

**Information
for
Critical Care Management of the Adult Patient
In Ireland with
Ebola Virus Disease 2014 / 2015**

Report of :

Critical Care Advisory Group on Ebola Virus Disease

Intensive Care Society of Ireland

Interim Guidelines Update 4th January 2015

(to be updated with evolving international guidelines)

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The information in this document is designed to draw together available guidelines and information to assist the critical care clinical teams access relevant materials. Best clinical practice remains the responsibility of each doctor caring for these patients. When better information becomes available regarding specific therapies for this disease in an ICM context, these shall be added to this information resource.

Glossary of Terms

EVD	Ebola Virus Disease
VHF	Viral Haemorrhagic Fever
CDC	Centers for Disease Control and Prevention
NIU	National Isolation Unit
PPE	Personal Protective Equipment
AGP	Aerosol Generating Procedure
FFP3 and N95	Single use/disposable tight fitting filtering face-masks
PAPR	Powered Air Purifying Respirator
HPSC	Health Protection Surveillance Centre

Clinical Role of Critical Care

Although evidence is limited due to the difficulties providing advanced healthcare and intervention in poorly resourced countries where viral hemorrhagic fever (Ebola / VHF) has been associated with a high mortality, it is likely that in better resourced countries, both facility and outcomes should be better. Critical Care consultation and engagement is therefore appropriate for these patients when they fulfill standard ICM referral criteria. As for all ICM referrals, each referral shall be addressed on a case-by-case basis in conjunction with the referring consultant¹.

Specific diagnostics and treatments relevant to critical care medicine will include management of hypovolaemia, electrolyte abnormalities, refractory shock, hypoxaemia, hemorrhage, septic shock, multi-organ failure, DIC, vasopressors, nutrition, secondary bacterial infections *inter alia* and therefore specific interventions and expertise relevant to all of these is a part of critical care practice. Of note, although knowledge is evolving^{2,3} and critical care experience is limited in this disease, respiratory failure appears to arise very late in the evolution of the disease and associated multi-organ failure. This may suggest that opportunities to reverse this progression are more likely early in the care (management of hydration etc as above).

1. Location / Isolation

The Mater Misericordiae University Hospital (MMUH) contains the National Isolation Unit (NIU) and all patients testing positive for Ebola shall be transferred there where possible. The decision on whether a patient of the NIU requires intensive care input is a clinical one and that decision making process rests with the senior ICU and senior ID clinicians. This may include the determination not to proceed with ICU management or to define the scope of such management and interventions¹. The clinical management of each case cannot be protocolised and will be determined on a case by case basis. It is presumed that at the current sporadic level of western society exposure, capacity within the NIU and MMUH is appropriate.

However should there be an exceptional cluster of Ebola Virus Disease in Ireland circumstances may arise where a patient requires critical care intervention at a different acute hospital prior to transfer, or it may be considered that a patient is too unwell for transfer. In such circumstances, patient location is likely to be the emergency department, in an appropriate isolation room.

Planning around this requires that PPE is made available and the cohort of staff identified in the plan had been offered and completed the necessary training as specified by CDC.

Current models suggest it is most unlikely that a patient with EVD would not be transferred to the NIU, and that the NIU / MMUH have or can develop the required capacity. It is sensible none-the-less to consider how to provide critical

care for these patients in the exceptional circumstance that a patient is not transferred to the NIU. Whether isolation and/or critical care is provided within or outside of critical care needs to be a component of such planning. Considerations should include most appropriate ICU within a network / region to provide such care.

