Office of the Provincial Health Officer

Recommendations for Cleaning and Decontaminating Medical Equipment from Ebola Virus Disease Isolation Rooms

Provincial Ebola Expert Working Group

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Introduction

Medical devices that have been used in the diagnosis or treatment of confirmed Ebola virus disease (EVD) patients, including persons under investigation (PUI)[1] who are subsequently confirmed to have EVD[2], may pose a hazard to health care workers and patients if they have not been thoroughly cleaned and disinfected prior to being put back into general circulation. This document provides information to the health care team on how to clean and disinfect various medical devices after they have been used in the care of a PUI or confirmed EVD patient, prior to being placed back into general circulation.

These procedures must be applied in concert with all infection control practices approved within each hospital/health authority. These include but are not limited to:

- Routine practices and additional precautions in health care settings for the prevention of transmission of infection.
- The use of approved personnel protective equipment, including processes for donning and doffing.
- Hand hygiene.
- Proper handling and disposal of biohazardous waste.

Definitions

- AHP: Accelerated Hydrogen Peroxide
    - Examples are Virox, OxivirTb and Accel Intervention.
- PPE: Personnel involved in the cleaning and decontamination of equipment used for confirmed EVD patients must use PPE approved for use in **lower transmission risk scenarios**.
    - This PPE is described in *British Columbia Ebola Virus Disease Personal Protective Equipment Guidelines*[3].
- Biohazardous Waste Container: A container for the disposal of biohazardous waste as specified in *Recommendations for Environmental Services, Biohazardous Waste Management, and Food and Linen Management for Ebola Virus Disease (EVD).*[4]
- Intermediate Level Disinfection: A process capable of killing vegetative bacteria, mycobacteria including Mycobacterium tuberculosis, fungi, and enveloped and non-enveloped viruses.
- Isolation Room: The room where a PUI or confirmed EVD patient resides and receives treatment.

[1] Defined as anyone with a potential exposure to the Ebola virus, any symptoms compatible with EVD (Public Health Agency of Canada).

[2] Defined as anyone with laboratory confirmation of EVD infection

[3] http://www.health.gov.bc.ca/pho/pdf/british-columbia-ebola-virus-disease-personal-protective-equipment-guidelines.pdf

[4] http://www.health.gov.bc.ca/pho/pdf/recommendations-for-environmental-services-waste-management-for-evd.pdf

- This is considered to be a "hot zone".

Quarantine room/area: A well-ventilated, controlled-access room or designated area, preferably adjacent to the isolation room, which is used for quarantine of equipment as part of the cleaning process. It may also be the designated doffing area. This is considered to be a "warm zone."

UVGI: Ultraviolet germicidal irradiation.

Scope

This guideline is intended to provide general instructions on how to process the medical devices shown in Table 1 only. Makes and models, as well as mounting, vary from health authority to health authority. Therefore, each health authority will need to adapt the guideline to meet their individual situation. Further, hospitals/health authorities may wish to use this as a foundational document, which can be adapted for cleaning/disinfecting other devices not covered in this document.

Table 1: Cleaning Medical Equipment Used in Diagnosis and Treatment of EVD Patients

Device		Additional Details
1	**Patient monitor**	Includes: electrocardiogram (ECG), oxygen saturation, non-invasive blood pressure, temperature, end-tidal CO2
2	**Infusion pump**	Single or dual channel general purpose
3	**Defibrillator**	
4	**Electronic thermometer**	
5	**Ventilator**	
6	**Diagnostic ultrasound**	Multiple probes
7	**Portable X-ray machine**	Computed radiography or digital radiography
8	**Dialysis machine**	
9	**Glucometer**	

Preparation of Equipment Prior to Use

1. Prior to taking medical equipment into an isolation room, each facility should:
   - determine who is responsible for tagging equipment and tracking its use; and
   - develop a template, which includes the name of the piece of equipment, the tag number, and a section for recording cleaning completed.

