

Care of Devices in Covid Intensive Care Units: A Measure to Curtail Infection

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Abstract: As coronavirus disease 2019 (COVID-19) spreads across the world, the intensive care units must be prepared for the challenges associated with this pandemic. This pandemic has highlighted that the ICU must have a emergency care delivery model which includes strategic reserves of PPE,ICU devices ,pharmaceuticals as well as effective supply chain and utilization of the protocols. Pre-existing protocols for the Care of ICU devices should be revised and updated time to time.Regular training should be provided to the health care workers about decontamination and disinfection sterilization of covid ICU devices so as to keep them updated moreover these practices also reduce crossinfections in the ICUs. The training of staff on infection control practices and care of ICU devices reduces the infection rate among HCWs and patients significantly.

Keywords: COVID-19, Intensive-care units, Decontamination, Disinfection, Infection control practices, , Sterilization.

1. INTRODUCTION

Intensive care units (ICU) are special departments of a hospital that provide regular care to the patients with severe illness and injuries to patients with severe illnesses or injury who require constant care, close supervision, life support devices, and medication to maintain normal bodily functions. With this, it is our responsibility to take care of ICU devices and their cleaning for preventing infection, complications and better prognosis.¹

Corona Virus Disease 2019 (COVID-19) caused by SARS CoV -2 has rapidly developed as a pandemic. Intensive care units are challenged on multiple fronts during the pandemic; these include resources limitation, infection control, protection of healthcare workers and ICU devices. Intensive care units are an integral part of any pandemic response, and various devices used in ICU require to be appropriately decontaminated, contaminated, and sterilized. All the healthcare providers, including nursing personnel, laboratory personnel, and other health care workers, must have adequate and accurate knowledge regarding these techniques to prevent the spread of pathogens.²

Different ICU devices are an integral part of COVID management. SARS CoV -2 to survive on various surfaces for a more extended period and demands special precautions by the healthcare professionals on devices used in healthcare settings. In this article, we discuss the various COVID ICU devices, their cleaning, and disinfection. The article highlights how to clean, disinfect and sterilize the devices with a respective set of protocols.

This article is based on different hospital protocols related to disinfection and sterilization of hospital devices, expert opinion, and current practices in our setting. This review is not meant to replace infection prevention policies and procedures established by the hospitals and manufacturers. However, it provides some updates on the care of covid ICU devices that the hospitals already use, which optimally reduces infection risk.

Basics of Care of ICU Devices

Devices used in an ICU range from standard equipment, such as blood pressure monitors, to highly specialized devices, such as dialysis machines and ventilators. We have discussed the decontamination and disinfection or sterilization methods of the most commonly used devices.³

Decontamination: The first step in caring for the ICU devices includes decontamination, which is a thorough cleaning of devices, primarily physically, to remove germs, and dirt from surfaces or devices with soap and water before they are subjected to disinfection and sterilization. It removes organic and inorganic material from objects and surfaces and is typically accomplished manually or mechanically using water with detergent or enzymatic products. It is the physical removal of foreign materials (e.g., dust, soil) and organic materials (e.g., blood, secretions, excretions, microorganisms). Cleaning physically removes rather than kills microorganisms.⁴ Prolonged or overnight soaking can damage the instrument and its function.

Disinfection: It is the thermal or chemical process for inactivating microorganisms on inanimate objects. Chemical compounds that inactivate or kill pathogens and other microbes are called disinfectants. They do not destroy the spores.

Disinfectants are of three categories based on chemical formulation low-level (alcohol-free quaternary ammonium compounds for cleaning floors, walls, and some countertops), mid-level (include water-based phenolics, alcohol-based phenolics, iodophors, sodium hypochlorite, and other chlorine compounds), and high-level (formaldehyde, glutaraldehyde, ortho-phthalaldehyde, hydrogen peroxide, peracetic acid, hydrogen peroxide/peracetic acid combination, sodium hypochlorite, or Iodophors.⁴

Sterilization: It is the process that destroys all forms of microorganisms, including both vegetative and spore forms, from a device, body surface, or medium. It can be achieved by physical or chemical methods. Sterilization is usually achieved by steam, boiling, autoclaving, ethylene oxide, glutaraldehyde, or gas plasma cidex.²

Care of Devices in Covid ICU

The commonly used ICU devices for caring for patients of COVID and their care process is described in table 1. The devices include infusion pump, cardiac monitor, nasal cannula, NIV mask, AMBU bag with mask, laryngoscope, ventilator, video laryngoscope, coagulation analyzer, defibrillator, ECG machine, ABG analyzer, ultrasound machine, echocardiography machine, hemodialysis machine, and oxygen cylinder.

