Factors associated with nosocomial urinary tract infections in maternity wards of public hospitals in Lubumbashi in DR Congo

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Abstract
Introduction: Nosocomial urinary tract infection represents between 30 and 50% of all these nosocomial infections. It occupies the first place and constitutes the third entry point for bacteremia. The objective of our study was to identify the risk factors associated with nosocomial urinary tract infections in maternity wards of public hospitals in Lubumbashi.

Method: We carried out an analytical cross-sectional study in which the population consisted of parturients who did not have a urinary tract infection on admission. The urine samples were taken and analyzed in the laboratory of the university clinics of Lubumbashi. A case of nosocomial urinary tract infection was defined according to the WHO definition. To collect this urine, the parturients did it themselves after a health education session. Two samples were taken, one at the entry and the other at the exit of the parturient from the maternity hospital. The univariate analysis used the prevalence ratio as an indicator of risk with a 95% confidence interval and the bivariate analysis included all risk factors that had a significance level $p < 0.05$ by a regression model binary logistics.

Results: Out of the total of 1240 parturients selected and who were distributed in seven maternities of public hospitals in the city of Lubumbashi. It was noted that women who gave birth at HGR Kampemba were up to ten times more likely to develop nosocomial urinary tract infection than those who did at HGR Kisanga. An association was observed between delivery with complications ($p = 0.032$), long length of stay ($p < 0.001$), delivery with surgical intervention ($p < 0.001$) and antibiotic therapy ($p = 0.020$).

Conclusion: Nosocomial urinary tract infections were varied depending on the characteristics of health structures, characteristics of parturients and health care. It is necessary to improve the hospital hygiene of the personnel, the hospital environment and the materials as well as a good policy of use of the antibacterials.

Keywords: Nosocomial urinary tract infection, associated factor and Lubumbashi

Introduction
Several studies have already shown that the risk of contracting an infection during health care is 2 to 20 times higher in low-income countries [1] such as the DRC than in high-income countries. In some low-income countries the proportion of patients with a healthcare associated infection may exceed 25%, while in other countries it is even unknown due to the scarcity of data in this topic [1-2].

Patients admitted to modern hospitals in developed countries contract between 5 and 10% of these nosocomial infections. In the United States of America, for example, 1 in 136 hospitalized patients contract a nosocomial infection, which is equivalent to 2 million cases and nearly 80,000 deaths each year. In England, more than 100,000 cases of infections resulting from health care lead to more than 5,000 deaths per year, directly attributable to nosocomial infections. In Mexico, an estimated 450,000 cases of health care-related infections cause 32 deaths per 100,000 population each year. Compared to the annual cost of these infections, it is estimated at one billion pounds sterling in England, 4.5 to 5.7

billion USD in the United States of America and 1.5 billion USD in Mexico [1-2].

In terms of frequency, nosocomial urinary tract infection represents between 30 and 50% of all of these nosocomial infections. It ranks first among nosocomial infections and is the third entry point for bacteremia. The most often isolated germ is Escherichia Coli, but the flora is changing and the ecological distribution is constant changing. They are observed in many medical, surgical or rehabilitation specialties of adults or the elderly [3-4].

In the DRC, particularly in Lubumbashi, the prevalence of nosocomial urinary tract infections was estimated at 17% of the total infection in a study carried out in 2010 at the University Clinics of Lubumbashi and at the Jason Sendwe General Reference Hospital [5].

In the previous chapters, we found that the hygienic conditions of these hospitals were not good and that multi-resistant germs were found on hospital surfaces. The incidence of nosocomial urinary tract infections was 14.4%. Germs such as Escherichia Coli, Pseudomonas Aeruginosa, Citrobacter freudii, Enterococcus aureus, Acinonobacter baumannii, and Staphylococcus aureus were germs involved in these infections. The germs found at the same time on the surfaces as in the biological fluids of the parturients were of the same strains [5].