2. Before taking medical equipment into an isolation room, all devices should have a clearly visible tag attached. This tag should have a unique identification number that can be used at all stages to record significant events (e.g., contamination events, stages of cleaning, etc.). The tag identifies the device as having been used in an EVD isolation room and should not be removed until the device has been approved for return to general service.

3. As there is a possibility the device may not be able to be adequately cleaned and disinfected, and therefore, never return to normal use, it is recommended that older devices (those nearing the end of the service lifespan) should be used where practical.

4. All reasonable steps should be taken to avoid the possibility of the device or its peripheral components becoming contaminated while in service. These measures should be consistent with the requirements of the device for safe operation. Special attention is required for ventilation and heat dissipation, which can become critical, particularly under extended periods of use. Some examples of preventive measures include:
   - Locating devices away from the patient (bedside monitors should be above and behind the patient, ventilators should be as far behind the patient as practical, etc.)
   - Placing plastic bag(s) or shrouds around ultrasound transducers and imaging plates.
   - Placing protective plastic covers over devices and monitors.

Cleaning and Decontamination Process for Equipment used by Confirmed EVD Patients

Please note: Equipment used in the care of persons under investigation, who are subsequently found to be EVD negative, is cleaned according to normal protocols. The extensive process described below applies only to equipment used in the care of confirmed EVD patients.

Personnel involved in the cleaning and decontamination of equipment used for confirmed EVD patients must use PPE approved for use in lower transmission risk scenarios:
http://www.health.gov.bc.ca/pho/pdf/british-columbia-ebola-virus-disease-personal-protective-equipment-guidelines.pdf

Cleaning and decontamination of medical devices used in the care of confirmed EVD patients includes seven distinct phases:

1. Initial cleaning and removal of all surface (visible) contaminants
2. Quarantine period of 48 hours
3. Intermediate level disinfection of exterior
4. Quarantine period of 48 hours
5. Disassembly, inspection, and cleaning of interior of device
6. Final quarantine of the device for 48 hours
7. Re-assembly, verification testing and return to service

These phases are described in the sections below.

1. Initial Cleaning and Removal of All Surface (Visible) Contamination

Prior to the device being removed from the patient care area and after the patient has been discharged from the area, clean and remove all visible fluids, residue and contamination from the exterior of the device. All devices should have all sources of power removed prior to any cleaning activity - this includes electrical, water and gases. Follow the steps below:

- Don lower transmission risk PPE.
- Ensure the working area is well lit and ventilated and there is adequate drainage.
- Remove all patient contact components and separate into disposable and reusable categories:
  - Disposable parts are those intended to be used for one patient only and then discarded. These include: ECG leads and cables, blood pressure cuffs and hoses, oxygen saturation sensors, breathing circuits, dialysis sets including the dialyzer, etc.
  - Reusable parts are those which can be well covered, and which can be cleaned, disinfected or sterilized. These include: ultrasound transducers and X-ray detector plates (including computed radiography plates).
- Dispose of all disposable parts in a designated biohazardous waste container for EVD waste.
- Autoclave all reusable parts, which can be safely disinfected by this process.
- For reusable parts that may be damaged by autoclaving, clean as described below.
- Using AHP or bleach wipes, wipe down all exterior surfaces and remove all visible contamination. Ensure cleaning fluid does not enter the medical device.
- Pay particular attention to areas where fluid may accumulate.
- For wheeled equipment: Before the device is removed from the patient care area, roll the device over a disinfectant-soaked mat for a minimum of two full wheel rotations. For 15 cm (six inch) diameter wheels this would be a minimum of one meter (39 inches). While on the mat, wipe down wheels and brakes with AHP or bleach wipes.
- All cleaning materials must be disposed of in a designated biohazardous waste container for EVD waste.
- Do not towel dry the device. Instead, allow the device to air dry prior to moving the device to the quarantine room.
- If any visible contamination cannot be removed, site experts including Infection Prevention and Control and Biomedical Engineering must be consulted before proceeding.

2. Quarantine Period of 48 Hours

- Move the device to the quarantine room, and leave for 48 hours to allow for desiccation of virus before proceeding with the next phase of cleaning.

