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Investigating the effects of the COVID-19 pandemic on obstetric anesthesia and perioperative outcomes in cesarean section surgery

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ABSTRACT

Aim: In the literature, studies comparing the preferred anesthesia methods and related parameters in obstetric anesthesia during the pandemic period with the pre-pandemic period are limited. I n this study, primarily in patients who gave birth by cesarean section before and during the COVID-19 (Coronavirus disease 19) pandemic; It was aimed to evaluate the anesthesia method, postoperative complications, length of hospital stay, clinical urgency of the patients and ASA (American Society of Anesthesiologists) scores. In addition, in patients who underwent cesarean section with positive and negative PCR (Polymerase Chain Reaction) tests during the COVID-19 pandemic; It was aimed to evaluate the anesthesia method, postoperative complications, hospital stay, clinical urgency of the cases and ASA scores.

Material and Method: In this retrospective, single-center study, we noted down and compared types of cesarean section (elective or emergency), anesthesia techniques (spinal, spinal+epidural, or general anesthesia), and patients' ages, ASA scores, PCR test results, postoperative complications (e.g., pneumonia, excessive postpartum bleeding), and lengths of hospital stay.

Results: We carried out this study with the data of 2,406 women, 1,458 of whom gave birth before the pandemic. The findings revealed that the rate of developing complications, the length of hospital stay, the number of patients with an ASA score of 3 and above, and the use of spinal anesthesia significantly increased during the pandemic. Moreover, 182 women were COVID-19-positive among a total of 948 applicants during the pandemic. Although the ASA scores and complication rates were significantly higher among those with a positive PCR test result, the length of hospital stay was similar between the patients by their PCR test results.

Conclusion: Our findings revealed a significant decrease in spinal + epidural anesthesia, which was frequently adopted before, in cases with cesarean section during the pandemic. Spinal anesthesia was mostly used alone. Despite increased complication rates in PCR-positive patients with higher ASA scores undergoing cesarean section, we concluded no significant change in the length of hospital stay. In cases of increased risk of infection and transmission (e.g., pandemic), neuraxial blocks may be preferred as an anesthesia technique to minimize the risk of infection in emergency obstetric operations. It should also be noted that the risk of developing postoperative complications always be high during pandemics.

Keywords: COVID-19, cesarean section, regional anesthesia, American Society of Anesthesiologists scores, postoperative complications

INTRODUCTION

The novel coronavirus disease 2019 (COVID-19), having first appeared in Wuhan - China in December 2019, poses a severe risk to mothers and infants, as many patient groups. In this sense, it was highly recommended to adopt regional anesthesia instead of general anesthesia in gynecological surgeries, as in many surgical procedures after the World Health Organization (WHO) declared COVID-19 as a pandemic as of March 2020 (1-7). Regional anesthesia may bring the following advantages in any pandemic: (1) prevention of inhalation and, thus, the reduction of the risk of transmission to healthcare staff, (2) reduced use of personal protective equipment (PPE; e.g., masks with filters), (3) cost savings, (4) fewer impacts on immune function, and (5) early discharge (8-14).

The scholarly interest seems to have missed the impacts of national/international anesthesia guidelines on the rates of general and regional anesthesia for cesarean section during the pandemic. Moreover, the literature hosts a paucity of research on changes in anesthesia techniques in delivery operations compared to the pre-pandemic periods (15-18). The present study, primarily in patients who gave birth by cesarean section before and during the COVID-19 (Coronavirus disease 19) pandemic; it was

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aimed to evaluate the anesthesia method, postoperative complications, length of hospital stay, clinical urgency of the patients and ASA (American Society of Anesthesiologists) scores. In addition, in patients who underwent cesarean section with positive and negative PCR (Polymerase Chain Reaction) tests during the COVID-19 pandemic; it was aimed to evaluate the anesthesia method, postoperative complications, hospital stay, clinical urgency of the cases and ASA scores.

MATERIAL AND METHOD

The Non-Invasive Clinical Research Ethics Committee of Izmir Bakircay University granted ethical approval to this retrospective, single-center study (No.: 393-373 dated 11.17.2021). All procedures were carried out in accordance with the ethical rules and principles of the Declaration of Helsinki.

