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Critical Care Management of Two Ebola Patients: A Biocontainment Unit Demystified

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In less than one year, during the dramatic rise of Ebola virus disease in Western Africa, the medical community has been required to respond to multiple areas of uncertainty regarding the best treatments for patients as well as the safety of health care workers. For patients repatriated to their home countries in Europe and the United States, the opportunity to provide higher levels of care added a new layer of complexity regarding the safety and appropriateness of invasive procedures (1-3). Several groups have issued practice guidelines for the safe provision of care to patients infected with the Ebola virus (4-6). Detailed reports of the process of delivering intensive care to these patients in resource-rich settings, however, are limited.

In the current issue of *Critical Care Medicine*, Johnson and colleagues provide a detailed summary of their experience delivering care to the first two Ebola-infected patients admitted to the Biocontainment Unit (BCU) at the University of Nebraska Medical Center (UNMC), with a focus on the planning and provision of critical care services to such patients (7). The authors focus on all aspects of critical care services for patients infected with high-consequence pathogens, such as intensivist training and staffing, practical considerations in the performance of invasive procedures, and preemptive planning for responding to acute life-threatening events.

Several practical issues of caring for critically ill patients are detailed in their review. Communication among key consultant services in the planning phase of high-containment units has been previously emphasized, however, the authors note that inclusion of critical care physicians in training exercises had not until recently been routinely done at UNMC (8). As the scope of care expanded for these patients the inclusion of critical care providers in the preparation phase prior to the arrival of patients to biocontainment units was found to be essential. While emphasizing the proper supervised donning and doffing of personal protective equipment (PPE), the performance of any task that requires fine motor dexterity (i.e., suturing a central venous catheter in place) in full PPE is challenging. Systematic planning and preparation for non-emergent airway management is essential. Considerations such as the need for heightened PPE to include powered air-purifying respirators given the possible proximity of the operator's face to the patient's oral cavity during an intubation

attempt, the liberal use of neuromuscular blockade, and the preferential use of video over direct laryngoscopy must all be carefully analyzed.

Furthermore, the challenge of adequate critical care staffing is reviewed. Initially, the first BCU patient was assigned to one of two critical care teams that, in addition to this patient, cared for other critically ill patients in the hospital. The intensivist assigned to the BCU patient coordinated care with the primary infectious disease team on a daily basis. However, the lack of a dedicated team was found to be suboptimal, given the extended time needed for proper donning and doffing of PPE. As a result, a dedicated intensivist team was created with the sole responsibility of responding to escalated care needs for the BCU patients.

In addition to practical and technical considerations, the authors further provide readers with an overview of the clinical course, and laboratory and physiological data pertaining to the first two Ebola-infected patients who were admitted to UNMC. Substantial gastrointestinal losses and electrolyte imbalance required aggressive electrolyte and fluid replacement. Additionally, the complexities of safe handling of samples from these patients made frequent laboratory testing challenging. Acquisition of point-of-care testing made the majority of critical care laboratory assays readily available. Profound nausea and emesis hindered adequate intake and both patients were given total parenteral nutrition.

Finally, the authors also discuss the need to achieve a balance between provider risk and eventual benefit to patients. At UNMC, the medical teams involved had agreed a priori that patients with Ebola virus disease would not receive chest compressions in the event of cardiopulmonary arrest. However, although some have advocated this approach, others have argued for a more individualized assessment of single patient cases in the decision to emergently provide life-saving measures (9-12).

In conclusion, Johnson and colleagues (7) emphasize the challenges associated with caring for patients infected with high-consequence pathogens in a biocontainment unit. As with other critically ill patients, a multidisciplinary team approach in the planning and implementation of all phases of care is necessary. This includes rigorous training and stringent adherence to PPE guidelines, as well as an understanding of the technical limitations of critical care in caring for patients infected with high-consequence pathogens.

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REFERENCES

1. Kreuels B, Wichmann D, Emmerich P, et al. A case of severe Ebola virus infection complicated by gram-negative septicemia. *N Engl J Med*. 2014; 371:2394–2401. [PubMed: 25337633]
2. Wolf T, Kann G, Becker S, et al. Severe Ebola virus disease with vascular leakage and multiorgan failure: treatment of a patient in intensive care. *Lancet*. 2014
3. Connor MJ Jr, Kraft C, Mehta AK, et al. Successful Delivery of RRT in Ebola Virus Disease. *J Am Soc Nephrol*. 2015; 26:31–37. [PubMed: 25398785]
4. Interim Guidance for Emergency Medical Services (EMS) Systems and 9-1-1 Public Safety Answering Points (PSAPs) for Management of Patients Who Present with Possible Ebola Virus

Disease in the United States. [<http://www.cdc.gov/vhf/ebola/hcp/interim-guidance-emergency-medical-services-systems-911-public-safety-answering-points-management-patients-known-suspected-united-states.html>]

5. Ebola Clinical Care Guidelines: a Guide for Clinicians in Canada version 2. [<http://www.ammi.ca/media/73235/Ebola%20Clinical%20Care%20Guidelines%20v2%2028%20Oct%202014.pdf>]
6. Infection prevention and control guidance for care of patients in health-care settings, with focus on Ebola. [http://www.who.int/csr/resources/publications/ebola/filovirus_infection_control/en/]
7. Johnson DW, Sullivan JN, Piquette CA, et al. Lessons Learned: Critical Care Management of Ebola Patients in the United States. Crit Care Med. 2015 in press.
8. Smith PW, Anderson AO, Christopher GW, et al. Designing a biocontainment unit to care for patients with serious communicable diseases: a consensus statement. Biosecur Bioterror. 2006; 4:351–365. [PubMed: 17238819]
9. Responding to Ebola: Questions about Resuscitation. [<http://www.thehastingscenter.org/Bioethicsforum/Post.aspx?id=7135&blogid=140>]
10. Should Doctors Deny Ebola Patients CPR?. [<http://healthaffairs.org/blog/2014/12/11/should-doctors-deny-ebola-patients-cpr/>]
11. Ebola Patients and the Ethics of Unilateral Do-Not-Resuscitate Orders. [<http://voicesinbioethics.org/2014/11/24/ebola-patients-dnr-orders/>]
12. Halpern SD, Emanuel EJ. Ethical Guidance on the Use of Life-Sustaining Therapies for Patients With Ebola in Developed Countries. Ann Intern Med. 2014