

Surgical site infection after Caesarean section in relation to operative time

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Abstract:

The main aim of this study is to find the incidence of post-operative infection and correlate it to the duration of Caesar section. In this study two group were made, patient group (who develop post-surgical infections), and control group (who do not develop any symptoms). Different demographic clinical data of both group measured such as age, duration of operation, duration of labor, type of CS, the presence of adhesions, subcutaneous thickness, an indication of CS (fetal distress, breech, APH, and cord prolapse) and BMI were recorded and compared with control group. A total of 120 women involved in C-section from both group and out of which 15 women develop post-operative SSI represent the incidence rate of 12.5% while the remaining one didn't develop any sign of post-surgical infections. The result of different parameters such as duration of operation (35.2 ± 16.4 min), obstetric history of Gravida/Para (G1P0 6 patient), emergency SC (53.3%), subcutaneous thickness >2cm (73.3%), Antepartum hemorrhage (6.7%), fetal distress (13.3%), cord prolapse (6.7%), indication of second stage of labor (20%), and primi breech (13.3%). The above mentioned parameters are found to be directly associated with post-operative surgical infections and with mother mortality and morbidity rate. The changes in incidence are because of differences in population characteristics and risk factors, perioperative practices, and the period from the procedure until ascertainment. Proper awareness would be able to prevent and/or shorten these post SSI and expensive hospital stay by early diagnosis and appropriate antibiotics treatment.

Keywords: Cesarean delivery, post-surgical infection, surgical site infection, Antepartum hemorrhage, duration of time

Introduction:

In the United States, Cesarean delivery (CD) is the most common major surgical procedure performed in the hospital, approximately 1.3 million in 2016, which accounted for almost one-third of total births and its incidence rate increased up to 41% in a 13 year period ¹. Similar data has been reported in other countries such as 26.5% in the UK and 32.3% in Australia, and recently China have 41% of all births ^{2,3} there are many factors involved behind this high incidence of CS such as mother request for cesarean deliveries without any medical complication and fear of litigation formation among medical specialist. The mortality rate of surgical site infection after cesarean deliveries increased up to 3% of overall infection. Moreover, the worldwide incidence rate of C-section is increasing, the number of patients with postpartum complications is also expected to rise. The changes in incidence are because of differences in population characteristics and risk factors, perioperative practices, and the period from the procedure until ascertainment.

After cesarean deliveries, the most common post-surgical complications are surgical site infections (SSI) and wound infections which affect approximately 3 to 15% of all delivery ⁴. These surgical complications result in a prolonged stay of patients in the hospital, representing a major cause of maternal morbidity and mortality and contribute financial burden to the health care system. It also causes emotional and physical stress on mother and financial burden which lead to other socioeconomic implications. According to one study, prolonged hospital stays and rise in morbidity link with surgical site infections, result in medical expenditure range from \$3000 to 29000 per SSI (Surgical site infections) and up to \$10 billion in annual health care costs in the US ⁵.

Therefore, dire need to identify ways to decrease surgical site and wound infections. For post-surgical complications, multiple factors have been identified. Risk factors that may increase maternal infections after delivery such as obesity, previous CD, parasitic infection (toxoplasmosis), premature rupture of membrane, tobacco, twins gestation, large incision length $\geq 3\text{cm}$, inappropriate antibiotics administration, ethnic minority, maternal hematoma and excess blood loss during emergency deliveries and malnutrition women which are very common in under developing countries, and chronic anemia.

Some of the factors are modifiable but others that are not ^{6,7}. From the past few decades, literature studies have been shown evidence-based strategies to reduce post-surgical infections after cesarean deliveries (CD). Evidence-based several practices which including: taking of right antibiotics prophylaxis within 60 minutes prior to skin incision reduce endometritis, neonatal sepsis ^{8,9}. The delivery rate by CS is rising worldwide and the prevalence of SSI following CS is probably showing a similar trend but a knowledge gap rests on the global prevalence of SSI ^{10,11,12}. The aim of this study was to explore surgical site infection after Caesarean section in relation to operative time.