We carried out this study on the data of 2,406 patients aged 18 years and older who underwent cesarean section before the pandemic (March 2019 - March 2020; Group 1; n=1.458) and during the pandemic (April 2020 - April 2021; Group 2; n= 948) in Izmir Bakircay University, Medical Faculty, Cigli Training and Research Hospital. However, we did not consider the data of cases with normal delivery and missing records. We noted down the nature of the operation (elective or emergency), anesthesia techniques, postoperative complications (e.g., pneumonia, excessive postpartum bleeding), and the patients' ages, ASA scores, PCR test results, and lengths of hospital stay.

While nasal and throat swamp samples were obtained from all cases for COVID-19 screening before cesarean section during the pandemic, the patients were taken for surgery without waiting for their PCR test results in only emergency cases. Besides, anesthesia procedures were performed as follows: (1) the patient was taken for spinal anesthesia after the L3-4 spinal space was localized and marked in the sitting position. Then, the skin was washed with antiseptic solutions, and 10 mg bupivacaine was injected into the subarachnoid space with a 25G spinal needle. (2) In spinal + epidural anesthesia, the skin was washed with an antiseptic solution in the sitting position. Next, the epidural space was identified from the L3-4 or L4-5 space with an 18-gauge Tuohy needle with the loss-of-resistance technique. Then, a 25-gauge spinal needle was passed through the Tuohy needle, and 10 mg of bupivacaine was administered into the subarachnoid space. Finally, the spinal needle was withdrawn, and the epidural catheter from the Tuohy needle was inserted 3-4 cm into the epidural space. In the postoperative period, analgesia was administered with the help of an epidural catheter (3). Preoxygenation was administered to patients prior to general anesthesia, and induction was ensured with propofol, rocuronium bromide, and fentanyl. Following induction, As maintenance, maintenance was provided with 50% O2/air and 1 MAC sevoflurane.

The data were presented using descriptive statistics. We resorted to the Kolmogorov–Smirnov test to check the normality of distribution. Accordingly, while performing independent samples t-test to make a pair-wise comparison of the normally distributed data, we used the Mann-Whitney U test to make the comparison above for the data without normal distribıtion. Moreover, we compared the categorical variables using Pearson's chi-square test with Fisher's exact test. We performed all statistical analyses on the IBM SPSS 22.0 program and considered a p-value < 0.05 to be statistically significant.

RESULTS

We evaluated the data of 2.406 patients undergoing cesarean section before (Group 1; n=1.458) and during the pandemic (Group 2; n=948). The groups had a mean age of 29.63±0.28 and 29.42±0.36 years, respectively, and we could not find a significant difference between the groups by age (p=0.09) (**Table 1**).

We found the mean length of hospital stay to be 2.20±0.03 days in Group 1 and 2.29±0.05 in Group 2 and discovered that Group 2 was hospitalized significantly longer ($p < 0.05$) (**Table 1**). Besides, the patients in Group 2 developed significantly more complications than those in Group 1 (n=19 vs. 13; $p < 0.05$). However, the groups did not significantly differ by emergency cesarean section. While 915 (62.8%) cases in Group 1 were taken for an emergency cesarean section, it was 613 (64.7%) in Group 2 (p=0.363). There were significantly more patients with an ASA score of 3 and above who underwent cesarean section in Group 2 (n=45; 4.7%) when compared to Group 1 (n=24; 1.6%) ($p < 0.05$) (**Table 1**).

Table 1. Comparison of the research parameters before and during the pandemic

	Group 1 (n=1.458)	Group 2 (n=948)	p
Age (years)	29.63±0.28	29.42±0.36	0.09
Emergency / Elective cesarean section	915 / 543	613 / 335	0.363
Patients with an ASA score of 3 and above	24 (1.6%)	45 (4.7%)	*0.001
Patients developing complications	13 (0.9%)	19 (2.0%)	*0.027
Length of hospital stay (days)	2.20±0.03	2.29±0.05	*0.044

*p < 0.05, Group 1: Pregnant women undergoing cesarean section before the pandemic Group 2: Pregnant women undergoing cesarean section during the pandemic

The numbers of patients receiving spinal anesthesia, spinal and epidural anesthesia, and general anesthesia before the pandemic were found to be 744 (51%), 675 (46.3%), and 39

(2.7%), respectively. When it comes to the mid-pandemic period, these numbers became 690 (72.8%), 213 (22.5%), and 45 (4.7%), respectively. In this regard, we concluded significant differences between anesthesia techniques in pre- and mid-pandemic periods ($p < 0.05$) (**Table 2**).

