Evaluation of the efficiency of antibiotic prophylaxis in cesarean cases

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Abstract

Background: In recent years the rate of cesarean section has significantly increased.To determine the efficacy of prophylactic antibiotics in reducing infectious morbidity after cesarean section.

Objectives: In our study, we aimed to evaluate the efficiency of prophylactic antibiotic administration by comparing three groups using single, multiple and no prophylactic antibiotic therapy.

Materials and Methods: Our study is a prospective, randomized controlled study including emergent cases, that developed cesarean indication while in active labor, and elective cesarean cases. A total of 90 patients were included in the study, including 30 patients who underwent cesarean delivery and did not undergo an antibiotic prophylaxis (Group 1), 30 patients who underwent a single dose antibiotic prophylaxis (Group II) and 30 patients who underwent multiple dose antibiotic prophylaxis (Group III).

Results: The incidence of wound infection was significantly higher in cases that were not using antibiotics at postoperative days 3, 5 and 7 compared to the cases using single and multiple antibiotics. There was not a significant difference between groups in terms of endometritis.

Conclusion: Administration of prophylactic antibiotics prevent wound infection but does not prevent development of endometritis.

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Background

Infection risk is significantly increased in women who undergo cesarean delivery compared to those who deliver vaginally. Infection rates following cesarean section vary between 7% and 20% due to demographic and obstetric factors.[1,2] Therefore, the most significant risk factor for postpartum maternal infection is cesarean delivery.[3] Hospitalization time increases due to the complications associated with infection following cesarean.[4]

Complications associated with infections following cesarean delivery are fever, wound infections, endometritis, bacteriemia, pelvic abscess, septic shock, necrotizing fascitis, septic pelvic vein thrombophlebitis and urinary system infections.[2,5,6] Endometritis and wound infections are still the most significant causes of postoperative infectious morbidity.[4] While the incidence of endometritis is between 20%-85% without antibiotic prophylaxis, severe complication rates associated with wound infection and infections are reported as 25%.[7]

The administration of prophylactic antibiotics decreases the incidence of infectious morbidity following cesarean by a rate of 75% in both planned and emergent caesarean deliveries.[8,9,10]

First generation cephalosporins are the most commonly used antibiotics in prophylaxis, generally being administered after clamping the cord of the newborn.[11] Antibiotics are given before skin incision in most of the surgical operations requiring prophylaxis.[12]

Sullivan and Thigpen have found that preoperative antibiotic prophylaxis decreased the incidence of infectious morbidity compared to prophylaxis administration after cord clamping.[13,14] Fejgin et al. also found that the incidence of wound infections was low in the group which was given preoperative antibiotic prophylaxis.[15] Wax et al. have reported that administration of prophylaxis before the operation or after cord clamping does not affect infectious morbidity.[16]

Objectives

In this study, we aimed to evaluate the efficiency of prophylactic antibiotic administration by comparing groups that were administered single dose and multiple doses along with those who were not administered prophylactic antibiotic therapy.

Materials and Methods

Our study is a prospective, randomized controlled study including emergent cases, who developed cesarean indications while in active labor, and cases of elective cesarean. A total of 90 patients were included in the study, including 30 patients who underwent cesarean delivery and did not undergo antibiotic prophylaxis (Group 1), 30 patients who underwent a single dose antibiotic prophylaxis (Group II) and 30 patients who underwent multiple dose antibiotic prophylaxis (Group III). Patients included were at 34-41st gestational weeks. Patients were excluded for the following reasons early membrane rupture, chorioamnionitis, vaginal bleeding, diabetes, maternal obesity, allergies to penicillin and cephalosporin and signs of infection. All patients were enrolled in the study after being informed about the aim and

possible results of the study and treatment protocols, and after giving informed consent. A catheter was inserted into the bladder before cesarean in all cases. The skin was cleaned with povidone iodine before the operation. All cases underwent cesarean delivery under general anesthesia. The study was approved by the ethics committee of the hospital.

1 g Cephazoline Sodium (Sefazol 1g flk,(Mustafa Nevzat) was used for antibiotic prophylaxis during cesarean delivery. 1g Cephazoline Sodium was mixed with 50 cc normal saline, and it was administered to the patients in Group II as a single dose at least 10 minutes before skin incision and to the patients in Group III as three doses including at least 10 minutes before skin incision and at 12 and 24 hours following skin incision. Antibiotic prophylaxis was not given to the patients in Group I.

