

# Comparison of the Effect of Administration Time of Prophylactic Antibiotics on Post-Operative Wound Infection after Caesarean Section

Maryam Mushtaq<sup>1</sup>, Humaira Rizwan<sup>2</sup>, Shermeen Kousar<sup>3</sup>, Ayesha Akram<sup>4</sup>, Samina Irshad<sup>5</sup>, Nasim Irshad<sup>6</sup>

<sup>1</sup> Medical Officer, Department of Obs & Gynae(Unit-I), Holy Family Hospital, Rawalpindi.

<sup>2,3</sup> Senior Registrar, Department of Obs & Gynae(Unit-I), Holy Family Hospital, Rawalpindi.

<sup>4</sup> Assistant Professor, Department of Obs & Gynae, HITEC Institute of Medical Sciences, Taxila.

<sup>5</sup> Associate Professor, Department of Obs & Gynae(Unit-I), Foundation University, Islamabad.

<sup>6</sup> Assistant Professor, Department of Forensic Medicine, Army Medical College, Rawalpindi.

## Author's Contribution

<sup>1</sup> Conception of study

<sup>1,2,3</sup> Experimentation/Study conduction

<sup>2,3,4</sup> Analysis/Interpretation/Discussion

<sup>4,5,6</sup> Manuscript Writing

<sup>5,6</sup> Critical Review

## Corresponding Author

Dr. Ayesha Akram,

Assistant Professor,

Department of Obs & Gynae,

HITEC Institute of Medical Sciences,

Taxila

Email: ayeshamaaz343@gmail.com

## Article Processing

Received: 22/02/2021

Accepted: 22/05/2021

**Cite this Article:** Mushtaq, M., Rizwan, H., Kousar, S., Akram, A., Irshad, S., Irshad, N. Comparison of the Effect of Administration Time of Prophylactic Antibiotics on Post-Operative Wound Infection after Caesarean Section. *Journal of Rawalpindi Medical College*. 30 Jun. 2021; 25(2): 251-257.

DOI: <https://doi.org/10.37939/jrmmc.v25i2.1596>

**Conflict of Interest:** Nil

**Funding Source:** Nil

**Access Online:**



## Abstract

**Objective:** To compare the post-operative wound infection rate after cesarean section in women receiving prophylactic antibiotics before skin incision with women receiving antibiotics after cord clamping of a baby.

**Materials and Methods:** This Randomized controlled trial was conducted in the Department of Obstetrics and Gynecology, Holy Family hospital, Rawalpindi from October 2017 to April 2018.

356 patients pregnant females of age 20-45 years who were at term undergoing elective cesarean section for any indication were enrolled. All the patients were randomly divided into two groups. Group A (study group) was comprised of patients who received prophylactic antibiotic doses 15-60 min before the start of surgery. Group B (control group) was comprised of patients who received the antibiotic after the cord clamping of the baby. The wound infection was noted for both groups.

**Results:** Mean maternal age of the total study population found to be 28.6±5.3 years. The mean gestational age in all the enrolled patients was found to be 37.7±1.2 weeks. Wound infection was noted in 28.4% (n=101) of the total study population. Out of 101 total patients who presented with wound infection, 63 patients (62.4%) were of the control group while only 38 (37.6%) patients belonged to the study group (P<0.05).

**Conclusion:** Prophylactic antibiotics are useful for controlling post-cesarean wound infection.

**Keywords:** Cesarean delivery, Ceftriaxone, Wound infection.

## Introduction

Cesarean section is a major operation performed on women throughout the world.<sup>1</sup> During cesarean section women are exposed to the risks of infection and operative morbidity including hemorrhage, hysterectomy, and even death in severe cases.<sup>2</sup> Post-operative infection remains the major cause of maternal morbidity and increased hospital stay after cesarean section.<sup>3</sup> Compared with vaginal delivery, cesarean section is associated with higher rates of post-operative infections. Severe infections can also lead to sepsis and even death of the patient.<sup>4</sup>

