

# Ceftriaxone in prevention of complications after cesarean section and its influence on the newborn

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*Summary:* The study included 303 patients subjected to elective cesarean section. Thirty two (11%) patients were classified in group A (with prophylactic ceftriaxone administration), 28 (87.5%) of whom had uneventful postoperative courses and 4 (12.5%) who had complications. Group B (with therapeutic application of ceftriaxone) was composed of 135 (45%) patients, 127 (94.1%) with uneventful postoperative courses and 8 (5.9%) with complications. Group C (in whom other antibiotics were used) consisted of 95 (31%) patients, 72 (75.8%) with uneventful postoperative courses and 23 (24.2%) with complications. Group D (no antibiotics used) was composed of 41 (13%) patients, 31 (75.6%) with uneventful postoperative courses and 10 (24.4%) with complications. Statistical analysis revealed highly significant differences in distribution of complications according to whether any, and which one of the antibiotics was used ( $X^2 = 17.81$ ,  $p < 0.005$ ). This difference mainly resulted from lower incidence of complications associated with ceftriaxone use than in patients with no antibiotic therapy ( $X^2 = 11.66$ ;  $p < 0.005$ ) as well as in patients using other antibiotics ( $X^2 = 15.95$ ;  $p < 0.005$ ). Significant difference was also noted when patients given antibiotics other than ceftriaxone were compared with patients receiving no antibiotics other than ceftriaxone were compared with patients receiving no antibiotic therapy ( $X^2 = 4.45$ ;  $p < 0.05$ ).

Group A of newborns included 17 (89.5%) with high Apgar score, while 2 children (10.5%) had the score below 8. Group B had 2 children (11.7%) with Apgar score below 8, while 15 (88.3%) children had higher scores. The acid-base balance of the children was also evaluated: Group A had the mean Ph of 7.26 (SD = 0.06) and group B had 7.27 (SD = 0.05). Statistical evaluation revealed no significant difference between the two values ( $X^2 = 0.02$ ;  $t = 0.22$   $p > 0.05$ ). Bacteriological studies revealed presence of bacteria in 6 (35%) of newborns in group B and in none from group A. Statistical analysis revealed significance of the difference ( $X^2 = 1.97$ ;  $p < 0.05$ ). Nevertheless, WBC count was lower in group A:  $18.95 \times 10^9/l$  (SD = 11.94) than in group B:  $28.29 \times 10^9/l$  (SD = 7.21), and the difference was highly significant ( $t = -2.79$ ;  $p < 0.001$ ). Bilirubin values were lower in group A: 126.4 (SD = 52.3) than in group B: 208.1 (SD = 22.01), and the difference was significant ( $p < 0.001$ ;  $t = 5.96$ ).

In this situation, a ceftriaxone dose of 1 g 12 hrs before the surgery significantly reduced incidence of infections after cesarean section. Besides, no adverse effects on the fetus were noted; due to its efficacy, safety and convenience, a single preoperative usage of ceftriaxone has a role in prevention of infections after cesarean section.

*Key words:* Prophylactic ceftriaxone; Elective cesarean section; Effects on newborns.

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## INTRODUCTION

Antibiotic prophylaxis is an important additional means in reducing morbidity of patients after cesarean section. Different antibiotics, including ceftriaxone, have proved effective in a single, preoperative or intraoperative dose. Establishing the best pattern of antibiotic prophylaxis is of utmost importance for efficacy, safety, convenience as well as cost/benefit effect.

Ceftriaxone, a third generation cephalosporin antibiotic has a wide spectrum of action against aerobic and anaerobic bacteria, long half-life, adequate tissue penetration and good elimination via the kidneys and liver.

The aim of the study was to investigate the effect of prophylactic administration of ceftriaxone in reducing of postoperative morbidity (in relation to other antibiotics and absence of any antibiotic prophylaxis). Besides, the Authors wanted to evaluate possible adverse effect of preoperative ceftriaxone administration on the newborns.

## MATERIALS AND METHODS

The study included patients who underwent cesarean section in the period 1990-1992 at the Clinic of Gynecology and Obstetrics. The patients were divided into four groups:

- A) receiving ceftriaxone 12 h before the operation, in a single dose of 1 g;
- B) receiving ceftriaxone postoperatively;
- C) receiving other antibiotics (penicillin, gentamicin) after the operation;
- D) patients receiving antibiotic therapy neither before nor after the surgery.