Complete blood count and C-reactive protein (CRP) were measured during the preoperative period. Patients were evaluated for axillary fever and an increase in vaginal temperature. Complete blood count and CRP were measured on the first day postoperative. Patients were evaluated for axillary fever, presence of purulent lochia, tachycardia and an increase in vaginal temperature. On postoperative days 3, 5 and 7, they were evaluated for the presence of purulent lochia, tachycardia, an increase in vaginal temperature, redness on the incision line, sensitivity, edema, local temperature increase and discharge.

Diagnosis of febrile morbidity was defined as fever that is above 37.5°C after postoperative 24th hours at 4-hour intervals. Increased uterine sensitivity and/or presence of malodorous or purulent lochia was accepted as endometritis. Diagnosis of wound infection was made in the presence of discharge, stiffness, erythema and edema on the incision site. Infection was not considered in the presence of hematoma, seroma and wound opening.

Empirical antibiotherapy was started after taking necessary cultures from the patients with postoperative infection. Re-treatment was arranged for the patients who did not respond to empirical treatment based on culture results. Cases were followed up for signs of infection during hospitalization. They were verbally informed to watch for signs of infection before discharge from the hospital and examined again at the second and fourth weeks following delivery.

Statistical Analysis

Results obtained from the study were evaluated, using the NCSS (Number Cruncher Statistical System) 2009 & PASS 2009 Statistical Software (Utah, USA) program for statistical analysis. In addition to descriptive statistical methods (mean, standard deviation, frequency), one way Anova test was used in intergroup comparisons of the parameters showing normal distribution, and Tukey HSD test was used for the detection of the group leading to the difference. Chi-Square test was used in intergroup comparisons of qualitative data and statistical significance was evaluated at $p<0.05$ level.

Results

The study included 90 women, between the ages of 18 and 35 years, at the

Ministry of Health Okmeydani Training and Research Hospital Maternity Clinic, between 1 June 2009 and 1 October 2009. The mean age of the patients was 28.04±4.18 years. Patients were assigned to three groups each containing 30 cases based on their prophylaxis use, including “Single Use”, “Multiple Use” and “No Antibiotics use”. Hospitalization time of the cases varied from 3 to 5 days and mean hospitalization was 3.20±0.60 days.

The mean body mass index of the cases was 76.51±7.92. The gestational weeks of the cases were between 31 and 42 weeks with the mean being 38.26±1.71 weeks. The number of gravida among the cases varied from 1 to 8 with a median of 2. The number of parities was between 0 and 5 with a median of 1. The number of abortions was between 0 and 4 with a median of 0 while the number of curettages varied between 0 and 2 and the median was 0. Preoperative hemoglobin levels varied from 8.3 to 14.9, with a mean of 11.50±1.39 (Table 1).

Table 1: Demographic data

		Mean±SD (Median)
Weight		**76.51±7.92**
Gestational week		**38.26±1.71**
Gravida		**2.23±1.23 (2)**
Parity		**0.84±0.86 (1)**
Abortion		**0.29±0.67 (0)**
Curettage		**0.67±0.33 (0)**
Preop Hemoglobin		**11.50±1.39**

The distribution of cesarean indications within each group and the total is given in Table 2. Among all cases, a previous cesarean section (C/S) was observed in 44.4%, fetal distress in 16.7%, preeclampsia in 10%, cephalopelvic disproportion (CPD) in 8.9%, obstructed labor in 6.7%, breech in 5.6%, placenta previa in 4.4%, maternal factor in 2.2% and twin pregnancy in one case.

