

Research Article

Bacteriological and Antibiotic Resistance Profile of Isolated Organisms of Post-Caesarean Suppuration in the Department of Gynaecology and Obstetrics of Laquintinie Hospital, Douala, Cameroon

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Abstract

Introduction: The objective of our study was to identify the bacteria associated with the post-Caesarean surgical site infection, and their antibiotic resistance profile, in the Department of Gynaecology and Obstetrics at Laquintinie Hospital in Douala.

Methods: We conducted a cross-sectional and analytical study on the removal of post-caesarean section suppuration at Laquintinie Hospital in Douala. After swabbing the superficial pus and syringe puncture for the deepest pus, the samples were sown on culture media allowing the growth of most of the germs involved in this type of infection. Identification was made using ApiTM galleries (BioMerieux, France), and antibiotic resistance using the Mueller Hinton agar plate method.

Results: We had 260 cases of caesareans during the study period. The mean age of the patients was 27.2 ± 0.6 years, the Mean Hospital Stay (MHS) was 9.1 ± 0.4 days. The prevalence of infection was 28.8%, considered to be associated with care in most of cases. The bacteria responsible for these infections were mostly Gram-positive cocci (45%), followed by enterobacteria (32%), and non-fermenting gram-negative bacilli (23%). *Staphylococcus aureus* was the predominant species with 33% of cases, followed by *Pseudomonas aeruginosa* 21% and *Klebsiella pneumoniae* 11%. The bacteria encountered were multi-resistant to the different families of antibiotics tested, with a resistance level varying between 92 and 98% with respect to betalactamines, including for imipenem (47% of resistant strains). Isolated organisms were resistant to aminoglycosides, namely gentamycin and netilmicin at 51.5% and 81.8%, respectively.

Conclusion: Post-caesarean infection is a concern at the Maternity of Laquintinie Hospital. Reinforcement of hygiene measures, knowledge of local bacterial ecology and surveillance of antibiotic resistance are necessary to improve the management of these infections.

Keywords: Sarcoidosis; Neurosarcoidosis; Epidemiology; Drug prescribing

Introduction

Caesarean section is one of the most commonly performed surgical procedures in obstetrics and is certainly one of the oldest operations in surgery [1,2]. The risk and safety associated with caesarean delivery differ from one place to another [3]. Despite the huge progress made in obstetrical technique and anaesthesia to provide better materno-foetal safety during caesarean section, the rates of infectious complications remain high, sometimes calling into question the vital prognosis and obstetric outcome of patients [4]. These infectious complications of obstetric surgeries are potential sources of post-caesarean morbidity and mortality. Postoperative infections in obstetric gynaecology include urinary tract infection, endometritis, surgical wound infection, perineal infection, and sepsis [5]. In France, the global incidence of nosocomial infections among women who have had a caesarean section is estimated at 19%, and a study conducted in 2005 revealed a rate of Surgical Site Infection (SSI) after caesarean section of 2.6% [6,7]. In Africa, a few authors have reported the incidence of infectious complications of caesarean section which ranges from 10.3% in Morocco to 40.5% in Guinea [8,9]. Post-caesarean suppuration rates remain high (between 19 and 38.7%), leading to prolonged hospitalization, increased health care costs and workload for health facility staff [10,11]. In Cameroon, a study conducted at the University Hospital in Yaoundé in 2007 revealed an incidence of high postoperative infection of 23.5% in

gynaecological and obstetric surgeries [12]. In 2015 the incidence of post-caesarean infectious complications was 9.04% and 1.17% respectively at Central Hospital and Yaoundé General Hospital [13]. The aim of this study was to identify the bacteria associated with post caesarean surgical site infection; and their antibiotic resistance profile in the department of Gynaecology and Obstetrics at Laquintinie Hospital in Douala, Cameroon.

