84-5,91
Eduarsella	1	0,52	0,01-2,84
Coagulase positive staphylococcus	41	**21,13**	15,61-27,56
Coagulase-negative Staphylococcus	30	15,46	10,68-21,33

4. DISCUSSION

The prevalence of asymptomatic bacteriuria observed during our study in Kisangani was 45.75%. 72.68% of our respondents were between 20 and 34 years of age; 86.08% were in union; 60.82% were unemployed; 48.97% resided in the municipality of Makiso; 65.98% had secondary education and 50% were poor. 48.97% of our respondents were poor and 61.34% were in their second trimester of pregnancy; 3.11% had a history of PMR and 48.97% had a history of cervico-vaginal infection. Escherichia coli was the most frequent germ in 36.08% followed by coagulase positive Staphylococcus in 21.13% of cases.

The prevalence of AD in Kisangani is close to that found in Benin by Erhumwunse et al.. which was 45.3% [9] and that of Ajayi et al. [10]; as well as Olusanya et al. [11] in Nigeria which were 49% and 52% respectively. It is also close tao that of Thapa in Nepal in Asia which was 42% [12]. Our prevalence is lower than those found in Nigeria by Okon K et al. [13] which was 63.3%, Akerele et al. [14] which was 86.6% as well as that of Oladeinde et al. [15] in Nigeria which was 55%. On the other hand, it is high compared to the prevalences found in Egypt by Abdelaziz et al. [16], in Ghana by Labi [17], in Ethiopia by Tadesse et al. [18], in Cameroon by Mokube [19], in Uganda by Andabati et al. [20], in Tanzania by Masinde et al. [21], in Kenya by Adelaide et al. [22], and in DRC by Gatti [23].

The difference observed in different studies could be attributed to geographical variations, socio-economic level, as well as social habits, much more to health education which differs from one environment to another.

Pregnant women aged 20-34 years were in the majority in our study with 72, 68%. Several studies have found that age is a risk factor for asymptomatic bacteriuria. Derese et al. [24] in Ethiopia and Sibi et al. [25] in India had found the age range of 25 to 34 years. Sharifa et al. [26] in Saudi Arabia, Manjula et al. [27] in Karnataka

and Thairu et al. [28] in Nigeria found age to be a risk factor for AD.

In contrast, Jennifer et al. [29] in Sri Lanka, Thapa et al. [12], Enayat et al. [30] in Iran as well as Hamdan et al. [31] in Sudan and Adelaide et al. [22] in Kenya had found that patient's age was not a risk factor for BA.

Of the occupation of our patients, 60.82% of them were unemployed; 65, 98 were of secondary education and 50% were poor. Several studies around the world confirm low socioeconomic level as a risk factor for AD. This is the case of the studies by Derese et al. [24], Oli et al. [32], Okon et al. [13] in Africa; as well as Thapa et al. [12] and Haider et al. [33] in Asia.

Thapa et al. [12] had found that unemployed women were a risk group for BA.

Regarding parity, 48.97% of our respondents were poor, 29.9% were multiparous and 5.15% were large multiparous. In the series by Stenkvist et al. [34], the cumulative incidence was 2% in wealthy multiparous patients, but reached 11% in poor multiparous women.

Among our respondents, 61.34% were in their second trimester of pregnancy. Regarding gestational age, Manjula et al., Okon et al., Thairu et al. had found a significant association between gestational age and BA [27, 13, 28]. Physiological dilatation of the excretory tract begins in the late first trimester and increases until the third trimester of pregnancy. Hormonal changes, progesterone having a muscle relaxant action would also favour ureteral stasis and an increase in bladder capacity. Changes in the physicochemical properties of urine and physiological immunodepression would also favor the presence of bacteria in the urinary tract. Studies on UTI in Nepal, India, Pakistan and Nigeria have found that parity is a risk factor for UTI. It appears that multiparity predisposes pregnant women to UTI [12, 27, 28, 33].

In contrast, several studies have found that parity is not a risk factor for BA.

Regarding the germs frequently encountered, enterobacteria are the most common with *Escherichia coli* (36.08%) followed by *Staphylococcus aureus* (21.13%). Labi et al. [17], Oladeinde B et al. [15], Andabati et al. [20] had also found *Escherichia coli to be* the common germ causing BA. Ajayi et al. found that *Staphylococcus aureus* was the most common germ in 72% of cases [10].

Our results corroborate those of the World Health Organization (WHO), according to which Escherichia coli urinary tract infections are by far the most frequent in the hospital and in the community [3].

5. CONCLUSION

Asymptomatic bacteriuria is a reality for pregnant women in Kisangani. *Escherichia coli* and *Staphylococcus aureus* are the germs frequently encountered. Screening during pregnancy followed by treatment based on the results of the antibiogram for positive pregnant women is essential for maternal-fetal well-being.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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