Table 2: Distribution of cesarean indications

C/S Indications	Single antibiotics use	Multiple antibiotics use	No antibiotics	Total
	n (%)	n (%)	n (%)	n (%)
Previous C/S	17 (56.7%)	10 (33.3%)	13 (43.3%)	40 (44.4%)
Preeclampsia	3 (10.0%)	5 (16.7%)	1 (3.3%)	9 (10.0%)
Fetal Distress	7 (23.3%)	3 (10.0%)	5 (16.7%)	15 (16.7%)
CPD	1 (3.3%)	3 (10.0%)	4 (13.3%)	8 (8.9%)
Placenta Previa	0 (0%)	4 (13.3%)	0 (0%)	4 (4.4%)
Obstructed labor	1 (3.3%)	2 (6.7%)	3 (10.0%)	6 (6.7%)
Maternal Factor	0 (0%)	2 (6.7%)	0 (0%)	2 (2.2%)
Breech	1 (3.3%)	0 (0%)	4 (13.3%)	5 (5.6%)
Twin pregnancy	0 (0%)	1 (3.3%)	0 (0%)	1 (1.1%)

There was not a statistically significant difference between WBC levels of the cases at preoperative and postoperative first days, between CRP levels during the preoperative period, between axillary fever values during the preoperative period, between axillary fever levels at postoperative days 1, 3, 5 and 7, between hospitalization times, and between the incidences of endometritis (p>0.05). Endometritis was observed in none of the cases at postoperative day 1 (Table 3, Figure 1).

Table 3: Evaluation of WBC, CRP, Axillary Fever, Hospitalization time, Endometritis and Wound Infection

	Single Antibiotics Use (n:30) Mean±SD	Multiple Antibiotics Use (n:30) Mean±SD	No Antibiotics Use (n:30) Mean±SD	ss
WBC Preop	10,504.67±1,780.60	10,691.00±2,689.02	10,216.33±225.79	0.718*
WBC Postop Day 1	12,978.00±2,125.08	13,263.33±381.75	13,552.00±240.58	0.743*
CRP Preop	5.79±3.40	4.53±1.70	5.94±2.77	0.094*
CRP Postop Day 1	68.17±23.24	52.27±18.95	103.38±25.83	0.001*
Axillary fever Postop Day 1	36.68±0.39	36.67±0.28	36.89±0.44	0.055*
Axillary fever Postop Day 3	36.67±0.32	36.66±0.24	36.84±0.44	0.076*
Axillary fever Postop Day 5	36.76±0.51	36.66±.41	36.86±0.52	0.285*
Axillary fever Postop Day 7	36.73±0.45	36.68±0.25	36.84±0.51	0.325*
Hospitalization time (days)	3.06±0.36	3.13±0.51	3.40±0.81	0.076*
Endometritis	n (%)	n (%)	n (%)	
Endometritis Postop Day 3	0 (0%)	0 (0%)	1 (3.3%)	0.364**
Endometritis Postop Day 5	3 (10%)	0 (0%)	3 (10%)	0.200**
Endometritis Postop Day 7	3 (10%)	0 (0%)	3 (10%)	0.200**
Wound Infection (WI)	n (%)	n (%)	n (%)	
WI Postop Day 3	0 (0%)	0 (0%)	8 (26.7%)	0.001**
WI Postop Day 5	4 (13.3%)	2 (6.7%)	14 (46.7%)	0.001**
WI Postop Day 7	4 (13.3%)	2 (6.7%)	12 (40.0%)	0.003**

*Oneway ANOVA Test, ** Chi-Square Test, p<0.01*

There was a statistically significant difference between CRP levels of the groups at postoperative day 1 (p<0.01). Postoperative day 1 CRP levels of the cases who were not using antibiotics was significantly higher compared to CRP levels of the cases who were using single and multiple antibiotics (p:0.001, p<0.01). Postoperative day 1 CRP levels of the cases who were using multiple antibiotics were significantly higher compared to CRP levels of the cases using single antibiotics (p:0.023, p<0.05). (Table 3, Figure 1).

The incidence of wound infections in the

cases who were not using antibiotics at postoperative days 3, 5 and 7 was significantly higher than the cases who were using single and multiple antibiotics ($p<0.01$).