Table 1: Care of Devices in Covid ICU

Devices	Care Description	Solution
Infusion pumps	The infusion pumps are used to give inotropes, antibiotics to the patients at a set rate and time. It has two parts, the pump, and the leads.	<ul style="list-style-type: none"> The leads should be removed first, and then the pump should be disinfected with 0.1% sodium hypochlorite/ 10% Ecoshield/ 5% carbolic acid. The spray method should be preferred.
Cardiac monitors	Monitors are used to assess vital functioning of the human body such as ECG, heart rate, invasive and non-invasive pressure, temperature, etc. It has a monitor/screen and leads.	<ul style="list-style-type: none"> 0.1% sodium hypochlorite or 10% Ecoshield, 10% bacillol/70% alcohol/ 10% ecoshield. The spray method should be preferred The screens can be disinfected according to the manufacturer’s recommendation.

		<ul style="list-style-type: none"> Probes and cables must be cleaned with a soft damp cloth and recommended cleaning agents by manufacture such as Soap/detergent and water cleaning, Chlorine bleach (30ml/l water). Do not immerse any part of the unit (including paddles) in water.¹⁰
Nasal cannula	It provides extra oxygen to compensate for the lower oxygen content available for breathing to prevent hypoxia.	<ul style="list-style-type: none"> Single-use
NIV Masks:	It is known as non - invasive ventilation, i.e., delivery of oxygen via a facemask. It assists breathing by supplying a mixture of air and oxygen using positive pressure to help the patient to take deeper breaths without an airway adjunct.	<ul style="list-style-type: none"> Single-use Before sterilization the NIV mask must be cleaned, rinsed with water and dried. For sterilization VBM recommends steam sterilization at 132/134°C / 270/273°F (5-18 min.).⁵ Before sterilization the devices should be cleaned, rinsed with water, and dried For sterilization, VBM recommend a validated steam sterilization process at 132/134°C / 270/273°F (5-18 min.).⁵
AMBU bag and Masks	<p>AMBU bags are used to ventilate critically ill patients who are suspected and admitted in the non-covid areas, where a ventilator is not available.</p> <p>It consists of three parts: a face mask, self-inflating resuscitation bag, and medical valve system.</p>	<ul style="list-style-type: none"> After using the AMBU bag and facemasks, it should be cleaned with detergent and water. After drying, it must be sent for ETO sterilization. Immerse in glutaraldehyde solution (Cidex) for 10 hours. Before use, clean it with the normal saline solution and dry it.^{6,7}
Laryngoscope	<p>Laryngoscopes are used to examine the larynx, including vocal cords and the insertion of the endotracheal tube.</p> <p>It has a blade, bulb, and handle.</p>	<ul style="list-style-type: none"> Blades should be disconnected from the handle, clean the blood or secretions from it, and then immerse in 2% glutaraldehyde (cidex) for at least 30 minutes, then rinse with sterile water. Blades can be sent for autoclaving. The handle and the bulb should be wiped with 70% alcohol.⁷
Ventilators	<p>It is a machine that is used to provide mechanical ventilation to the patient who is unable to breathe.</p> <p>It has a control panel, ventilator circuit, humidifier,</p>	<ul style="list-style-type: none"> Ideally, disposable ventilator circuits should be used with HME filters. If circuits are non-disposable, they should be washed thoroughly and sterilized by autoclaving or by ETO Daily cleaning of the ventilator with 0.1% sodium hypochlorite or 10% Ecoshield
C-MAC Video laryngoscope Machine:	<p>C-MAC video laryngoscope is used to achieve the best laryngeal view in patients with known difficult airways.</p> <p>It has: a Macintosh blade with a camera placed at its tip and a video display unit</p>	<ul style="list-style-type: none"> 0.1% sodium hypochlorite solution The spray method is preferred Manual cleaning with cold water, Hydrogen peroxide sterilization, ethylene oxide sterilization⁸

