Interim guidelines for managing Ebola virus disease patients in Queensland

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An electronic version of this document is available at www.health.qld.gov.au/ebola

Contents

Acknowledgement

The Queensland State Health Emergency Coordination Centre—Ebola Virus Disease Incident Management Team (SHECC EVD IMT) was activated in response to the threat of Ebola virus disease (EVD).

A key role of the SHECC EVD IMT is to ensure that support services are in place to manage patients with suspected, probable and confirmed EVD, and that Queensland's guidelines for managing EVD are clear, comprehensive and based on national and international recommendations.

The SHECC EVD IMT convened an EVD clinical management guidelines working group to develop interim guidelines for patient management. The working group included representatives from infectious diseases, infection control, intensive care, emergency medicine, public health and the SHECC EVD IMT.

This guideline was adapted from the Canadian Ebola clinical care guidelines, Clinical Disease Network Australia (CDNA) national guidelines and Centers for Disease Control and Prevention (CDC) guidelines.

1. Aim

The aim of these guidelines is to provide guidance to clinicians in key aspects of the clinical management of patients with Ebola virus disease (EVD).

2. Scope

These guidelines should be read in conjunction with the following documents which are available at www.health.qld.gov.au/ebola:

- *Queensland Ebola virus disease management plan*
- *Interim guidelines for Ebola virus disease voluntary home restriction*
- *Interim guidelines for healthcare workers caring for confirmed Ebola virus disease patients in Queensland*
- *Interim infection control guidelines for the management of Ebola virus disease in Queensland*
- *Interim PPE guidelines for managing Ebola virus disease patients*.

The Pathology Queensland *Suspected ebola virus infection – Pathology management plan* is available for Queensland Health staff via the intranet.

These guidelines describe general principles for the clinical management of patients with EVD in a hospital setting. Clinicians in Queensland hospitals manage critically ill patients with a range of illnesses on a daily basis. Therefore, these guidelines provide guiding principles for managing patients with EVD only and are not intended to be used as a manual for patient care.

2.1 Review

These guidelines are intended to focus on the management of individual cases of EVD who have been exposed to the virus during travel outside Australia. Future updates of these guidelines may be required as our understanding of EVD management improves, or if there is a need for clinical guidance for managing larger numbers of patients with EVD in Queensland hospitals.

3. Overview of Ebola virus disease

3.1 Infectious agent

Ebola viruses are classified within the family *Filoviridae*, which also contains the Marburg virus. The five known species are the *Zaire ebolavirus*, *Bundibugyo ebolavirus*, *Sudan ebolavirus*, *Reston ebolavirus* and *Taï Forest ebolavirus* species. The West African outbreak is caused by a viral variant from the *Zaire ebolavirus* species. Case fatality rates for EVD have ranged between 25 and 90 per cent in the past (average 50 per cent) [1], and are currently at 71 per cent in West Africa. [2]

The 2014 epidemic in West Africa involves three countries with widespread and intense transmission (Guinea, Liberia and Sierra Leone) and those with an initial case or cases with or without localised transmission (Mali, Nigeria, Senegal, Spain and the United States of America). Both Senegal and Nigeria controlled their outbreaks and were declared EVD free on 17 and 19 October 2014 respectively. The Democratic Republic of Congo had a separate EVD outbreak in 2014 and was declared free of Ebola transmission on 21 November 2014. Spain was declared free of Ebola on 2 December 2014 after a healthcare worker who had contracted the virus while working in Sierra Leone recovered and was tested negative for EVD twice.

As of 3 December 2014, the World Health Organization (WHO) has reported 17,145 cases of EVD and 6070 deaths in the current West African outbreak. See the World Health Organization's Ebola website at www.who.int for up-to-date information.[3]

3.2 Reservoir and transmission

Species of fruit bats from the family *Pteropodidae* are considered to be a likely natural host of the Ebola virus, with sporadic disease outbreaks amongst other species including chimpanzees, gorillas, monkeys and forest antelope, occurring from time to time. EVD is introduced into the human population through direct contact between mucous membranes or non-intact skin and the blood or other bodily fluids of infected animals.[1] There is no evidence that EVD is present in Australian bats or other Australian animals.

EVD can spread from person to person by:

- direct contact between the non-intact skin or mucous membranes and the blood or body fluids of people who have EVD, or have died from EVD (transmission by sexual contact may be possible up to three months following clinical recovery)
- large wet droplets which are considered a risk; however, transmission between humans via an airborne route has never been documented[4]
- objects (for example, needles, syringes, surfaces) contaminated with blood or bodily fluids of people with EVD.[1]

In about 95 per cent of cases, the incubation period of EVD is 2–21 days, but onset of symptoms most commonly occurs between 2–17 days after an exposure.[2]

3.3 Case definitions

3.3.1 Person under investigation

A person under investigation requires clinical and limited epidemiological evidence (for example, travel to an EVD affected area in the 21 days prior to onset).

