BRITISH COLUMBIA | Office of the Provincial Health Officer

# Recommendations for the Critical Care Management of Suspected and Confirmed Ebola Virus Disease (EVD) Cases

Provincial Ebola Expert Working Group

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# A. Preamble

While the probability of Ebola virus disease (EVD) in British Columbia is low, careful planning is necessary to ensure these patients receive high quality care in the critical care environment. Delivering effective time-sensitive therapy to patients under isolation for EVD is a significant challenge. The isolation procedures necessary to protect heath care workers require a marked deviation from normal routines. Thus, the usual processes that occur in critical care must be re-examined in light of the high degree of isolation that is necessary. If patient outcomes are to be optimized and health care worker safety maximized, it is crucial to minimize predictable delays and interruptions, as well as identify and circumvent processes that become either ineffective or impossible as a result of the isolation precautions.

This document has been developed by critical care experts from across British Columbia, and is intended to be read along with the recommendations set forth in the Canadian Critical Care Society/Canadian Association of Emergency Physicians/Association of Medical Microbiology and Infectious Diseases Canada Ebola Clinical Care Guidelines document (Report #2 – Updated Oct. 28, 2014).[1]

It should be noted these documents are based upon expert opinion at the time of writing, in the absence of significant higher quality evidence to support specific recommendations. Together, the two documents are intended to provide guidance to health care workers on the critical care management of patients with suspected or confirmed EVD. While the text of the Ebola Clinical Care Guidelines document discriminates between suspected and confirmed cases, it emphasizes the approach to care must similarly respect patient and health care worker safety at all times. Recognizing that it is not possible to distinguish between the two states on clinical grounds, this document focuses on the delivery of safe and effective care to the patient under isolation precautions, regardless of actual serologic status.

# B. Principles of Critical Care Management

1. Safety of patient and health care worker is paramount.
2. Health care workers must receive appropriate personal protective equipment (PPE) and training in donning and doffing, and must avoid short-cuts in hastily donning appropriate PPE in emergencies in an attempt to expedite care for patients with EVD. The recommended PPE for lower and higher transmission risk scenarios, as well as guidance on how to safely don/doff this PPE can be found in the *British Columbia Ebola Virus Disease Personal Protective Equipment Guidelines*, available at: www.health.gov.bc.ca/pho/physician-resources-ebola.html.

[1] Available from: www.ammi.ca/media/73235/Ebola%20Clinical%20Care%20Guidelines%20v2%2028%20Oct%202014.pdf

3. Both the number of health care workers and their duration of exposure to patients with EVD must be minimized, and staffing levels must be planned accordingly.
4. Strategies must be employed to mitigate and/or minimize delays in donning and doffing in order to minimize delays in providing care that may be needed urgently.
5. Like all intensive care unit patients, those with EVD should be treated in a compassionate, evidence-based (wherever possible) and ethically-supported manner.

# C. Ethical Challenges

The BC Ebola Preparedness Task Force has consulted with the Provincial Forum for Clinical Ethics Support and Coordination.

In arriving at sound ethical policy, one must work from good medical and scientific facts. We do know enough about the disease, its natural progression, and its transmission to derive strategies for treatment and containment. To be ethically sound, these strategies have to measure up to the risks in light of the scientific facts, and must reconcile what is possible to provide in the form of care and containment measures given our current infrastructure and resources. Risk of harm is great. The magnitude of the harm of any individual case of EVD is very high, and the probability of spread is very high if not contained. So the risk of harm to the society is very high and needs to be factored into any ethical response.

Care of the patient with EVD is therefore fraught with ethical challenges. The necessity for health care workers to don and doff PPE in a carefully scripted way to avoid self-contamination with the Ebola virus may create limitations in care, especially in responding rapidly to acute deteriorations in a patient's clinical condition. Consequently, decisions regarding isolation for possible EVD must weigh carefully the positive and negative consequences of both isolating and not isolating the patient from the perspective of the patient, the health care workers, and society. The decision to isolate a patient should imply the risks of isolation for a particular patient are warranted to protect others from the risk of spread of EVD.

Although isolation is a necessity, there must also be sensitivity to the vulnerability and needs of patients and their families. This is particularly important with pediatric patients with EVD. Isolation of the child from the parent will cause the child distress, which may increase difficulty with management of the child and risk to health care workers. In order to satisfactorily care for the child, there may be a need to provide support for the parent in the same room. If the parent becomes ill with EVD, the parent will require transfer to an adult facility equipped with appropriate isolation and critical care capabilities.