Methods

A total of 120 women who attended Babil teaching hospital for maternity and children from October 2016 To July 2018 underwent caesarean section were screened for developing post-operative surgical site infection. All women were assessed using history, physical examination and laboratory investigations to collect demographics, gynecological and obstetrical history, , indication of C/s, type, duration of C/S and presence of adhesions. Weight and height were also recorded to record body mass index. Statistical analysis was performed using SPSS v.24 (SPSS, IBM, USA) using Chi-square and unpaired t-test

Results:

A total of 130 women involved in cesarean delivery and out of which 15 women develop post-operative surgical site infection (SSI) represent the incidence rate of 12.5% while the remaining one didn't develop any sign of post-surgical infections. In this study two group were made, women who develop post-surgical infections following cesarean called patients group (15 women), and who do not develop any symptoms called control group (115 women). The women age distribution in this study according to group wise, mean of patient group (29.4 ± 7.6) and control group (30.4 ± 9.1) with a P value >0.05 . Duration of surgical operation is higher in patients group (35.2 ± 16.4) minutes as compared to control group (25.4 ± 9.5) reached to a significant level (P value < 0.01), while the duration of labor is also higher in patient group (5.5 ± 4.08) who develop surgical complications and control group (3.36 ± 2.4) as mentioned in the table (1). Body mass index (BMI) of women who involved in cesarean was also calculated for all patients depending on their height and weight. BMI of the patient group remains in range (26 ± 2.8) and control group (25.7 ± 3.5) with a significant p-value > 0.05 , as mentioned in the table (1).

Adhesion of all women who underwent cesarean delivery was measured. Out of 130 female, only 44 developed adhesion from both groups. Out of these only 3 patients (20%) developed adhesion +, ++, and +++ respectively were found post-surgical infection while the remaining 12 patients (80%) from the patient group didn't show any sign of infections with significant statistical Chi-Square test ($\chi^2=3.9$, $P>0.05$). Obstetric history, type of C/S, Thickness of subcutaneous tissue and indication for C/S are shown in tables 3,4,5 and 6 respectively

Results:

Table 1. Characteristics of patients and controls

	Patients	Controls	P value
No.	15	115	
age (years)	29.4± 7.6	30.4± 9.1	>0.05
duration of operation (min)	35.2± 16.4	25.4± 9.5	<0.01
BMI (kg/m ²)	26± 2.8	25.7± 3.5	>0.05
Duration of labour (hours)	5.5± 4.08	3.36± 2.4	>0.05

Table 2. The presence of adhesions in patients and controls

Adhesions	Group	
	Patients	Controls
	No. (%)	No. (%)
+	1(6.7)	27(25.7)
++	1(6.7)	5(25.7)
+++	1(6.7)	9(8.6)
nill	12(80)	60(57.1)

$\chi^2=3.9$, $P>0.05$

Table 3. Obstetric history in patients and controls

Gravida/Para	Group	
	Patients	Controls
G1P0	6(40)	27(25.7)

G2P1	1(6.7)	13(12.4)
G3P2	2(13.3)	15(14.3)
G4P3	2(13.3)	22(21)
G5P4	0(0)	12(11.4)
g6p5	1(6.7)	0(0)
G6P5	2(13.3)	8(7.6)
G7P6	1(6.7)	5(4.8)
G8P7	0(0)	3(2.9)

$\chi^2=11.8, P>0.05$

Table 4. Type of CS in patients and controls

Type of CS	Group	
	Patients	Controls
Emergency	8(53.3)	54(51.4)
Elective	7(46.7)	51(48.6)

$\chi^2=0.01, P>0.05$

Table 5. Subcutaneous thickness in patients and controls

Subcutaneous thickness	Group	
	Patients	Controls

<2cm	4(26.7)	54(51.4)
>2cm	11(73.3)	51(48.6)

X²=3.2, P>0.05

Table 6. Indication for CS in patients and controls

Indication	Group	
	Patients	Controls
APH	1(6.7)	3(2.9)
breech	0(0)	21
cord	0(0)	2
cord pro	1(6.7)	0(0)
CPD	0(0)	1(1)
failure	1(6.7)	0(0)
fetal distress	2(13.3)	12(11.4)
infertility	0(0)	2(1.9)
IVF	0(0)	1(1)
ligation	0(0)	1(1)
post date	0(0)	5(4.8)
previous 1 cs	0(0)	1(1)
prev 1	0(0)	8(6.7)
prev 2	2(13.3)	10(9.5)
prev 3	2(13.3)	8(7.6)
prev 4	1(6.7)	5(4.8)
prev 6	0(0)	2(1.9)
prev 7	0(0)	2(1.9)
prev1	0(0)	2(1.9)
prev3	0(0)	3(2.9)
primibreech	2(13.3)	3(2.9)
second stage arrest	3(20)	8(6.7)
triple	0(0)	3(2.9)

twin	0(0)	2(1.9)
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$\chi^2=33.1, P>0.05$