The prospective study also included children delivered by elective cesarean section. Group A was composed of children whose mothers received 1 g of ceftriaxone 12 h before the operation, and group B of children whose mothers received no antibiotic prophylaxis before the operation.

The criteria for exclusion from the study included fever exceeding 37 °C in the first 24 hrs after the operation, hypersensitivity to penicillin

and/or cephalosporin, impaired renal function with creatinine levels exceeding 2.5 mg/dl, clinical chorio-amnionitis associated with elevated WBC count, antibiotic therapy in 2 weeks preceding the operation as well as symptomatic urinary infection.

All patients included in the study were subjected to a complete physical examination, as well as to a series of laboratory investigations; hemoglobin, hematocrit, erythrocytes, leukocytes, leukocyte formula, platelet, bleeding and coagulation times, urea and creatinine in the sera, creatinine and urea clearances, bilirubin, SGOT and SGPT. Complete analysis of urine was performed as well as urine culture. A day after the surgery, the same laboratory procedures were performed. After delivery, bacteriological examinations to identify aerobic and anaerobic bacteria in the wound, lochia and cervical smear were also performed.

Complications were defined as clinical signs of infection (endometritis, parametritis/pelvic cellulitis, wound infection, bacteriemia, cystopyelonephritis, fever exceeding 38 °C in two of the first 10 postoperative days, except in the first 24 hrs.

In newborns, Apgar score, acid-base balance, leukocyte count, bilirubin level and results of bacteriologic investigation were evaluated.

The studied groups were matched according to age, number of abortions, preterm deliveries and gestational age at the time of the operation. Chi square test and t test were used for statistical analysis.

We had informed consent of all patients and approval of The Ethical Committee in accordance with the Helsinki declaration of 1975, as revised in 1983.

## RESULTS

Elective cesarean section was performed in 303 patients (table 1). Thirty two (11%) patients were classified in group A (with prophylactic ceftriaxone administration), 28 (87.5%) of whom had uneventful postoperative courses and 4 (12.5%) had complications. Group B (with therapeutical application of ceftriaxone) was composed of 135 (45%) patients, 127 (94.1%) with uneventful postoperative courses and 8 (5.9%) with complications. Group C (in whom other antibiotics were used) consisted of 95 (31%) patients, 72 (75.8%) with une-

Table 1.

Therapy	Complications	No complications
Cephtriaxone	8 ( 5.9%)	127 (94.1%)
Other antibiotics	23 (24.2%)	72 (75.8%)
No antibiotics	10 (24.4%)	31 (75.6%)
Prophylactic cephtriaxone	4 (12.5%)	28 (87.5%)
$X^2 = 17.81$		
$p < 0.05$		

ventful postoperative courses and 23 (24.2%) with complications. Group D (no antibiotics used) was composed of 41 (13%) patients, 31 (75.6%) with uneventful postoperative courses and 10 (24.4%) with complications. Statistical analysis revealed highly significant differences in distribution of complications according to which of the antibiotics was used ( $X^2 = 17.81$ ,  $p < 0.005$ ). This difference mainly resulted from lower incidence of complications associated with ceftriaxone use than in patients with no antibiotic therapy ( $X^2 = 11.66$ ;  $p < 0.005$ ) as well as in patients using other antibiotics ( $X^2 = 15.95$ ;  $p < 0.005$ ). Significant difference was also noted when patients given antibiotics other than ceftriaxone were compared with patients receiving no antibiotic therapy ( $X^2 = 4.45$ ;  $p < 0.05$ ). No significant

difference was recorded between groups in which ceftriaxone was given for prophylaxis or treatment ( $X^2 = 1.47$ ;  $p > 0.05$ ), or when other antibiotics were used ( $X^2 = 1.94$ ;  $p > 0.05$ ).