Additionally, when a patient is either very sick or dying, facilitating family presence is the norm in critical care. However, the biology of EVD combined with the stressful physical and emotional environment creates a potentially dangerous situation. A patient dying from EVD is likely to be very infectious, and during this time family members are more likely to breach proper isolation precautions and technique. Hence the care team must carefully consider the rationale for the family presence. If it is to provide

support for the dying patient, then it may only be appropriate in the setting of an awake, co-operative patient. If it is for the family member(s), then the team must consider whether there are other ways to achieve similar support without necessitating physical exposure to the patient.

# D. Initial Management

Patients isolated for EVD will undergo the following monitoring:

- Vital signs at least every four hours.
- Daily weight.
- Strict intake and output.
- Nursing assessment each shift, with particular attention to presence of rash; mental status; state of hydration; and presence of nausea, vomiting or diarrhea.

Laboratory testing in patients with suspected or confirmed EVD has significant limitations. All admission and subsequent laboratory testing should be performed on an as-needed basis dependent upon the patient's clinical condition. For example, severe vomiting and diarrhea may require monitoring electrolytes several times a day.

All procedures will be performed in the patient's room. In the event that a patient requires additional testing (e.g., portable X-rays, ultrasound studies or placement of an arterial or central venous catheter with ultrasound guidance), the necessary equipment will be brought into the room, where it will remain until a terminal clean of the room is indicated. See *Recommended Personnel for Persons under Investigation, Probable and Confirmed Ebola-Virus Disease (EVD) Cases*.[2]

Other investigations will be evaluated on a case-by-case basis, taking into account the patients infectivity, the natural consequence of investigative findings (i.e., surgery may not be a therapeutic option) and the difficulty in sterilizing used equipment. It is expected the harm associated with transporting the patient for advanced radiological evaluations will outweigh possible benefit.

Initial treatment should include restoration of pre-existing intravascular volume deficits, with a balanced crystalloid solution and broad-spectrum antibiotic therapy.

# E. Advanced Somatic Support

The Expert Clinical Working Group Critical Care Subcommittee under the B.C. Provincial Ebola Task Force endorses the principles outlined in the Ebola Clinical Care Guidelines document. [3]

[2] www.health.gov.bc.ca/pho/pdf/recommended-personnel-for-evd-cases.pdf
[3] www.ammi.ca/media/73235/Ebola%20Clinical%20Care%20Guidelines%20v2%2028%20Oct%202014.pdf

**Cardiopulmonary resuscitation:** While warning signs are often present for several hours in patients prior to cardiac arrest, unpredictable deteriorations still inevitably occur. The importance of individualization of care in all aspects of clinical medicine is recognized. However, practical barriers to the provision of cardiopulmonary resuscitation exist in patients with EVD. As outlined in the Canadian Ebola Clinical Care Guidelines, health care workers must not take short cuts in donning PPE when responding to emergencies. Additionally, it is very difficult to ensure the safety of health care team members during the provision of chest compressions and emergency insertion of vascular access in a cardiac arrest scenario with a patient with EVD. **Hence, it is the expectation that the vast majority of patients isolated for EVD will not be candidates for chest compressions.** Administration of medications via the endotracheal route is also not advisable due to the risk of generating aerosols.

The unavoidable time delay in donning appropriate PPE mandates the creation of a care process that permits rapid response to changes in a patient's clinical condition, while simultaneously avoiding breaches in isolation precautions. Several successful strategies have been employed and/or suggested, including the constant availability of a health care worker wearing appropriate PPE either in the antechamber or in the patient's room, in addition to the use of hands-free technologies such as automated external defibrillators and automated chest compression devices.

**Fluid resuscitation:** Fluid and electrolyte losses can be substantial. Data from care of patients with Dengue fever suggests Ringer's Lactate or D5 Ringer's Lactate may be the preferred fluid for volume replacement. It should be noted that, in the context of large volume fluid replacement, pulmonary edema requiring mechanical ventilation may occur. Hypoalbuminemia is common and albumin repletion may be indicated. Intractable vomiting may preclude enteral nutrition and require total parenteral nutrition.

**Blood product support:** Due to the risk to laboratory staff in crossmatching blood products, uncrossmatched O-negative packed red blood cells and AB plasma are the preferred blood products to be administered. Routine correction of coagulopathy is not indicated in the absence of severe bleeding. Given the coagulopathy in severe Ebola infection is likely due to disseminated intravascular coagulation, there is no role for transfusion of plasma or platelets in the absence of active bleeding. Blood component therapy can be considered for the correction of coagulopathy in the actively bleeding adult or pediatric patient.

**Vasoactive drug support:** Vasoactive agents have rarely been used in the management of severe Ebola infection. However, as EVD is an inflammatory disorder, inotropes and vasopressors may be required to support blood pressure and cardiac output after correction of intravascular volume depletion. Furthermore, gram-negative bacteremia complicated one case of EVD that was treated in Germany. In the absence of new evidence, norepinephrine is the preferred agent for adults and either epinephrine or norepinephrine for children, depending on the clinical condition of the patient.

