

## ELECTIVE CAESAREAN SECTION AND MODALITIES OF ANTIBIOPROPHYLAXIS

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Caesarean section (CS) is an often necessary operation widely used in obstetrics. After CS, infectious morbidity is the most common complication. The study aimed to compare the effectiveness of a single dose of ceftriaxone intraoperatively (2.0 g) with a three-day regimen of ceftriaxone postoperatively (2.0 g/24 h) in the prevention of postoperative complications in patients undergoing elective CS. This research included 68 patients for an elective CS. Patients were divided into two groups of 34 subjects randomly assigned to receive ceftriaxone in the form of a single dose (2.0 g) intraoperatively, or three-day ceftriaxone (2.0 g/24 h) postoperatively. A CS was performed using standard technique. Postpartum complications were recorded. An examination, microbiological diagnosis, and adequate dressing of the wounds were performed. At discharge, patients were instructed to report any irregularities. The results were statistically processed. Postpartum complications occurred in 7 patients in the first group, 5 patients had fever and 2 did not have fever. Of the 5 febrile patients, 3 had wound infection, 1 endometritis, and 1 transient postpartum febrility. In the second group, 9 patients had complications, 6 patients had fever, and 3 had no fever. Of the 6 patients with fever, 3 had wound infection, 1 had endometritis, 1 had urinary infection, and 1 transient postpartum febrility. There was no reduction in the incidence of postoperative morbidity in patients who received ceftriaxone in a three-day regimen. Results showed that the three-day use of antibiotics was unjustified because it did not reduce the risk of postoperative morbidity. The prophylactic administration of antibiotics in elective CS is the most adequate modality of antibiotic administration. Research indicates the benefit of intraoperative monodose administration after umbilical cord clamping.

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**Key words:** antibiotic prophylaxis, caesarean section, endometritis, infective morbidity

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### Introduction

Caesarean section is the most common, largest and often necessary operation widely practiced in obstetrics. Over the past three decades, the cesarean rate has been steadily increasing and could have reached up to 50% in some centers (1). Infectious morbidity is the most common complication after the caesarean section

with reported rates ranging from 18% to 83%, while being less than 10% for vaginal delivery (2).

Antibioprophylaxis in surgery is an effective method for preventing and reducing the risk of surgical site infections (2).

Prophylactic use of antibiotics has reduced the incidence of endometritis by two-thirds to three-quarters, and therefore their routine use in all patients undergoing cesarean section is justified. While the risk of postoperative infection after caesarean section is higher for emergency than for elective cesarean sections, prophylactic antibiotic use was shown to reduce both postoperative endometritis and wound infection after an elective cesarean delivery (3).

Penicillins, cephalosporins, metronidazole, and combinations of clindamycin and gentamicin were used for prophylaxis. There does not appear to be a clear advantage of any of these antibiotics over the others (4–6). There are data that the combination of penicillin and aminoglycosides significantly reduces febrile morbidity in a higher percentage compared to the use of penicillin

alone. The duration of antibiotic prophylaxis and the modality of therapy (one or two antibiotics) are still under discussion. Which antibiotics should be used for prophylaxis and which is the best prophylactic regimen has not yet been defined and determined in detail (7).

### Aim

This study aimed to compare the effectiveness of a monodose (2.0 g) of ceftriaxone intraoperatively with a regimen of three-day administration of ceftriaxone postoperatively (2.0 g/24 h) in the prevention of postoperative complications (endometritis, wound infection and other febrile morbidity) in patients undergoing elective caesarean section.

### Materials and Methods

This research was conducted at the Department of Perinatology, Clinic for Gynecology and Obstetrics, University Clinical Center Niš. The study included 68 patients who were scheduled for elective caesarean section for various reasons. The patients were divided into two groups of 34 subjects each. The patients were excluded from the study if they had received antibiotics before surgery, had any visible infection or fever before and during surgery, or were allergic to the antimicrobial medicine used.