The Ebola Clinical Care Guidelines, a guide for clinicians in Canada, Interim Report August 29th 2014, updated October 28th, from the Canadian Critical Care Society, the Canadian Association of Emergency Physicians, and the Assoc. of Medical Microbiology and Infectious Diseases Canada⁴ provides useful guidance for the management of the critically ill Ebola patient, and will be referenced throughout this document (ref. CCCS – CCAEP – AMMI Ebola Clinical Care Guidelines). These guidelines include specific considerations for the in-hospital location and environment of such a patient. For the patient requiring critical care, the intensive care unit is likely the best place to provide such care for the reasons identified in the guidelines, including quality of the facility, accessibility to isolation rooms with negative pressure capability, and staff skill-mix. Isolation room facility must therefore be guided by the above considerations, the severity of illness, and whether aerosol generating procedures (AGPs) are likely to be required. Planning needs to include identified clean gowning-up (full PPE) area separate from dirty areas, areas for removing PPE safely, and waste (see Waste section below). A work area is required outside of this isolated zone to allow case discussion and communication. IT and communication facilities need to be suitable for staff, patient and visitor use. The defined isolation and work area will need to be segregated physically from the rest of the intensive care unit where non-Ebola Virus Disease (non-EVD) patients are being cared for.

2. Personal Protective Equipment (PPE)

Use of PPE shall be as per the The Management of Viral Haemorrhagic Fevers in Ireland, November, 2012⁵ and Ebola Virus Risk Assessment for use in Hospital Settings⁶ guidelines, or as advised by the National PPE Group. For the critically ill, these patients shall all be considered to be at the high risk category and PPE and isolation procedures consistent with that level of risk.

Current standards include the use of Airborne Infection Isolation rooms for these patients when feasible for aerosol generating procedures (AGPs) [see CDC Guideline for the Infection Prevention and Control Recommendations for Hospitalized Patients with Known or Suspected Ebola Hemorrhagic Fever in U.S. Hospitals August 2014⁷].

Specific PPE recommendations for the Critically ill patient:

The Critical Care Advisory Group recommends and adopts the CDC Guideline as the reference standard.

CDC updated guidelines October 20th 2014 make the following recommendations:

“CDC is recommending all of the same PPE included in the August 1, 2014 guidance, with the addition of coveralls and single-use, disposable hoods. Goggles are no longer recommended as they may not provide complete skin coverage in comparison to a single use disposable full face shield. Additionally, goggles are not disposable, may fog after extended use, and healthcare workers may be tempted to manipulate them with contaminated gloved hands. PPE recommended for U.S. healthcare workers caring for patients with Ebola includes:

- *Double gloves*
- *Boot covers that are waterproof and go to at least mid-calf or leg covers*
- ***Single use fluid resistant or impermeable gown that extends to at least mid-calf or coverall without intergraded hood.***
- ***Respirators, including either N95 respirators or powered air purifying respirator(PAPR)***
- *Single-use, full-face shield that is disposable*
- *Surgical hoods to ensure complete coverage of the head and neck*
- *Apron that is waterproof and covers the torso to the level of the mid-calf should be used if Ebola patients have vomiting or diarrhea*

☒The guidance describes different options for combining PPE to allow a facility to select PPE for their protocols based on availability, healthcare personnel familiarity, comfort and preference while continuing to provide a standardized, high level of protection for healthcare personnel.

The guidance includes having:

- ***Two specific, recommended PPE options for facilities to choose from. Both options provide equivalent protection if worn, donned and doffed correctly. [these two options are highlighted above]***
- *Designated areas for putting on and taking off PPE. Facilities should ensure that space and lay-out allows for clear separation between clean and potentially contaminated areas*
- *Trained observer to monitor PPE use and safe removal*
- *Step-by-step PPE removal instructions that include:
Disinfecting visibly contaminated PPE using an EPA-registered disinfectant wipe prior to taking off equipment*
- *Disinfection of gloved hands using either an EPA-registered disinfectant wipe or alcohol-based hand rub between steps of taking off PPE.”*

This guideline and web-based training can be read in full at:

<http://www.cdc.gov/vhf/ebola/hcp/procedures-for-ppe.html>

The CDC and WHO have now issued specific guidelines which addresses the PPE qualities and technical specifications.

[http://apps.who.int/iris/bitstream/10665/137411/1/WHO EVD Guidance SpecPPE 14.1 eng.pdf?ua=1](http://apps.who.int/iris/bitstream/10665/137411/1/WHO_EVD_Guidance_SpecPPE_14.1_eng.pdf?ua=1)

The HPSC PPE Subcommittee report / guidance has published a guidance document on PPE 17th December 2014.