Table 2. Comparison of the anesthesia techniques adopted before and during the pandemic

Anesthesia technique	Group 1 (n=1.458)	Group 2 (n=948)
Spinal	744 (51%)	690 (72.8%)
Spinal+epidural	675 (46.3%)	213 (22.5%)
General	39 (2.7%)	45 (4.7%)

Group 1: Pregnant women undergoing cesarean section before the pandemic
Group 2: Pregnant women undergoing cesarean section during the pandemic

The PCR test result came positive for 182 patients (Group A) and negative for 766 patients (Group B) in Group 2. While the mean age of Group A was 28.47±0.85 years, it was 29.25±0.40 years in Group B. Nevertheless, we did not find a significant difference between the patients in the said groups by age (p=0.142). There was also no significant difference between the groups by the length of hospital stay (M=2.39±0.19 vs. 2.27±0.05; p=0.465). While eight patients (4.4%) developed complications (e.g., pneumonia and excessive postpartum bleeding) in Group A, we detected complications among 11 patients (1.4%) in Group B, and the rate of complication development was significantly higher in those with a positive PCR test result ($p < 0.05$). Although the groups did not significantly differ by the type of cesarian section (elective or emergency; p=0.095), there were significantly more cases with an ASA score of 3 in Group A (n=16; 8.8%) than in Group B (n=26; 3.4%) ($p < 0.05$; **Table 3**). Finally, the groups did not significantly differ by anesthesia technique applied (p=0.251; **Table 4**).

Table 3. Comparison of the patients with positive and negative PCR test results

	Group A (n=182)	Group B (n=766)	p
Age (years)	28.47±0.85	29.25±0.40	0.142
Emergency / Elective cesarean section	108 / 74	505 / 261	0.095
Patients with an ASA score of 3 and above	16 (8.8%)	26 (3.4%)	*0.005
Patients developing complications	8 (4.4%)	11 (1.4%)	*0.017
Length of hospital stay (days)	2.39±0.19	2.27±0.05	0.465

*p < 0.05, Group A: Patients testing positive for COVID-19
Group B: Patients testing negative for COVID-19

Table 4. Comparison of the anesthesia techniques adopted in cases with positive and negative PCR test results

Anesthesia technique	Group A (n=182)	Group B (n=766)
Spinal	126 (69.2%)	564 (73.6%)
Spinal+Epidural	49 (26.9%)	164 (21.4%)
General	7 (3.8%)	38 (5.0%)

Group A: Patients testing positive for COVID-19
Group B: Patients testing negative for COVID-19

DISCUSSION

We carried out this retrospective, single-center study to investigate anesthesia technique, postoperative complications, length of hospital stay, clinical urgency, and ASA (American Society of Anesthesiologists) scores among patients who gave birth by cesarean section before and during the pandemic. Our findings revealed that the patients undergoing cesarean section during the pandemic had significantly more complications and prolonged hospitalization. The disease status of 182 COVID-19-positive cases, some of whom had clinical lung-related findings, may have contributed to their complications (e.g., pneumonia) and length of hospital stay. In the subgroup analysis, COVID-19-positive cases also had more complications and an ASA score of 3 and above than healthy subjects. However, it still remains covered if the findings above are associated with the impacts of COVID-19 on the respiratory system or with patient characteristics. We discovered a significant decrease in the preference for spinal + epidural anesthesia; instead, spinal anesthesia was mostly adopted in cesarean section operations during the pandemic. Due to the extended close contact with patients in spinal+epidural anesthesia, the tight protection measures in the pandemic may have significantly hindered the use of this technique. On the other hand, since general anesthesia had already been a less-adopted technique in cesarean sections than regional techniques, there was no significant difference between anesthesia techniques applied before and during the pandemic.

