

# Determining the Covid-19 Existence in Peritoneal Fluid

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## Research Article

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# Abstract

**Purpose:** To determine the SARS-CoV-2 existence in the peritoneal fluid for preventing healthcare workers from surgical smoke and aerosolization of Covid-19 during laparoscopy

**Methods:** All the data of the 6 Covid-19 positive patients included in this study were collected prospectively between the 31st August 2020 and 31st November 2020. Clinicopathologic data of the patients including age, symptoms, radiological and laboratory findings, antiviral treatment before the operation, operation, and peritoneal fluid Covid-19 existence were recorded. Covid-19 status of the patients was diagnosed with a nasal swab test. Covid-19 existence in the peritoneal fluid was determined by the RT-PCR test.

**Results:** All the 6 Covid-19 positive patients were pregnant. Therefore, all the operations were cesarean section operation. Only one patient had high fever. The Covid-19 specific radiological finding was detected only in one patient. In laboratory findings: 4 of 6 cases had lymphopenia and all cases had D-dimer positivity. Antiviral drugs were not used in any of the cases in this study. There was no detected Covid-19 virus in the peritoneal fluid examples of any cases.

**Conclusion:** Aerosolization of Covid-19 from the peritoneal cavity by laparoscopy or electrocautery is not a big concern under the condition of applying cautions according to the guidelines.

## Introduction

World Health Organization (WHO) made a statement that the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) outbreak was a pandemic at the international concern on 30th January 2020 (1). The disease firstly started in China and spread to the other 72 countries with rapid acceleration. Viral transmission among people was showed and over 90000 people were infected worldwide. The fatality rate in China was 2.3%, however, this ratio was lower outside of China with a rate of 1.6% (2).

Current knowledge is SARS-CoV-2 is a respiratory virus and possible ways of viral transmission are respiratory droplets, close contact, and fecal-oral route (3). Operating rooms (OR) are risky places in viral outbreak situations because patients and healthcare workers are being in close contact. National and international surgical guidelines still evolve to protect healthcare workers against each other and patients.

Surgical smoke caused by electrocautery or laparoscopic procedures that may lead to inhaling patient's intraabdominal aerosols are risk factors for transmission of the SARS-CoV-2 (4, 5). Mintz et al. claimed that laparoscopy should be used whether the benefits are higher for the patient. However, they also stated that evidence-based researches were needed to determine the safety of laparoscopy (5). Peritoneal fluid viral load is the main factor that increases the risk of transmission via laparoscopic gas leakage or electrocautery smoke.

This study was designed to evaluate the viral genome presence at the peritoneal cavity in patients who underwent surgery due to gynecological or obstetrical reasons.

## Materials And Methods

### Patient selection

All women with the positive result of nasal Covid-19 swab test who underwent surgery at Dokuz Eylul University Hospital, Department of Obstetrics and Gynecology between August 31, 2020 and November 31, 2020 were included in the study. The diagnosis was determined with the Covid-19 respiratory swab test. A positive test was defined as a positive result for SARS-CoV-2 with the reverse transcriptase-polymerase chain reaction (RT-PCR) assay.

Ethical approval for the present study was obtained from the local ethic committee of Dokuz Eylul University Hospital (No:2020/04-41).

Written informed consent was obtained from the participants who were enrolled in the study.

## Data collection

The study is designed as a prospective study. Epidemiological, clinical, laboratory and radiological data of the patients were obtained from the hospital electronic database or from the patients, directly. Nasal swab samples were obtained and tested for SARS-CoV-2 at the microbiology laboratory of Dokuz Eylul University Hospital by using Kit (EZ1 Virus Mini Kit v2.0, Germany), followed by RT-PCR according to WHO guidelines.

If the patient gave birth, birth weight and gestational age at the delivery were recorded. Amniotic fluid samples were collected in addition to peritoneal washing fluid for the pregnant patients during the cesarean-section (C/S). Peritoneal washing fluid was collected at the time of access to the abdominal cavity by giving 10 cc saline solution and taking back it again. All biological samples were tested for SARS-CoV-2 with the same Kit that was used for testing respiratory specimens (EZ1 Virus Mini Kit v2.0, Germany), followed by RT-PCR according to WHO guidelines.

## Statistical analysis

All analyses were performed by using IBM SPSS Statistics Version 25. Only descriptive statistics were calculated and given. Mean  $\pm$  standard deviation was used to present the data.