The patients were divided into two groups, which were assigned to receive either ceftriaxone intravenously in the form of a monodose (2.0 g) intraoperatively, or ceftriaxone in a three-day regimen intravenously postoperatively (2.0 g/24 h). All caesarean sections were performed using standard techniques, and all post-operative care followed standard clinical practice. Also, consent to participate in the study was obtained from all patients. The following postpartum complications were noted:

1. Postoperative febrile morbidity, defined as an axillary temperature of 38 degrees Celsius measured on two occasions, four hours apart
2. Postoperative infection including:
  - Endometritis
  - Wound infection
3. Other febrile morbidity (urinary tract infection, respiratory infections).

When febrile morbidity was identified, the patients were examined to reveal a potential source of infection (upper respiratory tract, breast, abdominal and pelvic infections). A general urine examination with urine culture, blood count with leukocyte formula and C-reactive protein (CRP) were performed. Wound swabs and lochia were sent for bacteriological examination and sensitivity testing when necessary. Wound infections were treated with local cleaning, hydrogen, saline irrigation and povidone-iodine solution. Upon release from the hospital, the patients were

advised to contact their chosen doctor (gynecologist) immediately if they developed a high temperature, noticed a change in the appearance of the wound, pain or discomfort in the lower abdomen or wound area, or felt foul-smelling lochia.

The obtained results were statistically processed using X, Student's T-test and Fisher's test. A p-value < 0.05 was considered statistically significant.

### Results

A total of 68 patients included in the study were divided into two groups: the first group of 34 patients received ceftriaxone as a monodose (2.0 g) intraoperatively, and the second group of 34 patients who received the same drug (ceftriaxone) for three days (2.0 g/24 h). The groups were similar in terms of age, parity, gestational age, weight, preoperative hemoglobin, and body temperature (Table 1).

Indications for caesarean section were similar in both groups. The patients who had a previous caesarean section made up more than half of the subjects in both groups (Table 2).

The approach to opening the abdomen, duration of surgery, intraoperative complications, intraoperative blood loss, and the abdominal closure technique were practically the same in both examined groups and without statistical significance (Table 3).

Postpartum complications occurred in 7 patients who received a monodose of ceftriaxone intraoperatively (2.0 g): out of these 7, 5 patients had fever and 2 did not. Out of 5 patients with fever, 3 had wound infection, 1 had endometritis and 1 had transient postpartum fever. Two patients without fever had a wound infection.

Considering the second group, that is, the group of patients who received ceftriaxone three days postoperatively (2.0 g/24 h), 9 of them had postoperative complications. There were 6 patients with fever, while 3 of them were without it. Out of 6 patients with fever, 3 had wound infection, 1 had endometritis, 1 had urinary infection, and 1 had transient postpartum febrility (Table 4).

Wound infection was the most common type of postoperative morbidity in both groups, with a prevalence of 14.7% in group I and 17.64% in group II. Microbiologically confirmed wound infection in group I was 8.82%, and in group II was 11.76%. *Staphylococcus aureus* was the most frequently isolated bacterium, while *Enterococcus faecalis*, *Streptococcus B* and *Escherichia coli* were isolated in a smaller number of patients. Although there was no difference in morbidity, patients who received a single dose of ceftriaxone intraoperatively (2.0 g) were hospitalized one day less, which is statistically significant (Table 5).

**Table 1.** Reproductive and biohumoral characteristics

	Ceftriaxone monodose intraoperatively (2.0 g) n = 34				Ceftriaxone postoperatively for three days (2.0 g / 24h) n = 34			
Age (years)	28.6 ± 1.35				28.1 ± 1.44			
Parity	Primipara		Multipara		Primipara		Multipara	
	12	35.29%	22	64.7%	9	26.47%	25	73.53%
Gestational age (weeks)	38.6 ± 1.12				38.67 ± 1.15			
Body weight (kg)	78.8 ± 5.34				79.1 ± 6.17			
Preoperative HgB (g/L)	95.6 ± 7.49				95.9 ± 7.19			
Body temperature	36.6 ± 0.12				36.7 ± 0.11			

**Table 2.** Indications for caesarian section

	Ceftriaxone monodose intraoperatively (2.0 g) n = 34		Ceftriaxone postoperatively for three days (2.0 g/24 h) n = 34	
Previous caesarian section	24	70.59%	25	73.52%
Fetal distress	3	8.82%	2	5.88%
Maternal Distress	1	2.94%	2	5.88%
Malpresentation	5	14.7%	3	8.82%
Other	1	2.94%	2	5.88%

