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Bacteriology of Healthcare-Associated Infections in the Gynecology and Obstetrics Department of CHU Gabriel Touré

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Abstract

Introduction: Healthcare-associated infections (HAIs) are a public health issue. An infection is said to be associated with the care if it occurs during or after the care of a patient, and if it was neither present nor incubation at the beginning of the care. **Objective:** The purpose of this work was to study the bacteriology of infections associated with obstetric care in the gynecology-obstetrics department of CHU Gabriel Touré. **Patients and Methods:** This is an epidemiological, descriptive, analytical study conducted in the gynecology-obstetrics department of the CHU Gabriel Touré, from April 11th, 2016 to August 29th, 2016 (5 months). Data collection focused on the clinical and laboratory characteristics of healthcare-associated infections in patients during their hospitalization. Included in the study were any patients hospitalized in the Gynecology and Obstetrics Department who agreed to participate in the study. The criteria used to diagnose the associated infection were those of the Atlanta CDC. Operative wound monitoring was done up to the 30th postoperative day. **Results:** We have recorded 200 patients, out of whom 138 were operated on and 23 cases of bacterial infection associated with care (11.50%). The average age of the patients was 32.52 years ± 13.36 years against 29.36 years ± 10.28 years for the patients who did not present the infection. Seven point five percent of the evacuated patients had an infection associated with care. The most common types of infection were surgical site infection (60.86%), urinary tract infection (26.08%), endometritis and sepsis

with 13.04% each. The isolated organisms were all resistant to Amoxicillin, to Amoxicillin + Clavulanic acid (88.88%) and to Ciprofloxacin (77.77%). The average duration of hospitalization for patients who developed the infection was 14.70 days. The lethality was 1.50%. The average cost of management of patients who developed the surgical site infection was 119,837 FCFA. **Conclusion:** The bacterial infections associated with the care remain frequent in our service and dominated by the infections of the operating site. Isolated organisms were all resistant to amoxicillin in 88.88% case ciprofloxacin.

Keywords

Bacterial Infection, Resistances, Gabriel Touré University Hospital, Antibiotics, Obstetrics

1. Introduction

An infection is said to be associated with the care (HAI) if it occurs during or after the care of a patient, and if it was neither present nor incubation at the beginning of the care. They constitute a public health issue. For operative site infections, HAI is defined as infections occurring within 30 days of surgery or if an implant or prosthesis is implanted within one year of surgery [1]. They are responsible for an increase in morbidity, mortality, hospital stay and patient care costs [2]. The WHO estimates that an average of 190 million people is hospitalized each year around the world and that 9 million people are infected with the disease [3]. Approximately 1 million patients die each year from these care associated infections [3]. In sub-Saharan Africa, the rate of infection associated with care is estimated at 40% of hospitalizations [2] [4]. HAI risk factors are in the order of three categories: patient-related factors, environmental factors, and medical practice factors [5]. In France, there are 15 million hospitalizations per year with 800,000 cases of nosocomial infections per year among which 4000 deaths per year are attributable to nosocomial infections with an estimated annual cost of 800 million euros [6]. The frequency of infections associated with care is 4.50% in the USA; 10.50% in Canada; 6.70% in France and 6.20% in Belgium [7] [8]. The risk of contracting an infection during health care is 2 to 20 times higher in developing countries than in developed countries. In Albania, the frequency was 19.10%; in Brazil, it is 14.00%; in Tunisia, it is 17.80% and 14.00% in Tanzania in 2009 [7]. A study conducted in Morocco in 2006 showed an infection rate of 17.80% [9]. In Mali, in 2011, a frequency of 14.00% was reported in the General Surgery Department of the University Hospital Gabriel Touré [10].

At the Gabriel Touré Teaching Hospital, few studies have been carried out on bacterial infections associated with care. We did not find a study in obstetrics in the department of gynecology-obstetrics hence the interest of our study.

2. Material and Methods

This is an epidemiological, analytical study, from April 11th, 2016 to August 29th,

2016 (5 months) with prospective data collection that focused on the clinical and biological characteristics of infections associated with obstetric care. Included in the study were any hospitalized patients (operated or not) in the gynecology obstetrics department, who agreed to participate in the study. The criteria used to diagnose the associated infection were those of the Atlanta CDC (See Table 1). A content analysis of the records, anesthesia cards and registers has permitted to complete the patient data.

A monitoring of operative wounds was performed every three days up to the 30th day post-procedure. Nosocomial infection was identified according to the criteria defined by C.D.C of Atlanta (Center for Diseases Control). A sample was made for each type of infection. These samples were sent directly to the private laboratory of medical biology "PA & KA".