Prophylactic antibiotics are known to play an important role in the prevention of post-operative infections.<sup>5</sup> The timing of prophylactic antibiotics is a matter of debate.<sup>6</sup> Traditionally antibiotic prophylaxis for cesarean delivery has been administered after clamping the umbilical cord as if given earlier there is a fear that through placenta there would be exposure of fetuses to the antibiotics. But prophylactic antibiotics given one hour before the skin incision are shown by certain studies to be more efficacious in post-operative infection prevention.<sup>7</sup> However some studies point that antibiotic administration timing does not impact postpartum infection rates considerably. In one such study, 8.4% of 896 women who were included in the study developed postpartum infections.<sup>8</sup> In a study done by Dlamini et al, one group of the patients received prophylactic antibiotics about one hour before the skin incision and the other group received the antibiotics after the cord clamping. The results showed that there was much lower post-operative wound infection in the first group (51.10%) as compared to the second group (64.45%; p-value 0.029).<sup>9</sup>

This study is designed to determine the optimal time of giving prophylactic antibiotics during cesarean section to reduce post-cesarean wound infection. By just following simple and cost-effective measures, this study may greatly reduce post-operative morbidity in mothers and its secondary effects on neonates.

## Materials and Methods

It was a randomized controlled trial. The study was carried out in the Department of Obstetrics and Gynecology, Holy Family hospital, Rawalpindi over a period of six months from 02-10-2017 to 02-04-2018. The sample was drawn by Consecutive Non-probability Sampling. Pregnant women with age

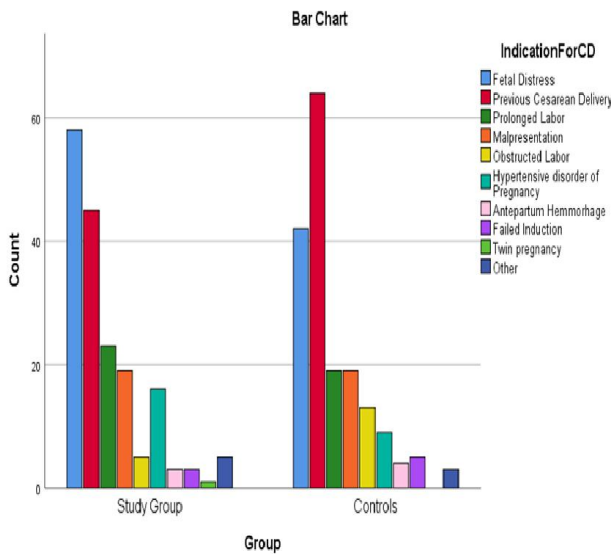
between 20-45 years at term with Hb  $\geq$  10mg/dl, undergoing cesarean section for any indication were included in the study. While the patients with renal disease, heart disease, diabetes mellitus (documented history of any of these), or those who presented with ruptured membranes were excluded from the study. Also, the pregnant women with evidence of infection at the time of presentation, or with a history of exposure to antibiotics in the past 1 week, or who are allergic to cephalosporin are excluded from the study.

After permission from the concerned authorities and ethical committee, pregnant women were selected from the indoor-patient department of the obstetrics ward of Holy Family Hospital, Rawalpindi according to the inclusion criteria. Informed consent was taken. Hospital registration numbers were taken from all patients. A detailed history was taken and patients were examined thoroughly. All the patients were assessed by a consultant gynecologist with more than 2 years of experience after fellowship. The patients were divided randomly into two groups. Group A (study group) received prophylactic antibiotic doses 15-60 min before the start of surgery while group B (control group) received the prophylactic antibiotic after the cord clamping of the baby. After the completion of the cesarean section, all the patients were shifted to the ward and standard post-operative care was given. Wound infection was accessed clinically by examining the wound during the 8<sup>th</sup> post-operative day. Wound infection was labelled as present if there is any erythema, seroma induration of skin, separation of skin, fever, or discharge from the wound as defined in the operational definition. All the required demographic details and study results were recorded on the performa.

Data were analyzed using SPSS version 22. Mean and standard deviation was calculated for quantitative data like the age of the mother and her gestational age. Frequency and percentages were calculated for analysis of qualitative data like presence or absence of post-operative wound infection and indication for C-Section. To compare the proportion of women with post-operative wound infection in both groups, the Pearson chi-square test at a 5% level of significance was applied. Effect modifiers like age, gestational age, and an indication of C-section were stratified. The post-stratification chi-square test was applied. A P-value of  $\leq$  0.05 is considered significant.

## Results

Total of three hundred and fifty-six (n=356) pregnant females of age 20-45 years with Hb  $\geq$ 10mg/dL at the time of presentation who were at term undergoing cesarean section for any indication were selected in this study after the informed consent from parent or caregiver of every patient. Exclusion criteria were strictly followed. The following figure is showing the indications for caesarean section in both groups.