**Table 3.** Surgical data

	Ceftriaxone monodose intraoperatively (2.0 g) n = 34				Ceftriaxone postoperatively for three days (2.0 g/24 h) n = 34			
Pfanennstiel section	31		91.17%		32		94.12%	
Median section	3		8.83%		2		5.88%	
Duration of surgery (min)	48.55 ± 8.31				51.12 ± 5.42			
Adhesions	5		14.7%		3		8.82%	
Abdominal closure	Single suture		Dermodermal suture		Single suture		Dermodermal suture	
	3	8.82%	31	91.18%	2	5.88%	32	94.18%
Atony	0		0%		1		2.94%	
Blood loss	1		2.94%		1		2.94%	

**Table 4.** Postpartal morbidity

	Ceftriaxone monodose intraoperatively (2.0 g) n = 34				Ceftriaxone postoperatively for three days (2.0 g/24 h) n = 34			
Postpartum morbidity	n = 7 (20.58%)				n = 9 (26.47%)			
	With t°		Without t°		With t°		Without t°	
	5	14.7%	2	5.88%	6	17.65%	3	8.82%
Wound infection	3	8.82%	2	5.88%	3	8.82%	3	8.82%
Endometritis	1	2.94%	0	0%	1	2.94%	0	0%
Urinary infection	0	0%	0	0%	1	2.94%	0	0%
Transient postpartum fever	1	2.94%	0	0%	1	2.94%	0	0%

**Table 5.** Maternal outcome

	Ceftriaxone monodose intraoperatively (2.0 g) n = 34		Ceftriaxone postoperatively three for days (2.0 g/24 h) n = 34	
Resuture	1	2.94%	1	2.94%
Days of hospitalisation*	4		5	
Microbiologically diagnosed wound infection	3	8.82%	4	11.76%
Change of antibiotics	1	2.94%	1	2.94%

\*p-value <0.05- statistically significant

## Discussion

According to the Centers for Disease Control and Prevention (CDC) in Atlanta, surgical site infections are considered an important global problem. Surgical site infections are associated with a longer duration of treatment, the need for additional surgical procedures, and a higher rate of postoperative mortality and morbidity. International guidelines and National Clinical Practice Guides provide clear guidelines and recommendations for the proper implementation of antibiotic prophylaxis. Irrational and inadequate use of antibiotics is one of the main drivers of the development of bacterial resistance with the appearance of numerous side effects of antibiotics and increased overall treatment costs (6, 8).

Although prophylactic antibiotic administration has been shown to reduce the incidence of postoperative infectious morbidity after cesarean delivery, the most effective administration regimens have not been determined (7). This study on the prophylactic use of antibiotics in elective caesarean section included 68 patients to compare the risk of postoperative morbidity in two different modalities of antibiotic use. Our research compared two regimens of prophylactic antibiotic administration: intraoperative administration of ceftriaxone monodose (2.0 g) versus three-day administration of the same drug in a dose of 2.0 g/24 h.

The prevalence of febrile morbidity in 35.29% of patients after elective caesarean section was comparable to the data from the literature (8, 9). Febrility can occur after any surgical procedure, and a subfebrile temperature after elective caesarean section is not necessarily an indicator of infection. Febrility with the presence of infection would require initiation of an empiric regimen of antibiotic therapy before the

results of wound swabs or lochia are available (10).

Endometritis is another indicator of postoperative cesarean infection. In most studies, as in this one, it is clinically diagnosed based on elevated temperature, uterine tenderness, compromised uterine involution, and abnormal lochia. The low rate of endometritis in this study can be explained by the fact that patients who delivered by elective caesarean section had intact fetal membranes and did not have cervicovaginal infection or, if they did, there was not a sufficient number of pathogenic microorganisms in the vagina to colonize the endometrium (11–13).