**Non-invasive ventilation:** Due to the potential for generating aerosols, non-invasive ventilation is not recommended for patients with respiratory failure in the setting of EVD.

**Endotracheal intubation and invasive mechanical ventilation:** Endotracheal intubation should be undertaken early in patients recognized to be deteriorating. A rapid sequence technique by the most experienced available operator is suggested to minimize aerosol generation. **Health care workers should wear PPE designed for aerosol-generating medical procedures.**[4] For principles related to aerosol generating medical procedures (AGMP) in EVD patients, see Appendix A.

The approach to unexpected extubation should follow similar guidelines to the principles explained above.

Data regarding the incidence of acute lung injury are lacking. Consequently, while lung protective ventilation is suggested, the effect of limiting tidal volume and airway pressure may be less substantial than in other forms of critical illness, and its importance should be considered on a case-by-case basis.

**Renal replacement therapy:** Continuous renal replacement therapy is the modality of choice, due to the contained nature of the effluent. Either high-flow or citrate anticoagulation strategies should be employed to minimize circuit changes and need for blood work. Citrate locking of temporary dialysis catheters should be utilized when dialysis catheters are not in use, and consider flushing the citrate locking solution INTO the patient rather than aspirating and discarding when connecting to the dialysis machine.

The Centers for Disease Control website (www.cdc.gov/vhf/ebola/hcp/guidance-dialysis.html) contains additional information around renal replacement therapy in the setting of EVD.

**Nutrition:** Enteral nutrition should be considered for all patients as the optimal route to provide an energy substrate for patients. However, bowel edema, vomiting and diarrhea may preclude effective oral intake. Consideration for nasogastric tube insertion and enteral supplementation should be made early, but specific attention should be paid to avoidance of inducing vomiting. Total parenteral nutrition may ultimately be required due to the nature and severity of gastrointestinal dysfunction.

**Surgery and other invasive procedures:** At the present time, operative intervention and other invasive procedures are unlikely to be performed, but will be considered on a case-by-case basis. Should such interventions be considered, only teams with sufficient training in the necessary isolation precautions should be utilized.

**Experimental Therapies**[5] (None of these therapies are currently available in British Columbia. However, the critical care team can contact the Office of the Provincial Health Officer who will initiate negotiations with Health Canada regarding release):

- *ZMapp* – cocktail of monoclonal antibodies
- Plasma from recovered patients
- Recombinant vaccines (adenovirus based, VSV-based, rabies virus based, many others)

[4] www.health.gov.bc.ca/pho/pdf/ebola-ppe-guidelines-2014-11-17.pdf
[5] Ansari J Autoimmun. 2014 Sep 23

- *TKM-Ebola* - short interfering RNA (siRNA) and antisense based such as AVI-7537)
- *Favipiravir* and *Brincidofovir* - potent inhibitors of Ebola virus replication – undergoing trials
- *S-Adenosylhomocysteine Hydrolase inhibitors* - inhibits Ebola virus in vitro

# F. Who to Contact for Assistance with Pediatric Patients

**For assistance in management of pediatric patients with EVD, contact the Patient Transfer Network (604 215 5911).**

The network will contact the pediatric Ebola response team leaders to review the case, provide management advice and co-ordinate transfer of the patient. The adult Ebola response team may be involved in patients over the age of 13 who have physiology more consistent with an adult.

# References

Canadian Critical Care Society/Canadian Association of Emergency Physicians/Association of Medical Microbiology and Infectious Diseases Canada Ebola Clinical Care Guidelines. Accessed Nov. 13, 2014 from: cccsnew.businesscatalyst.com/website/Guidelines/Ebola%20Clinical%20Care%20Guidelines-2014-10-28.pdf.

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# Appendix A:
# Aerosol Generating Medical Procedure (AGMP) Principles

The following principles should be used for AGMPs:

1. AGMPs should be avoided for all patients suspected or confirmed to have EVD.
2. If AGMPs are absolutely necessary (e.g., endotracheal intubation), implement strategies to reduce aerosol generation.

   These include:

   - AGMPs should be anticipated and planned for.
   - Appropriate patient sedation should be used.
   - The number of health care workers in the room should be limited to those required to perform the AGMP and to those highly skilled in performing the required task.
   - AGMPs should be performed in an airborne infection isolation room (also referred to as negative pressure room),
   - Appropriate ventilation (e.g., number of air changes, level of air filtration and correct direction of air flow) should be maintained,
   - Single rooms (with the door closed and away from other patients) should be used in settings where airborne infection isolation rooms are unavailable.
   - Fit tested, seal checked respirators (NIOSH approved N95 at minimum) should be worn by all health care workers in the room during an AGMP.
   - Closed endotracheal suction systems should be used wherever possible.