**Figure 1: Indications for caesarean delivery in both groups of study**

**Wound Infection in Both Groups:** Wound infection was noted in 28.4% (n=101) of the total study population. The incidence of infection was higher in the control group. Out of 101 total patients who presented with wound infection, 63 patients (62.4%) were of the control group while only 38 (37.6%) patients belonged to the study group. There was a statistically significant (P<0.05) difference. Detailed results are presented in Table 1

**Table 1: Comparison of Wound infection in both groups (n=356)**

Wound Infection	Group		Total	P-Value Chi-Square
	Study Group	Control Group		
<b>Present</b>	38 21.3%	63 35.4%	101 28.4%	0.003
<b>Absent</b>	140 78.7%	115 64.6%	255 71.6%	
<b>Total</b>	178 100.0%	178 100.0%	356 100.0%	

Among all the patients who presented with wound infection, fever was present in 17.7% of patients (n= 63), wound discharge was the second most frequent sign of infection being present in 12.4% (n=44) of patients. Erythema, seroma and skin separation was present in 12.1% (n=43), 11.8% (n=42) and 11.2% (n=40) patients respectively. The distribution of signs of infection in both groups is also explained in Table 2.

**Table 2: Comparison of signs of infection in both groups (n=356)**

Sign Of Infection		Group		Total	P-Value Chi-Square
		Study Group	Control Group		
<b>Seroma</b>	<b>Present</b>	19 45.2%	23 54.8%	42 100.0%	<b>0.51</b>
	<b>Absent</b>	159 50.6%	155 49.4%	314 100.0%	
<b>Erythema</b>	<b>Present</b>	9 20.9%	34 79.1%	43 100.0%	<b>0.00</b>
	<b>Absent</b>	169 54.0%	144 46.0%	313 100.0%	
<b>Skin Separation</b>	<b>Present</b>	22 55.0%	18 45.0%	40 100.0%	<b>0.50</b>
	<b>Absent</b>	156 49.4%	160 50.6%	316 100.0%	
<b>Wound Discharge</b>	<b>Present</b>	8 18.2%	36 81.8%	44 100.0%	<b>0.00</b>
	<b>Absent</b>	170	142	312	

<b>Fever</b>	<b>Present</b>	54.5%	45.5%	100.0%	<b>0.01</b>
		20	43	63	
	<b>Absent</b>	31.7%	68.3%	100.0%	
		158	135	293	
		53.9%	46.1%	100.0%	

Stratification was done for the maternal age group, gestational age group, and indication for cesarean delivery. It is noted that for age, there was a significant difference statistically ( $P < 0.05$ ) in both groups. The result has been displayed in the following Table 3.

**Table 3: Comparison of wound infection in both groups (maternal age based stratification) (n=356)**

<i>Maternal Age Group</i>	<i>Wound Infection</i>	<i>Group</i>		<i>Total</i>	<i>P-Value Chi-Square</i>	
		<i>Study Group</i>	<i>Control Group</i>			
<b>Age &lt;30</b>	<b>Present</b>	17 19.5%	44 33.6%	61 28.0%	<b>0.024</b>	
	<b>Absent</b>	70 80.5%	87 66.4%	157 72.0%		
<b>Age ≥30</b>	<b>Present</b>	21 23.1%	19 40.4%	40 29.0%		<b>0.033</b>
	<b>Absent</b>	70 76.9%	28 59.6%	98 71.0%		

On the other hand, when results were stratified based on indications for cesarean delivery, a significant difference was noted only in fetal distress. No significant difference was found for any other indication for cesarean delivery. The result is displayed in the following Table 4.

