Incidence of post cesarean section wound infection in a tertiary hospital, Riyadh, Saudi Arabia

Fawzia A. Habib, *ABOG, MD.*

ABSTRACT

Objective: To measure the rate of wound infection after cesarean section and assess risk factors for such infection.

Methods: A prospective surveillance was conducted at King Khalid University Hospital, Riyadh, Kingdom of Saudi Arabia, during the period January 2000 through to December 2000. This included a total of 754 cesarean sections. The following risk factors, which were studied included, age, parity, gravida, gestational age, antenatal care, type of cesarean section emergency or elective, previous history of cesarean section, duration of operation, rank of surgeon, use of antibiotics, wound infection, complications and length of stay in the hospital. Post discharge surveillance carried out 5-10 days later to check for wound infection.

Results: The overall wound infection rate was 4.5% (95% confidence interval [CI], 3-6%). In the multivariate analysis, the independent risks factors for wound infection were age of the mother less than 20 years (Odds ratio (OR)=12.13: 95% CI 1.43-118.50: P=0.039), the duration of surgery, more than one and a half hour (OR=23.9: 95% CI 10.36 – 55.78: P=<.001) and medical complications namely diabetes mellitus (OR=2.28: 95% CI 1.01-5.05: P=0.03). There was a statistical significant relationship between wound infection and length of stay (P<0.001).

Conclusion: A protocol for prophylactic antibiotics is needed, in addition to a new strategy to reduce the nosocomial infection, in order to decrease the incidence of wound infection after cesarean section.

Keywords: Cesarean section, wound infection, risk factors.

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The rate of cesarean section (CS) has been reported to be on the increase worldwide.[1-2] In the last decade, cesarean deliveries rate were reported as 21% and 16% of total deliveries in the United States of America and United Kingdom.[3-4] In the Middle East in general and the Kingdom of Saudi Arabia (KSA) in particular no such studies are available. Reports from maternity hospitals from these countries suggest a rising trend in the incidence of CS. This increase in cesarean delivery is associated with complications of which wound infection is a major one. Wound infection is responsible for the higher maternal morbidity and costs associated with management of patients with CS deliveries than those with vaginal delivery. The higher cost compared to vaginal delivery is attributed to extended stay in hospital, additional allocations of staff and sepsis management protocols. This practice usually exerts much strain on the limited resources available in most hospitals in developing countries. The actual rate of post cesarean wound infection is not known in KSA, but it varies from as low as 1.1% in low risk population to as high as 9.6% in high risk population.[5] A recent study at the King Fahad

From the Department of Obstetrics & Gynecology, King Khalid University Hospital, Riyadh, *Kingdom of Saudi Arabia*.

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Address correspondence and reprint request to: Dr. Fawzia A. Habib, Consultant & Assistant Professor, Department of Obstetrics & Gynecology (36), PO Box 7805, Riyadh 11472, *Kingdom of Saudi Arabia*. Tel. +966 (1) 4670818. Fax. +966 (1) 4679557. E-mail: fhabib@healthgulf.com

National Guard Hospital, Riyadh, KSA estimated the wound infection rates following CS as 2.8%.[6] This study may not be representative of the situation in the KSA, as this hospital serves only families of National Guard soldiers and their dependents. Our present study took place in a tertiary hospital accessible to a wide distribution of population in KSA, with a wide range of socio-economic groups including national and non national residents with a walk in emergency system. Also the hospital is typical of most of general hospitals in the KSA.

Methods. The study took place in the Obstetric Unit of King Khalid University Hospital (KKUH), Riyadh, KSA in the year 2000. King Khalid University Hospital is an 850-bed hospital with an average of 5000 deliveries per year with 12-13% delivered by CS. The data collected included items of information such as patients' age, parity, gravida, gestational age, whether received Antenatal Care or not. It also included whether CS was emergency or elective, previous history of CS, duration of operation, rank of surgeon, use of antibiotics, wound infection, complications and length of stay in the hospital. Every patient was followed up for 10-days after discharge and the presence of minor or major wound infection were recorded. Wound infection was defined as 1. Purulent discharge present within or exuding from the wound, or 2. Painful spreading arrhythmia indicative of cellulitis. An infection was defined minor if deep tissue destruction or lymphangitis were absent, and major if these elements, wound dehiscence or systemic symptoms were present. Swabs were obtained from infected wounds and cultured using standard microbiological methods. After discharge, follow-up was carried out in the out patient post natal clinic by the obstetrician by the 5th-10th post discharge day where checking of the surgical wound conditions, searching for wound infection. As there was no written protocol for prophylaxis antibiotics use in labor and delivery, the antibiotics were either administered pre-operatively, intra-operatively or post-operatively according to the preference of the treating doctor. The time interval between delivery and administration of antibiotics was highly variable. A variety of antibiotics were used, but most regimens included either ampicillin or a second generation cephalosporin in addition to metronidazol. The antibiotics usually continued for approximately 7-days but the duration of usage was variable.