Methods

Framework and type of study: we conducted a cross-sectional and analytical study in the departments of Gynaecology and Obstetrics at Laquintinie Hospital in Douala (LHD) where patient recruitment and sample collection were performed; and the Clinical Biology Laboratory at Douala General Hospital (DGH) for the analysis of these samples. The study was conducted from 03rd December 2015 to 30th April 2016, giving a duration of 05 months.

Study population: this included women who had a caesarean section at Laquintinie Hospital, whether admitted to the Gynecology and Obstetrics department or not, and who had suppuration of the postoperative wound.

Surgical Site Infections (SSI) was defined according to the criteria of the Centers for Disease Control and Prevention (CDC) [14]:

- Superficial SSI affecting the skin, subcutaneous tissues above the fascia.
- Deep SSI affecting tissues or spaces located at or below the fascia.
- Organ or site SSI including endometritis and pelvic abscess were excluded.

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Table 1: Socio-demographic and clinical data.

Characteristics		POST-CAESAREAN INFECTION		Total N = 260 n (%)	P
		OUI	NON		
Age group (years)	[15-25]	23	57	80 (30,76)	0,146
	[25-35]	41	101	142 (54,62)	
	[35-45]	11	27	38 (14,62)	
Marital status	Married	56	138	194 (74,62)	0,001
	Single	19	47	66 (25,38)	
Level of Education	Primary	25	62	87 (33,46)	0,001
	Secondary	41	101	142 (54,62)	
	University	09	22	31 (11,92)	
Occupation	Housewife	63	155	218 (83,85)	0,000
	Employed	12	30	42 (16,15)	
Average length of stay (Days)		9	7		
HIV +		3	0	3	
HBV +		1	0	1	
Diabetes		1	0	1	

Data collection procedure: After obtaining the informed consent of the patients concerned, all information was collected using anonymous questionnaires that included demographic variables (age), the Human Immunodeficiency Virus serological status, the date of entry, postoperative hospital stay and operative wound evolution; as well as the results of the bacteriological analysis of pus.

Samples: These were taken at the site of the infection after careful decontamination of the wound margins with an antiseptic. Superficial pus was collected with a sterile swab, and deep pus with a sterile syringe needle.

Isolation of microorganisms: After noting the macroscopic appearance of secretions (colour, odour, abundance), direct examination of smears after Gram staining allowed the identification and quantification of polynuclear cells. Seeding was carried out on the usual culture media to isolate most bacteria generally found in this type of infections, including Chapman agar for Staphylococci, Eosin Methylene Blue (EMB) for Gram-negative bacilli, Chocolate for Streptococci. The inoculated media were then incubated in a stove in a normal atmosphere and at 37 °C. for 18 to 24 hours.

Identification of microorganisms

The colonies obtained were identified based on the study of their biochemical and enzymatic characteristics, using the APITM galleries (BioMérieux, France) after incubation at 37 °C. for 24 hours and visual colorimetric reading according to the manufacturer's recommendations.

Antibiotic sensitivity: performed by diffusion technique of antibiotic discs on Mueller Hinton agar medium (thickness of 4 ± 0.5 mm), and measurement of the inhibition diameter using sliding callipers after 18 to 24 hours incubation at 37 °C, according to the recommendations of the committee of the antibiogram of the French Society of Microbiology (CA-SFM) [15]. Results were categorized as Resistant (R), Intermediate (I) and Sensitive (S). For the calculation of resistance rates, the "intermediate" strains were included in the "Resistant" category.

Seventeen discs of antibiotics (Bioanalyse[®]) were used, namely:

- Amoxicillin, Amoxicillin + Clavulanic acid, Ceftazidime, Ceftriaxone, Imipenem, Amikacin, Netilmicin, Gentamicin, Tobramycin, Ciprofloxacin, Levofloxacin, Ofloxacin, Colistin for Gram-negative Bacilli.

- Oxacillin, Netilmicin, Gentamicin, Tobramycin, Ciprofloxacin, Levofloxacin, Ofloxacin, Pristinamycin, Fusidic acid, Vancomycin, for Gram-positive cocci.

The gap of 2 cm was respected between two discs and 1.5 cm between the discs and the edges of petri dishes.

