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**DETERMINANTS ASSOCIATED WITH POST-CESAREAN OPERATING SITE INFECTIONS FROM JANUARY 01, 2013 TO JUNE 30, 2019 AT THE BRAZZAVILLE UNIVERSITY HOSPITAL CENTER**

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**ABSTRACT**

**Introduction:** Contaminated clean surgery, caesarean section remains by far the most short-term surgical intervention, in obstetrics and gynecology, of the operating site infection (OSI) whose incidence varies between 3 and 15% in Africa. The risk of infection being less linked to the technique, there are factors which predisposed certain caesareans to its occurrence. This is how this study set itself the objective of analyzing the determinants of infections of the post-caesarean operating site at the University Hospital Center of Brazzaville.

**Patients and Methods:** Analytical cross-sectional study, conducted from January 01, 2013 to June 30, 2019 at university hospital of Brazzaville, comparing 230 caesareans having presented a post-caesarean OSI during hospitalization until the first 30 days of post-operative, to 230 Caesareans who did not present an OSI during the same period. The variables studied were preoperative, intraoperative and postoperative.

**Results:** Four hundred and eight caesareans having presented an OSI were collected among 1063 caesareans, either a prevalence of 38.4%. Post-caesarean OSI were dominated by endometritis (40%), superficial suppuration (22%) and pelviperitonitis (16%). In 22% of cases, it involved the associated forms. The determinants associated with post-caesarean OSI were pre, intra and post-operative. This was after multivariate analysis of: age less than 25 years (ORa = 2 [1.04-4.09]), level of primary education (ORa = 4.1 [1.4-11, 8]), BMI > 30kg / m<sup>2</sup> (ORa = 5.9 [1.2-27.1]), the RPM of more than 6 hours (ORa = 2.2 [1.1-4.1]), stained

**amniotic fluid (ORa = 3.6 [1.6-7.6]), duration of cesarean section over 45 minutes (ORa = 21.1 [11.3-39.4]) and absence of breast-feeding (ORa = 2.5 [1.3-4.5]).**

**Conclusion:** Post-cesarean OSI are common and multifactorial in origin. Their reduction requires considering the determinants associated with them.

## INTRODUCTION

An infection is called an operating site infection (OSI) when it is localized in the operating wound, an operated tissue, an organ or the operated space, which occurs within 30 days following a surgical intervention, and for which there is no indication that it was present or in the incubation phase at the time of admission, unless it can be linked to a previous admission within the same hospital [1]. Its occurrence limits the potential benefit of surgical interventions, since they are one of the main causes of morbidity and mortality in surgery [2]. Among obstetric and gynecological surgeries, cesarean section remains the most performed which attributes short-term complications such as OSI, which extend the hospital stay and in the same direction generates additional costs [3]. In developed countries, the incidence of post-cesarean OSI varies from 1.5% to 7% [4, 5]. Whereas in developing countries, this incidence varies from 6% to 27% [6]. In Africa, it varies from 3 to 15% [7]. Based on the classification of the surgical wound, the caesarean section is a clean contaminated surgery, where the risks of infection related to the technique are less likely to occur. As a result, these OSI do not occur unexpectedly, there are certain determinants which can be preoperative, intraoperative but also postoperative, thus predisposing certain patients performed caesarian section to OSI. To analyze the determinants of infections of the post-cesarean operating site at teaching Hospital of Brazzaville.

## PATIENTS AND METHODS

This was an analytical cross-sectional study conducted from January 1, 2013 to June 30, 2019, in the Obstetrics Gynecology department of Brazzaville University Hospital. Sampling was done from a simple random draw without replacement. Thus, 230 caesareans who presented an infection of the operating site in hospital or on an outpatient basis within 30 days of the postoperative period, were compared to 230 other caesareans who did not present it.

Caesarean sections admitted secondarily or those whose dressings had not been performed in the department had been excluded. Parturient had been prepared in the delivery room and taken to the operating room for the cesarean. The caesarian incision was segmental transverse after the cutaneous approach.

The intraoperative antibiotic prophylaxis before incision was exclusive based on a 2nd generation cephalosporin dosed at 750 mg, with a rate of 1.5 g intravenously.

In post-operative, the management of the operative wound was hospital and ambulatory. It consisted of:

In the absence of suppuration, to the realization of a first dressing in hospital on the fourth post-operative day before discharge, then every other day after discharge until the 15th day. The dressing was made with polyvidone iodine dermal. The suturing was removed partially on the seventh day and then completely on the fifteenth. Post-operative follow-up continued until the 30th day.

In the event of suppuration, the sutures were released either partially or completely. The dressings were twice-daily, moist, made from a concentrated solution of sodium hypochlorite and hydrogen peroxide until the

fleshy, regular banks were completely red and did not externalize pus. From then on, the dressing was performed as in the absence of suppuration.

The variables studied were preoperative (socio-demographic characteristics, pre and per part), intraoperatively (appearance of amniotic fluid, quantity of blood loss, duration of intervention) and post-operative (dressing, vulvovaginal toilet, antibiotic therapy).