The data was analyzed in a microcomputer using the EPI-INFO statistical software 6.04 for data entry and statistical package for social sciences for statistical analysis. The response variable in this report was wound infection and its association with each maternal, theater and post-operative categorical variables was investigated by the X^2-test in a uninvariable analysis. For quantitative variables such as age, duration of operation and length of stay in hospital, the student t-test or Mann Whitney U test (where appropriate) was used to compare mean values between infected and non-infected patients. Odds ratio of potential risk factors and their 95% CI were calculated. Variables significant at the 10% probability level were included in a multiple logistic regression model to assess the independent and simultaneous association with the occurrence of wound infection. All tests of significance were carried out at the 2 sided 5% probability level.

Results. The monthly distribution of the 754 CS varies between lowest 5.7% to highest 10.9%. The highest frequency of CS took place in June (10.9%) and July (10.8%) while the least were in March and December (5.7%). There were no statistically significant differences in the monthly distribution of wound infections. But the highest incidence 9.6% occurred in April followed by June (7.4%). There were no infections recorded for the months of January and March. The annual incidence of wound infections was 4.5%, (95% confidence interval (CI), (3-6%). **Table 1** shows the distribution of wound infections by maternal variables in which age of mother was the only statistically significant variable ($P<0.05$). The mothers aged 20-24 years had the least proportion with wound infection and were taken as reference category in the calculation of odds ratio. Mothers less than 20-years of age have 12-fold more risk to have wound infection than those in the 20-24 year age group. Also, parity, gravida and gestational age were not significantly associated with wound infections ($P>0.05$). Women with ruptured membrane at less than 24 hours were 2.5 times more likely to have wound infections but this was also not statistically significant ($P>0.05$). **Table 1** also showed that women covered with antibiotics, post-operatively have lower proportions of wound infection but not statistically significant ($P>0.1$). Patients with diabetes mellitus were more than 2-fold more likely to have wound infection ($P<0.05$). Other medical problems such as hypertension and systemic lupus erythromatous were not statistically significant associates of wound infections. There was a statistical significant relationship between wound infections and length of stay ($P<0.001$). The longer the length of stay the higher the proportions with wound infection.

A multiple logistic regression analysis suggested duration of operation (Wald Statistic=49.256, $P<0.0001$), length of stay, Wald Statistic=6.8660, $P<0.05$ were independently and significantly associated with wound infection. The same model suggested patients on elective surgery could be independently associated but it did not reach the 5% level of probability ($P=0.0546$). The model has a

Table 1 - Relationship of maternal factors to rate of post cesarean section wound infection at King Khalid University Hospital, Riyadh, Kingdom of Saudi Arabia.

Maternal variables	n of cases	Infection (%)	Odds Ratio	95% confidence interval (CI)	P-value
Age (Years)					
<20	15	3 (20)	12.13	1.43-118.50	
20-24	99	2 (2)	1.0		
25-29	188	5 (2.7)	1.33	0.22-10.06	
30-34	209	10 (4.8)	2.44	0.49-16.44	0.039
35-39	190	10 (5.3)	2.69	0.54-18.19	
40+	53	4 (7.5)	3.96	0.59-32.37	
Total	**754**	**34 (4.51)**			
Parity					
0-1	271	11 (4.1)	1.0		
2-4	271	9 (3.3)	1.67	0.33-11.37	0.160
5-9	194	14 (7.2)	1.84	0.76-4.45	
10+	18	0 (0)	0		
Gravida					
1-4	385	12 (3.1)	1.0		
5-9	303	19 (6.3)	2.08	0.94-4.64	
10-14	58	3 (5.2)	1.70	0.37-6.74	0.226
15	8	0 (0)	0		
Gestational age (weeks)					
<30	19	1 (5.3)	1.0		
30-35	63	4 (6.3)	1.22	0.11-30.5	
36-40	584	25 (4.3)	0.81	0.11-16.81	0.898
41+	88	4 (4.5)	0.86	0.8-21.37	
Antenatal Care					
Yes	714	32 (4.5)	0.87	0.19-5.45	0.850
No	40	2 (5.1)	1.0		
Previous History (CS)					
Yes	346	18 (5.2)	1.34	0.64-2.82	0.398
No	408	16 (3.9)	1.0		
Rupture of membrane					
<24 hours	698	33 (4.7)	2.78	0.4-55.6	0.298
≥24 hours	56	1 (1.8)	1.0		
Post operative antibiotics					
Yes	609	26 (4.3)	1	(0.53, 3.11)	0.322
No	145	8 (5.5)	1.31		
Diabetes mellitus					
Yes	136	11 (8.1)	2.28	(1.01, 5.05)	0.03
No	618	23 (3.7)	1.0		
Hypertension					
Yes	59	2 (3.4)	0.73	(0.12, 3.23)	0.67
No	695	32 (4.6)	1.0		
SLE					
Yes	4	0 (0)	-	-	
No	750	34 (4.5)	-	-	0.433
Others			2.09	(0.88, 4.85)	0.07
Yes	114	9 (7.8)	1.0		
No	640	25 (3.9)			
Length of stay (Days)					
4-7	577	16 (2.8)	1.0		
8-14	168	15 (8.9)	3.44	(1.57, 7.52)	.0001
15+	9	3 (3.73)	3.73	(1.32, 10.59)	

n - number, CS - cesarean section, SLE - systemic lupus erythematosus

Table 2 - Relationship of operative factors to rate of wound infection at King Khalid University Hospital, Riyadh, Kingdom of Saudi Arabia.