The incremental cost of healthcare-associated infection was calculated from supplementary exam bills and prescription invoices for the purchase of antibiotics and dressing materials.

The data was entered into a Microsoft Excel 2010 database and analyzed on the Epi-Info software (version 7.0). The graphics were made using Microsoft Excel software. The chi2 test was used for the comparison of qualitative variables. The threshold of significance was set for $p < 0.05$.

The number of patients to be included was calculated based on the frequency of healthcare-associated infections. The sample size was calculated according to the formula below:

$$N = 4(p \cdot q)/I^2 .$$

P = Frequency of infection obtained previously.

$Q = 1 - P$.

I = risk of error.

4 = a constant about $E^2 = (1.96)^2$. The maximum size of the sample will be 200 patients.

3. Results

3.1. Frequency

We have collected 200 patients out of whom 23 patients developed a bacterial infection (11.50%). The infections associated with obstetric care were: operative site infection (60.87%), urinary tract infection (26.08%), endometritis and sepsis (13.04% each) and peritonitis (8.70%).

3.2. Socio-Demographic Data (See Table 2 and Table 3)

The average age of patients with an infection associated with obstetric care was 32.52 ± 13.36 years.

Housewives with a HAI accounted for 14.00% of the sample versus 30.00% for civil servants. In our study, 22.00% of patients with low income had a HAI compared to 7.00% whose income level was high.

Table 1. Operational criteria of nosocomial infections according to Atlanta CDC.

Type of infection	Clinical and/or radiological criteria	Bacteriology	Minimum criteria for the diagnosis
Infection of operative site	- Pus (1) - Runny sero-bloodstream (2) - Redness and/or warm (3) - Fever > or = 38˚C (4)	- Positive urine culture (18)	1 2 + 18 3 + 18
Urinary tract infection	- Low back pain - or suprapubic (5) - Dysuria or pollakiuria (6) - Fever > or = 38˚C - Orchills (7)	- Positive urine culture (>105 Germs/ml) (19) - two positive urine cultures (20)	5 + 6 + 7 5 + 7 + 19 6 + 19 20
Pulmonary infection	- Fever (8) - Cough (9) - Purulent expectoration or secretion (10) - Signs of home examination (11) - Clinical signs of pleural effusion (12) - Radiological image of pneumonitis or abscess (13)	Isolation of pathogen in expectoration products And or in the blood (21)	- 11 + three other criteria 13 + three other criteria two criteria after ndotracheal manoeuvres (Ex: 8 + 9, 9 + 10…)
Infection on catheter	- Pus (14) - Runny sero-bloodstream (15) - Redness and/or warm (16) - Fever ≥ 38˚C disappearing at catheter removal (17)	- Positive urine culture (22)	

Table 2. Distribution according to the age group.

Age group	Infection		Total (%)
	YES (%)	NO (%)	
[14 - 24]	05 (4.77)	60 (95.23)	65 (32.50)
[25 - 34]	08 (8.89)	82 (91.11)	90 (45.00)
[35 - 45]	08 (21.62)	29 (78.38)	37 (18.50)
[46 - 70]	09 (60.00)	06 (40.00)	15 (7.50)
Total	23 (11.50)	177 (88.50)	200 (100)

Table 3. Distribution according to the level of income of the patient.

Level of income	Infection		Total (%)
	YES (%)	NO (%)	
Low	14 (22.00)	50 (78.00)	64 (32.00)
Middle	06 (11.00)	50 (89.00)	56 (28.00)
High	03 (07.00)	39 (93.00)	42 (17.50)
Total	23 (11.50)	177 (88.50)	200 (100)

3.3. Risk Factors (See Table 4)

Nineteen percent of patients who stayed in the 3rd-class of hospital wards reported healthcare-associated infection versus 4.00% of patients admitted to 1st-class wards.

Table 4. Distribution according to the category of hospitalization.

Category hospitalization	Infection		Total (%)
	with (%)	without (%)	
1st class	01 (4.00)	24 (96.00)	25 (12.50)
2nd class	03 (7.15)	39 (92.85)	42 (21.00)
3rd class	26 (18.57)	114 (81.43)	140 (70.00)
Total	23 (11.50)	177 (85.50)	200 (100)

Patients admitted in an emergency context presented a HAI in 7.50% versus 3.00% for patients received outside the emergency (RR = 4.1250 and P < 0.05).

