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LETTER

The role of clinical engineers in the coronavirus disease 2019 pandemic

Motohiko Sato*, Takashi Fukaya, Tatsunori Ogawa, Naoto Nunose, Shigeru Hosaka

Medical Equipment Management Office, National Center for Global Health and Medicine, Tokyo, Japan.

Abstract: The duties of a clinical engineer (CE) during the coronavirus infection 2019 (COVID-19) pandemic were diverse. The original duties of a CE included operation and maintenance of life support equipment used for respiratory therapy, hemodialysis, and extracorporeal membrane oxygenation. The management of life support equipment is critical. The PB-840 ventilator is equipped with a heat sink system that dissipates internal heat through thermal conduction. Therefore, internal contamination is less likely to occur. The exhalation filter used in the PB-840 can be used for up to 15 days. It can be used for long periods of time without maintenance, reducing the risk of infection. The PB-840 is a suitable device for patients with COVID-19. Its use in critically ill patients was determined to be a priority. Thus, use of an appropriate device for infection control requires a proper understanding of and familiarity with the device in question.

***Keywords*:** invasive ventilators, non-invasive ventilators (NIV), high-flow nasal cannulas (HFNC)

The work of clinical engineers (CE) during the COVID-19 pandemic includes operation and maintenance of life support equipment used for respiratory therapy, blood purification therapy, and extracorporeal membrane oxygenation. Plasma from patients recovering from COVID-19 (*1*) is also collected by CEs.

Internal contamination of the equipment after use is an issue faced by CEs. Most medical devices are equipped with cooling fans to cool the central processing unit (CPU) inside the device. If the cooling fan fails to function, the CPU is heated, and the device stops working. Though the cooling fan is equipped with a dust filter that filters room air, it is not equipped with filters against viruses. This may cause viral contamination inside the device. The survival period of the COVID-19 virus depends on the surface material it is attached to (*2*). Currently, the survival period of the virus inside medical devices remains unknown. The survival period of the virus appears to vary depending on the type of surface, temperature, humidity, and even sunlight (*3*). Contaminated equipment may cause a secondary infection upon cleaning and inspection or when it is used on another patient. We attached high-efficiency particulate air filters to cooling fans to prevent internal contamination. After use, the system was operated in a well-ventilated area to eliminate internal contamination. Regular equipment maintenance was also done.

The PB-840 ventilator (Medtronic, USA), an invasive ventilator used during the COVID-19 pandemic, contains a heat sink system that dissipates internal heat via thermal conduction rather than by a cooling fan. This reduces the chances of internal contamination. The exhalation filter used in the PB-840 can be used for a maximum of 15 days without maintenance, thereby, reducing the risk of infection. The PB-840 was deemed to be a suitable device for patients with COVID-19 and it was prioritized for use in critically ill patients.

The trends in use of invasive and non-invasive ventilators (NIV), and high-flow nasal cannulas (HFNC) in patients with COVID-19 are shown in Figure 1. At the beginning of the pandemic, use of NIVs and HFNCs decreased because they were thought to increase the risk of infection among medical personnel due to the dispersal of air exhaled by patients. However, a study conducted in December 2020 revealed that virus dispersal by this equipment was limited (*4*). Thereafter, the use of NIVs and HFNCs increased. Usage peaked during the fifth wave of the pandemic, and in August 2021, 10 patients were using the PB-840, 61 were using an NIV, and 51 patients were using an HFNC. Something that must be noted is that using NIVs and HFNCs poses a higher risk of environmental contamination than invasive ventilation using a closed suction system (*5*). Therefore, adequate care must be taken to prevent infection. Following the Centers for Disease Control and Prevention (CDC) guidelines (*6*), we ensured that personal protective equipment (PPE) was properly donned and removed by all COVID-19-positive patients under the guidance of

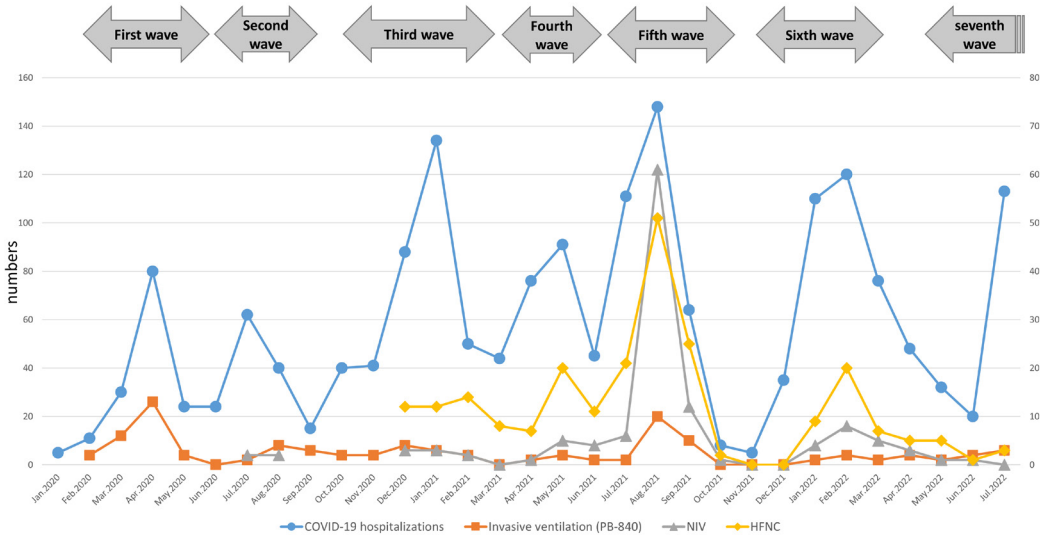

Figure 1. Trends in COVID-19 hospitalizations and artificial respiration therapy. August 2021 was the month with the highest number of patients receiving respiratory therapy; a total of 10 patients used the PB-840, 61 used an NIV, and 51 used an HFNC. Data are from the NCGM Center Hospital.

our infection control team (ICT).

In conclusion, CEs have a wide range of duties during the COVID-19 pandemic. They need to be well-versed in the use of required equipment in order to ensure that appropriate machines are used to treat a specific infection. Moreover, they need to maintain the equipment after each use to ensure the safety of its users and operators.

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**Address correspondence to*:
Motohiko Sato, Medical Equipment Management Office, National Center for Global Health and Medicine, 1-21-1, Toyama, Shinjuku-ku, Tokyo 162-8655, Japan.
E-mail: mosato@hosp.ncgm.go.jp