3.3.2 Suspected case

A suspected case requires clinical evidence and epidemiological evidence (for example, contact with an individual with confirmed EVD).

3.3.3 Probable case

A probable case requires clinical and epidemiological evidence and laboratory suggestive evidence, that is positive EVD testing by Forensic and Scientific Services pending confirmation by the Victorian Infectious Disease Reference Laboratory (VIDRL), or the Special Pathogens Laboratory, CDC, Atlanta, or Special Pathogens Laboratory, National Institute of Virology (NIV), Johannesburg.

3.3.4 Confirmed case

A confirmed case requires laboratory definitive evidence only (test confirmed by VIDRL, Special Pathogens Laboratory, CDC, or Special Pathogens Laboratory, NIV).

For further details and the most up-to-date definitions, please refer to the *Ebola Virus Disease (EVD) CDNA National Guidelines for Public Health Units* available at www.health.gov.au.

3.4 Clinical presentation

The early symptoms of EVD are similar to other tropical diseases, including malaria. The onset of symptoms is sudden and most frequently includes fever (temperature of 37.5ºC or greater), myalgia, fatigue and headache. The next stage of disease may include symptoms that are gastrointestinal (hiccups, vomiting, diarrhoea), neurological (headaches, confusion), vascular, conjunctival injection, cutaneous (maculopapular rash), and respiratory (sore throat, cough) with prostration. Cases may develop a profound electrolyte disturbance, a septic shock-like syndrome, and progress to multi-organ failure, sometimes accompanied by profuse internal and external bleeding.[1]

Note: Fever may be absent if the patient has taken antipyretics[5] and in up to a quarter of cases at presentation[6].

3.5 Diagnosis

The primary diagnostic method at this time is detection of Ebola virus RNA in blood by reverse transcription polymerase chain reaction (RT-PCR). Serology is not available in Queensland and has limited availability at VIDRL.

The differential diagnosis of EVD includes a wide range of diseases, notably malaria, dengue and other vector-borne diseases. Owing to the highly infectious nature of EVD, there are strict limitations on the availability of additional testing until the diagnosis of EVD has been excluded.

Appropriate precautions must be used in the collection, packaging and transport of clinical specimens, and the management of associated clinical waste. Where possible invasive testing should be limited and utilise dedicated point-of-care testing equipment. Decisions on further diagnostic tests should be discussed with a clinical microbiologist.

Further information on testing for differential diagnoses, laboratory safety and the packaging of specimens is contained in Pathology Queensland's *Suspected ebola virus infection – Pathology management plan* (available for Queensland Health staff via the intranet).

3.6 Treatment

The skills needed to care for a patient with EVD are fundamental acute care skills and include:

- safe and effective management of early presentations with **simple measures,** for example, oral rehydration solution. **Invasive procedures are to be minimised.**
- careful management of fluid and electrolyte balance
- correction of coagulation abnormalities
- nutritional support
- pain management
- antibiotics for secondary bacterial infections.[5]

There has been intense public, media and medical attention on specific experimental treatments for EVD, including monoclonal antibodies.[7] At this stage, insufficient evidence is available for the safety and efficacy of these treatments in humans. Clinical trials are under way for some therapies.[5]

4. Key aspects of the safe management of patients with Ebola virus disease

- Safety, that is patient, healthcare worker (HCW) and community safety, is a key consideration in clinical care.
- Hospital administration and senior leaders should ensure that sufficient resources are available such as personal protective equipment (PPE) and training in the use of PPE, experts in patient management and infection prevention and control, as well as general staffing, equipment and medical supplies.
- Clinical leaders are to ensure that a team is in place to coordinate the overall response. The team may include an infectious diseases physician, senior nurse and infection control practitioner.
- Patients are to be placed in a single room, with a private bathroom and an anteroom, with the door being kept closed.[1]
- The number of people who enter the patient's room should be restricted to the doctors and nurses in the treating team. Visitors are to be restricted to areas where they can communicate with the patient from a safe distance—a 'non-isolation' area more than one metre away from the patient. Any restriction placed on the movement of contacts of EVD patients must be strictly followed. For children with EVD, see Section 10.16 Paediatric considerations.
- All staff and visitors are to wear appropriate PPE prior to entering the patient's room. All skin should be covered using a suitable combination of PPE, such as a disposable fluid-resistant gown, gloves and eye protection (for example, goggles or face shield), leg and shoe coverings, and overalls when entering a patient care area. A trained observer must oversee the donning and removing of PPE.[5]
  See *Interim PPE guidelines for managing Ebola virus disease patients* and *Interim infection control guidelines for the management of Ebola virus disease in Queensland*.