3. Intermediate Level Disinfection of Exterior

In this phase, the exterior of the device is cleaned again with AHP or bleach wipes. Follow the steps below:

- Don lower transmission risk PPE.
- With assistance from Biomedical Engineering (if required), remove and discard any air cleaning filters from the device, and dispose of in a designated biohazardous waste container used for EVD waste.
- Using AHP or bleach wipes, clean **ALL EXTERIOR SURFACES** of the device. Where possible, ready-to-use solutions should be considered, and where dilution is needed, ensure the recommended dilution rate is followed.
- Do not allow cleaning fluids to get inside the device (i.e., through ventilation or other openings).
- Disconnect all cables and transducers from the device and clean separately.
- Clean the power cord and plug separately.
- Using a mirror mounted on a handle in conjunction with adequate lighting (flashlight or inspection lamp), inspect the underside of the device, paying particular attention to the wheels and brakes.
- Allow to air dry.
- Dispose of all cleaning materials in a designated biohazardous waste container used for EVD waste.
- Record any problems or difficulties encountered in the cleaning process and consult site experts including Infection Prevention and Control and Biomedical Engineering before proceeding.

4. Quarantine Period of 48 Hours (Post Intermediate Level Disinfection of Exterior)

- Leave the device in the quarantine room for 48 hours to allow for desiccation of virus before proceeding with the next phase of cleaning.
- After the quarantine period, submit a work request to Biomedical Engineering or the appropriate service based on the site/piece of equipment. This request should clearly indicate the environment the device has been used in and that it has been subject to intermediate level disinfection, and is ready for the next phase of cleaning.

5. Disassembly, Inspection and Cleaning of Interior of Device

After the intermediate level disinfection and second quarantine period (Step 4) is complete, the next phase is disassembly, inspection and cleaning of the interior of the device. This work is done by Biomedical Engineering or other services as appropriate for the site/piece of equipment. Follow the steps below while the device is still in the quarantine room:

- Don lower transmission risk PPE.
- Inspect the exterior of the device to ensure there is no visible contamination.
- Remove any remaining air cleaning filters from the device and dispose of in a designated biohazardous waste container for EVD waste.
- Remove the covers of the device and inspect all internal components for signs of internal contamination.
- Pay particular attention to areas around ventilation openings.
- If there are signs of internal contamination on the electronic circuitry:
  - Do not attempt to clean the device.
  - Cover the entire device in clear plastic wrap with a minimum thickness of four mm.
  - Tag the device as contaminated.
  - Report the contamination to site experts, including Infection Prevention and Control, who will consult and advise on further action to be taken.
- If there are no signs of internal contamination of the electronic circuitry, use AHP or bleach wipes to clean, where possible, all interior surfaces of the device (except the electronic circuitry). Where possible, ready-to-use solutions should be considered, and where dilution is needed, ensure the recommended dilution rate is followed.
- Do not allow cleaning fluids to get onto the electronic circuitry.
- After the interior has been inspected and cleaned as per above, subject the open device to UVGI sterilization (if available) while the device is in the quarantine room. Note: This step may only be undertaken after the device has been thoroughly cleaned and all organic material removed. A technical expert should be consulted at the time of UVGI use to ensure adequate exposures are achieved.
- When the above steps have been completed, the device should be put back together.
- Ensure all tools used in the process are thoroughly disinfected prior to removal from the isolation area. They should also be subjected to UVGI along with the equipment.

6. Final Quarantine of the Device for 48 Hours

- Leave the device in the quarantine room for a final 48 hours to allow for further desiccation of any residual virus.

7. Re-assembly, Verification Testing and Return to Service

- Once the device has been cleared by Infection Prevention and Control to leave the quarantine room, Biomedical Engineering or other services (as appropriate for the site/piece of equipment) will move the device to a place where routine performance and verification testing can be performed. The tag will be removed and a copy of the work order will be made available for the record of the event.
- When all testing has been successfully completed, the device may be returned to routine service. Each health authority will determine who will provide the authorization and under what conditions each device may be placed back into routine service.