## Results

The mean age of the patients was  $28 \pm 2$  years. Elective surgeries due to gynecological reasons in Covid-19 positive patients were postponed unless it is urgent. So, all the cases were pregnant, and the laboratory-confirmed Covid-19 positive. Therefore, all the operations were cesarean Sect. 3 of the 6 (50%) patients were in their first pregnancy. All the participants were in the term period of their pregnancy. All the cases were clinically asymptomatic except for one. One patient had high fever ( $39^{\circ}\text{C}$ ) at the time of admission to the hospital. The time period between the symptom (fever) and the operation was 4 days. Radiological scanning was not performed on the patients due to being pregnant. However, postpartum computerized tomography (CT) scanning was performed on case 6. Ground-glass opacities and patchy lung consolidation were detected in the CT scan of this patient. None of the patients received any anti-viral drugs before cesarean section (Table 1, Table 2).

For the laboratory results within 24 hours before surgery: white blood cell counts  $9 (7-12) \times 10^3$  cells/L, lymphocyte  $1.4 (1-1.7) \times 10^3$  cells/L, neutrophile  $7.5 (4.9-9.5) \times 10^3$  cells/L, platelet  $294 (240-326) \times 10^3$  cells/L, C reactive protein 17.4 mg/L (9.8-31.7 mg/L), alanine transaminase 11 IU/L (9.7-28.2 IU/L), aspartate transaminase 24.5 IU/L (19.5-33 IU/L), urea 6 mg/dL (3.9-6.8 mg/dL), creatinine 0.4 mg/dL (0.3- 0.5 mg/dL), D-dimer 2.8  $\mu\text{g/dL}$  (1.7-6.4  $\mu\text{g/dL}$ ). As a laboratory finding specific to Covid-19 infection, lymphopenia was detected in 4 of 6 patients and increased D-dimer in all patients (Table 3).

Cesarean sections were performed in an isolated operating room. The average birth weight was  $3330 \pm 166$  g. Peritoneal washing fluid and amniotic fluid SARS-CoV-2 test results were all determined to be negative.

## Discussion

Currently, there is limited data regarding intraoperative aerosolization of SARS-CoV-2. Most of the centers have different protocols for urgent and elective surgeries. Preoperative Covid-19 test is performed on all patients who are planned to perform any surgery, both elective or urgent. Personal protective equipments (PPE) should be used around the Covid-19

positive patient by all healthcare staff including surgeons, nurses, anesthesia staff, and other healthcare personal. Current knowledge is that SARS-CoV-2 is a respiratory virus and possible ways of viral transmission are respiratory droplets, close contact, and fecal-oral route (6–9). Although airborne transmission is not a possible way for viral transmission, past experiences on the SARS-CoV outbreak shows us aerosol-generating procedures such as tracheal intubation can have the possibility to spread the disease (10, 11). However, there is limited data regarding the management of procedures that can result in aerosolization of Covid-19.

There have been several studies that investigated the viral existence in peritoneal fluid till now (12, 13). None of them were detected Covid-19 positivity in peritoneal fluid, except one (14). This viral absence may be attributed to the reason of peritoneal membranes have pores of a maximum of 20–40 nm in diameter, by contrast with, SARS-CoV-2 virion diameter is approximately 125 nm (15). SARS-CoV-2 was not detected according to a case report that investigates the Covid-19 virus existence in the peritoneal cavity fluid of a non-perforated appendicitis patient (12). The variation of test methods can play a crucial role in the test results. False-negative rates up to 20% or more were declared according to the methods of the tests (16).

There are several studies evaluating the viral presence of hepatitis B virus (HBV), human papillomavirus (HPV), and human immunodeficiency virus (HIV) in surgical smoke. All these viruses were detected in the surgical smoke (17–21). On the other hand, during prior viral outbreaks, the transmission of other coronaviruses such as SARS and MERS-CoV through surgical smoke or laparoscopic gas was never confirmed (22). Concern for aerosolization of peritoneal fluids in laparoscopic surgery or electrocautery usage for Covid-19 patients may not be necessary due to the limited controversial data of SARS-CoV-2 existence in peritoneal fluid. Operation of Covid-19 patients should be performed under the conditions of PPE equipped staff and operating room management according to current Covid-19 guidelines. Further studies are needed that investigate the Covid-19 existence in the peritoneal fluid to establish reliable protocols. Until that time acceptable and logical precautions must be taken to prevent healthcare workers from Covid-19 positive and suspicious patients.