- Invasive procedures, for example, intubation or surgical interventions, should be anticipated where possible so that emergency responses are reduced and procedures are conducted in a suitable environment by staff who are adequately prepared, trained and protected with appropriate PPE.
- An appropriate number of HCWs must be present to look after the patient for periods up to (and not exceeding two hours). **HCWs must not look after the patient on their own.**
- Interpreting services may be required.
- Hospitals should keep a register of all healthcare workers involved in the care of patients with EVD and are to provide a key contact person for the monitoring and recording of staff health during and after their provision of care to a patient with EVD.[1]

5. Point of first contact: emergency departments

5.1 Preparedness

Key aspects of emergency department's preparedness include:

- a process for surveillance for suspected cases of EVD
- plans to respond to a potential patient with EVD—this should be part of a broader hospital/facility plan which incorporates key disciplines in the overall aspects of staff and patient safety, clinical assessment, pathology testing, patient movement and isolation of a suspected, probable or confirmed EVD case within a facility
- identification of emergency department team members and roles, for example, the senior clinician who will be doing the clinical assessment and specimen collection
- isolation room(s) designated for patients with EVD (or other emerging pathogens, for example, MERS-CoV)
- procurement of appropriate PPE
- staff training to use appropriate PPE
- trained observer to ensure cross-checks of PPE and potential risk procedures such as phlebotomy
- small posters with guidelines for staff in key areas which should also be made available online
- simulations to assess preparedness activities.[5]

5.2 Risk factors in emergency departments

An important risk factor is overcrowding in waiting rooms and triage areas. To mitigate this, emergency departments should have prominent posters at the entrance instructing individuals with risk factors for Ebola virus infection and/or relevant signs and symptoms of EVD to immediately report to the triage nurse so they can be isolated. These posters should also be clearly visible in key areas of the hospital (for example, hospital entrance, outpatient clinics, areas near elevators) to encourage symptomatic

individuals with risk factors for Ebola virus infection to immediately report to the emergency department. Sample EVD posters are available at www.health.qld.gov.au/ebola.

To ensure that space is available in emergency departments to treat incoming patients, hospitals should also support the timely transfer of admitted patients from emergency departments to wards. Infection control and waste management guidelines for EVD should be followed for patients with suspected, probable or confirmed EVD.[5]

5.3 Triaging the patient with risk factors for Ebola virus infection

- Most patients presenting to emergency departments will be relatively well, that is, no vomiting, diarrhoea or haemorrhagic signs. The risk of transmission is low.
- **The triage nurse must avoid touching the patient.** The triage nurse must maintain a comfortable distance that is more than one metre away from the patient or child with parent. As soon as EVD is suspected, the triage nurse must escort the patient to an isolation room.
- A thermometer is to be provided to the patient. The triage nurse will instruct the patient to take their temperature and ask the patient to read the temperature.
- The triage nurse should not ask detailed questions. He/she should focus on isolating the patient, ideally in a dedicated room. This room should have a bathroom or should be large enough for a commode. If this room is occupied by another patient, it should be vacated as soon as possible. The patient with risk factors for Ebola virus infection should remain in the triage area until the isolation room is available.
- Once the patient has moved to the isolation area, the triage area should be cleaned according to the recommendations for environmental cleaning.
- An area where healthcare workers can safely don and remove PPE needs to be prepared[5] as described in the *Interim PPE guidelines for managing Ebola virus disease patients*.

5.4 Examining patients with symptoms of Ebola virus disease in an isolation room

- The consultant emergency physician on call should be advised prior to examining the patient.
- Appropriate PPE is required prior to examining the patient, as per the PPE guidelines. The number of staff examining the patient is to be limited to the minimum number required to provide safe patient care. Students and family members should not be allowed into the room.
- To minimise exposure, the patient may be interviewed from a safe distance (more than one metre away from the patient).
- If the history identifies the patient as a suspected case (see Section 5.5 Case identification), consultation with an infectious diseases physician and advice to the local public health physician is needed. For contact details for public health units visit www.health.qld.gov.au.

Note: Clinicians who suspect a person may have EVD must immediately notify the public health physician at their local public health unit.