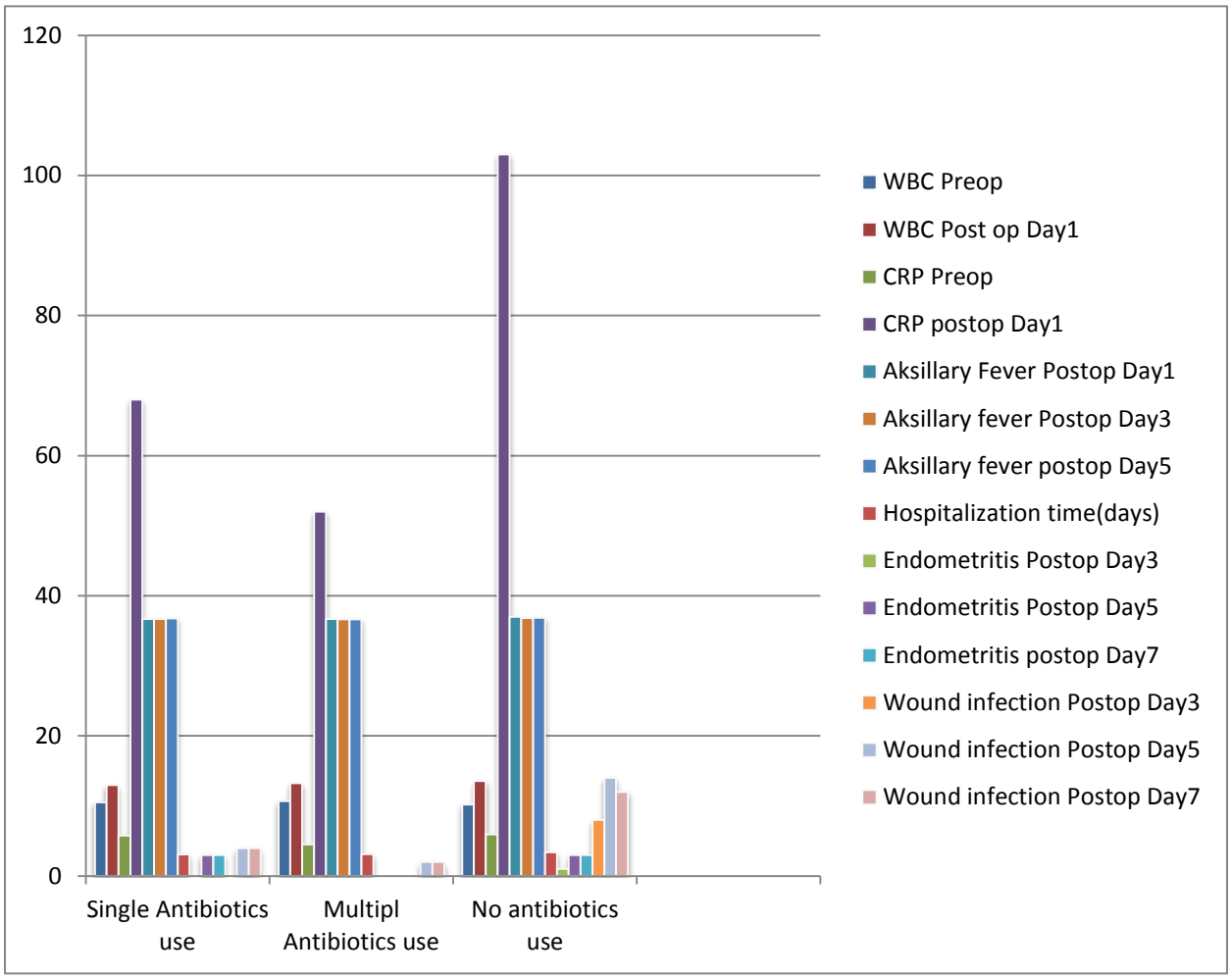

Figure 1: Graphical distribution of WBC, CRP, Axillary Fever, Hospitalization time, Endometritis and Wound Infection

Discussion

The most significant causes of postoperative morbidity following cesarean delivery are still endometritis and wound infections.[17] There are various factors that determine infectious morbidity following cesarean delivery. These are operation time, maternal obesity, membrane rupture time, antenatal visits less than seven and not using prophylactic antibiotherapy.[18]

In general, prophylactic antibiotherapy is given before surgical procedures. Antibiotic prophylaxis has eliminated 2/3 of endometritis cases and the majority of wound infections in cesarean cases (elective or non-elective cases).[19] Burke et al. have first shown that antibiotic use before wound contamination decreased the incidence of wound infections in animal model studies.[20]

In a study by Jakobi et al. evaluating

prophylactic antibiotic administration, it was found that the use of a single dose of prophylactic antibiotics significantly decreased fever, wound infections, endometritis and urinary system infections compared to the group that was not using prophylactic antibiotics.[19]