Twenty-two percent of patients classified as American Society of Anesthesiologists (ASA) III presented a HAI versus 14.00% for those classified as ASA I (RR = 7.53, P = 0.000). The patients who developed the infection were overweight in 60.00% of cases versus 8.00% of patients with normal weight.

Twenty percent of our patients with anemia developed HAI compared to 7% of patients without anemia (P = 0.0000).

The diagnoses of the patients were the high blood pressure associated with the pregnancy in 28.00%, the uterine fibroma 11.50% and the Placental retro hematoma (PRH) in 10.00%.

In our study, 138 patients have undergone surgery, of which 78.50% were performed in emergencies versus 21.50% for scheduled interventions. The rate of infection associated with care was 7.00% for non-programmed interventions versus 3.50% for programmed interventions (P: 0.57, RR: 1.28).

Among the patients who underwent general anesthesia, 15.00% presented a HAI versus 6.00% for the so-called locoregional technique.

In our study, 45.00% of patients in whom the procedure lasted more than 90 minutes had a healthcare-associated infection.

Forty percent of patients with the National Nosocomial Infections Surveillance (NNIS) 2 Score experienced a care-associated bacterial infection versus 10.00% for NNIS 0 patients.

Healthcare-associated infection occurred in 32.00% of patients who had a bladder catheter versus 5.00% in bladder-free patients (P: 0.0001, RR: 6.6667).

A care-associated infection was diagnosed in 47.00% of transfused patients versus 8.00% in non-transfused patients (P: 0.0001, RR: 4.2721).

Patients who received prophylactic antibiotic prophylaxis based on Amoxicillin developed a care-associated infection in 11.00% versus 23.50% for patients who did not receive (P: 0.027, RR: 4816).

3.4. Type of Healthcare Associated Infection and Germs in Origin (See Table 5; Figure 1, Figure 2)

Infection of the surgical site is an obsession for any surgeon to ensure a simple operation. Sixty point eighty-seven percent of the patients who have undergone surgery developed an infection of the operative site and the average time to onset

Table 5. Type of infections associated to care.

Type of infection	Frequency	Percentage
Sepsis	03	13.04
Endometritis	03	13.04
Urinary tract infection	06	26.08
Peritonitis	02	08.70
OSI	14	60.87
Total	23	100

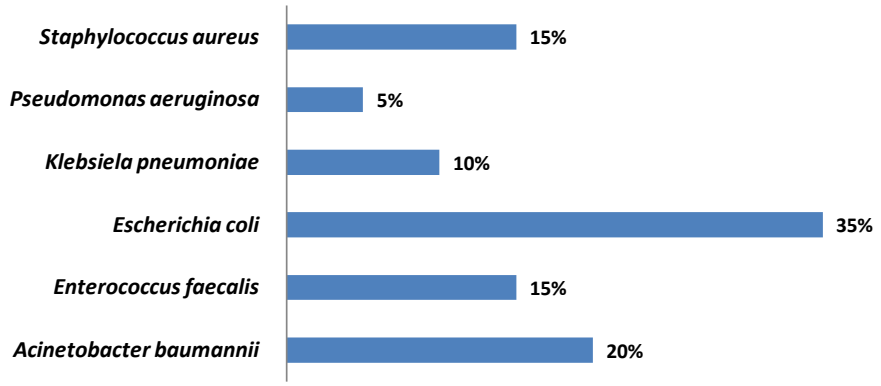

Figure 1. Isolated germs in bacterial examination of the pus.

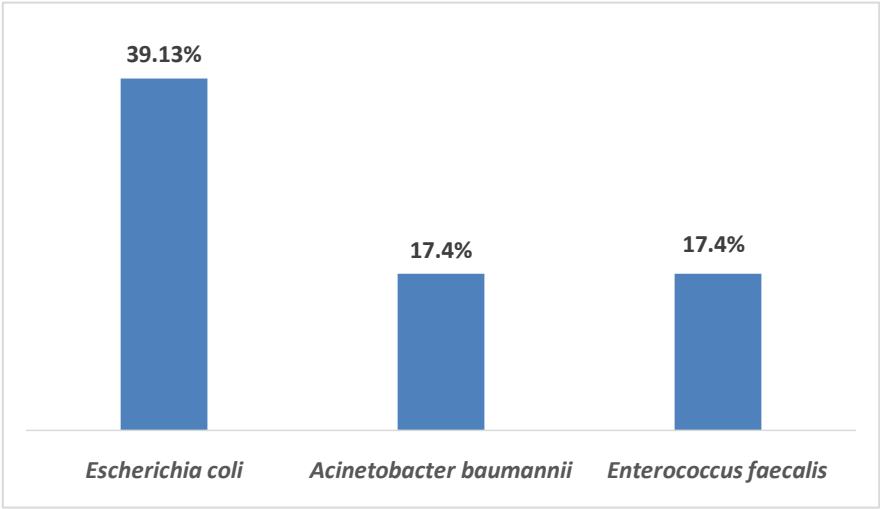

Figure 2. Isolated germs in CBEU and CBE of the pus.