Nosocomial infections constitute a public health problem, not only because of the prolongation of hospital stays, the financial cost they generate, but also and above all the deaths they cause [6-7]. In view of the results obtained in our previous studies on the hospital environment and on the incidence of urinary INs and operating sites; which stipulate that this hospital environment is contaminated with multi-resistant bacteria, with health personnel who are not trained in hospital hygiene and are not sufficiently protected against the risk of AES. Likewise with a high incidence of nosocomial urinary tract infections caused by once again multi-resistant bacteria producing beta-lactamase.

Study hypothesis
Our hypothesis is summed up by a statement such that factors associated with the environment, health care and pregnancy are risk factors for nosocomial urinary tract infections in maternity wards of public hospitals in Lubumbashi.

Goal of the study
It is for this reason that we carried out a study which aimed to identify the risk factors associated with nosocomial urinary tract infections in these maternities.

Materials And Methods
Type of study
We carried out an analytical cross-sectional study using the data collected for the incidence study. The data were collected for a longitudinal study presented in chapter five of this thesis and were used to study the risk factors associated with urinary tract infection.

Population, inclusion and exclusion criteria for the study
The target population of our study was made up of parturients who stayed in these maternities, while the source was made up of women who met the inclusion criteria, in particular who did not have a urinary tract infection on admission.

Were included in our survey, all the women who gave birth in the maternity wards of public hospitals in Lubumbashi and who were selected in our first incidence survey. They are women whose first urine sample taken before the 12 hours of the hospital stay was negative for a urinary tract infection. All women who had a urinary tract infection on admission were automatically excluded from this group.

Data collection and definition of study variables
The census of the study population was carried out according to the inclusion and exclusion criteria. Data collection was carried out exhaustively in all pregnant women from admission to discharge.

The dependent variable was nosocomial urinary tract infection, while the socio-demographic and obstetrical parameters of the parturients, and the factors of the hospital environment were explanatory or independent variables for which a statistical association was sought.

Data collection tools and techniques
Of the 7 maternities 1482 Parturientes were recruited, 1281 were free from infection at the start of the study and were included in the study. 153 of them had urinary tract infection before the start of the study and were excluded in the second phase. 41 refused the second sample or left before 72 hours and 1240 parturients made up the size of the population in our study, i.e. an acceptance rate of 96.8%.

As we pointed out at the beginning, the data collection technique for this study is that of Chapter Five. Urine samples were taken and analyzed at the CUL laboratory to confirm the existence of the infection, identify the germs involved and then study the antibiogram in the urine of parturients. A case of nosocomial urinary tract infection was defined according to the WHO definition, in particular: "positive urine culture (one or two species) with at least 105 bacteria / ml, with or without clinical symptoms [9-10].

Analysis and interpretation of results
Data were analyzed using STATA 13 software and we used standard statistics to describe our samples and calculate frequency measurements. The association between the potential exposure factors and the occurrence of nosocomial urinary tract infections was sought by calculating a 95% confidence interval.

The ratio of the prevalence of nosocomial urinary tract infections was calculated by relating the number of parturients whose first urinalysis on admission was negative (free from urinary tract infection at entry) to the denominator and the number of cases of urinary tract infection at second scan (discharge) to the numerator during the study period. Univariate analysis used the prevalence ratio as an indicator of risk. Bivariate analysis included all variables that were significant at the significance level $p < 0.05$ and used binary logistic regression.

Results

We identified 1240 parturients distributed in seven maternities in public hospitals in the city of Lubumbashi, including the Lubumbashi University Clinics (20.3%), the Kenya General Reference Hospital (19.6%), the General Hospital Kisanga Referral Hospital (18.3%), Katuba General Referral Hospital (15.8%), Sendwe General Referral Hospital (12.4%), SNCC Hospital (7.1%) and the Kampemba General Reference Hospital (6.5%). The parturients were mostly living in the municipality of Katuba (35%), Kampemba (21.4%), followed by Kenya (16.2%), Lubumbashi (14.5%), Annex (6.4%), Kamalondo (4.4%) and Rwashi (2.7%). Compared to age 11.5% of parturients were less than 20 years old, 71.5% were between 20 and 34 years old, and 16.9% were greater than or equal to 35 years old and several women were married (90.7%). In relation to the level of study, 11.4% had a high level (university), 50% an average level (secondary) and 38.6% a low level (primary). Those who mainly took care of housework were in the majority (59.7%), 34.3% were in charge of liberal activities and public service and private companies.