<http://www.hpsc.ie/A-Z/Vectorborne/ViralHaemorrhagicFever/Ebola/EbolaInformationforPublicHealthdoctors/File,14958,en.pdf>

It is essential that procedures be put in place to practice the wearing of this PPE with an emphasis on the “buddy” system to ensure safe and supervised PPE use.

Practical aspects related to the wearing of PPE and other aspects of clinical care for these patients is available on the CDC Webinar of 14th October:

Preparing for Ebola: What U.S. Hospitals Can Learn From Emory Healthcare and Nebraska Medical Center

http://emergency.cdc.gov/coca/ppt/2014/10_14_14_preparing_for_ebola.pdf

3. Critical Care Staffing

The demands of care for an Ebola patient, the extra risks for the nursing and medical staff, and the difficulties inherent in working while dressed in PPE will require shorter shifts and therefore greater numbers of nurses and an extra rota of doctors for ICM separate (or supporting) those already rostered to the care of the rest of the intensive care unit patients. Different hospitals will require different configurations of such staffing, but presuming that 6 hour shifts would be the maximum tolerable for any nursing staff in this context, there would be a need for a staffing ratio of 3:1 nursing to patient (normal 1:1) per standard shift. This will significantly drain the numerical pool of ICU nursing staff for any institution and mandate closure of a number of ICU beds, impacting negatively on the ability of that center to provide for other acutely ill patients. Restrictions to major elective surgeries and redistribution of ambulance take may be required.

4. Clinical Care and Interventions for the Critically Ill

The significant escalation of interventions and therefore risk of needlestick injuries for a critically ill patient raises particular risks for healthcare workers in this environment. A risk / benefit analysis shall be required as part of every intervention and diagnostic test consistent with the 2012 Guidelines. It is implicit in this that such patients shall undergo less invasive procedures and diagnostics than many intensive care patients.

Knowledge can be presumed to be expanding in the area of best clinical care, and therefore best and most appropriate critical care, for these patients. The CCCS – CCAEP – AMMI Ebola Clinical Care Guidelines underline tenets of standard critical care practice with particular reference to patients suffering from viral haemorrhagic fever – fluid management, electrolytes, vasopressors and organ supports. Caution is advised in selection of invasive monitoring devices (arterial lines, CVP lines) but with a recognition that appropriate patient selection will also dictate such choices. Table 1 below is extrapolated from the Canadian Guidelines, modified here to include specific considerations related to patient interventions.

The clinical decision as to the appropriateness of intubation and mechanical ventilation will be consultant based and patient specific. (see “Clinical Role of Critical Care” above). The risk of aspiration and aerosolization in particular should be a consideration if NIV is a clinical option, such that endotracheal intubation may offer a more controlled environment. NIV has however been successfully used². Should intubation and mechanical ventilation be appropriate, full PPE for aerosol generating procedures is required, and ideally an Airborne Infection Isolation room (negative pressure room with 12 – 15 air exchanges / hr). Expired ventilator gasses should be HEPA filtered and scavenged. Similarly, a HEPA filter should be placed in a c-circuit between angle piece and expiry valve during bag and mask ventilation prior to intubation. Closed suctioning is advised. Individual hospitals and intensive care units will need to consider systems in place to scavenge expired gasses and suction gas as these vary from institution to institution.

The CDC has recently issued guidance with regard to haemodialysis for patients with Ebola Virus disease, both modalities of intermittent and continuous RRT.

<http://www.cdc.gov/vhf/ebola/hcp/guidance-dialysis.html>

Cardiopulmonary resuscitation in the context of full critical care management requires case by case consideration (see P 41 CCCS – CCAEP – AMMI Ebola Clinical Care Guidelines), with the added complexities of providing safe and effective CPR in such an environment.

The care of the pregnant patient (P45. CCCS – CCAEP – AMMI Ebola Clinical Care Guidelines) raises specific issues and the potential for surgery for any patient with VHF requires local consideration around such logistics, the principles of which will be logically the same for the theatre environment as for elsewhere in

the hospital. These issues are beyond the scope of the critical care guidelines which have been written to address specifics of critical care.