- If the patient is a child, the risk of allowing the parent into the room should be considered on a case-by-case basis in consultation with public health physicians and hospital infection control specialists. One parent/carer may accompany and remain with the child. Full PPE, as described below, should be worn by the parent/carer at all times when in the room with the child.
- Applying infection control precautions, transfer to the appropriate designated treatment hospital (Royal Brisbane and Women's Hospital or Lady Cilento Children's Hospital) should be arranged.
- If a symptomatic parent is admitted, appropriate placement of the child requires individual discussion and will depend on whether the child also has symptoms or not. Important considerations will also include the age of the child, the clinical status of the symptomatic parent/carer and the availability of other carers for the child.
- Safety is a key consideration in obtaining clinical specimens. Unless absolutely necessary for clinical management, blood and other specimens should only be collected in a designated EVD treatment hospital or by members of an EVD treatment team deployed to support care in a non-designated EVD treatment facility.
- The pathology laboratory should be notified in advance and decisions on further diagnostic testing must be discussed with a clinical microbiologist. In addition to Ebola virus RT-PCR, further tests may include full blood count, creatinine, urea and electrolytes, liver function tests, coagulation studies, blood cultures and malaria tests.
- X-rays should be taken only if absolutely essential. If X-rays are taken, additional decontamination of equipment and the diagnostic area is required.[5]

5.5 Case identification

Early identification of patients who may have EVD is based on clinical presentation and epidemiological risk. Refer to EVD CDNA National Guidelines for Public Health Units available at www.health.gov.au for current case definitions for EVD.

See Section 3.4 Clinical presentation for further information on history and presenting features.

EVD should be considered in a patient with fever or other Ebola-compatible symptoms, whose onset of symptoms was within 2–21 days of:

- residence in or travel to a country with widespread EVD transmission
- caring for a patient with probable or confirmed EVD, or contact with the environment or fomites associated with a case
- contact with someone who is symptomatic and is known to have travelled to an EVD affected country
- spending time in a healthcare facility where EVD patients are being treated
- household exposure to a confirmed or probable case of EVD
- processing laboratory specimens from a probable or confirmed case of EVD
- direct exposure to human remains (for example, through participation in funeral rites) in an area where EVD transmission is active

- contact with bats or other primates, or handling or preparing 'bush meat' in an EVD affected country.[4]

The above information will be required for further discussion with clinical and public health specialists. The local public health unit should be notified.

6. Receiving and treatment hospitals for patients with suspected, probable or confirmed Ebola virus disease

The likelihood of an EVD case occurring in Queensland is low. A suspected EVD case may initially present to any clinical facility in Queensland. However, the aim of the *Queensland Ebola virus disease management plan* is to ensure that suspected EVD cases are identified and initially assessed at one of the designated EVD **receiving** hospitals in Queensland, and then referred to one of the two designated EVD **treatment** hospitals in Queensland, depending on their distance and travel time to the receiving hospitals.

In Queensland, the designated EVD **receiving** hospitals are:

- Royal Brisbane and Women's Hospital (RBWH)
- Lady Cilento Children's Hospital
- Cairns Hospital (for cases arriving in Queensland via Cairns International Airport)
- Townsville Hospital (for cases arriving in Queensland via Townsville International Airport)
- Gold Coast University Hospital (for cases arriving in Queensland via Coolangatta International Airport if unable to be safely transported to RBWH).

Definitive assessment, investigations and management is provided at one of the designated EVD **treatment** hospitals.

In Queensland, the designated treatment hospitals for EVD are:

- RBWH
- Lady Cilento Children's Hospital.

Stable patients with suspected, probable or confirmed EVD will be transferred to the metropolitan designated treatment hospitals. If the patient is unstable or otherwise unsuitable for transfer to a designated EVD treatment hospital, an EVD treatment team will be deployed to the referring hospital to assist in the care of the patient. The EVD treatment team will bring an I-Stat machine. For more information, see Section 11. General considerations for inter-facility transport.

Key considerations for areas to care for a patient who may have EVD are:

- The patient should be isolated from other people in the highest containment room available. At minimum, they should be placed in a single room with a door, private bathroom and anteroom. Negative pressure rooms should be used for aerosol generating procedures.

- The room should have restricted access with procedures to record staff entry.
- The room should have infrastructure for the patient to communicate with staff and family members outside the room.
- PPE and medical supplies are to be stored outside the room. There should be sufficient space to don and remove PPE.
- Appropriate facilities should be available for cleaning and waste disposal, as per infection control and waste management guidelines.
- A plan should be in place for an intensive care review at the earliest signs of deterioration to use existing protocols for a safe transfer to intensive care units.

7. Key considerations for personal protective equipment

The *Interim PPE guidelines for managing Ebola virus disease patients* contain information on the required standards of PPE and the procedures for donning and removing PPE.