The median parity was three children per woman, the median gestational age was 38.5 weeks amenorrhea, 24.4% of parturients gave birth with complications including prematurity (10%), breech presentation (15 %), a pelvis that is too narrow (6.7%), maternal hemorrhage (20%), excessive fetal distress (30%), multiple pregnancy (8.3%), placenta previa (6.7 %), preeclampsia (3.3%). To remedy these complications, 18.5% underwent a procedure including episiotomy (15.7%) and cesarean section (84.3%). In relation to treatment, 83.9% of the infected parturients had received an antibiotic, namely amoxicillin, ampicillin, gentamicin combined with ampicillin and ciprofloxacin. The length of hospitalization was for half (50.4%) of parturients from 4 to 7 days, 24.0% between 1 to 3 days, 9.6% between 8 to 10 days, 8.6% between 11 to 14 days and 7.4%, 15 days or more. Regarding invasive devices, 79.5% of parturients had an invasive device, particularly a venous catheter, and 61.7% had an evacuation catheter. More than a third of these parturients had an individual history, including diabetes, immunodeficiency and malaria. Regarding also the place of accommodation of parturients, 97.1% of parturients were hospitalized in a common room.

Table 1 : Prevalence of nosocomial urinary tract infections according to the health facilities of origin

Variables	Workforce	Prevalence (%)	PR	95% CI	p
Health training					<0.001
HGR Katuba	210	10.0	3.0	1.3-7.0	
ASS	251	14.7	4.7	2.2-10.4	
SNCC Hospital	88	13.6	4.3	1.7-10.9	
HGR Kampemba	67	26.9	10.0	4.1-24.5	
HGR Sendwe	154	16.9	5.6	2.4-12.6	
HGR Kenya	243	23.0	8.1	3.8-13.4	
HGR Kisanga	227	3.5	1		

In this table, it appears that nosocomial urinary tract infection had varied depending on the health structure, it was noted that women who had given birth at the HRH Kampemba had up to ten times the risk of developing a nosocomial urinary tract infection than those who had it done at HGR Kisanga.

Table 2 : Prevalence of nosocomial urinary tract infections according to parity, age of the pregnant woman, civil status of parturients and type of hospital room

Variables	Workforce	Prevalence (%)	PR	95% CI	P
Parity (number)					0.19
1	444	11.9	1.0		
2 -4	522	15.9	0.7	0.4-1.3	
≥ 5	274	15.3	0.6	0.3-1.3	
Pregnant's age (year)					0.77
≤ 20	143	16.1	1.1	0.7-1.7	
20 -34	887	14.3	1		
≥ 35	210	13.3	0.9	0.6-1.4	
Marital status of the pregnant woman					0.89
Not married	115	13.9	0.9	0.6-1.6	
Married	1125	14.4	1.0		

Hospitalization room					0.08
Single bedroom	69	7.2	1		
Common room	1171	14.8	2.2	0.9-5.6	

From this table, it emerges that nosocomial urinary tract infection did not vary according to parity, the age of the pregnant woman and the marital status of the parturients.

Table 3 : Prevalence of nosocomial urinary tract infections according to gestational age, types of childbirth, length of stay and types of intervention

Variables	Workforce	Prevalence (%)	PR	95% CI	P
Gestational age (SA)					0.25
<32	63	14.3	0.9	0.5-1.9	
32 - 34	85	11.8	0.8	0.4-1.4	
35-37	43	4.7	0.3	0.1-1.2	
≥ 38	1049	15.0	1		
Type of childbirth					0.032
With complication	302	10.6	1.0		
Without complication	938	15.6	0.6	0.4-0.9	
Type of complications					0.06
Hemorrhage	22	4.5	÷		
Other complications	282	11	÷		
Length of stay (day)					<0.001
1-3	297	14.5	1		
4-7	625	18.7	1.4	0.9-1.9	
8-10	119	8.4	0.5	0.3-1.1	
11-14	107	4.7	0.3	0.1-0.8	
≥ 15	92	3.3	0.5	0.2-1.8	