Group A of newborns included 17 (89.5%) with high Apgar score, while 2 children (10.5%) had the score below 8 (Table 2). Group B had 2 children (11.7%) with Apgar score below 8, while 15 (88.3%) children had higher scores. Acid-base balance of the children was also evaluated: Group A had the mean pH of 7.26 (SD = 0.06) and group B had 7.27 (SD = 0.05). Statistical evaluation revealed no significant difference between the two values ( $X^2 = 0.02$ ;  $t = -0.22$ ;  $p > 0.05$ ). Bacteriological studies revealed presence of bacteria in 6 (35%) of newborns in group B; three times *Escherichia coli*, *Peptostreptococcus* and *Streptococcus fecalis* once, and in none from group A. Statistical analysis revealed significance of the difference ( $X^2 = 1.97$ ;  $p < 0.05$ ). Nevertheless, WBC count was lower in group A:  $18.95 \times 10^9/l$  (SD = 11.94) than in group B:  $28.29 \times 10^9/l$  (SD = 7.21), and the difference was highly significant ( $t = -2.79$ ;  $p < 0.001$ ). Bilirubin values were lower in group A: 126.4 (SD = 52.3) than in group B: 208.1 (SD = 22.01), and the difference was significant ( $p < 0.001$ ;  $t = 5.96$ ).

Table 2.

	Ceftriaxone	No antib.	t	p
Bilirubin	126.40 ± 52.3	208.10 ± 22.1	5.96	< 0.001
Leucocytes	18.95 ± 11.94	28.29 ± 7.21	2.79	< 0.001
pH	7.26 ± 0.06	7.27 ± 0.05	0.22	> 0.05
			X	p
Apgar ≤ 7	2 (10.5%)	2 (11.7%)	0.02	> 0.05
Bacteria posit.	0 (0%)	6 (35%)	5.71	< 0.05

## DISCUSSION

The patients in whom delivery was performed transabdominally are a risk group for developing postoperative complications. Increased numbers of cesarean sections makes this issue even more important. It is estimated that puerperal infections occur 5-30 times more often if delivery is performed transabdominally, i.e. in 12-50% of all cases. Bacteriemia occurs in 8-20% of cases, and more severe infections such as abscesses or pelvic septic thrombophlebitis in 1-2% (<sup>1</sup>).

In the analyzed sample the infection occurred in 45 (15%) patients with elective operations. In the analyzed group of women with matched risk factors prophylactic administration of ceftriaxone proved effective in lowering postoperative morbidity, as evidenced by clinical and microbiological parameters. A lower number of patients receiving ceftriaxone had clinical signs of postoperative infection as well as positive bacterial culture.

The study showed that in cases of elective cesarean sections preventive single dose of 1 g of ceftriaxone reduced postoperative complications as compared to patients in whom antibiotic prophylaxis was not used, as well as in those to whom other antibiotics were used (a combination of penicillin and gentamicin). Besides, it revealed that antibiotic prophylaxis reduced the number of postoperative infections. Similar results were reported by other Authors (<sup>2,3</sup>).

One of the reasons for caution in preventive use of antibiotics is change of flora and more common occurrence of highly pathogenic microorganisms such as Enterococci, Bacteroides, Enterobacter or Pseudomonas. In this study no cases of severe pelvic infections were reported. Mead (<sup>4</sup>) reports the incidence of most severe infections, such as pelvic abscesses or septic pelvic thrombophlebitis to be 0.5% in patients receiving antibiotic prophylaxis as compared to 1.4% in those without it. (<sup>4</sup>). Our results suggest that

the risk of these infections in the studied population with ceftriaxone prophylaxis was below 0.4%. Prophylactic preoperative administration of a single dose of ceftriaxone (1 g) results in reducing the risk of occurrence of most severe forms of postoperative pelvic infections.

Caution in the course of prophylactic administration of antibiotics is needed because of their potential adverse effect to both mother and newborn. Because of that it has been recommended to administer these drugs only after clamping the umbilical cord. Since we administered antibiotics 12 hrs before the operation, the Authors also studied their potential adverse and beneficial effects on the fetus. It was evidenced that preoperative administration of ceftriaxone did not affect the condition of the fetus, his/her acid-base balance at birth expressed in Apgar score and Ph value. Bacteriological studies revealed that ceftriaxone usage has led to occurrence of fewer isolated bacteria. WBC count was also lower in children whose mothers received prophylaxis. Bilirubin levels in newborns were lower in children whose mothers received ceftriaxone prophylaxis than in those who did not. Prophylactic preoperative single dose of ceftriaxone did not induce any adverse effects in newborns.

In this study the use of a single dose of 1 g of ceftriaxone 12 hrs preoperatively significantly influenced reduction of infection such as complications after cesarean section. Besides, no adverse effects on the fetus were noted. Due to its efficacy, safety and convenience for usage a single preoperative dose of ceftriaxone plays important role in prevention of infections after cesarean section.

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