**Table 4: Comparison of wound infection in both groups (indication for CD-based stratification) (n=356)**

	<i>Wound Infection</i>	<i>Group</i>		<i>Total</i>	<i>P-Value Chi-Square</i>
		<i>Study Group</i>	<i>Control Group</i>		
<b>Fetal Distress</b>	<b>Present</b>	9 15.5%	16 38.1%	25 25.0%	<b>0.01</b>
	<b>Absent</b>	49 84.5%	26 61.9%	75 75.0%	
<b>Previous Cesarean Delivery</b>	<b>Present</b>	9 20.0%	20 31.3%	29 26.6%	<b>0.19</b>
	<b>Absent</b>	36 80.0%	44 68.8%	80 73.4%	
<b>Prolonged Labor</b>	<b>Present</b>	5 21.7%	9 47.4%	14 33.3%	<b>0.08</b>
	<b>Absent</b>	18 84.2%	10 52.6%	28 66.7%	
<b>Malpresentation</b>	<b>Present</b>	3 15.8%	5 26.3%	8 21.1%	<b>0.43</b>
	<b>Absent</b>	16 84.2%	14 73.7%	30 78.9%	
<b>Obstructed Labor</b>	<b>Present</b>	1 20.0%	3 23.1%	4 22.2%	<b>0.89</b>
	<b>Absent</b>	4 80.0%	10 76.9%	14 77.8%	
<b>Hypertensive disorder of Pregnancy</b>	<b>Present</b>	7 43.8%	4 44.4%	11 44.0%	<b>0.97</b>
	<b>Absent</b>				

<b>Antepartum Hemorrhage</b>	<b>Absent</b>	9 56.3%	5 55.6%	14 56.0%	0.66
	<b>Present</b>	2 66.7%	2 50.0%	4 57.1%	
<b>Failed Induction</b>	<b>Absent</b>	1 33.3%	2 50.0%	3 42.9%	0.21
	<b>Present</b>	0 0.0%	2 40.0%	2 25.0%	
<b>Twin pregnancy</b>	<b>Absent</b>	3 100.0%	3 60.0%	6 75.0%	0.0
	<b>Present</b>	1 100.0%	0 0.0%	1 100.0%	
<b>Patient wish (Other)</b>	<b>Absent</b>	0 0.0%	0 0.0%	0 0.0%	0.19
	<b>Present</b>	1 20.0%	2 66.7%	3 37.5%	
	<b>Absent</b>	4 80.0%	1 33.3%	5 62.5%	

## Discussion

The most common complication of cesarean delivery is wound infection that is associated with a longer hospital stay, maternal morbidity, and increased medical expenditures.<sup>10</sup> There are several factors associated with an elevated risk of infections in women undergoing caesarean section. Some of them are the socioeconomic status of women, ruptured membranes and their duration, number of vaginal examinations during labour, use of prophylactic antibiotics or not, emergency caesarean section, number of antenatal visits, diabetes, anemia, blood loss, obesity. Also, the skill of operating obstetrician, technique, and general anesthesia is included in such factors.<sup>11</sup> The useful effect of prophylactic antibiotics in the reduction of incidence of infection after caesarean section is already recognized.<sup>12,13</sup> With the justification of the impact of maternal antibiotic use on neonates, the antibiotics are administered after umbilical cord clamping, in many institutions.<sup>14</sup> Recently better understanding of bacteria, newer antibiotics, knowledge about pelvic infections, and stress on expenditure control in medical care has modified antibiotic prescription patterns. Thus antibiotics should be selected according to the susceptible infectious organisms and their potency in reducing those organisms.<sup>15,16</sup>

For women undergoing caesarean section, it has been verified that antibiotic prophylaxis is useful in reducing post caesarean section infections both in high and low-risk women.<sup>17,18</sup> As per NICE

recommendation, antibiotics prophylaxis which is effective against the microorganisms causing wound infection, endometritis, and urinary tract infections should be used for women undergoing caesarean section. These antibiotics rapidly cross the placenta and will reach the baby's circulation before birth so hypothetically it can affect the newborn's microbial colonization. To avoid such neonatal exposure, previously NICE guidelines advised antibiotics administration to mother after umbilical cord clamping.<sup>19</sup> But it was later updated and it is stated that antibiotic prophylaxis has no harmful effects on neonates if given before umbilical cord clamping.<sup>20</sup> From a baseline risk of infection as high as 20-50%, the routine use of antibiotic prophylaxis reduces it by more than 50%. A single dose of antibiotic given peri-operatively is as beneficial as multiple doses.<sup>21</sup> Ceftriaxone is a third-generation, beta-lactam cephalosporin antibiotic that is frequently used for prophylaxis, before caesarean section. It may become the desired third-generation cephalosporin for prophylaxis and treatment of diverse serious infections because of its proven safety, effectiveness, and suitable schedule of dosing.<sup>22</sup> A Prospective single-blind study by Kumari R et al, assessed the effectiveness of Ceftriaxone as a prophylactic antibiotic (single dose) in caesarean section in low-risk patients. They concluded that a single dose of Ceftriaxone is effective for the prevention of post-caesarean infectious complication.<sup>23</sup> The present study aimed at exploring the efficacy of prophylactic antibiotics in terms of prevention of wound infection following caesarean section, so that, we might be able to reduce postoperative wound