Discussion:

In this case control study design of post-operative surgical site infection following the cesarean deliveries, we recorded 12.5% incidence rate of surgical site infection. Out of total 120 women who underwent delivery only 15 patient develop a different kind of infections and our baseline incidence rate is almost within the previously reported range, it exceeds that reported in many previous studies¹⁴. An Australian and Ireland conducted a study recorded a rate of 11.2% and 16% respectively³. As compare to other studies such as Iraq 6.3% (n=3036), US 5.5% (n=2417), but this study result is slightly higher, might be due to smaller sample number (n=120)^{15,16,17}. Other part of world also give different range of incidence SSI after C-section like a 4.7% in Italy to 11.2% in Scotland, 17% in Queensland^{13,14}, and Norway (8.3%)¹⁸⁻²³

However, difference in incidence rate around the world probably because of differences in patient populations, interpretation of case definitions and risk factors, perioperative practices, and the period from the procedure until ascertainment.

Many different risk factors are involved in post-surgical infection after cesarean delivery. One of the noticeable factors in our study was the duration of time (min) during C-section. In this study, the duration of time in cesarean in the patient group (35.2± 16.4) more than the control group (25.4± 9.5). This result shows that increasing operation time during CD may be a risk factor for developing a post-surgical infection. A Norway study conducted in 2007 which indicate that operating time exceeding 38 min substantially increases the risk of SSI²⁴. Whereas, another study reported that likelihood of SSI increased with increasing operating time > 30min²⁵.

In our result all women involved from both group (patient & control) BMI < 30, while the other study reported, if women BMI >30 is generally categorized in obesity which is main risk factor for developing SSI²⁶. Similar results also reports by different studies^{19,24}. On the basis of previous evidence we can say that our result related to BMI <30 is non-significant.

In Table (3) obstetric history of Gravida/Para. Gravida defined as a number of pregnancy in women, whereas the para number of birth women has had. Most of women (40%) in patient group who develop post-SSI were found to be in G1P0 (one pregnancy, zero delivery). This shows that the obstetric history of Gravida/Para can cause infections after delivery. Higher risk of developing pre-eclampsia, and Dystocia (or difficult labor) was found in 37% of primagravidae in one Danish stud ². Gheorghe et al reported that pregnancy losses also risk factor for developing SSI ^{28,29}

Many different indications for SSIs following CD have been reported (Table 6). Out of 120 cesareans meeting inclusion criteria, 11 (11.0%) were performed in the second stage of labor, whereas 109 (89%) were performed in the first stage of labor. The risk of SSI (endometritis) was directly associated with endometritis and 3-fold higher in second- compared with first-stage cesareans. This shows that when cesarean occurred in the second stage of labor chances of developing infections are high and this result supported by different studies ³⁰. In our study out of 15 patients who develop post-op surgical site infection only 3 women's develop adhesions (+, ++, +++ respectively) (Table 2). From control group 41 cases also develop adhesion but no sign of infections. Formation of adhesion after first delivery may delay delivery time up to 10 mint which is directly associated with other serious complication like more blood loss, longer duration of operation, wound infections, fetal distress

Conclusion:

12.5% SSIs following CDs represent complex clinical situations and are caused by many risk factors such as duration of operation (min), obstetric history of Gravida/Para (G1P0), emergency SC, subcutaneous thickness >2cm, Antepartum hemorrhage (APH), fetal distress, cord prolapse, indication of second stage of labor, and primi breech are found to be directly associated with post-operative surgical infections and mother mortality and morbidity rate. Proper awareness would be able to prevent and/or shorten these post SSI and expensive hospital stay by early diagnosis and appropriate antibiotics treatment.

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Conflict of Interest - None

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