Data analysis: Performed using the IBM SPSS software version 20. The Chi-square test was used for the qualitative variables. A value of $p < 0.05$ was considered significant.

Ethics: We obtained the research authorization of the Directors of the LHD, the DGH and the clearance from the Institutional Ethical Committee of the University of Douala.

Results

During the recruitment period, 260 eligible caesarean sections were included in the study. The mean age of the patients was 27.24 ± 0.67 years with a range of 15 to 44 years. The most represented age group was 25-35 years old (54.62%). Most women who had a caesarean were married (74.62%) with a high school education (54.62%) and were housewives (83.85%) (Table 1).

Of the 260 cases of caesarean section, 75 had a Surgical Site Infection (SSI), giving a prevalence of 28.8%. The age group most affected by the infection was 25-35 (54.62%).

Infection occurred between the 6th and 14th post-caesarean days in 72% of patients, and before day 6 in 8% of cases (Table 2). These patients made a sum of 685 days of hospitalization, with an average length of stay (LOS) of 9.1 ± 0.4 days with a range of 7 to 28 days.

Table 2: Characteristics of the infection.

Characteristics		n	%	Total	
Type of infection	Deep	6	8	75	
	Superficial	69	92		
Time of appearance (days)	≤ 5	6	8	75	
	[6-14]	54	72		
	[15-30]	15	20		
Culture	Positive	Mono-microbial	44	61,1	75
		Bi-microbial	28	38,9	
	Negative	3	4		

Table 3: Bacteria associated with post-caesarean wound infection.

Bacteria		Frequency	Total n (%)	
Gram-positive cocci	Staphylococcus aureus	33	45(45)	
	Staphylocoques à coagulase négative	S hominis		7
		S haemolyticus		3
		S saprophyticus		1
Enterococcus faecalis	1			
Non-fermenting gram-negative bacilli	Pseudomonas aeruginosa	21	23(23)	
	Acinetobacter baumannii	2		
Enterobacteriaceae	Klebsiella pneumoniae	11	32(32)	
	Enterobacter	E cloacae		6
		E sakasakii		3
		E aerogenes		1
	Proteus mirabilis	4		
	Escherichia coli	3		
	Serratia	S odorifera		1
		S liquefaciens		1
	Citrobacter freundii	1		
Morganella morganii	1			
Total		100	100	

Surgical site infections were surgical-related in 8% of cases and related to post-operative care in 92% of cases (Table 2).

A total of 75 pus samples were analysed with 3 (4%) sterile cultures and 72 (96%) positive cultures, of which 44 (61.1%) in mono-microbial culture and 28 (38.9%) in bi culture.

On positive cultures, 100 bacterial strains were isolated, including 55% Gram-negative bacilli and 45% Gram-positive Cocci. Staphylococcus aureus (33%) was the major strain, followed by Pseudomonas aeruginosa (21%), Klebsiella pneumoniae (11%) and coagulase-negative Staphylococci (11%) (Table 3).

Staphylococcus aureus, which was the predominant germ, had a high resistance to antibiotics, 78.79% to methicillin (MRSA), more than

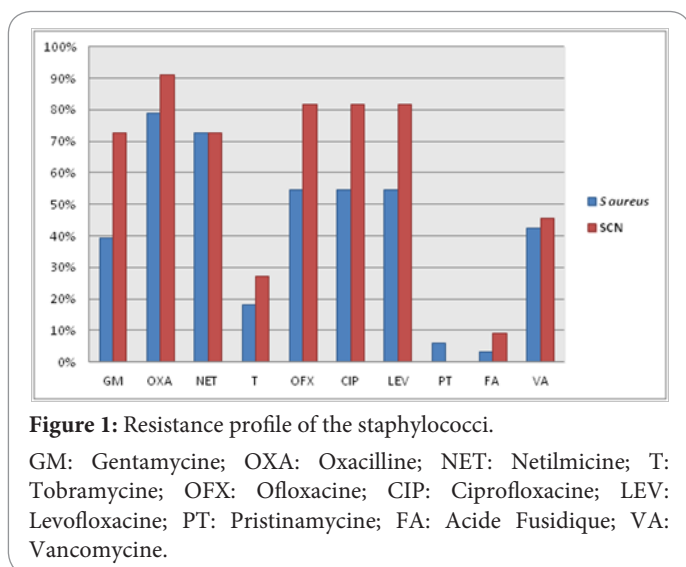


Figure 1: Resistance profile of the staphylococci.