of the surgical site infection was 1.5 ± 1.12 days. Three percent of all our patients developed urinary tract infection. Endometritis and sepsis accounted for 13.04% each of the bacterial infectious complications.

On the result of six CBEUs requested, *Escherichia coli* was found in 83.00% and *Enterococcus faecalis* in 17.00% of cases.

Concerning infection of the operative site, *Escherichia coli* was found in 35.00%, followed by *Acinetobacter baumanii* (20.00%), *Enterococcus faecalis* (15.00%),

Staphylococcus aureus (15.00%), *Klebsiela pneumonia* (10.00%) and *Pseudomonas aeruginosa* (5.00%).

3.5. Result of Antibiogram

Escherichia coli was resistant to Amoxicillin in 100%, Amoxicillin + Clavulanic acid in 77.80%, Cefotaxime in 66.70% but sensitive in 100% to Nitrofurantoines.

Acinetobacter baumanii was resistant to Ciprofloxacin, Gentamicin and Cotrimoxazole in 75.00% of cases but sensitive to Nitrofurantoinesin 75.00%.

Enterococcus faecalis was sensitive to Nitrofurantoinesin 100%, 75% Gentamicin but resistant to Cefotaxime, Chloramphenicol and Ciprofloxacin in 100% of cases.

The most used antibiotic was Furadantine (26.66%) followed by Ciprofloxacin (13.66%) and Cefotaxime (13.33%).

4. Discussion

4.1. Frequency

Our infection rate is higher than those of Western literature [7] [8]: 4.50%; 10.50%; 6.70%, and 6.20%. According to Katouar *et al.* [6] in 2014 out of 300,330 hospitalized patients, the prevalence of healthcare-associated infections was 5.10%. Katouar *et al.* [6] reported in their study that urinary tract infection (29.90%), pneumopathies (16.70%) and operative site infection (13.50%) were the most common. The lack of hospital hygiene due to inadequate maintenance of equipment, hand hygiene, or the placement of the urinary catheter could explain the frequency of the OSI and urinary tract infection in our study.

4.2. Socio-Demographic Data

The median age of patients with care-associated infection was 32.52 ± 13.36 years with extremes of 14 and 70 years. Diallo [11] reports an average age of 26.80 years with extremes of 16 and 45 years. Zhang [12] in China and Deptula [13] in Poland reported an average age of 55.90 ± 19.2 years and 64 ± 16 years, respectively. In our study, 22.00% of patients with low income had a HAI versus 9.00% for patients with a high-income level. There is a statistically significant difference between the patient's income level and the risk of healthcare-associated infections because poverty is a delay in acquiring drugs that are paid for by patients.

4.3. Risk Factors

Hospitalization in precarious hygiene conditions may favor the occurrence of healthcare-associated infections. Nineteen percent of the patients who stayed in the 3rd class of hospital rooms had a healthcare-associated infection to 4.00% of patients admitted to the first-class rooms. A large number of patients hospitalized in the 3rd class rooms with the risk of contamination could explain the high rate of infections in this category.

The clinical state of the patients especially if they are bedridden with comorbidities generates infectious risks during the care. The circumstances of admission of patients in emergency or out-of-hospital settings have an impact on the risk of infections during care. There is a statistically significant difference between the HAI rate in emergency admitted patients (7.50%) and the HAI rate in non-emergency patients (3.00%) (RR: 4.1250 and $P < 0.05$).

The reasons for hospitalization were hypertension and pregnancy (28.00%), uterine fibroid (11.50%) and PRH (10.00%).

138 patients underwent surgery, of which 78.50% were performed in emergencies versus 21.50 for scheduled interventions. The rate of infection associated with care was 7.00% for programmed interventions versus 3.50% for non-programmed interventions (P: 0.57, RR: 1.28). Forty percent of patients with NNIS 2 score had a care-associated bacterial infection versus 10.00% for NNIS 0 score.