Wound infection was the most common postpartum complication in both groups. Although the prophylactic application of antibiotics did not reduce the rate of wound infection, the patients from the first group stayed in the hospital one day shorter. Wound infection and endometritis contributed to prolonging the hospital stay by more than one week in all cases (14). Surgical preparation of the surgical field and failure in surgical technique and hemostasis can affect wound infection. The majority of infected wounds did not require the application of additional antibiotics but were treated with a local cleaning with hydrogen, irrigation with saline and povidone-iodine solution (15).

## Conclusion

The study showed that there was no reduction in the incidence of postoperative morbidity of any etiology in patients who received ceftriaxone in a three-day regimen. Adequate surgical technique and adequate surgical hemostasis are probably of greater importance in reducing postoperative morbidity than the therapeutic use of antibiotics. Accordingly, it is

important to emphasize that the three-day use of antibiotics is unjustified because it does not reduce the risk of wound infections, postoperative endometritis, urinary infections and other causes of febrility. Prophylactic administration of antibiotics in the form of a single dose

intraoperatively in elective caesarean section is the most adequate modality of antibiotic administration and is therefore recommended as a routine practice. This study indicates the benefit of intraoperative monodose administration after umbilical cord clamping.

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**ELEKTIVNI CARSKI REZ I MODALITETI ANTIBIOTIČKE PROFILAKSE**

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Carski rez (CR) predstavlja neophodnu operaciju koja se široko primenjuje. Najčešća komplikacija nakon CR-a jeste infektivni morbiditet. Cilj ovog istraživanja bio je da se uporedi efikasnost primene monodoze ceftriaksona aplikovanog intraoperativno (2,0 g) sa režimom trodnevnog ceftriaksona aplikovanog postoperativno (2,0 g / 24 č) sa ciljem prevencije postoperativnih infektivnih komplikacija pri elektivnom CR-u. Studija je obuhvatila 68 pacijentkinja kod kojih je planiran elektivni CR. Pacijentkinje su podeljene u dve grupe u kojima su bile po 34 ispitanice. Ispitanice iz jedne grupe primale su ceftriakson u vidu monodoze (2,0 g) intraoperativno, dok su ispitanice iz druge grupe primale ceftriakson postoperativno u trodnevnom režimu (2,0 g / 24 č). CR je urađen standardnom tehnikom. Zabeležene su postpartalne komplikacije. Urađeni su pregled i mikrobiološka dijagnostika, a rane su tretirane na odgovarajući način. Pacijentkinje su prilikom otpusta bile upućene da prijave febrilnost, promenu izgleda rane i ostale nepravilnosti. Rezultati su statistički obrađeni. Postpartalne komplikacije javile su se kod sedam pacijentkinja u prvoj grupi: pet pacijentkinja je imalo povišenu telesnu temperaturu, dok je kod dve pacijentkinje, čija telesna temperatura nije bila povišena, došlo do infekcije rane. Od pet pacijentkinja sa povišenom telesnom temperaturom, kod tri pacijentkinje zabeležena je infekcija rane, kod jedne endometritis, a kod jedne tranzitorna postpartalna febrilnost. Do komplikacija je u drugoj grupi došlo kod devet pacijentkinja; šest pacijentkinja imalo je povišenu telesnu temperaturu, dok su tri pacijentkinje bile bez povišene telesne temperature. Od šest pacijentkinja sa povišenom telesnom temperaturom, kod tri pacijentkinje došlo je do infekcije rane, jedna pacijentkinja je imala endometritis, jedna urinarnu infekciju, a jedna tranzitornu postpartalnu febrilnost. Studija je pokazala da ne postoji smanjenje incidencije postoperativnog morbiditeta bilo koje etiologije kod pacijentkinja koje su primale ceftriakson u trodnevnom režimu. Trodnevna upotreba antibiotika nije opravdana budući da ne smanjuje rizik od postoperativnog morbiditeta. Profilaktička primena antibiotika u elektivnom CR-u predstavlja najadekvatniji modalitet primene antibiotika. Ovo istraživanje ukazuje na korist primene monodoze antibiotika intraoperativno nakon klemovanja pupčane vrpce.

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**Ključne reči:** *antibiotička profilaksa, carski rez, endometritis, infektivni morbiditet*

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