Key considerations are:

- Prior to working with patients with EVD, healthcare workers must have received repeated training and have demonstrated competency in performing all EVD-related infection control practices and procedures, specifically in donning and removing proper PPE.
- While working in PPE, healthcare workers caring for patients with EVD should have no skin exposed.
- Each step of every PPE donning/removing procedure must be supervised by a trained observer to ensure proper completion of established PPE protocols.[6] The trained observer does not provide clinical care to the patient with EVD.
- HCW may experience fatigue while in PPE. To minimise fatigue, time spent with a patient must be limited to sessions not exceeding two hours. This may be further reduced by ambient conditions.

8. Key considerations for waste management

Plans and processes should be in place to address how waste will be managed in a patient's room, and safely transported from the patient's room to a holding area and then ultimately to a disposal area.[5]

Key principles include:

- training of staff who handle clinical waste in the use of PPE
- procedures for double bagging of clinical waste and further packaging in a rigid container for transport
- procedures for the safe cleaning up of body fluid spills
- procedures for the safe cleaning and disinfection of any reusable equipment
- procedures for cleaning and disinfection of toilets prior to flushing.

Full information is contained in the *Interim infection control guidelines for the management of Ebola virus disease in Queensland*.

9. Care of patients with suspected Ebola virus disease

The majority of patients with suspected EVD in Australia is unlikely to have EVD. The typical turnaround time for Ebola RT-PCR in Brisbane is six hours. It may not be feasible to wait for the results of this test before proceeding to treat the patient for EVD or other suspected conditions.

9.1 Investigations in suspected Ebola virus disease patients

- Lab tests should be minimised. In designated EVD treatment facilities a separate dedicated I-Stat machine will be available to support most pathology investigations that may be required.
- Tests outside the designated hospital are to be conducted using a designated I-Stat machine, delivered by the deployable EVD treatment team (see Pathology Queensland guidelines for further information on laboratory tests and safe handling of specimens).
- Imaging should be requested only if essential. Use of imaging will require additional cleaning of diagnostic areas and equipment.[5]

9.2 Empiric therapy

The decision to initiate empiric therapies for malaria and systemic bacterial infections should be made in consultation with infectious diseases physicians, particularly if diagnostic investigations are delayed and the patient has risk factors for these conditions.[5]

9.3 Life support and resuscitation

The majority of suspected cases of EVD in Australia will not have EVD. Life support and resuscitation should be considered for suspected cases if medically indicated. Key considerations are:

- Staff safety is a priority. All staff involved in resuscitation must don PPE safely prior to patient contact.
- PPE requirements may delay resuscitation. Therefore, a plan should be in place for an intensive care review at the earliest signs of deterioration to use existing protocols for safe transfer to intensive care units.
- The number of staff involved in the resuscitation should be limited.
- An organising team outside the room may help support the resuscitation (for example, preparing medications, managing logistical issues, monitoring team safety in the room).[5]

10. Care of patients with probable or confirmed Ebola virus disease

HCWs must not provide care to EVD patients alone. Time spent with a patient must be limited to sessions not exceeding two hours (see Sections 4 and 7).

10.1 Clinical examination and assessment

Frequency of clinical examination and monitoring of patients with probable or confirmed EVD will depend on the condition of the patient. Patients who are more severely unwell will require more intense monitoring, similar to other critically ill patients.

Early symptoms are non-specific and can include fever, headache, myalgia, arthralgia, fatigue, nausea, vomiting and non-bloody diarrhoea.

Later symptoms can include profuse diarrhoea and vomiting, neurological symptoms (for example, confusion, delirium), conjunctivitis, jaundice, capillary leak and peripheral oedema and bleeding. Only a minority of patients will have haemorrhagic manifestations of EVD.

Some symptoms (for example, fatigue, myalgia and arthralgia) may persist during the recovery phase.[5]

10.2 Monitoring

In the early stages of EVD, the majority of patients can be monitored and treated with non-invasive measures (for example, oral rehydration solution).

Invasive monitoring and/or organ support is to be provided if indicated. Appropriate safety precautions must be followed at all times.

10.3 Body fluid control

Patients may be too weak to walk to bathrooms. A bedside commode may be the preferred option. Alternative measures, for example, a large bucket, may be considered if the patient has ‘cholera volumes’ of stool (up to ten litres per day).

If the patient is incontinent of urine or faeces, urinary catheters and faecal collection systems should be considered if the patient is in intensive care.

Body fluid spills should be cleaned as per the interim infection control guidelines for EVD.

10.4 Airway management and ventilation

Respiratory failure in patients with EVD may be secondary to shock, fatigue from prolonged compensation of respiratory acidosis, or iatrogenic complications.

