

# Infection control of COVID-19 in operating theaters in a designated hospital for specified infectious diseases in Japan

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**Abstract:** At the beginning of the COVID-19 pandemic in 2020, many hospitals around the world recommended stopping elective surgery as a precaution to stop the spread of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). The number of elective surgeries was reduced in Japan due to several waves of the pandemic. This work describes the management of COVID-19 and actual polymerase chain reaction (PCR) screening in operating theaters at the National Center for Global Health and Medicine (NCGM), a designated hospital for specified infectious diseases in Japan. The following three steps for COVID-19 infection control were taken to maintain the operating theater: *i*) Do not bring COVID-19 into the operating theater, *ii*) Infection control for all medical staff, and *iii*) Surgical management of surgical patients with COVID-19. We introduced checklists for surgical patients, simulations of surgery on infected patients, screening PCR tests for all surgical patients, and use of a negative pressure room for infective or suspected cases. We determined the flow and timing of surgery for patients with COVID-19. However, many aspects of COVID-19 infection control measures in the operating theater are still unclear. Therefore, infection control measures require further advances in the future to manage new infections.

**Keywords:** COVID-19, surgery, PCR screening, operating theater

## Introduction

At the beginning of the COVID-19 pandemic in 2020, most governments and academic institutions worldwide recommended stopping elective surgery to stop the spread of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). This action was key to freeing up hospital beds, obtaining a supply of personal protective equipment (PPE), and protecting patients and medical staff (1-6).

In Japan, the number of surgeries has been reduced because of several waves of the pandemic. The number of surgeries was restricted, and the total number of surgeries was about 80-90% of that in 2019.

For surgeons, the spread of COVID-19 has required surgeries to be reduced to protect patients and staff through infection control. At first, there was no evidence of the effectiveness of measures to prevent COVID-19, and various measures had to be taken. The current work reports on COVID-19 infection control for staff in operating theaters at the National Center for Global Health and Medicine Hospital (NCGM), a designated

hospital for specified infectious diseases in Japan.

## Infection control in the operating theater

The following three steps for COVID-19 infection control were taken to maintain the operating theater: *i*) Do not bring COVID-19 into the operating theater, *ii*) Infection control for all medical staff; and *iii*) Surgical management of surgical patients with COVID-19.

When COVID-19 is found in the operating theater, medical staff are isolated and surgery is postponed, and the damage to the hospital is immeasurable. In operating theaters at the NCGM, various steps have been taken and polymerase chain reaction (PCR) screening has been implemented based on infection status. PCR screening has been performed on all surgical patients two to seven days before surgery.

Fortunately, an unexpected case of COVID-19 did not occur in the operating theater between April 2000 and December 2021. In addition, surgery on COVID-19-positive patients was simulated and then performed if necessary. The current authors previously reported on

management of COVID-19 in operating theaters at the NCGM (Figure 1) (7-9).

### COVID-19 management in the operating theater

COVID-19 management in the operating theater is shown in Supplementary Table S1 (<https://www.globalhealthmedicine.com/site/supplementaldata.html?ID=62>). When the first wave of the pandemic hit Japan in April 2020, we discussed steps to deal with a preoperative fever and respiratory symptoms. We created a medical checklist to enter the operating theater. The decision to perform surgery was not made by the attending physician alone, and an operating room checklist was created so that it could be confirmed by multiple personnel such as ward nurses, doctors in charge, operating rooms, and anesthesiologists (Supplementary Table S2, <https://www.globalhealthmedicine.com/site/supplementaldata.html?ID=62>). The checklists are still being created and are being used for treatment endoscopy and angiography. Body temperature in particular is recorded on the morning of the day of surgery so that people are aware of a fever before entering the operating theater.

### PCR screening for surgery

The most common technique for molecular diagnosis of COVID-19 is PCR testing (10). We have introduced PCR screening for surgical patients after meeting with relevant departments (the operating room, the testing department, the infection control team, the nursing department, and the administrative office). Initially, PCR tests were performed on patients suspected of having COVID-19 based on clinical findings, but some COVID-19-positive patients may be asymptomatic due to prolonged infection. Since PCR results are not available on the day of surgery, rapid tests (an antigen test and film array) were introduced for emergency surgery, but the number of reagents was limited. However, the test reagents have been gradually replenished, and rapid tests mainly in the form of film arrays can now be performed (7).

At the beginning of April 2020, infections were identified based on clinical findings and checklists. Due to the further spread of COVID-19, PCR screening was performed on all patients undergoing elective surgery. Since August 2020, some patients that appear unlikely to have COVID-19 have tested positive, and all results are presented before entering the operating room, except for emergency surgery (bleeding events, trauma, *etc.*). PCR screening for elective surgery should be performed within one week of surgery. The risk of infection may indeed increase because a patient has ventured out unnecessarily after the test, and patients are instructed to refrain from going out after the test. Moreover, rapid tests (film array) were introduced for emergency cases, and the results improved: results can now be obtained in

a short amount of time (about 1–2 hour). However, rapid tests are more costly than normal PCR screening.