Statistical analysis had been done using SPSS 21 and Stata 14 software. Pearson's Chi<sup>2</sup>-square test and that of t-Student had been used, as well as Fisher's exact test with theoretical numbers less than 5. The Odds Ratio with its 95% confidence interval not including 1 was calculated to estimate the association between two variables. The p-value of the probability was considered significant for a value less than 0.05. Multivariate analysis used to eliminate the confounding factors.

## RESULTS

During the study period, 15,675 deliveries were recorded, of which 1,063 caesareans giving a caesarean rate of 6.8%. Among the caesareans, 408 had developed an infection of the operating site giving a prevalence of OSI of 38.4%. The patients who presented the OSI were younger aged 15 to 25 years (OR = 1.8 [1.2-2.8]), without gainful activity [OR = 1.8 (1.2-2.7)], less educated [OR = 7 (2.8-17.4)] and single [OR = 3.9 (1.6-9.2)]. Obese patients were more likely to have post-caesarean ISO [OR = 7 (1.6-19.7)], as well as those referred [OR = 1.8 (1.2-2.7)] and caesarean conducted as an emergency [OR = 12.6 (4.4-35.8)]. During childbirth, the risk of OSI was increased in caesarean sections who presented with fever [OR = 4.8 (1.8-12.8)], prolonged labour [OR = 3.2 (2, 1-4.9)] and premature rupture of the membranes for more than 6 hours [OR = 2.4 (1.5-3.6)], shown in Table 1.

**Table 1**  
*Preoperative characteristics of caesarean patients*

	Caesarean sections		OR [CI 95%]	p
	With OSI	Without OSI		
	n (%)	n (%)		
<b>Sociodemographic characteristics</b>				
Age (years) Mean ± SD	26 ± 0.4	29 ± 0.5		<b>0.004</b>
[15-25]	95 (41.3)	58 (25.2)	1.8 [1.2 – 2.7]	<b>0.006</b>
[25-35]*	97 (42.2)	108 (47)		1
[35-47]	38 (16.5)	64 (27.2)		0.09
Non-remunerative activity	162 (70.4)	130 (56.5)	1.8 [1.2 – 2.7]	<b>0.002</b>
Education level				
Primary	31 (13.5)	9 (3.9)	7 [2.8-17]	<b>0.001</b>
Secondary	172 (74.8)	172 (74.8)	1.8 [1.1-3.0]	<b>0.02</b>
Single	25 (10.8)	7 (3)	3.9 [1.6 -9.1]	<b>0.002</b>
<b>Clinic characteristics</b>				
Obesity (BMI≥30kg/m <sup>2</sup> )	16 (7)	3 (1.3)	5.6 [1.3-19.7]	<b>0.006</b>
Preoperative stay (days)	41 (17.8)	85 (37)	0.4 [0.2-0.6]	<b>0.001</b>
Referred	52 (22.6)	80 (34.8)	1.8 [1.2 – 2.7]	<b>0.004</b>
Emergency Caesarean	226 (98.3)	188 (81.7)	12.6 [4.4-35.8]	<b>0.001</b>
Fever during labour	22 (9.5)	5 (2.2)	4.8 [1.7-12.8]	<b>0.002</b>
Prolonged labour	192 (83.5)	141 (61.3)	3.2 [2.1-4.9]	<b>0.001</b>
Premature rupture of membranes> 6H	43 (18.7)	81 (35.2)	2.4 [1.4-3.6]	<b>0.001</b>

\* Reference

However, the short preoperative stay of less than 72 hours was a protective factor. Parturient admitted to emergency departments were more likely to develop an OSI compared to those who had come on their own or had elective Caesarean section. On the other hand, fever, prolonged labour and premature rupture of the membranes for more than 6 hours, were associated with an excess of OSI.

Likewise, this risk was noted intraoperatively, in the case of tinted amniotic fluid, blood loss of more than 500 ml and duration of surgery greater than 45 min (Table 2). In the post-operative period, the failure to perform the dressing and the absence of vulvovaginal cleansing increased the risk of OSI by 2. Furthermore, post-operative dual antibiotic therapy did not improve the risk of developing SSI compared to mono-antibiotic therapy (Table 2).

**Table 2**

*Intra and post-operative characteristics of caesarean patients*

	Caesareans			
	with OSI	Without OSI		
	n (%)	n (%)	OR [CI 95%]	p
<b>Intraoperative</b>				
Tinted amniotic fluid	62 (27)	18 (7.8)	4.4 [2.4-7.6]	<b>0.001</b>
Blood loss > 500 ml	15 (6.5)	3 (1.3)	4.2 [1.1-15.0]	<b>0.02</b>
Duration of surgery > 45 (min)	164 (71.3)	27 (11.7)	18.7 [11.4-30.6]	<b>0.001</b>
<b>Post-operative</b>				
No wound dressing	173 (75.2)	145 (63)	1.8 [1.2-2.6]	<b>0.004</b>
Lack of vulvovaginal hygiene	61 (26.5)	82 (35.6)	1.5 [1.03-2.2]	<b>0.03</b>
Antibiotics *	170 (74)	78(34)	5.5 [8.6- 8.2]	<b>0.001</b>

\* Amoxicillin-clavulanic acid combination (1g/8H in Direct Intravenous Injection) and metronidazole (500mg/12H in Slow Direct Intravenous Injection).

