Scientific Foundation SPIROSKI, Skopje, Republic of Macedonia
Open Access Macedonian Journal of Medical Sciences. 2021 Aug 04; 9(B):836-840.
https://doi.org/10.3889/oamjms.2021.6522
eISSN: 1857-9655
Category: *B - Clinical Sciences*
Section: *Gynecology and Obstetrics*

Is It Necessary to Perform a Routine Antibiotic Prophylaxis before an Elective Surgery of Cesarean Section?

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Edited by: Ksenija Bogoeva-Kostovska
Citation: Belyaev S, Nazarenko L, Dubrova L, Fedota O. Is It Necessary to Perform a Routine Antibiotic Prophylaxis before an Elective Surgery of Cesarean Section? Open Access Maced J Med Sci. 2021 Aug 04; 9(B):836-840. https://doi.org/10.3889/oamjms.2021.6522
Keywords: Cesarean section; Antibiotic prophylaxis; Infectious complications of the postpartum period
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Received: 25-May-2021
Revised: 21-Aug-2021
Accepted: 25-Aug-2021

Funding: This research did not receive any financial support
Competing Interest: The authors have declared that no competing interest exists.

Abstract

BACKGROUND: According to the data by World Health Organization, the broad and often insufficiently substantiated prescription of antibiotics, including for prophylactic purposes, has led to the growth of antibiotic-resistant microflora, which is a dangerous and intractable problem of modern medicine. Despite the undoubted benefits of antibiotics in the management of wound infection and endometritis after cesarean section, the routine prophylactic administration of antibacterial drugs can not only carry the risk of growth of resistant nosocomial microflora, but also have doubtful effects on the health of a newborn.

AIM: The purpose of the study was to justify the possibility of carrying out elective cesarean section operations without routine antibiotic prophylaxis.

MATERIALS AND METHODS: An analysis of 333 cases of elective cesarean section operations carried out in the obstetric department in the period from 2017 to 2019 was performed. Routine antibiotic prophylaxis before surgery was not prescribed in 118 healthy patients with an uncomplicated history and a smooth course of the gestational process. The remaining 215 women received a single intravenous injection of 1 g of cefazolin sodium intraoperatively, after extraction of the fetus. A comparative analysis of the clinical groups was carried out according to the following criteria: vaginal microbiocenosis before surgical delivery, duration, and features of the operation, clinical blood count on days 1 and 5 of the post-operative period, condition of postoperative sutures, the presence of discharge from the wound, signs of infectious complications from the uterus or other organs, uterine involution rate, duration of hospital stay before and after surgery, follow-up history for 1 month after discharge from the maternity ward. The data obtained were subjected to statistical processing.

RESULTS: We have found no significant differences in the course and number of complications in the postpartum period in the compared clinical groups. The statistically significant transient leukocytosis observed on the 1st day of the postoperative period in patients who did not undergo antibiotic prophylaxis before the surgery seems to be associated with a more pronounced adaptive reaction and was not combined with any clinical symptoms of development of infection.

CONCLUSION: No relationship has been identified between the routine prescription of antibiotics before or during an elective cesarean section and the risk of developing infectious complications in the post-operative period. Antibiotic prophylaxis before surgery should be carried out differentially, taking into account the history and features of the course of this pregnancy.

Introduction

Caesarean section is one of the most frequently performed delivery operations in modern obstetrics. According to statistics provided by the Department of Health Care of the Kharkiv City Council for 2019, the frequency of this operation varies from 16 to 40% of all births in various obstetric institutions in Kharkiv, and in recent years these numbers have a tendency to increase.

Despite the fact that caesarean section is among clean or conditionally clean surgical interventions, the risk of infectious complications in which is 2–10%, the clinical protocols of many countries, including Ukraine, prescribe the mandatory antibiotic prophylaxis before or during the surgery with a difference only in the choice of specific antibacterial drugs or their combinations with local antiseptic agents [1], [2], [3], [4]. This is motivated by the fact that the preventive administration of antibiotics before the surgery can reduce the risk of endometritis by 60% and wound infection by 70% [5].

Nevertheless, despite the certain benefits of antibiotics in the prevention of postoperative complications, their use is associated with significant risks. In 2018, the World Health Organization (WHO) published antimicrobial resistance surveillance data demonstrating a high level of antibiotic resistance of a number of serious bacterial infections in both high- and low-income countries. According to the data by new WHO Global Antimicrobial Resistance Surveillance System (GLASS), about 500,000 people with suspected bacterial infection in 22 countries around the world

have experienced antibacterial resistance [6]. Cases of infection resistance to antibiotics of not the penicillin series only, but also to fluoroquinolones, which are traditionally used as reserve drugs, the resistance of microflora to which develops much more slowly, have become significantly more frequent. Thus, the resistance of the microbial flora to penicillin, according to the same WHO report, reaches 51%, and resistance to ciprofloxacin is 8–65% [6].