An association was observed between nosocomial urinary tract infection and: delivery with complications (p = 0.032), long stay (p <0.001)

Table 4 : Prevalence of nosocomial urinary tract infections according to the characteristics of the health care administered

Variables	Workforce	Prevalence (%)	PR	95% CI	p
Wearing an invasive device					0.44
No	986	19.1	1.0		
Indwelling probe	30	30.0	2.0	1.1-4.9	
Evacuation probe	69	21.7	1.4	0.8-2.6	
Catheter	155	21.9	0.8	0.5-1.3	
ATB resistance					0.020
Yes	1041	15.4	1.8	1.1-3.0	
No	199	9.0	1		
Type of interventions					<0.001
Without intervention	1011	12.7	1		
Episiotomy	193	24.4	2.2	1.5-3.2	
Cesarean	36	8.3	0.6	0.1-2.0	

From this table which presents the prevalence of nosocomial urinary tract infections according to the characteristics of the healthcare administered, we noted a variation of nosocomial urinary tract infection with resistance to antibiotics (p = 0.020) and delivery with intervention (p <0.001).

Discussion

To compare our results with those in the literature, we have taken into account three types of results obtained throughout this chapter: in fact, as risk factors for urinary INs, we have retained that the factors related to the characteristics of structures conditions such as the condition of the Kampemba General Reference Hospital, factors linked to parturients such as gestational age and factors linked to the health care administered to parturients, such as antibiotic therapy and the duration of stay were risk factors for these infections.

Women who gave birth at HGR Kampemba were up to ten times more likely to develop a nosocomial urinary tract infection than those who did at HGR Kisanga.

An association was observed between delivery with complications (p = 0.032) and the presence of nosocomial urinary tract infection. This will consequently influence the long duration of stay (p <0.001). Another association was also observed between childbirth with surgical intervention, particularly cesarean section (p <0.001), resistance to antibiotics (p = 0.020) andthe presence of nosocomial urinary tract infection. This can be explained by the fact that the infrastructures of the HGR Kampemba are not adapted to house a second level hospital, because the hygienic conditions are deplorable not only by the smallness of the premises, but also of very advanced dilapidation of the toilets.

In the literature, the most frequent infections are urinary tract infections, generally found in patients probed, followed by infections of the surgical sites after cesarean section, endometritis and episiotomy [11-12]; in accordance with our results which support a period prevalence of 14.4% of urinary tract infections, which is the highest prevalence of the two types of infections studied previously.

Our study reported more nosocomial infections in the groups of patients with an invasive device, but no association was observed.

El Rhazi, found that patients who stayed three weeks or more in hospital were more at risk of developing a nosocomial infection than patients with a stay of less than three weeks [13]. Stay was a risk factor not only in our study but also in that of El Rhazi [13] and Kasongo and Mbutshu [5-6]. Our results corroborate those of these authors, since all these studies were carried out in Africa in general and in the same environment, particularly that of Kasongo et al [5].

The other studies have found that children with anemia or malnutrition were much more likely to develop a nosocomial infection [10]. The same goes forpatients over 60 years old (32.9%) [3, 14-17]. This could be explained by the decrease in immune defenses at this age. However, our study having included women who were in the maternity hospital, women of 60 years old were automatically excluded, as were cases of anemia and malnutrition, the propor-

tion of which was not significant and no association was observed.

Conclusion

Ultimately, the factors linked to the characteristics of health structures, factors linked to parturients and factors linked to the health care administered to parturients constitute the risk factors associated with nosocomial urinary tract infection in the maternities of public hospitals in Lubumbashi.

Thus, women who had given birth at HGR Kampemba whose environmental conditions are precarious have up to ten times the risk of developing a nosocomial urinary tract infection than those who did at HGR Kisanga.

Complicated childbirth and long length of stay, delivery with intervention and resistance to antibiotics were associated with the prevalence of these nosocomial urinary tract infections in maternity wards of public hospitals in Lubumbashi.

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