4.4. Type of Infection Associated with the Care and Germs Involved

Sixty-point eighty-seven percent (60.87%) of the patients who underwent surgery developed an infection of the operative site (OSI) and the median time of OSI onset was 1.5 ± 1.12 days.

This rate is higher than data from the literature such as Egypt [14] (29.00%), Italy [15] (22.20%) and the USA [16] (21.80%) and Mali [11] (40.60%). Three percent of all our patients developed urinary tract infection. Endometritis and sepsis accounted for 26.08% of infectious bacterial complications.

In Europe [17] in 2016, 10,304 cases of OSI were reported including 4972 cases (48%) of superficial infections, 3107 cases (30%) of deep infections and 2182 cases (21%) of organ infections. The proportion of deep infections or organs was 17% in caesarean sections.

Escherichia coli was detected in 83.00% and *Enterococcus faecalis* in 17.00% of cases at CBEU.

Concerning operative siteinfection, *Escherichia coli* was detected in 35.00%, followed by *Acinetobacter baumanii* (20.00%), *Enterococcus faecalis* (15.00%), *Staphylococcus auerus* (15.00%), *Klebsiela pneumoniae* (10.00%) and *Pseudomonas aeruginosa* (5.00%). The germs found in our study are identical to data from the literature such as in Mali in 2011 [11] *Escherichia coli* (53.30%), *Staphylococcus aureus* (26.70%) in China in 2016 [12] *Escherichia coli* (14.80%) followed by *Pseudomonas aeruginosa* (13.90%) and Zarb [18] in 2012, pointed out Escherichia coli (15.20%) followed by *Staphylococcus aureus* (12.10%). In France Katouar *et al.* [6] reported in their study that *Escherichia coli* (26.00%), *Staphylococcus auerus* (15.90%) and *Pseudomonas aeruginosa* (8.40%) were the most common.

According to the European Center for Disease Prevention and Control in 2016 [17], out of 5171 of OSI from 13 European countries, *Staphylococcus aureus* (17.9%) and *Escherichia coli* (14.7%) were the microorganisms the most

commonly accounted for.

4.5. Result of the Antibiogram

Antibiotic resistance is today one of the most serious threats to global health, food security and development. It can affect anyone, at any age and in any country. *Escherichia coli* was resistant to Amoxicillin in 100%, Amoxicillin + Clavulanic acid in 77.80%, Cefotaxime in 66.70% but sensitive in 100% to Nitrofurantoines.

Acinetobacter baumanii was resistant to Ciprofloxacin, Gentamicin and Cotrimoxazole in 75.00% of cases but sensitive in 75.00% to Nitrofurantoines.

Enterococcus faecalis was sensitive to 100% Nitrofurantoines, 75% Gentamicin but resistant to Cefotaxime, Chloramphenicol and Ciprofloxacin in 100% of cases.

The most used antibiotic was Furadantine (26.66%) followed by Ciprofloxacin (13.66%) and Cefotaxime (13.33%). Furadantine was the most used antibiotic because of the sensitivity of all *Escherichia coli* strains to this antibiotic.

Jose [19] in Spain in 2016 and Micha [20] in Gabon in 2014 had a resistance of 34.90% and 57.00% of strains of *Escherichia coli* with Amoxicillin + clavulanic acid and a resistance of 53.5% and 35.7% with Ciprofloxacin. We can deduce that *Escherichia coli* has a strong resistance to beta-lactams and this resistance can be explained by the fact that this class of antibiotic is usually prescribed in the gynecology and obstetrics department of the CHU Gabriel Touré.

In India, in 2014, Mehta [21] reported in her study a sensitivity of strains of *Acinetobacter baumanii* in 50.00% to Cotrimoxazole.

Antibiotic resistance leads to an increase in hospitalizations, an increase in medical expenses and an increase in mortality. The lethality was 1.50%. The average cost of management of patients who developed the surgical site infection was 119,837 FCFA. The average hospital stay of the infected patients was 14.70 days with extremes of 5 and 46 and a standard deviation of 10.80.

5. Conclusion

The bacteriology study of care-associated infections is a key element in the prevention of healthcare-associated infections and an important tool for monitoring the effectiveness of prevention measures. Despite all the efforts made in the fight against and prevention of HAI, they remain worrying because of the risk factors, the diversity of hospital bacterial flora. *Escherichia coli* is the most recovered germ followed by *Enterococcus faecalis* in our study. Respecting asepsis in the operating room even as in hospital care in general reduces the risk of healthcare-acquired infections.

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Conflicts of Interest

The authors declare that they have no competing interests.

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