The question of how harmless is the use of antibiotics before caesarean section surgery in connection with their passage through the placental barrier and a sufficiently rapid entry into the bloodstream of the fetus remains disputable. The results of studies devoted to the relationship between the prophylactic administration of cephalosporins to mothers and hyperbilirubinemia in newborns are few, contradictory, and need to be clarified [7], [8].

Based on the foregoing, we attempted to carry out elective caesarean section operations without antibiotic prophylaxis in somatically healthy women with a low risk of developing infectious complications in the obstetric department of the city clinical maternity hospital in an oblast center of eastern Ukraine (Kharkiv).

Purpose of the study

The purpose of the study was to justify the possibility of carrying out elective cesarean section operations without routine antibiotic prophylaxis.

Study materials and methods

From 2017 to 2019, 693 cesarean section operations were performed in the obstetric department, including 333 elective ones. Indications for the latter were a scar on the uterus, an anatomically narrow pelvis or abnormalities of the pelvic bones, incorrect presentation of the fetus, placenta previa, and other (combined) factors. The reasons for emergency surgical delivery were a functionally narrow pelvis (obstructive labor), anomalies of labor, acute or progressive fetal distress, placental abruption, and progression of the severity of late gestosis.

Patients for this study were selected from those having indications for elective caesarean section. The main group (Group-1) included 118 patients who were not prescribed with antibiotic prophylaxis. Inclusion criteria were as follows: Healthy women at the term of full-term pregnancy with no history of any chronic somatic or gynecological diseases, spontaneous or artificial abortions, hemorrhagic complications during previous pregnancies and deliveries, as well as the absence of similar complications during the present pregnancy.

Indications for the surgery were a scar on the uterus, an anatomically narrow pelvis and malpresentations of the fetus.

The control group (Group-2) consisted of the remaining 215 patients who underwent antibiotic prophylaxis by a single intravenous injection of 1 g of ceftriaxone intraoperatively after extraction of the fetus. We chose the intraoperative method of administering the antibiotic in order to maximize the safety of its passage through the placental barrier to the fetus, as well as taking into account the results of a randomized controlled trial that showed the same effectiveness in the prevention of infectious complications with administration of an antibiotic before or during surgery [8]. Isolated cases of continued antibiotic therapy in the post-operative period were dictated by the expansion of the scope of surgery or complications of the post-operative period.

Vagina preparation in all patients before the operation was performed using drug product containing a lyophilized culture of lactobacteria *L. casei rhamnosus Doderlein*, which are Gram-positive anaerobic non-spore-forming bacteria exhibiting antagonistic activity against a broad range of pathogenic and conditionally pathogenic bacteria (including *Staphylococcus* spp., *Proteus* spp., and enteropathogenic *Escherichia coli*), and at the same time not affecting the natural vaginal microbiocenosis [9].

Particular attention was paid to the quality of hand treatment by the medical personnel involved in the operation, as well as strict adherence to asepsis and antiseptic rules in the operating ward.

A comparative analysis of clinical groups was performed according to the following criteria:

- Vaginal microbiocenosis before surgical delivery;
- The duration and features of the operation;
- Clinical blood count on days 1 and 5 of the postoperative period;
- The condition of post-operative sutures, the presence of discharge from the wound, as well as signs of infectious complications from the uterus or other organs;
- The rate of uterine involution by ultrasonography;
- Duration of hospital stay before and after surgery;
- Prospective follow-up for 1 month after discharge from the maternity ward.

Statistical analysis of normally distributed data was carried out by parametric methods. Statistical hypotheses were tested using the t-test. The Fisher's angular transformation method was used to assess the reliability of the difference between the relative indicators. Conclusions regarding statistical hypotheses were made at a significance level of $p < 0.05$.

The design of research was approved by the Kharkiv Medical Academy of the post-diploma education. It was recognized to be in conformity with the principles of the Helsinki Declaration of the General Assembly of the World Medical Association (1964-2000), the European Council Convention on Human Rights and Biomedicine (1997), the International Council of Medical Scientific Communities and International Code of Medical Ethics and the rights of Ukraine.

