

# Impact of COVID-19 history on anxiety and complications in elective cesarean sections

## *Impacto del antecedente de COVID-19 en la ansiedad y las complicaciones en las cesáreas electivas*

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### Abstract

**Objectives:** This study aims to examine the effect of COVID-19 history on pre-operative anxiety and intraoperative complications in elective cesarean section patients. **Methods:** A total of 200 patients undergoing elective cesarean section were divided into two groups based on COVID-19 history: Group C (n = 100, with COVID-19) and Group K (n = 100, without COVID-19). Anxiety was assessed using the state-trait anxiety inventory (STAI) I and II. Vital signs were monitored peroperatively. Intraoperative complications and APGAR scores were recorded. **Results:** Pregnant women with a history of COVID-19 had significantly higher state anxiety (STAI-1) scores than those without (p = 0.017). No significant difference in intraoperative or post-operative complications was observed between the groups. **Conclusions:** Anxiety levels were higher in pregnant women undergoing elective cesarean sections, especially those with a history of COVID-19. Managing increased anxiety is essential because of its potential effects on maternal and neonatal health outcomes.

**Keywords:** Pre-operative anxiety. COVID-19. Elective cesarean section. Intraoperative complications.

### Resumen

**Objetivos:** Examinar el efecto de los antecedentes de COVID-19 sobre la ansiedad preoperatoria y las complicaciones intraoperatorias en pacientes sometidas a cesárea electiva. **Métodos:** Un total de 200 pacientes sometidas a cesárea electiva se dividieron en dos grupos en función de los antecedentes de COVID-19: grupo C (n=100, con COVID-19) y grupo K (n = 100, sin COVID-19). La ansiedad se evaluó mediante el Inventario de Ansiedad Estado-Rasgo I y II. Se controlaron las constantes vitales durante la operación. Se registraron las complicaciones intraoperatorias y las puntuaciones APGAR. **Resultados:** Las embarazadas con antecedente de COVID-19 presentaron puntuaciones de ansiedad estado (STAI-1) significativamente más altas que las que no lo tenían (p = 0.017). No se observaron diferencias significativas en las complicaciones intraoperatorias y posoperatorias entre los grupos. **Conclusiones:** Los niveles de ansiedad fueron mayores en las embarazadas sometidas a cesárea electiva, especialmente en aquellas con antecedente de COVID-19. Es esencial controlar el aumento de la ansiedad debido a sus posibles efectos en los resultados de salud maternos y neonatales.

**Palabras clave:** Ansiedad preoperatoria. COVID-19. Cesárea electiva. Complicaciones intraoperatorias.

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## Introduction

Pre-operative anxiety, characterized by tension toward anesthesia and surgery, typically initiates with the anticipation of hospitalization.<sup>1</sup> High anxiety levels can lead to emotional and physical stress, affecting post-operative recovery, pain, and potentially delaying same-day discharge. Anesthesiologists play a key role in reducing anxiety by establishing trust and guiding the patient through the process, from preparation to recovery.<sup>2</sup>

Pregnant women commonly experience anxiety pre-operatively due to concerns about post-operative pain, fear of not waking up from anesthesia, and worries about divulging personal information under its influence.<sup>3</sup> Pre-operative anxiety in pregnant women undergoing cesarean section is associated with perioperative complications. The mental health of the pregnant woman is crucial as it can impact the emotional bond between mother and fetus and increase the likelihood of adverse neonatal outcomes such as intrauterine growth retardation, preterm delivery, and low birth weight.<sup>4</sup>

The COVID-19 pandemic, declared a global pandemic by the World Health Organization on March 11, 2020, has significantly impacted global health, with cases detected across 113 countries. The pandemic's widespread effects have heightened anxiety levels and increased uncertainties regarding risks, particularly impacting the mental health of pregnant individuals.<sup>5</sup>

Understanding pre-operative anxiety in pregnant women is essential for developing strategies to manage anxiety effectively and mitigate perioperative complications. This study aims to contribute to the literature by exploring the relationship between pregnancy data, demographic characteristics, COVID-19 history, and anxiety levels in pregnant women scheduled for elective cesarean section. In addition, we discuss factors that may influence anxiety levels and intraoperative complications in this population.