After logistic regression, the determinants of the OSI are shown in Table 3.

**Table 3**

*Logistic regression*

	OR adjusted	CI (95%)	p
Age [15-25]years	2	[1.01-4.1]	0.04
Primary education	4.1	[1.4-11.8]	0.009
Obesity (IMC $\geq$ 30kg/m <sup>2</sup> )	5.9	[1.2-27.1]	0.02
Premature rupture of membranes > 6 hours	2.2	[1.1-4.1]	0.02
Tinted amniotic liquid	3.6	[1.6-7.6]	0.001
Duration of surgery > 45 min.	21.1	[11.3-39.4]	0.001
No dressing	2.5	[1.3-4.5]	0.004
Antibiotics	3.9	[2.2-6.8]	0.001

Endometritis was the predominant type of OSI, noted in 40% of the cases. In the remaining cases, it involved: associated forms endometritis and pelviperitonitis (22%), deep suppuration (16%) and superficial suppuration (22%). The risk of endometritis and / or pelviperitonitis was associated with the young age between 15 and 25 years (ORa = 1.8 [1.02-3.2];  $p < 0.03$ ); premature rupture of the membranes greater than 6 hours (ORa = 2.8 [1.6-4.7];  $p < 0.001$ ) and the duration of intervention greater than 30 minutes (ORa = 4.6 [2.6- 7.9];  $p < 0.001$ ). The risk of deep and superficial suppurations was multiplied by 5 (ORa = 5.4 [2.1 - 13.7];  $p < 0.001$ ) and 2 (ORa = 1.9 [1.04 - 3.7], respectively);  $p < 0.03$ ) in the event of a cesarean duration greater than 45 min.

## DISCUSSION

Post-caesarean OSI represented 38.4% of the caesareans recorded during the study period, superimposable on those found in India [7]. However, these results are superior to those found in the literature, varying between 2.9% and 12.6% depending on the series [8]. It emerges that post-caesarean OSI are not exceptional, affecting maternities with limited resources as well as those of developed countries in variable proportions [8].

When it came to socio-demographic characteristics, like teaching hospital in his meta-analysis [9] and Wloch [10], young age was a factor exposing to OSI. Among other things, this series reports the absence of professional activity and the low level of education. However, this contrasts with the observation of Scottish studies [11] which identified advanced maternal age as a risk factor. If in the youngest the lack of post-operative hygiene because of their immaturity is incriminated, in the oldest on the contrary the anatomical and physiological aspects (the thinning of the cutaneous barrier, the reduction of the immune responses) are mentioned [11].

Clinically, both in this series and in that of Wloch [10] in England and Krieger [12] in Israel, there has been a risk of post-caesarean OSI in obese and overweight patients. This could be explained by the poor intratissular concentration of the standard dose of antibiotic prophylaxis enough due to the poor vascularization of adipose tissue delaying skin healing and consequently increasing the exposure time [13]. Likewise, the incision in these patients must be deep, which exposes more tissue to contamination and the difficulties of post-operative wound care [14]. Furthermore, Krieger and Merzougui [12, 15], report other factors such as diabetes mellitus and high blood pressure.

In part, premature rupture of the membranes for more than 6 hours, fever and prolonged labour were associated with the risk of OSI, corroborating the results of the series of Tran [14] and Assawapalangool [16]. Indeed, contamination of the uterine cavity by ascending route after rupture of membranes, the notion of fever, the context of emergency and long work in a mainly referred population would contribute to the genesis of infections of the operating site. Also, the notion of urgency would most often encourage aseptic errors due to the haste of some and the lack of rigor of others [12, 15].

Regarding the intraoperative period, the factors exposing to OSI were stained amniotic fluid, blood loss greater than 500ml and the duration of cesarean section over 45 minutes. Indeed, the color of the amniotic fluid by meconium would promote uterine infection against a background of premature rupture of membranes, by potentiating bacterial colonization. Regarding significant blood loss, source of anemia would be incriminated in puerperal endometritis by uterine hypoperfusion causing a slowing of uterine involution and consequently a microbial proliferation [12].

Most often multifactorial puerperal endometritis was the predominantly represented type of OSI, as in the

Assawapalanggol series [15]. In fact, it is the most common puerperal infection in the case of a caesarean, varying according to the series. If endometritis is partly linked to factors related to the bacterial colonization of the uterine cavity, deep and superficial OSI (suppurations) would be dependent on factors linked to intervention and the organization of care. The absence of a sample for bacteriological examination in order to identify the germs in question of OSI constituted a limitation, and essentially used the clinical diagnosis.

### CONCLUSION

Operative site infections remain frequent and multifactorial, linked to both individual and pre, intra and post-operative factors. Their knowledge and understanding are a crucial avenue for combating operating site infections.

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