Theater variables	n of cases	n of wound infections	Infection %	Odds ratio	95% Confidence interval	P-value
Type of operation						
Elective	268	17	6.4	1.87	0.89, 3.92	0.071
Emergency	486	17	3.5	1.0		
Duration of operation						
< 1 hour	170	0	0			
1-1.49 hours	533	14	2.6	1.0		0.00001
≥1.5 hours	51	20	39.2	23.9	10.36, 55.78	
Intra-operative use of antibiotics						
Yes	34	5	14.7	4.11	1.29, 12.23	0.015
No	720	29	4	1.0		
Type of cesarean section						
Midline	32	3	9.4	2.31	0.53, 8.53	0.17
Transverse	722	31	4.3	1.0		
Grade of surgeon						
Consultant	44	5	11.4	3.13	0.99, 9.23	
Registrar	635	25	3.8	1.0		0.067
Resident	75	4	5.3	1.37	0.39, 4.32	

n - number

high negative predictive value of 99.3% but a poor positive predictive value of only 20.5%. **Table 2** showed the rates of wound infections in relation to the operating theater variables. The duration of operation and use of antibiotics intra-operatively were variables significantly associated with wound infections P<0.02. There was no wound infections in 170 (22.5%) operations that lasted for less than one hour while almost 40% of operation that lasted more than 1.5 hours had wound infections (P<0.001). Patients who received antibiotics during operations were 4-fold more likely to develop wound infection. Also, women with elective CS were almost twice at risk but were significant only at the 10% probability level. The patients operated on by registrars had the least risk of wound infection (3.8%) while those operated on by consultants had the highest proportion of patients (11.4%) with wound infections, higher than residents (5.3%). However, the association of grade of surgeon with wound infection was also only significant at 10% probability level. There were few patients with midline section (4.5%) but a higher proportion of them had wound infections. The difference was not statistically significant (P>0.1).

Discussion. The overall wound infection rate obtained by our study was 4.5%. This rate is significantly higher than the prospective surveillance carried out at a tertiary referral hospital in Riyadh, KSA 2.8%.[6] This may be explained by the fact that our hospital is serving a population with a mixture of high risk and low risk patients, and it is typical of a general hospital not like the previous study[6] which took place in a hospital serving a certain group of patients. Our finding of increased wound infection associated with older age above 40 years is consistent with another studies.[7,8] Scott et al[8] reported that the ratio of pre-delivery hospitalization for severe complications of pregnancy per 100 deliveries was significantly higher for women aged 40 years and older. The rate of cesarean delivery, with its associated higher morbidity, increases with maternal age.[5] Mothers less than 20-years of age have 12 fold more risk to have wound infection than those in the 20-24 years age group. Most of these mothers are admitted with pregnancy complication namely hypertension and intrauterine growth restriction ended with early intervention and CS.

Some previous studies showed that the post operative febrile morbidity and wound infection rates after CS are reduced by the use of prophylactic antibiotics,[9,10] while others failed to find such association.[11] Our results showed high rate of wound infection with those who have post operative antibiotics, but these results could not be compared with previous studies, as we do not have a prophylactic antibiotics protocol. As there is reported increase in enterococcal endometritis and urinary tract infection after CS,[10] we suggested that more careful selection of patients and the use of broad spectrum antibiotics may be needed. In addition administration of prophylactic antibiotics after cord clamping may reduce adverse effects to the fetus

without influencing efficacy. No association was found between the wound infection rate and duration of labor or duration of ruptured membranes, this is in accordance with the findings of Parrot et al.[12]

This study also showed an association between the length of operation, rank of surgeon, and the infection rate. The risk of infection was more when the length of the operation was more than one hour, and it was usually more when the consultant or senior obstetrician was performing the CS. Previous studies have reported similar findings.[13] The increase in infection related to consultant performing the procedure may be explained by the fact that they are needed in complicated cases namely placenta accreta which could not be handled by the junior staff. It was interesting to find more wound infection during the month of June and July, which coincide with the beginning of summer holidays but the total number of deliveries and particularly CS were more during these months. This increase in infection rate could be due to the reduction in the number of medical and auxiliary staff during the summer holidays.

In conclusion, despite our wound infection rate is 4.5%, this study extends our knowledge of the frequency and risk factors for increasing the rate of wound infection post CS in our institution. Some corrective actions should take place in the future including a written protocol to indicate which patient should have antibiotics and why, which antibiotics and for how long, and it should be implemented. A written strategy should be implanted to reduce nosocomial infection in obstetrical patients with continuous surveillance of population with specific infection rates and reporting them to infection control committee. Research efforts should continue in order to decrease serious maternal morbidity after childbirth.

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