infection by recommending prophylactic antibiotics in every woman undergoing cesarean delivery. In our study, 356 patients were recruited after taking the informed consent from every patient. Wound infection was present in 28.4% (n=101) of the total study population. However, in group A (study group) wound infection was significantly lower than group B (control group). It was present in 63 patients (62.4%) of the control group and 38 (37.6%) patients of the study group ( $p < 0.05$ ). Furthermore, signs of infections were analyzed in both groups and statistically, a significant difference was observed only in erythema, wound discharge, and fever. Our results are in concordance with the results already published on the subject.<sup>20,24</sup> In a randomized controlled trial, Khelifi A et al compared the effect of antibiotics prophylaxis on the postoperative infections' incidence in two groups of patients undergoing elective caesarean section, one group (A) received prophylactic antibiotics half an hour before skin incision and another group (C) received it after clamping of the umbilical cord. The risk of overall postoperative infection was not considerably less (P value=0.07; [A] 4.37% vs. [C] 9.85%) when antibiotic prophylaxis was given before skin incision. But wound infections were found to be significantly reduced (P value=0.03; [A] 2.2% vs. [C] 8.45%) in the group where women received prophylactic antibiotics before skin incision. No negative effect on the newborn's features was noticed in the study. So they came up with the conclusion that the risk of post-operative infections specifically wound infections is reduced if antibiotics prophylaxis is given before skin incision, in women undergoing caesarean section.<sup>25</sup> This also supports the results of our study.

## Conclusion

This study concludes that prophylactic antibiotics administered before skin incision are much better in controlling postoperative wound infection following cesarean delivery than administration of similar antibiotics after cord clamping of the baby.

## References

1. Rabinerson D, Ashwal E, Gabbay-Benziv R. Cesarean section through history. *Harefuah*. 2014 Nov 1;153(11):667-70.
2. Mylonas I, Friese K. Indications for and Risks of Elective Cesarean Section. *Dtsch Arztebl Int*. 2015 Jul 20;112(29-30):489-95. DOI: 10.3238/arztebl.2015.0489.
3. Shrestha S, Shrestha R, Shrestha B, Dongol A. Incidence and risk factors of surgical site infection following cesarean section at Dhulikhel Hospital. *Kathmandu Univ Med J (KUMJ)*. 2014 Apr-Jun;12(46):113-6. DOI: 10.3126/kumj.v12i2.13656.
4. Weinstein RA, Boyer KM. Antibiotic Prophylaxis for Cesarean Delivery - When Broader Is Better. *N Engl J Med*. 2016 Sep 29;375(13):1284-6. DOI: 10.1056/NEJMe1610010.
5. Skjeldestad FE, Bjørnholt JV, Gran JM, Erisken HM. The effect of antibiotic prophylaxis guidelines on surgical-site infections associated with cesarean delivery. *Int J Gynaecol Obstet*. 2015 Feb;128(2):126-30. DOI: 10.1016/j.ijgo.2014.08.018. Epub 2014 Oct 14.
6. Westen EH, Kolk PR, van Velzen CL, Unkels R, Mmuni NS, Hamisi AD, et al. Single-dose compared with multiple day antibiotic prophylaxis for cesarean section in low-resource settings, a randomized controlled, noninferiority trial. *Acta Obstet Gynecol Scand*. 2015 Jan;94(1):43-9. DOI: 10.1111/aogs.12517.
7. Lamont RF, Joergensen JS. Prophylactic antibiotics for caesarean section administered preoperatively rather than post cord clamping significantly reduces the rate of endometritis. *Evid Based Med*. 2014 Feb;19(1):17. DOI: 10.1136/eb-2013-101429.
8. Francis C, Mumford M, Strand ML, Moore ES, Strand EA. Timing of prophylactic antibiotic at cesarean section: a double-blinded, randomized trial. *J Perinatol*. 2013 Oct;33(10):759-62. DOI: 10.1038/jp.2013.56. Epub 2013 May 23.
9. Dlamini LD, Sekikubo M, Tumukunde J, Kojjo C, Ocen D, Wabule A, et al. Antibiotic prophylaxis for caesarean section at a Ugandan hospital: a randomised clinical trial evaluating the effect of administration time on the incidence of postoperative infections. *BMC Pregnancy Childbirth*. 2015 Apr 12;15:91. DOI: 10.1186/s12884-015-0514-3.
10. Leth RA, Møller JK, Thomsen RW, Uldbjerg N, Nørgaard M. Risk of selected postpartum infections after cesarean section compared with vaginal birth: a five-year cohort study of 32,468 women. *Acta Obstet Gynecol Scand*. 2009 Sep;88(9):976-83. DOI: 10.1080/00016340903147405.
11. Conroy K, Koenig AF, Yu YH, Courtney A, Lee HJ, Norwitz ER. Infectious morbidity after cesarean delivery: 10 strategies to reduce risk. *Rev Obstet Gynecol*. 2012;5(2):69-77.
12. Fetter CE, Franco Farret TC, S, Scherer J, Antonello VS. Factors related to surgical site infections after obstetric procedures. *Sci Med [Internet]*. 2013 Mar. 30 [cited 2021 May 2];23(1):28-33. doi.org/10.15448/1980-6108.2013.1.12715
13. Baaqeel, H, Baaqeel, R. Timing of administration of prophylactic antibiotics for caesarean section: a systematic review and meta-analysis. *Br J Obstet Gynaecol*. 2013;120:661-9. DOI: 10.1111/1471-0528.12036
14. Srun, S, Sinath, Y, Seng, AT. Surveillance of post-caesarean surgical site infections in a hospital with limited resources, Cambodia. *J Infect Dev Ctries*. 2013;7:579-85. DOI: 10.3855/jidc.2981
15. Ledger WJ. Current problems in antibiotic treatment in obstetrics and gynecology. *Rev Infect Dis*. 1985;7:S679-89. doi: 10.1093/clinids/7.supplement\_4.s679.
16. Kunz J, Lüthy R. Recommendations for the systemic perioperative prevention of infections in gynecology and obstetrics. *Schweiz Med Wochenschr*. 1984;114:956-60. doi.org/10.1111/1471-0528.15125
17. ACOG practice bulletin number 47, October 2003: Prophylactic Antibiotics in Labor and Delivery. *Obstetrics & Gynecology*. 2003;102(4):875-882.
18. Chelmow D, Ruehli MS, Huang E. Prophylactic use of antibiotics for nonlaboring patients undergoing cesarean delivery with intact membranes: a meta-analysis. *Am J Obstet Gynecol*. 2001;184:656-61. DOI: 10.1067/mob.2001.111303.
19. Bailey SR, Field N, Townsend CL, Rodger AJ, Brocklehurst P. Antibiotic prophylaxis for women undergoing caesarean section