GM: Gentamycine; OXA: Oxacilline; NET: Netilmicine; T: Tobramycine; OFX: Ofloxacine; CIP: Ciprofloxacine; LEV: Levofloxacine; PT: Pristinamycine; FA: Acide Fusidique; VA: Vancomycine.

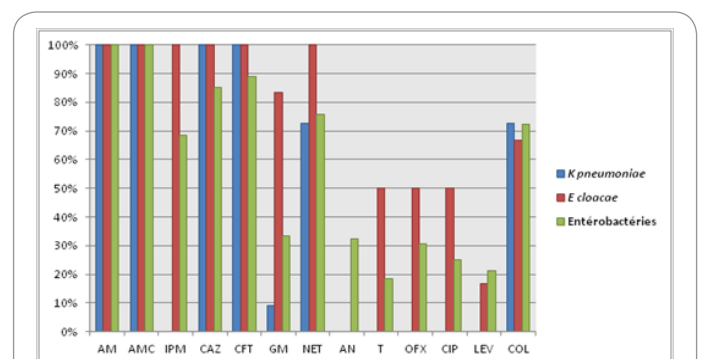
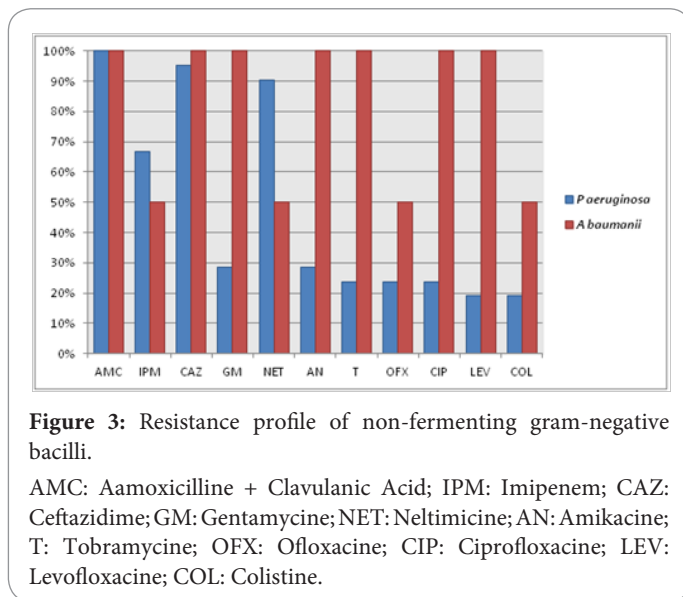


Figure 2: Resistance profile of the Enterobacteriaceae.

AM: Amoxicilline; AMC: Amoxicilline + Clavulanic Acid; IPM: Imipenème; CAZ: Ceftriaxone; CFT: Ceftriaxone; GM: Gentamycine; NET: Netilmicine; AN: Amikacine; T: Tobramycine; OFX: Ofloxacine; CIP: Ciprofloxacine; LEV: Levofloxacine; COL: Colistine.

50% to quinolones and vancomycin, variable for aminoglycosides. The most active molecules on these S. aureus strains were fusidic acid (3% strength), pristinamycin (6%), and Tobramycin (18.1%) (Figure 1). Klebsiella pneumoniae was 100% resistant to Amoxicillin + Clavulanic acid and third generation cephalosporins. The resistance rate was also high for Netilmycin (72.7%) whereas these strains of K pneumoniae showed a good sensitivity to other aminoglycosides with 9% of resistance for Gentamycin and 0% for amikacin and tobramycin. All strains were sensitive to Imipenem and fluoroquinolones (Figure 2).