Table 1: Critical Care Management Considerations:

Symptom	Aetiology	Management	Procedural Implications
Hypotension and shock	Hypovolaemia 2 ^o to GI losses; secondary infection; SIRS	Close fluid balance. Aggressive fluid resus. Electrolyte replacement K, Ca. Assess fluid responsiveness. Consider Vasopressors	Consider CVC <ul style="list-style-type: none"> - K+ replacement - Vasopressors - Difficult IV access - ScvO₂ Ultrasound Guided Senior Clinician
Severe vomiting / diarrhoea	Early in disease	NGT Ondansetron Haloperidol Metoclopramide ? Rectal tube	Caution re NGT and/or faecal collection system with coagulation abnormalities
Dyspnoea or Respiratory Failure	Late in disease.	O ₂ ?NIV ?Intubation & mechanical ventilation. ? Bacterial infection	Adjunctive Strategies Hepa filtration <ul style="list-style-type: none"> - Ambu / C-Circuit - Expired gasses Senior Clinician Protective ventilation strategies
Seizure / Coma	Ominous and late	Medical management of seizures. Check Na+, glucose	
Intolerant of PO	Vomiting	Enteral Nutrition if tolerated Parenteral Nutrition	PN usually mandates CVC
Renal failure	Hypovolaemia. DIC	Close fluid balance. Aggressive fluid resus. ? CRRT ? IHD	Vascath. Considerations: CRRT Complexities IHD case suitability CDC Guidelines re dialysis Ultrasound Guided Senior Clinician
Liver dysfunction	Common in severe cases. Maybe early in disease	Monitor LFTs Coagulation Consider Vit K Beware hypoglycaemia	
Haemorrhage	Late in disease. DIC	Correct coagulation abnormalities. Target Hb 7g/dl	

		Blood Bank EVD protocol	
CPR		Patient Context Patient wishes	Ability to provide safe and effective CPR

5. Laboratory and ICU Point of Care testing

Laboratory and point-of-care testing shall comply with the EVD Laboratory Biosafety Guidance, HPSC, 15th August 2014⁹. Note, the blood bank / blood transfusion service shall not cross-match blood for these patients and hence only O-negative or type specific (if known) will be made available.

6. Waste:

The care of the critically ill, through the intensity of management, generates considerable waste, including waste related to patient cleaning and care procedures, urine containers, potentially CRRT bags, interventional procedures including many sharps, medicine wrapping and packaging, and changes of PPE for HCWs and others over many cycles per day.

The logistics of such waste management and containment, access and egress from the patient area, need rigorous planning by each hospital caring for such patients.

The management of waste is covered by the HPSC guidelines available on

<http://www.hpsc.ie/A-Z/Vectorborne/ViralHaemorrhagicFever/Assessingapossiblecase/>

Room cleaning and waste management and disposal is not a role for the critical care nurse. Each hospital will need to review its procedures for same including appropriate training and education of cleaning staff.

7. Transfer of the Critically Ill

Transfer of the critically ill to the NIU / MMUH ICU complies with the National Ambulance Service "Transportation of suspected VHF June 2012"¹⁰ document (current) or later updates.

The decision to transfer such a patient requires multi-disciplinary discussion between the referring team, the NIU Consultant on duty, and the Mater Intensive Care Consultant on duty. This may include the determination not to proceed with ICU management or to define the scope of such management and interventions..

The clinical management of each case cannot be protocolised and will be determined on a case by case basis.

A volunteer consultant rota has been established for the transport of the critically ill EVD patient. This is to allow collaborative training with the NAS with a small cohort of paramedics and doctors given the complexity of the PPE and patient context. This service is only for the transport of critically ill EVD patients and requires critical care consultant referral, and assumes critical care team involvement at the referring site at a level similar to that required for current MICAS activation in a non-EVD patient.