- and infant health. *Br J Obstet Gynaecol.* 2016;123:875-6. doi.org/10.1111/1471-0528.13701
20. NICE. Caesarean section: full guideline. NICE clinical guideline 132. London: NICE; 2011
21. Dinsmoor MJ, Gilbert S, Landon MB, Rouse DJ, Spong CY, Varner MW, et al. Perioperative antibiotic prophylaxis for nonlaboring cesarean delivery. *Obstet Gynecol.* 2009;114:752-6. DOI: 10.1097/AOG.0b013e3181b8f28f
22. Lamb HM, Ormrod D, Scott LJ, Figgitt DP. Ceftriaxone: an update of its use in the management of community-acquired and nosocomial infections. *Drugs.* 2002;62(7):1041-89. DOI: 10.2165/00003495-200262070-00005
23. Kumari R, Sharma A, Sheetal, Roy P, Anupriya. To study the effectiveness of prophylactic use of ceftriaxone (single dose) in caesarean section in low risk patients in a tertiary care center, Moradabad, India. *Int J Res Med Sci.* 2017;5:5278-82. DOI: <http://dx.doi.org/10.18203/2320-6012.ijrms20175440>
24. Mackeen AD, Packard RE, Ota E, Berghella V, Baxter JK. Timing of intravenous prophylactic antibiotics for preventing postpartum infectious morbidity in women undergoing cesarean delivery. *Cochrane Database Syst Rev.* 2014 Dec 5;(12):CD009516. DOI: 10.1002/14651858.CD009516.pub2
25. Khlifi A, Kouira M, Bannour I, Hachani F, Kehila M, Ferhi F, et al. What's the optimal time of cesarean section antibiotic prophylaxis, before skin incision or after umbilical cord clamping? A prospective randomized study. *J Gynecol Obstet Biol Reprod (Paris).* 2016;45:1133-43 DOI: 10.1016/j.jgyn.2016.03.004