Isolated strains of Pseudomonas aeruginosa had resistance levels greater than 20% for the set of molecules tested, apart from Colistin and Levofloxacin (19%) (Figure 3).



Discussion

In this study, which aimed to identify bacteria associated with post-caesarean infections, the mean age was 27.24 years; these are young patients, which corresponds to the average age of pregnancies among women from Africa (27.2 years), unlike most Western countries where the maternal age of women at first pregnancy is over 30 years old; in France in 2015, all births combined, women gave birth on average at 30.4 years [16,17].

Data from Ouattara et al. in Burkina Faso show an average age of 27 years, Gelaw et al. in Ethiopia in 2017 found a majority of 20-34 years, 89.3% [18,19].

The prevalence of surgical site infection in this population is high (28.8%), significantly higher than those obtained in other countries around the world, particularly in Benin (12.7%), Scotland (11.7%), 2%), Cambodia (6.25% in 2011) and France (3.2% and 1.9%) [20-23]. This prevalence varies according to the aseptic and hygiene measures used in the various health care establishments; active monitoring with feedback of results to care teams also reduces the incidence of post-caesarean infections [23].

Most of the SSIs occurred between the 6th and 14th days after Caesarean section. Ouattara in Burkina Faso found that 61.6% of SSI occurred after D5 post-caesarean and 38.4% before D5 post-caesarean [18].

The post-caesarean infection results in an increase in the average hospital length of stay (LOS), it was 9 days in our patients, compared to seven days for uninfected patients, which is close to the data of Barbut et al. in France (8.5 days and 5 days) [23]. In a Canadian study, the authors reported a 14-day hospital LOS [24].

The bacteria mostly related to nosocomial infections were *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Klebsiella pneumoniae*. Data from the National Surveillance Network for Infection of the Operative Site (ISO-RAISIN) in France in 2013 show that the most encountered germs are *Staphylococcus aureus* (37.8%), *Pseudomonas aeruginosa* and *Klebsiella pneumoniae* are also incriminated in 3% cases each [25]. Srun et al. Cambodia in 2011 also found a prevalence of *Staphylococcus aureus*, 66.67% [22]. On the other hand, in some studies, the isolated germs are dominated by *Escherichia coli*, which is the case in Burkina Faso where Ouattara et al. report 37.5% of *E. coli*, followed by *S. aureus* (22.5%) and *K. pneumoniae* (17.5%) [18].

The bacteria encountered were sensitive only to a small number of antibiotics usually active in therapy. Shittu in South Africa found that betalactamines were the least active molecules of all antibacterial agents tested [26]. In our series, 78.79% of strains of *Staphylococcus aureus* were resistant to Methicillin (MRSA), Srun in Cambodia in 2011 found 50% of MRSA [22]. *Pseudomonas aeruginosa* and *Klebsiella pneumoniae* showed a high level of resistance to betalactamines (third-generation cephalosporins and Amoxicillin + Clavulanic acid), these high levels of resistance observed could be explained by the fact that most Enterobacteriaceae including these strains of *Klebsiella pneumoniae*, produced broad-spectrum beta-lactamases, whereas Imipenem, Tobramycin, Amikacin, and fluoroquinolones remained very active, and Eddlimi in Tunisia in 2010 found that *K. pneumoniae* had a very good sensitivity to imipenem and fluoroquinolones [27].

Conclusion

Bacteria frequently isolated from post-caesarean wounds have elevated levels of resistance to the main families of antibiotics tested. This work should make it possible to adapt probabilistic antibiotherapy, and to set up a reinforcement of the hygiene measures, as well as a global policy of identification of the favourable factors, which will make it possible to significantly reduce these germs multi resistant responsible for these post-caesarean surgical site infections.

Limitations of the study: We could not have data on the urgency or not and the duration of the intervention, which are factors that can promote post-operative infections.

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