## Methods

Our study included 200 volunteer patients aged between 20 and 45 years, classified as American Society of Anesthesiologists risk II-III, scheduled for elective cesarean section at the gynecology and obstetrics clinic between July 1, 2022, and May 1, 2023, following approval from the local ethics

committee (2022/145). The study was conducted prospectively.

Exclusion criteria: patients with a body mass index > 35 kg/m<sup>2</sup>, allergies to induction agents or opioids, use of medications for chronic pain, active infections, autoimmune, cardiovascular, gastrointestinal, or neurological diseases, renal or hepatic failure, chronic respiratory pathology, malignancies (colorectal, gastric, pancreatic, esophageal, lung, gynecological, etc.), chronic systemic diseases (hypertension and diabetes mellitus), hematological disorders (leukocyte and platelet diseases), and psychiatric disorders under treatment were excluded from the study. Patients who were uncooperative or unable to undergo physical and verbal performance comparisons were also excluded from the study. New participants were recruited to replace any excluded patients to achieve the planned sample size.

All patients underwent preanesthetic examinations the day before surgery. They received verbal and written information about the study and provided informed consent. Patients with a history of COVID-19, asymptomatic (no symptoms were present during the infection period), moderate (patients who had mild symptoms that did not require hospitalization), and severe (patients who required hospitalization or intensive care for their COVID-19 infection) were classified.

Pre-operative anxiety levels were assessed using the state-trait anxiety inventory (STAI), consisting of STAI-I (state anxiety) and STAI-II (trait anxiety) tests. Patients scoring 60 and above on STAI-II were excluded. Anxiety levels were categorized as follows: scores < 30 indicating little or no anxiety, 31-49 indicating moderate anxiety, and 50 and above indicating severe anxiety.

Patients were divided into two groups based on whether they had a history of COVID-19 in the past year: Group C (with COVID-19 history, n = 100) and Group K (without COVID-19 history, n = 100).

Non-invasive measurements, including mean arterial pressure (MAP), systolic arterial pressure (SAP), diastolic arterial pressure (DAB), heart rate (HR), peripheral oxygen saturation (SpO<sub>2</sub>), and electrocardiogram were recorded. Intravenous access was established with an 18-G catheter, and 0.9% NaCl infusion was administered at 5-10 mL/kg/h. Spinal anesthesia was performed using 12 mg bupivacaine with a 25 g spinal needle. Oxygen supplementation was provided through a transparent mask as needed.

## Data collection

Vital signs (SAB, DAB, MAP, HR, and blood pressure) were recorded during ward follow-up, pre-operative waiting period, intraoperative periods (0 min, 15 min, 30 min, 45 min, 60 min, 90 min after surgical incision), and post-operative period. SpO<sub>2</sub> values were documented accordingly. Intraoperative complications and APGAR scores of newborns were also noted.

Following surgery, patients were transferred to the post-anesthesia care unit (PACU). Vital signs (SAB, DAB, MAP, HR, and SpO<sub>2</sub>) upon PACU admission and discharge were recorded. Stable patients were then transferred to the obstetrics and gynecology service.

## Statistical analysis

Data were analyzed using the Statistical Package for the Social Sciences 23.0. Descriptive statistics were presented as numbers/percentages for categorical variables and as mean, standard deviation, minimum, and maximum for numerical variables. To control for confounding variables such as age, gestational week, previous cesarean history, and chronic illness, multivariate regression analysis was performed. Normal distribution was assessed using the Kolmogorov-Smirnov test. Parametric tests (Student's t-test, analysis of variance) were used for normally distributed data, whereas non-parametric tests (Mann-Whitney U test, Kruskal-Wallis test) were used otherwise. Chi-square analysis was employed for categorical data. *Post hoc* analysis evaluated differences between groups. Significance level was set at  $p < 0.05$ .

## Sample size calculation

The Open Epi 3.01 program was used to calculate the sample size. Based on previous studies, 25% of pregnant women without severe acute respiratory syndrome coronavirus 2 infection were reported to have anxiety. Assuming a 45% anxiety rate in pregnant women with COVID-19, with a type 1 error of 5% and power of 80%, the study required a total of 196 participants (98/group).