Non-invasive ventilation should not be used in patients with respiratory failure due to EVD because of the risks associated with disease transmission. In the event of potentially reversible respiratory failure due to EVD, invasive mechanical ventilation

should be instituted. Invasive mechanical ventilation should be instituted early to mitigate against the risks associated with emergency intubations.

Patients should be intubated and ventilated in a negative pressure room. Ventilators must have HEPA filtration of exhaled gases capability. An emergency plan must be in place to manage self-extubation.[5]

10.5 Fluid resuscitation and electrolytes

- In the early stages of EVD, the majority of patients may be managed with oral rehydration solutions if able to be tolerated. However, in an advanced stage of the disease, aggressive supportive measures of hydration, electrolyte correction and transfusion of blood products may be required.[8]
- The medical literature reports patients experience substantial intravascular volume depletion and marked electrolyte abnormalities associated with vomiting and high volume diarrhoea.
- Oral fluid and electrolyte replacement is preferred if tolerated.
- Nasogastric tube insertion may be considered if indicated. Nasogastric tubes must be inserted in a controlled environment and benefits need to be balanced against the risk of EVD transmission to staff.
- Patients unable to tolerate oral fluids will require intravenous access. Central or peripherally inserted central venous access should only be considered in patients requiring intravenous electrolytes, vasopressors or poor peripheral venous access. Pleural effusions are a recognised potential complication.
- Based on the management of patients with Dengue Haemorrhagic Fever, Ringer's Lactate may be preferred to normal saline.
- Artificial colloids should be avoided, given their associated risks of renal injury, bleeding and mortality.
- If the patient is bleeding, transfusion of red blood cells, platelets, fresh frozen plasma or cryoprecipitate should be considered if indicated. Due to safety considerations, blood should not be sent for cross-matching. Unless the patient has sickle cell disease, they should be issued O negative, Kell negative blood.[7]

10.6 Vasopressors

Vasopressors should be administered according to the usual clinical indicators and regimens.

10.7 Antibiotics

The clinical manifestation of severe EVD may overlap with symptoms and signs observed in septic shock of bacterial origin. A patient with severe EVD complicated by gram-negative septicaemia was recently treated in Hamburg, Germany. Blood cultures revealed growth of a gram negative bacterium resistant to ampicillin, ciprofloxacin and third-generation cephalosporins, but sensitive to meropenem. More advanced tools for full identification of the organism were not available.[9]

Decisions to initiate antibiotics should be made in consultation with an infectious diseases physician.

10.8 Organ support

Dialysis should be considered in patients with EVD and renal failure. HCWs involved with this procedure must wear the highest level of PPE available. The Centers for Disease Control and Prevention has developed a guidance document on the provision of acute haemodialysis in patients with EVD.[10]

Invasive methods of organ support should be offered to all EVD patients to manage reversible conditions.

10.9 Cardiopulmonary resuscitation

Key considerations for cardiopulmonary resuscitation (CPR) are:

- medical indication and utility of CPR in that context
- ability to provide effective CPR
- safety of those providing care
- patient preferences.

Patients with late-stage EVD and multi-organ failure who experience a cardiac arrest are unlikely to survive. Commencement of CPR may be considered only in highly selected cases where the treating clinicians believe there is a rapidly reversible aetiology for the arrest.

If medically indicated, CPR presents a number of challenges, including:

- The time to don PPE. **Regardless of the patient's condition, it is important that staff don appropriate PPE prior to attending to the patient.**
- In the context of cardiac arrest, timely initiation of CPR can prevent ischaemic organ damage. PPE requirements may delay initiation of CPR.
- Challenges associated with performing chest compressions when the number of staff allowed in the patient's room is limited.

Taking all the above issues into consideration, in the majority of situations CPR is unlikely to be of benefit to patients with EVD. Decisions regarding CPR should be made early in the patient's admission and should be discussed with the patient and their family.

10.10 Symptom management

Given that treatment of EVD is supportive, the management of symptoms and signs is important. Treatment may involve the management of:

- seizure or coma
- hypotension and shock
- dyspnoea or respiratory failure
- severe diarrhoea and vomiting

- intolerance to oral intake
- hiccups
- right upper quadrant pain and hepatomegaly
- haemorrhage (gastrointestinal and puncture sites)
- fever, chills, headaches and myalgias
- pain.

Note: Non-steroidal anti-inflammatory medications should be strictly avoided due to their platelet-inhibiting effects.[5]

10.11 Preventative measures for the critically ill

Prevention of complications in the critically ill should be managed in accordance with existing unit protocols.

10.12 Nutrition

Enteral nutrition is preferred. Nutrition to critically ill patients is to be provided as per unit protocols. Nasogastric tubes are to be placed if indicated.