## Conclusion

In this study, SARS-CoV-2 was not detected in the peritoneal fluid of the six nasopharyngeal swab Covid-19 test positive patients. Of course, C/S is not a laparoscopic surgery, however, the key point is the virus existence in peritoneal fluid. Although this finding seems promising for aerosolization of SARS-CoV-2 through laparoscopy, further studies are needed in the field of Covid-19 surgery. This can be extracted from this study, laparoscopy can be performed on the convenient Covid-19 positive patients under the light of current guidelines. This study contributes data to the literature to enhance the current operative guidelines for Covid-19 patients. Besides, guidelines should be updated regularly as new findings are discovered.

## Declarations

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**Conflict of interest:** The authors declare that they have no conflict of interest.

**Ethical approval:** This study was carried out in consensus with our university's ethics guidelines. The ethics committee approval was obtained for this study (No:2020/04-41).

**IRB approval:** This study was carried out in consensus with our university's ethics guidelines.

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## Tables

Table 1: Characteristics of the patients

| Case No.  | Nasal swab for Covid-19 | Age (year) | Parity | Gestational age (week) | Birth Weight (g) |
|-----------|-------------------------|------------|--------|------------------------|------------------|
| 1         | +                       | 26         | 0      | 39                     | 3115             |
| 2         | +                       | 27         | 0      | 40                     | 3348             |
| 3         | +                       | 30         | 1      | 37                     | 3400             |
| 4         | +                       | 33         | 2      | 38                     | 3600             |
| 5         | +                       | 30         | 1      | 39                     | 3217             |
| 6         | +                       | 27         | 0      | 39                     | 3300             |
| Mean ± SD |                         | 28±2       |        |                        | 3330±166         |

Table 2: Clinicopathologic data of the patients

| Case No. | Fever | Cough | Dyspnea | Radiological finding | Time between symptoms and delivery (day) | Antiviral treatment before delivery | Covid-19 test in amniotic fluid | Covid-19 test in peritoneal fluid |
|----------|-------|-------|---------|----------------------|--|-------------------------------------|---------------------------------|-----------------------------------|
| 1        | -     | -     | +       | -                    | 4  | -                                   | -                               | -                                 |
| 2        | -     | -     | -       | -                    | 0  | -                                   | -                               | -                                 |
| 3        | -     | -     | -       | -                    | 0  | -                                   | -                               | -                                 |
| 4        | -     | -     | -       | -                    | 0  | -                                   | -                               | -                                 |
| 5        | -     | -     | -       | -                    | 0  | -                                   | -                               | -                                 |
| 6        | -     | -     | -       | +                    | 0  | -                                   | -                               | -                                 |

Table 3: Laboratory findings of the patients

| Case No. | Leukocyte (x10 <sup>9</sup> cells/L) | Lymphocyte (x10 <sup>9</sup> cells/L) | Neutrophile (x10 <sup>9</sup> cells/L) | Platelet (x10 <sup>9</sup> cells/L) | C-reactive protein (mg/L) | Aspartate transaminase (IU/L) | Alanine transaminase (IU/L) | Urea (mmol/L) | Creatinine (μmol/L) | D-dimer (μg/ml) |
|----------|--------------------------------------|---------------------------------------|--|-------------------------------------|---------------------------|-------------------------------|-----------------------------|---------------|---------------------|-----------------|
|          | 9.1                                  | 1.1*                                  | 7.3*                                   | 272                                 | 70.4*                     | 45*                           | 44                          | 7             | 0.6                 | 3.2*            |
|          | 15.7*                                | 1.7                                   | 12.8*                                  | 329                                 | 4.7                       | 22                            | 10                          | 6.8           | 0.52                | 1.8*            |
|          | 4.2                                  | 1.1*                                  | 2.8                                    | 144                                 | 11.6*                     | 29                            | 12                          | 3.3           | 0.53                | 5.9*            |
|          | 10.8*                                | 1.8                                   | 8.5*                                   | 280                                 | 18.8*                     | 15                            | 10                          | 6.7           | 0.36                | 1.5*            |
|          | 9                                    | 0.9*                                  | 7.8*                                   | 308                                 | 18.4*                     | 21                            | 9                           | 5.3           | 0.36                | 8.1*            |
|          | 8                                    | 1.7                                   | 5.7                                    | 326                                 | 16.4*                     | 27                            | 23                          | 4.2           | 0.38                | 2.4*            |
| Median   | 9 (7-12)                             | 1.4 (1-1.7)                           | 7.5 (4.9-9.5)                          | 294 (240-326)                       | 17.4 (9.8-31.7)           | 24.5 (19.5-33)                | 11 (9.7-28.2)               | 6 (3.9-6.8)   | 0.4 (0.3-0.5)       | 2.8 (1.7-6.4)   |