## Results

The study initially involved 304 pregnant women. Of these, 61 were excluded due to emergency situations, 24 due to chronic diseases, and 19 declined to

participate, resulting in a final analysis of data from 200 patients.

Demographic characteristics, including age, weight, education level, income-generating employment, smoking status, infant gender, gestational week, history of miscarriage, and history of *in vitro* fertilization (IVF), were compared between the groups with and without a history of COVID-19 infection. Statistical analysis (Table 1) showed no significant differences between the groups ( $p > 0.05$ ).

The intraoperative MAP follow-up values were analyzed based on the history of COVID-19 infection. Graph 1 illustrates that there was no statistically significant difference in MAP values between patients with and without a COVID-19 history ( $p > 0.05$ ) (Fig. 1).

STAI-1 (state anxiety) and STAI-2 (trait anxiety) scores were evaluated in relation to COVID-19 history among pregnant participants. Table 2 reveals that STAI-1 scores were significantly higher in Group C (with COVID-19 history) compared to Group K (without COVID-19 history) ( $p = 0.017$ ). However, there was no significant difference in STAI-2 scores between the two groups.

Complications during the perioperative period were compared between patients with and without COVID-19 history. Table 3 shows that there was no statistically significant difference in the development of specific complications between the groups, except for bradycardia ( $p > 0.05$ ). Complications occurred in 67 (33.5%) of the pregnant women, with the most common being nausea and vomiting in 47 (23.5%) patients.

Apgar scores at 1<sup>st</sup> and 5<sup>th</sup> min were analyzed according to COVID-19 history. Table 4 indicates that there were no statistically significant differences in APGAR scores between the groups at the 1<sup>st</sup> min and 5<sup>th</sup> min ( $p > 0.05$ ).

## Discussion

In this study, we investigated the pre-operative anxiety levels in pregnant women undergoing elective cesarean section with and without a history of COVID-19 infection. We found a significant difference in state anxiety (STAI-1) between the two groups, suggesting that a history of COVID-19 may contribute to higher levels of acute anxiety in pregnant women facing surgery. We also identified factors such as a history of IVF and non-active employment status that influenced anxiety levels in pregnant women with COVID-19 history.

**Table 1. Comparison of demographic characteristics between groups with and without a COVID-19 history**

| Variables                                       | Total<br>(n = 200) | Group C<br>(n = 100) | Group K<br>(n = 100) |
|-------------------------------------------------|--------------------|----------------------|----------------------|
| Age (years), mean $\pm$ SD                      | 32.0 $\pm$ 5.5     | 32.6 $\pm$ 5.7       | 31.4 $\pm$ 5.4       |
| Weight (kg), mean $\pm$ SD                      | 81.7 $\pm$ 12.9    | 81.0 $\pm$ 12.1      | 82.4 $\pm$ 13.8      |
| COVID-19 symptoms, n (%)                        |                    |                      |                      |
| Asymptomatic                                    | 82                 | 82 (72)              | NA                   |
| Moderate                                        | 13                 | 13 (20.0)            | NA                   |
| Severe                                          | 5                  | 5 (51.0)             | NA                   |
| Working status, n (%)                           |                    |                      |                      |
| Yes                                             | 47                 | 29 (29.0)            | 18 (18.0)            |
| No                                              | 153                | 71 (71.0)            | 82 (82.0)            |
| Smoking status, n (%)                           |                    |                      |                      |
| None                                            | 175 87.5           | 89 89.0              | 86 86.0              |
| Before pregnancy                                | 14 7.0             | 6 6.0                | 8 8.0                |
| Before and during pregnancy                     | 11 5.5             | 5 5.0                | 6 6.0                |
| Gestational week, mean $\pm$ SD                 | 37.4 $\pm$ 2.1     | 37.2 $\pm$ 1.8       | 37.6 $\pm$ 2.3       |
| Baby gender, n (%)                              |                    |                      |                      |
| Female                                          | 105                | 52 (52.0)            | 53 (53.0)            |
| Male                                            | 95                 | 48 (48.0)            | 47 (47.0)            |
| History of miscarriage, n (%)                   |                    |                      |                      |
| Yes                                             | 43                 | 19 (19.0)            | 24 (24.0)            |
| No                                              | 157                | 81 (81.0)            | 76 (76.0)            |
| History of <i>in vitro</i> fertilization, n (%) |                    |                      |                      |
| Yes                                             | 7                  | 4 (4.0)              | 3 (3.0)              |
| No                                              | 193                | 96 (96.0)            | 97 (97.0)            |

SD: standard deviation; NA: not applicable.