10.13 Experimental antiviral medications and vaccinations

The available data for monoclonal antibodies, small inhibitory RNA molecules, Ebola virus specific convalescent plasma therapy and hyper-immune globulin, pre- and post-exposure immunisation are limited. Safety and efficacy has not been determined in humans.

Efforts to launch clinical trials are rapidly under way and the World Health Organization has issued ethical guidance on the use of such agents.[11]

10.14 Discharge decisions

Discharge decisions should be made in consultation with infectious diseases physicians and may depend on the detection of Ebola virus in blood, urine and sweat.

Ebola virus may persist in semen for up to three months after recovery. Patients should be given advice about the use of condoms or abstinence from sex.[5]

10.15 Pregnancy and obstetrics

EVD in pregnancy is associated with increased severity of illness, complications and mortality. There is a high risk of miscarriage, stillbirth and severe genital tract bleeding.[12]

Management should include consideration of alternative diagnoses for fever and coagulopathy, such as puerperal sepsis, thrombotic thrombocytopenic purpura, and severe pre-eclampsia.

Clinical management is similar to non-pregnant EVD patients, with a few exceptions:

- Fever is harmful to the foetus and should be avoided. Usual management principles of hydration and antipyretics apply.
- Infection control precautions should be supplemented with planning for management of excessive peripartum blood loss.
- Planning should include adequate PPE and equipment for obstetric, anaesthetic and neonatal teams.
- Infants born to mothers with EVD are reported to have high neonatal mortality rates. Viability of the foetus should be confirmed to avoid the risks associated with futile neonatal resuscitation.[5]

10.16 Paediatric considerations

- The principles of managing EVD in paediatric patients are similar to adult patients. Children are especially susceptible to electrolyte abnormalities and hypovolaemia. Therefore, early recognition and treatment should be the standard of care.
- If the patient is stable and does not have profuse vomiting, diarrhoea or bleeding, they should be transferred to the Lady Cilento Children's Hospital.
- Decisions about immediate family visiting the patient should be made on a case-by-case basis. All visitors must don appropriate PPE.[5]
- Breastfeeding is to be avoided if either the mother or baby has EVD.

10.17 Impact on healthcare workers

- HCWs may experience fatigue while in PPE. To minimise fatigue, time spent with a patient must be limited to sessions not exceeding two hours.
- HCWs will be concerned about the risks of acquiring EVD and transmitting the infection to their family and others. If appropriate infection control precautions are followed, the risk of transmission to HCWs is very low. The recent infection of HCWs in well-resourced settings with adequate access to PPE and dealing with advanced EVD suggests the margin of error in donning and removing PPE is very low.
- HCW caring for patients with probable or confirmed EVD should monitor their temperature twice daily, commencing 48 hours after their first contact with the patient and continuing until 21 days after their last contact with the patient. If they develop symptoms consistent with EVD, they should isolate themselves and notify their employer and public health unit immediately. Full details on the management of HCWs involved in the treatment of confirmed EVD cases and the responsibilities of the HHSs/facility are described in the *Interim guidelines for healthcare workers caring for confirmed Ebola virus disease patients in Queensland*.
- The potential psychological impact is described below.

10.18 Psychological support (patients, families and providers)

Rare and life threatening infectious diseases can cause considerable stress for patients, their families and the providers who care for them.

Honest communication with the patient and their family is important for decision-making. Families may require support for grief and bereavement.

Hospitals should provide support services to patients and their families. These may include social work, chaplaincy and psychiatrists. To minimise the risk of exposure to providers of support services, internet video chat or a phone should be used to provide support to the patient.

Plans should be in place to support HCWs caring for a patient with EVD. Stressors may include fear of contracting the illness, concern for infecting family members, prolonged periods in PPE, social isolation, fatigue from working long hours and poor patient outcome.[5]

11. General considerations for inter-facility transport

11.1 The stable patient

Patients with suspected, probable or confirmed EVD, who present to a hospital that is not a designated EVD treatment hospital should be transported to a designated EVD treatment hospital if they do not have vomiting, diarrhoea or haemorrhage.

Depending on the location, the patient may be transported by road or air ambulance. Infection control and waste management guidelines are to be followed when transporting patients. The coordination of the patient transport will include representation from infectious diseases physicians, emergency department physicians and the Director of Medical Services at the sending (referring) and receiving hospitals, the State Health Emergency Coordination Centre—Ebola Virus Disease Incident Management Team and Retrieval Services Queensland (RSQ).

For further information on transport, refer to Queensland Health's inter-facility retrieval and transport guidelines for EVD which will be made available at www.health.qld.gov.au/ebola once finalised.