<p>Sonoclot Coagulation Analyzer :</p>	<p>The Sonoclot Coagulation Analyzer versatile instrument for measuring coagulation and platelet function in the blood samples during hemostasis. It is the latest version of thromboelastography. It is to monitor bleeding disorders.⁹</p> <p>The transducers attached to the probe mount hubs can easily be damaged by debris or liquids.</p>	<ul style="list-style-type: none"> • The analyzer can be sprayed or wiped with a disinfectant approved by the institution. Close the heads when spraying to avoid contaminating the transducers. • Avoid excess wetting. • Gently wipe around the cuvette holders or inside the heads. • Do not clean the probe mount hubs unless necessary. • NOTE: Do not use isopropyl alcohol or other solvents on the front panel or LCD cover.
<p>Defibrillator, ECG Machine, ABG analyzer, Machine, USG Machine, Echo Machine</p>	<p>A defibrillator is used for cardioversion or defibrillation; an ECG machine is used for bedside ECG; an ABG analyzer is used for ABG analysis; USG is used for ultrasound, and Echocardiography is done for patients with suspected structural heart defects and to check the ejection fraction.</p>	<ul style="list-style-type: none"> • Avoid using abrasives (e.g., paper towels) on the display window. • 90% Isopropyl alcohol can be used but not on adapters and patient cable • Probes and cables must be cleaned with a soft damp cloth and recommended cleaning agents by manufacture such as Soap/detergent and water cleaning, Chlorine bleach (30ml/l water). • Do not immerse any part of the unit (including paddles) in water.¹⁰
<p>Hemodialysis machine</p>	<p>Hemodialysis is a process in which the machine filters the blood through a dialyzer and sends the cleaned blood back into the body. It is used in End-stage kidney disease patients.</p> <p>It has the following parts: a screen/ monitor, Blood pump, spare pump, heparin pump, and a hydraulic compartment.</p>	<ul style="list-style-type: none"> • Cleaning is done with detergent and water to remove blood, body fluids, and other contaminants from the surfaces. • For disinfection, use an EPA registered hospital disinfectant such as Ethanol 60% or 70% Isopropanol 60%, Sodium hypochlorite 1.5% except on touch screen, art & pumps, air detector, blood sensor, hemo scan sensor, arterial & venous line clamps, and automatic pinch valves.¹¹
<p>Oxygen cylinders</p>	<p>Oxygen cylinders are metal cylinders that store oxygen under pressure.</p> <p>It has a regulator, flowmeter, pressure gauge, inlet, wheel knob valve, and cylinder.</p>	<ul style="list-style-type: none"> • For the initial cleaning, hot portable water with detergents not exceeding 50 degrees Celsius should be used to clean cylinders minimum of 2 minutes. • Pressure gauze, regulators, wheel knob valves, and inlets should be covered to prevent them from water • After cleaning, disinfection by 70% Iso Propyl Alcohol, Ethyl Alcohol, Diluted Bleach/Water Solution, 0.1% Sodium Hypochlorite Solution, 0.5% Hydrogen Peroxide Solution.^{12,13,14}

Care of Environmental Surfaces in Covid ICU

Environmental surfaces that patients utilize or where specific medical procedures are performed are more likely to be contaminated with the COVID-19 virus in healthcare settings. They includes furnitures and other fixed items inside and outside patients room as well as surfaces of non critical include furniture and other fixed items inside and outside of patient rooms and bathrooms, such as tables, chairs, walls, light switches, and computer peripherals, electronic equipment, sinks, toilets as well as the surfaces of non-critical medical equipment, such as suction bottles, blood pressure cuffs, stethoscopes, wheelchairs, and incubators¹⁵. Therefore, these surfaces must be appropriately cleaned and disinfected to prevent further transmission of the virus.

Cleaning should be done with detergent and water and then disinfected with 70-90% alcohol and 0.1% sodium hypochlorite. Hypochlorite displays a broad spectrum of antimicrobial activity. It is effective against several common pathogens at various concentrations, and 0.1% (1000 ppm) is recommended in the context of COVID-19, it inactivates the majority of other pathogens which may be present a conservative concentration that will inactivate the vast majority of other pathogens that may be present in the healthcare setting. For blood and body fluids, large spills (i.e., more than 10mL), a concentration of 0.5% (5000 ppm) is recommended¹⁶, and institute protocol is to be followed. Each healthcare provider involved in caring for patients with COVID-19 needs to be meticulous about infection control practices to prevent cross-contamination. Adequate training, monitoring, and supervision must be in place to ensure the care of devices and infection control practices.¹⁷ Along with all adaptation, certain modifications were done in various settings of the hospitals during the COVID-19 pandemic,^{18,19} where the care of the devices is integral in curtailing the disease transmission and preventing hospital-acquired infections.

2. CONCLUSION

As a part of appropriate infection control measures, adequate caution should be exercised and made a part of the routine care of Covid ICU devices and the environmental cleaning. Healthcare workers should be aware of cleaning schedules and practices to avoid contaminating the devices and hands during patient care. Decontamination and disinfection/sterilization of all the devices should be done routinely. Evidence-based protocols on device care must be formulated and implemented in Covid ICUs and all healthcare settings to prevent Covid 19 transmission.

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