In their report evaluating the efficiency of antibiotic regimens and medications in cesarean section, Hopkins et al. reported that administration of prophylactic ampicillin or first generation cephalosporins decreased the risk for postoperative endometritis and administration of wide-spectrum antibiotics or multiple dose antibiotic regimens did not provide an additional benefit compared to ampicillin and first generation cephalosporin administration.[21] In the study by Alekwe et al., there was no difference in terms of endometritis, wound infections and urinary system infections when a single dose of ceftriaxone was compared with multiple dose combinations of ampicillin, gentamycin and metronidazole for infectious morbidity.[22]

In the study by Smaill et al. comparing administration of prophylactic antibiotics with no prophylaxis administration, it was detected that antibiotic prophylaxis significantly decreased endometritis and it was quite beneficial in preventing wound infections.[19]

In a study comparing the timing of antibiotic prophylaxis, no difference was detected between prophylactic antibiotherapy before skin incision or following cord clamping in terms of infectious morbidity and endometritis.[23]

In the studies evaluating prophylaxis regimens and antibiotics used before cesarean, it was reported that ampicillin and first generation cephalosporins had similar effects in decreasing postoperative endometritis; it was also determined that the addition of multiple dose antibiotic regimens or wide-spectrum antibiotics to prophylaxis regimens did not have an additional benefit.[20]

In our study, the criteria for wound infections were defined as axillary fever, skin redness, sensitivity, discharge, edema, local temperature increase; endometritis was defined as vaginal temperature increase, tachycardia and the presence of purulent lochia. Laboratory tests of complete blood count and CRP were used to detect infectious morbidity.

Signs of wound infection were only detected in the group which did not undergo antibiotic prophylaxis at postoperative day 3. The number of cases in this group was 8 (26.7%), the number of cases presenting signs of wound infection at postoperative day 5 was 4 (13.3%) in the group of single dose prophylaxis, 2 (6.7%) in the group of multiple dose prophylaxis and 14 (46.7%) in the group who did not undergo prophylaxis; the number of cases presenting signs of wound infection at postoperative day 7 was 4 (13.3%) in the group of single dose prophylaxis, 2 (6.6%) in the group of multiple dose prophylaxis and 12 (40%) in the group who did not undergo prophylaxis. When all groups were compared, signs of wound infection in the group, who had not received prophylactic antibiotics, on postoperative days 3, 4 and 7 was found to be higher than the other groups ($p<0.05$). No significant difference was detected when single and multiple dose prophylaxis were compared.

There was not a significant difference between preoperative CRP levels of the groups. When CRP levels on postoperative day 1 were compared, CRP level in the group which did not use antibiotherapy was significantly higher compared to the cases that used single and multiple dose antibiotherapy (p=0.001). Moreover, when cases who underwent single and multiple dose antibiotherapy were compared for CRP at postoperative day 1, CRP level was found to be significantly higher compared to the patients who underwent multiple dose antibiotherapy (p=0.023). There was not a statistically significant difference between axillary fever levels of the groups on postoperative days 1, 3, 5 and 7 (p>0.05). There was also no significant difference between groups in terms of hospitalization time.

In general, similar to the literature, wound infections were found to be higher in cases that did not use antibiotics; however, there was no efficiency of dose regimen on infectious morbidity.

When cases of endometritis were evaluated in our study, it was detected in only one case (3.3%) in the group who did not use prophylaxis on postoperative day 3. On postoperative days 5 and 7, endometritis was detected in three cases (10%) each in the group of single prophylaxis and in the group who did not undergo prophylaxis. No endometritis was observed in the group of multiple prophylaxis. When the groups were compared, no significant difference was observed in terms of endometritis.

Conclusion

Wound infection and endometritis are still the most significant causes of postoperative morbidity following cesarean operation. Administration of prophylactic antibiotics is a conventional practice before surgical interventions. In the studies evaluating the efficiency of prophylactic antibiotic administration, it was reported that prophylactic antibiotic administration before the intervention decreased febrile morbidity, wound infection, endometritis and urinary system infection; but there was no difference between single and multiple dose prophylactic antibiotics administration. Also in our study, it was found that prophylactic antibiotics decreased febrile morbidity, wound infection and endometritis; however, there was not a difference between single or multiple dose antibiotic administration.

It is necessary to perform multicentric and randomized controlled studies including increased number of cases in order to achieve more accurate results.

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