Pregnancy inherently involves physiological and psychological changes, often accompanied by increased levels of fear and anxiety, particularly in the context of impending surgery.<sup>6</sup> Studies by Rubertsson et al. and Morris et al. have consistently shown high anxiety levels among pregnant women scheduled for cesarean sections, with a significant portion experiencing severe anxiety.<sup>7,8</sup> Our findings align with these studies, indicating that pre-operative anxiety remains a prevalent concern among pregnant women.

The COVID-19 pandemic has significantly influenced global mental health, exacerbating anxiety and depression in the general population.<sup>4</sup> Our study aimed to evaluate this impact specifically among pregnant women who had experienced COVID-19. Studies by Khubchandani et al. and Ayaz et al. highlighted increased psychological distress and anxiety symptoms in COVID-19 survivors and pregnant women during the pandemic.<sup>9,10</sup> Similarly, our findings indicate

**Table 2. Comparison of STAI-1 and STAI-2 scores according to COVID-19 history**

| Variables    | Group C         | Group K         | p      |
|--------------|-----------------|-----------------|--------|
| STAI-1 score | 50.9 $\pm$ 13.0 | 47.0 $\pm$ 10.2 | 0.017* |
| STAI-2 score | 46.4 $\pm$ 9.1  | 44.9 $\pm$ 7.7  | 0.142  |

\*p &lt; 0.05 indicates statistical significance.

STAI: state-trait anxiety inventory.

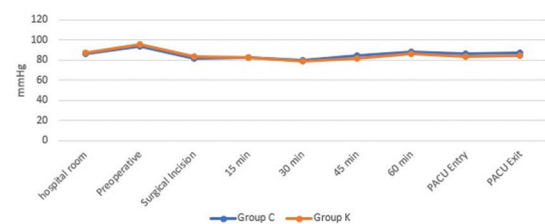
**Table 3. Comparison of complication development according to COVID-19 history**

| Complications               | Group C<br>n (%) | Group K<br>n (%) | p     |
|-----------------------------|------------------|------------------|-------|
| Any complication present    |                  |                  |       |
| Yes                         | 34 (34.0)        | 33 (33.0)        | 1.000 |
| No                          | 66 (66.0)        | 67 (67.0)        | 1.000 |
| Nausea-vomiting             |                  |                  |       |
| Yes                         | 23 (23.0)        | 24 (24.0)        | 1.000 |
| No                          | 77 (77.0)        | 76 (76.0)        | 1.000 |
| Mask oxygen requirement     |                  |                  |       |
| Yes                         | 8 (8.0)          | 5 (5.0)          | 0.568 |
| No                          | 92 (92.0)        | 95 (95.0)        | 1.000 |
| Spinal block level increase |                  |                  |       |
| Yes                         | 5 (5.0)          | 5 (5.0)          | 1.000 |
| No                          | 95 (95.0)        | 95 (95.0)        | 1.000 |
| Bradycardia                 |                  |                  |       |
| Yes                         | 1 (1.0)          | 5 (5.0)          | 0.097 |
| No                          | 99 (99.0)        | 95 (95.0)        | 1.000 |
| Bleeding                    |                  |                  |       |
| Yes                         | 2 (2.0)          | 2 (2.0)          | 1.000 |
| No                          | 98 (98.0)        | 98 (98.0)        | 1.000 |

**Table 4. Comparison of APGAR scores (1<sup>st</sup> and 5<sup>th</sup> min) according to COVID-19 history**

| Variables                                 | Group C       | Group K       | p     |
|-------------------------------------------|---------------|---------------|-------|
| APGAR 1 <sup>st</sup> min (mean $\pm$ SD) | 6.3 $\pm$ 1.4 | 6.6 $\pm$ 1.4 | 0.098 |
| APGAR 5 <sup>th</sup> min (mean $\pm$ SD) | 7.8 $\pm$ 1.1 | 7.8 $\pm$ 1.3 | 0.743 |

SD: standard deviation.