Results

Microbiological examination of the vaginal discharge before the surgical delivery was performed in 86.4% of pregnant women of Group 1 and in 90.7% of Group 2 (Table 1). The vast majority of patients in both clinical groups (78.4% of the main group and 74.9% of the control group) had normal vaginal microbiocenosis with predominance of lactobacteria. The rest showed mixed and conditionally pathogenic microflora, including lactobacteria, enterococci, epidermal staphylococci and fungi (*Candida albicans*), and, occasionally, pathological microflora represented by *S. pyogenes*, *S. aureus,* and *S. agalactiae* (Table 1).

Table 1: Data of infectological examination and duration of hospital stay before surgical delivery

Parameters	Group-1	Group-2
Vaginal microbiocenosis, n (%)		
Predominance of lactobacteria	80 (78.4%)	146 (74.9%)
Mixed and conditionally pathogenic microflora	12 (11.8%)	33 (16.9%)
Pathological microflora	10 (8.5%)	36 (16.7%)
S. pyogenes,	2 (2.0%)	8 (3.7%)
S. aureus,	4 (3.9%)	16 (7.4%)
S. agalactiae	4 (3.9%)	12 (5.6%)
Duration of hospital stay before the surgery, days (X±Sx)	4.24 ± 0.19	4.50 ± 0.30

The difference between the rates in the comparison groups is statistically incorrect.

The duration of stay of pregnant women before elective surgical delivery in our hospital turned out to be approximately the same in both clinical groups and amounted to about 4 days (Table 1). Often, early hospitalization was associated with the need for additional consultations or examinations. Nevertheless, the duration of stay of patients in the ward before the surgery directly correlates with the risk of infectious complications in the postoperative period, and therefore, admission to the hospital on the eve of the operation should be considered optimal [10].

The duration of cesarean section in both clinical groups, as a rule, did not exceed 1 h and was performed in a standard scope (Table 2). Cases of prolonged intervention time were associated with the need for additional hemostasis, the expansion of the scope of the operation, or the technical difficulties of its implementation (adhesive process). The volume of intraoperative blood loss, at the same time, did not exceed 500 ml in 82–88% of the cases. We have not observed a single case of pathological blood loss of more than 1 l among the electively operated patients (Table 2).

Table 2: Surgical intervention features

Parameters	Group-1	Group-2
Duration of surgery, n (%)		
Up to 40 min	45 (38.1%)	77 (35.8%)
40–60 min	58 (49.2%)	105 (48.8%)
More than 1 h	15 (12.7 %)	33 (15.3%)
Expansion of scope and complication of the surgery, n (%)		
Sterilization	11 (9.3%)	12 (5.6%)
Adhesive process	4 (3.4%)	9 (4.2%)
Ligation of the uterine vessels	6 (5.1%)	4 (1.9%)
Conservative myomectomy	6 (5.1%)	12 (5.6%)
Cystectomy	7 (5.9%)	4 (1.9%)
Supravaginal amputation of the uterus	–	2 (0.9%)
Blood loss during the surgery, n (%)		
Up to 500 ml	97 (82.2%)	190 (88.4%)
500–1000 ml	21 (17.8%)	25 (11.6%)
More than 1 L	–	–

The difference between the rates in the comparison groups is statistically incorrect.

The early post-operative period was unremarkable in 94% of patients of both clinical groups; however, all women were under our follow-up for 1 month after the surgery, which provided the possibility of identifying late complications of the postpartum period. Peripheral blood parameters (the absolute number of leukocytes, and leukocyte formula), the process of involution of the uterus and the associated clinical symptoms of infectious complications, the state of the postoperative suture, and the time spent in the hospital after childbirth were analyzed (Table 3).

Table 3: Post-operative period characteristics

Parameters	Group-1	Group-2
Duration of stay in inpatient department after the surgery, days		
(X ± Sx)	4.99±0.12	4.76±0.05
More than 5 days, n (%)	17 (14.4%)	25 (11.7%)
Peripheral blood leukocytes on the first day after the surgery, n (%)		
Up to 9 × 10^9/L	14 (11.9%)	42 (19.5%)
9–15 × 10^9/L	70 (59.3%)	144 (67.0%)
15–20 × 10^9/L	25 (21.2%)*	24 (11.2%)
More than 20 × 10^9/L	8 (6.8%)*	4 (1.9%)
Proportion of blood segmented neutrophils on the 1st day after the surgery, n (%)		
Up to 6%	85 (72.0%)	142 (66.0%)
More than 6%	33 (28.0%)	73 (34.0%)
Peripheral blood leukocytes on the fifth day after the surgery, n (%)		
Up to 9 × 10^9/L	67 (56.8%)**	164 (76.3%)
9–15 × 10^9/L	50 (42.4%)**	46 (21.4%)
15–20 × 10^9/L	–	4 (1.9%)
More than 20 × 10^9/L	–	–
Proportion of blood segmented neutrophils on the fifth day after the surgery, n (%)		
Up to 6%	105 (89.0%)	183 (85.1%)
More than 6%	13 (11.0%)	32 (14.9%)
Complications of post-operative period, n (%)		
Gapping of the post-operative suture	1 (0.9%)	3 (1.4)
Subinvolution of the uterus	4 (3.4%)	7 (3.3%)
Lochiometra	2 (1.7%)	3 (1.4%)