The referring clinicians will need to identify with the ambulance service any specific needs for a patient (eg. power for infusion pumps and ventilator / oxygen supply needs etc). It is unclear at the time of writing whether equipment used for the transfer shall be decontaminated or destroyed after transfer. Full PPE for AGPs are required for such transfer of a critically ill patient. The use of a portable ventilator where needed is recommended rather than ambu bag or c-circuit ventilation where the risk of AGP is considered to be higher. A HEPA filter should be placed in the expired gas limb of the ventilation tubing. The NAS is currently investigating the purchase of isolation trollies for use in ambulance transport, designed to allow such established interventions as ventilation, but to contain the patient on a stretcher as a mobile isolation system.

8. Supplementary Materials

These critical care guidelines are supplementary to the Management of Viral Haemorrhagic Fevers in Ireland, November, 2012 and Assessment Acute Hospital Setting guidelines both from HPSC and should be read in conjunction with these documents.

The Ebola Clinical Care Guidelines, a guide for clinicians in Canada, Interim Report August 29th 2014, from the Canadian Critical Care Society, the Canadian Association of Emergency Physicians, and the Assoc. of Medical Microbiology and Infectious Diseases Canada is recognized by this Critical Care Advisory Group as addressing many of the concerns for critical care as known to date. Readers to this site are reminded that knowledge and guidelines are evolving rapidly with a need for clinicians to routinely source the latest evidence.

Recommended Core Information sites:

1. Health Protection Surveillance Centre

<http://www.hpsc.ie/A-Z/Vectorborne/ViralHaemorrhagicFever/Ebola/>

2. Centers for Disease Control and Prevention

<http://www.cdc.gov/vhf/ebola/>

References:

1. FICM Statement: Ebola Clinical Management & Guidance. Thu.2004-10-16

<http://www.ficm.ac.uk/news-events/ficm-statement-ebola-clinical-management-guidance>

2. A Case of Severe Ebola Virus Infection Complicated by gram-negative septicaemia. Kreuels B et al. NEJM Oct23,2014

<http://www.nejm.org/doi/full/10.1056/NEJMoa1411677?query=TOC>

3. Clinical Care of two patients with Ebola Virus Disease in the United States.

Lyon et al. NEJM Nov 12th 2014.

http://www.nejm.org/doi/full/10.1056/NEJMoa1409838?query=featured_home#t=article

4. The Ebola Clinical Care Guidelines, a guide for clinicians in Canada, Interim Report October 28th 2014

http://www.wrh.on.ca/Site_Published/wrh_internet/Document.aspx?Body.Id=60888

5. The Management of Viral Haemorrhagic Fevers in Ireland, November,2012

<http://www.hpsc.ie/A-Z/Vectorborne/ViralHaemorrhagicFever/Guidance/File,12936.en.pdf>

6. Ebola Virus Risk Assessment for use in Hospital Settings.

<http://www.hpsc.ie/A-Z/Vectorborne/ViralHaemorrhagicFever/Assessingapossiblecase/File,14074.en.pdf>

7. CDC Guideline for the Infection Prevention and Control Recommendations for Hospitalized Patients with Known or Suspected Ebola Hemorrhagic Fever in U.S. Hospitals August 2014

<http://www.cdc.gov/vhf/ebola/hcp/infection-prevention-and-control-recommendations.html>

8. Management of Hazard Group 4 viral haemorrhagic fevers and similar human infectious diseases of high consequence. Advisory Committee on Dangerous Pathogens. September 2014

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/354640/VHF_guidance_document_updated_links.pdf

9. Interim Routine Diagnostic Laboratory Biosafety Guidance for Processing Samples from Individuals with Suspected or Confirmed Ebola Virus Disease. August 2014

<http://www.hpsc.ie/A-Z/Vectorborne/ViralHaemorrhagicFever/Assessingapossiblecase/File.14766.en.pdf>

10. Transportation of patients suffering from suspected or confirmed Viral Haemorrhagic Fever VHF June 2012

<http://www.hse.ie/eng/services/list/3/nas/educationcompetencyassurance/rptspoliciesandprocedures/suspectedvhf.pdf>