**Figure 1. Intraoperative mean arterial pressure follow-up values according to COVID-19 history.**

that pregnant women with a history of COVID-19 exhibited significantly higher state anxiety levels compared to those without such a history.

In a survey study conducted by Zainiyah and Susanti among 70 pregnant women during the coronavirus pandemic, it was shown that 31.4% of pregnant women experienced very severe anxiety, and 12.9% experienced severe anxiety. It was emphasized that anxiety during the coronavirus pandemic is an important issue that should be addressed in pregnant women to prevent negative effects on the mother and unborn child.<sup>11</sup> In our study, the STAI-1 (state) score of pregnant women with a history of COVID-19 was statistically significantly higher than that of those without a history of COVID-19. In terms of STAI-1 levels, severe anxiety level was found to be statistically significantly higher than moderate and mild anxiety levels in pregnant women with a history of COVID-19 compared to those without a history of COVID-19.

Literature reports varying impacts of COVID-19 on perioperative complications among pregnant women.<sup>12</sup> Studies like those by Zhang et al. have observed higher incidences of complications such as hypotension in COVID-19-positive pregnant women undergoing cesarean sections.<sup>13</sup> However, our study, consistent with findings from Kho et al., did not find significant differences in complication rates between pregnant women with and without a history of COVID-19.<sup>14</sup>

The relationship between COVID-19 during pregnancy and neonatal outcomes remains an area of active investigation. There are studies that found a significant association between low Apgar scores and neonatal intensive care unit admission in pregnant women with active COVID-19 infection, as well as studies showing that pregnancy-related anxiety increased during the COVID-19 pandemic, but this did not have a direct effect on neonatal outcomes after cesarean section.<sup>15-18</sup> In our study, we did not find significant differences in Apgar scores at 1<sup>st</sup> and 5<sup>th</sup> min between groups with and without COVID-19 history, likely due to the absence of active infection and emergency cases in our study cohort.

Previous research has established a link between maternal anxiety levels and neonatal outcomes, including lower Apgar scores.<sup>19,20</sup> Our study also found that higher state anxiety levels (STAI-1) were associated with lower Apgar scores at both 1<sup>st</sup> and 5<sup>th</sup> min. This underscores the importance of managing maternal anxiety to potentially improve neonatal outcomes.

## Limitations

This study has limitations, including its single-center design and exclusion criteria that may limit generalizability. In addition, the study did not assess long-term maternal mental health outcomes beyond the immediate perioperative period. Future studies could benefit from larger, multicenter designs and longitudinal follow-up to comprehensively evaluate these relationships.

## Conclusions

Our study highlights the heightened anxiety levels among pregnant women with a history of COVID-19 undergoing elective cesarean section. The pandemic context has exacerbated anxiety, which may impact perioperative and neonatal outcomes. Effective management of pre-operative anxiety is crucial to mitigate potential complications and improve maternal and neonatal health outcomes. Future research should continue to explore the long-term impacts of the COVID-19 pandemic on maternal mental health and pregnancy outcomes.

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The authors declare that they have not received funding.

## Conflicts of interest

The authors declare no conflicts of interest.

## Ethical considerations

**Protection of human subjects and animals.** The authors declare that no experiments on humans or animals were performed for this research.

**Confidentiality, informed consent, and ethical approval.** The authors have followed their institution's confidentiality protocols, obtained informed consent from all patients, and secured approval from the Ethics Committee. SAGER guidelines have been followed as applicable to the nature of the study. Ethical approval for this study (Ethical Committee 2022/145) was provided by the Local Ethical Committee.

**Declaration on the use of artificial intelligence.** The authors declare that no generative artificial intelligence was used in the writing or creation of the content of this manuscript.

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