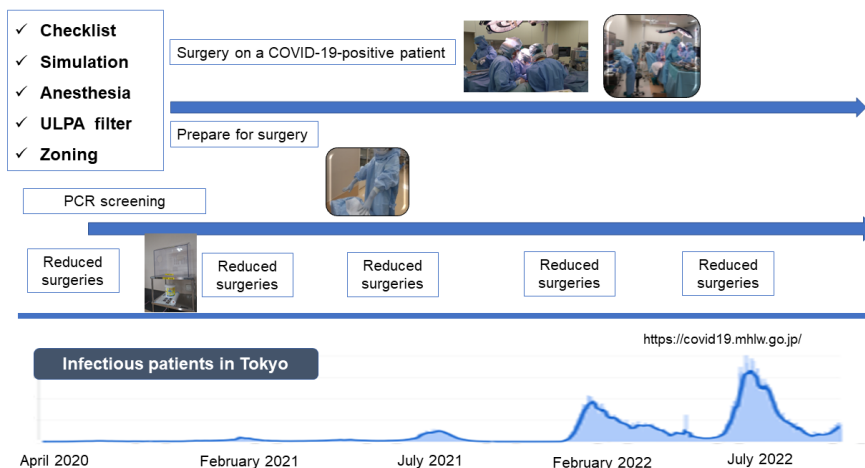
By the end of October 2022, infection was not noted in operating staff. PCR screening revealed that 78 out of 14,043 cases (0.5%) were positive, but fortunately almost of them were identified preoperatively and no positive patients were brought in. No new cases of infection were noted after surgery. Surgeons wore a powered air purifying respirator (PAPR) and performed surgery on 23 COVID-19-positive patients under general, spinal, or local anesthesia within four weeks of developing COVID-19. In the first half in 2020, infection could not be ruled out in eight patients undergoing emergency surgery. The results of the rapid test were not known, but the patients were able to return to the general hospital ward after they were confirmed to be negative during surgery.

### Timing of elective surgery for patients with COVID-19

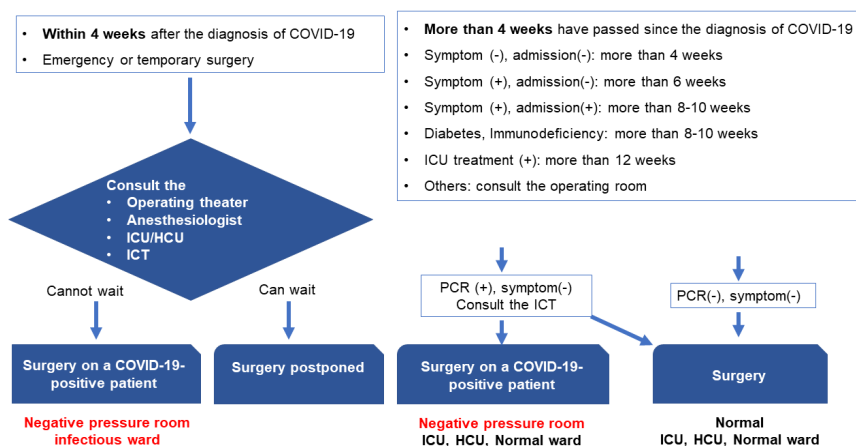
In April 2020, surgery on a patient with COVID-19 was high-risk. Little information was known about surgical practices and postoperative complications in the initial phase of the COVID-19 pandemic. After that, numerous studies reported on COVID-19 and the timing of elective surgery (11-15). In 2022, Deng *et al.* reported that elective surgery within 4 weeks after the development of COVID-19 was associated with an increased risk of postoperative complications (16). At 4 to 8 weeks, elective surgery was associated with an increased risk of postoperative pneumonia. We performed elective surgery on infected patients (Figure 2). Within 4 weeks, we performed emergency surgery (a caesarean section, perforation of the gastrointestinal tract, open bone fracture, brain hemorrhage, *etc.*) and temporary surgery (advanced cancer surgery) while wearing a PAPR and using a negative pressure room. Four weeks after the development of COVID-19, we determined elective surgery depending on the patient's COVID-19 status and the presence of systemic complications (diabetes mellitus, immunodeficiency *etc.*). Fortunately, by October 2022, post-operative infections did not worsen and medical staff dealing with surgical patients with COVID-19 were not infected.

### Surgery for COVID-19-positive patients

We are prepared to perform surgery on COVID-19-positive patients. Moreover, we can perform emergency surgery on COVID-19-positive patients and also treat previously infected patients. The flow for surgery on patients with COVID-19 is shown in Figure 2. We have amassed considerable experience performing surgery on infected patients: *i*) The flow needs to be organized (staff flow, time zone, entrance/exit), *ii*) Changing clothing such as gowns is difficult, *iii*) More nurses are needed



**Figure 1. Infection control in operating theaters at the NCGM.** Total management in operating theaters from April 2020 to October 2022. PCR, polymerase chain reaction; UPLA filter, ultra-low penetration air filter.



**Figure 2. Therapeutic strategy for patients with COVID-19.** PCR, polymerase chain reaction; ICU, intensive care unit; HCU, high-risk care unit; ICT, infection control team.

for surgery on patients with COVID-19, iv) Protracted surgery is more tiring than expected, and v) Regular simulation of surgery on infected patients is required.

Due to the COVID-19 pandemic, the number of surgeries was restricted. The number of surgeries was about 80% of the number in 2019 (Figure 1). The acceptance of emergency patients at hospitals in Tokyo has become stricter, and emergency surgeries have increased.

In conclusion, this work has reported on the status of COVID-19 in operating theaters at the NCGM. Actual PCR screening was also described. Many aspects of COVID-19 infection control in the operating theater are still unclear, and we are searching for answers. PCR screening was performed by multiple medical professionals and individual judgments were not made. Central management of the entire hospital was possible. In addition, the number of surgical patients has not

increased, and financial issues remain. Infection control measures, including those dealing with new infectious diseases, need to be advanced further in the future.

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