As expected, pneumonia was significantly prevalent in cases testing positive for COVID-19. However, we could not conclude a significant difference between the groups by the length of hospital stay, which may be because patients were discharged earlier to prevent transmission and reserve available beds primarily for severe COVID-19 patients. Moreover, the COVID-19-positive patients had significantly higher ASA scores. While spinal anesthesia was significantly more adopted among all patients the pandemic period, there was no significant difference in the management of anesthesia between the two groups, which is thought to be because operations may have been initiated immediately after swab samples were taken, but PCR test results came out later.

The literature offers limited findings on the clinical courses of patients undergoing cesarean section during the pandemic, anesthesia techniques applied, postoperative complications, and their ASA scores and lengths of hospital stay. Moreover, the previous research usually associated changes in such cases only with the anesthesia technique adopted (16-20). In their study, Korkusuz et al. investigated the mid-pandemic anesthesia preferences of 140 pregnant women with a cesarean delivery at least

once under general anesthesia before the pandemic (18). Their findings showed that 50.7% of the subjects preferred regional anesthesia during the pandemic due to mostly contagion anxiety. Yet, we included all pregnant women undergoing cesarean section regardless of their previous preference for a specific anesthesia technique. In addition, we evaluated types of cesarean section (elective or emergency) and the patients' ASA scores, complications, and lengths of hospital stay.

Binyamin Y and his colleagues included a total of 413 pregnant women receiving elective cesarean section before (n=205) and during the pandemic (n=208) (17). The researchers performed their study in a region where conservative Bedouins are widely settled and general anesthesia is preferred more in cesarean delivery. Their results demonstrated that the cesarean delivery rate with neuraxial anesthesia significantly increased compared to before the pandemic thanks to informing the patients and their relatives well about the possible outcomes of anesthesia techniques. However, it was noted that they investigated a particular group with a small number of pregnant women and that epidural anesthesia was performed on few patients. Although spinal and spinal + epidural anesthesia were widely used techniques in our hospital before and during the pandemic, spinal + epidural anesthesia was preferred significantly less during the pandemic. Ay N et al. evaluated anesthesia techniques, maternal outcomes, and clinical courses among 107 COVID-19-positive patients undergoing cesarean section during the pandemic (19). While spinal anesthesia was adopted for 85 patients, 22 received general anesthesia. The authors also explored the impacts of COVID-19 on the patients and noted that the pregnant should be examined and operated on by experienced teams due to the higher risk of mortality or admission to the intensive care unit among COVID-19-positive and symptomatic pregnant women .

Keita H et al. reported the clinical, obstetric, and anesthesia results of 126 COVID-19-positive or suspicious pregnant women referred to 18 tertiary maternity units (20). About half (52%) of the patients with a distressed general condition underwent cesarean section, 40% gave premature birth, and 86% received neuraxial anesthesia. The authors found COVID-19 to be associated with significant maternal morbidity. In another study, Bhatia K et al. compared anesthesia techniques among 2.480 cases of cesarean delivery in six maternity units during the pandemic with those among 2.555 cesarean deliveries in a similar period before the pandemic (16). Their results revealed a significant decrease in general anesthesia in cesarean delivery cases during the pandemic. In addition, there was a slight increase in the preference for cesarean delivery compared to vaginal delivery, but the difference was not significant. In our study, we discovered no significant change in the preference for general anesthesia despite a significant increase in spinal anesthesia and a decrease in spinal + epidural anesthesia.

The retrospective design of this study may pose a limitation to our findings, but it should be noted that we scrutinized an issue with varying parameters and a relatively larger sample size. In addition, we discovered no mortality among the cases included in this study.

CONCLUSION

We concluded that anesthesia techniques with a lower risk of contagion seem to have been preferred more in cesarean sections during the pandemic. In addition, we determined that postoperative complications and the average length of hospital stay increased during the pandemic.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Izmir Bakircay University Non-Invasive Clinical Research Ethics Committee (Date: 11.17.2021, Decision No: 393-373).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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