Description: *p <0.05 versus the control group; **p < 0.001 versus the control group.

In the group of patients operated without prescription of antibiotics, there were significantly more cases compared to the control, when the number of peripheral blood leukocytes on the 1st day after the operation exceeded 15 × 10^9/l (Table 3). In the future, by the 15th day, there was a rapid decrease in the level of leukocytosis, although its level in the range of 9-15 × 10^9/l significantly more often exceeded that in the control group. The leukogram, however,

did not undergo any changes characteristic of the inflammatory process, which allows us to interpret the described features as an adaptive reaction, more pronounced in the absence of the immunosuppressive effect of antibiotics.

The process of uterine involution after delivery was monitored in all women using ultrasound scanning. In addition to the absolute dimensions, the width of the uterine cavity and the presence of contents in it were taken into account, and the information obtained was compared with the clinical features of a particular case [11], [12].

The post-operative period complications included post-operative wound dehiscence and the lochiometra, which was an indication for prolonging antibiotic therapy. Cases of uterine subinvolution, not complicated by endometritis, were managed conservatively without antibiotics (Table 3). The statistical analysis performed did not reveal any significant differences between the number of infectious complications in the comparison groups, which allows us to conclude that there is no relationship between routine antibiotic prophylaxis before cesarean section and the risk of infectious complications in the postoperative period.

Scheduled discharge from the hospital of patients after cesarean section, in the case of a smooth course of the post-operative period, occurred on the 5th day after the operation. The reasons for the delay of a woman in the hospital were complications of the postpartum period or the condition of the newborn, requiring treatment and medical support. The number of such cases did not significantly differ between groups and amounted to no more than 14% of the total number of electively operated women (Table 3).

Discussion

Solving the problem of the postoperative infectious complications using the antibiotics and antiseptics has been the subject of close attention of researchers for the last years. The subject of discussion is the ways to use the antibacterial drugs (parenterally or locally), the time of their administration (before the surgery, intraoperatively or within the post-surgery period), as well as the choice of a specific drug and its dosage [13], [14], [15]. The last thing is considered to be especially important due to the proven fact of the spread of resistant microflora. It leads to the need for frequent changes in antibiotics used in a particular medical institution. It is connected with a wide range of medicines used for routine prevention of the infectious complications: Azithromycin, clavulanic acid, metronidazole, cefazolin, gentamicin, and clindamycin [13], [16], [17]. However, the progressive decrease in the effectiveness of antibacterial agents leads to the search for alternative methods, devoid of these disadvantages [18].

The studies during the last years suggest that the absence of the post-surgery infectious complications during the planned surgeries is far from always associated with the routine use of antibacterial drugs, but depends on the big number of accompanying factors, among which there are the organization of the work of medical personnel, the strict complying with the rules of aseptics and antiseptics in the operating unit and the proper preparation of the patient, including the conduct of hygiene procedures [2]. It makes possible to substantially decrease the dose of antibiotics used for prophylactic purposes, or completely abandon them, using locally acting, vaginal forms of medicines, without worsening postoperative outcomes at all [15], [19]. It is consistent with the results of our research, on the ground of which we propose an individual approach to the prevention of infectious complications during elective cesarean section operations. Managing the women with a low risk of infection realization, it is advisable to abandon the routine use of antibiotics, preferring the vaginal use of a lyophilized culture of lactobacilli L. casei rhamnosus Doderlein. An absolute requirement, in this case, remains the rational organization of the work of the operating unit personnel with the strict complying with the rules of aseptics and antiseptics.

Conclusions

No relationship has been identified between the routine prescription of antibiotics before or during an elective caesarean section and the risk of developing infectious complications in the postoperative period.

Antibiotic prophylaxis before surgery should be carried out differentially, taking into account the history and features of the course of this pregnancy. Prophylactic administration of antibiotics to healthy women, without concomitant infectious pathology, with a smooth course of the gestational process is inappropriate.

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