11.2 The unstable patient

If a patient with suspected, probable or confirmed EVD has symptoms such as vomiting, diarrhoea or haemorrhage, it should be considered to continue to provide care in the initial hospital. Vomiting, diarrhoea and bleeding substantially increase the risk of transmission to the retrieval team. With existing retrieval aircraft and equipment limitations, including ISOPOD capability, it may not be possible to transfer patients in a sufficiently safe manner.

A clinical case conference will be conducted to coordinate the ongoing care provision for such patients, and will include infectious disease, emergency department and intensive care staff from the initial hospital and the designated EVD treatment hospital.

Should it be considered that transferring the patient is not the most suitable course of action, a deployable EVD treatment team (DETT) will be sent to the hospital to assist in the care of the patient.

The DETT will be sourced from metropolitan hospitals with sufficient expertise in infectious diseases and infection control procedures to manage an EVD case. The composition of the team will include trained senior medical and nursing staff who possess competencies in the infection control and PPE requirements to manage a case. The DETT will bring a dedicated I-Stat machine for the patient with EVD.

DETT deployment will ideally occur within 12 hours of a decision being made to continue care in the initial hospital. RSQ will facilitate the transport of the DETT and associated equipment.

Review

These guidelines will be reviewed as new information and evidence emerges and no later than 5 December 2015.

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Version control

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1.0	24/11/2014	SHECC EVD IMT	New document

Appendix 1 Pathophysiology of Ebola virus infection

Ebola virus initially infects key cells of the immune system, including dendritic cells (DC) and macrophages, but not lymphocytes, travelling around the body in the blood and lymphatics. Virus spreads to the lymph nodes, liver and spleen infecting tissue macrophages including Kupffer cells and a range of other tissue cells, including hepatocytes, adrenal cortical and medullary cells and later in disease, endothelial cells and endocardium.[1,2] Expanding foci of necrosis result in multifocal organ damage. Lymphocytes, despite not being infected, undergo apoptosis later in the infection.[3]

Rising serum alanine aminotransferase is a marker of hepatic damage; falling serum calcium and rising urea and creatinine are consistent with acute renal failure.[4] Leukopeania (leukocytosis can occur later in disease if bacterial peritonitis develop), neutrophilia and thrombocytopaenia are observed.[5,6] Antimicrobial therapy is needed to manage sepsis. Endothelial damage and decreasing serum protein concentration due to rigorous volume management may lead to pleural and pericardial effusions, ascites and increasing intestinal oedema. These may lead to deficits in organ perfusion, complicated by hypoglycaemia and lactic acidosis. Later in the course of disease, tachycardia, hypertension, encephalopathy with altered mental status (delirium and hallucinations) and respiratory failure may occur.[6]

Ebola virus induces an inflammatory state but also has mechanisms to by inhibit interferon responses, deplete natural killer cells and impair DC cell function.[1]

Coagulopathy results early on due to activated phagocytosis, activated coagulation cascades, lack of coagulation factors as a result of hepatic damage, and later platelet aggregation and loss, and endothelial cell damage.[1,3] The procoagulant state develops into disseminated intravascular coagulation and the cytokine-fuelled degradation of the endothelial barrier combine to lead to shock. Necrosis of the liver, lymph nodes, kidneys, testis and ovaries may occur and impairment to coagulation can manifest as conjunctival haemorrhage, bruising, impaired clotting at venepuncture sites and/or the presence of blood in urine or faeces.[7]

Patients are at risk from hypovolemic shock, producing up to ten litres of fluid a day due to copious vomiting, diarrhoea and sweat. Oral rehydration may not be tolerated or be ineffective due to vomiting. Dehydration and haemoconcentration are notable with high haemoglobin creatinine levels. Hypokalaemia (low potassium) and elevated aspartate aminotransferase are observed. These issues may require continuous intravenous substitution; a central venous catheter may be required to meet demand. EVD cases can go on to develop hypoxemia, tachycardia, shortness of breath and abdominal pain after diarrhoea and vomiting slows.[6,1]

Abbreviations

CDC	Centers for Disease Control and Prevention
CDNA	Communicable Diseases Network Australia
DETT	Deployable Ebola treatment team
EVD	Ebola virus disease
HCW	Healthcare worker
ISOPOD	Single-person isolation transport pod
MERT	Medical emergency response team
PPE	Personal protective equipment
RSQ	Retrieval Services Queensland
RT-PCR	Reverse transcription-polymerase chain reaction
SHECC EVD IMT	State Health Emergency Coordination Centre—Ebola Virus Disease Incident Management Team
VIDRL	Victorian Infection Disease Reference Laboratory

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