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Caring for Critically Ill Ebola Virus Disease Patients with One Hand Tied Behind Your Back

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During the past year, considerable anxiety was generated by media reports of the high death rates from Ebola virus disease (EVD) in Western Africa, the risk to healthcare workers there and to the public at large if the infection spread outside of Africa. As of June, 2015 the total number of cases in Western Africa was 27,173 with 11,149 deaths while mortality rates during the outbreak ranged from 43 – 74% in hospitalized patients (1–3).

The outbreak of EVD occurred predominately in three West African countries with limited civil infrastructure, a paucity of hospital supplies, a shortage of healthcare workers and an overwhelming number of severely ill patients. The care provided to patients with EVD ranged from community-based care with limited capacity for basic therapeutic or comfort-based interventions to the Ebola treatment units that provided the majority of care to thousands of patients (4). The mainstay of care in these units was oral therapy (i.e., rehydration fluids, nutrition, anti-nausea and anti-diarrheal medications, antibiotics and anti-malarials for secondary infections). These interventions were best suited for hypovolemic patients who were not in shock and able to provide self-care. Patients with hypovolemia and not in shock but unable to provide self-care would benefit from intravenous therapy but this was not routinely available during the peak outbreak months. The oral therapies had little effect in altering the outcome of patients with shock and organ failure (4).

In the treatment units, the requirement to wear personal protective equipment (PPE) in a high heat and humidity environment limited the time to care for each patient to only minutes (3, 4). The quality of the PPE was of paramount importance as many health care workers in

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West Africa lost their lives to EVD because of inadequate PPE. The majority of treatment units had no ability to provide higher levels of care such as laboratory monitoring, diagnostic imaging, intravenous therapy, supplemental oxygen, mechanical ventilation or dialysis.

Most health care workers outside of Western Africa have little experience with the clinical course or treatment of EVD. By May 2015, 27 patients with EVD (0.1% of total) have been managed in the United States and Europe (personal communication June 4, 2015, Timothy M. Uyeki, MD, Centers for Disease Control, Atlanta, GA). In this issue of CCM, Sueblinvong et al. detail the hospital courses of three critically ill patients who developed multiple organ failure and required mechanical ventilation, vasopressors and renal replacement therapy during the course of their illness (5). They describe the spectrum of critical illness and the temporal sequence of multi-organ system failure with severe EVD in the “resource-rich” settings of the United States. They conclude that patients with high viral loads and renal and respiratory failure can potentially survive with advanced life support measures (5). In contrast to Ebola treatment units, EVD patients in a higher resource center may have ongoing monitoring of vital signs and the continuous presence of nursing care. Further, organ support (i.e., mechanical ventilation, renal replacement therapy and vasopressors) is feasible and potentially life saving.

Unfortunately, the term “resource-rich” is somewhat of a misnomer as it implies the availability and application of sophisticated resources to assist in the diagnosis and treatment of EVD patients. The reality is quite different. The process of care for EVD patients in any higher resource center remains substantially constrained by the potential risk of infection to the health care workers and others by contact with EVD body fluids. As such, the process of care does not rise to the usual standards provided for other critically ill patients.

Management strategies that are daily occurrences in most ICUs including therapeutic drug monitoring, microbiologic tests (stains, cultures, molecular probes and antibiotic sensitivities), clinical laboratory tests beyond point-of-care tests, microscopic analysis of blood smears or urine, imaging with computerized tomography or magnetic resonance imaging, bronchoscopy, endoscopy or surgical interventions are for the most part not available or provided to these patients. Some examples include the inability to measure phosphorous during continuous renal replacement therapy because of its absence on the available testing devices (6), the inability to image or intervene in an EVD patient with an acute abdominal emergency (5), or the absence of radiologic imaging for neurologic deterioration and in fatal cases of EVD, any histological examination of the central nervous system (7). Some higher resource centers withhold cardiopulmonary resuscitation from patients with EVD which is controversial and not held by all centers (8). These limitations fundamentally affect clinical practice and importantly contribute to a significant knowledge gap of EVD. There is perhaps no other infection in recent times that has presented such profound impediments to understanding its clinical course.

The reader may ask why are different clinical aspects of the same core of patients being described in different publications? With the publication of Sueblinvong et al, one of the patients will have been described in part in four different peer-reviewed manuscripts (5, 6, 9, 10). This may reflect the need to use any opportunity where expanded care capabilities are

provided to address the existing gaps in knowledge regarding the clinical management of this infection.

The provision of critical care support for patients with severe EVD comes at a substantial cost with investments in human resources, capital equipment, infrastructure modifications, developing specific processes of care, staff training, public relations and ultimately some risk to health care providers (8). One patient described by Sueblinvong et al. was the index case for nosocomial spread of EVD to two nurses, likely due to inadequate PPE and or training (5, 11). Similar to the outcomes of patients who survive severe sepsis or the acute respiratory distress syndrome, survivors of EVD from previous outbreaks have long term effects that significantly affect their activities of daily living (i.e., uveitis, orbital pain, blurred vision, hearing loss, difficulty swallowing, sleeping and limits due to memory loss or confusion) (12). These observations confirm the need for long-term follow-up and rehabilitation of the EVD survivors.

The successful outcomes in some of these cases described by Sueblinvong et al and others (5, 13, 14), even with the constraints described above, suggest that in seriously ill patients with EVD, critical care can have an impact on the outcome of the infection. However, the approach in future outbreaks should not limit the provision of critical care to patients who are transferred to higher resource centers. Instead, appropriate critical care resources and personnel should be made available to all patients who otherwise would not survive because of resource limitations in their home countries. This will require major investments to modernize the health care systems of these countries in order to provide advanced life support measures in a safe environment that prevents nosocomial spread of infection to health care workers and others (15).

References

- Centers for Disease Control. Ebola Outbreak in West Africa – Case Counts. 2014. (accessed June 4, 2015). <http://www.cdc.gov/vhf/ebola/outbreaks/2014-west-africa/case-counts.html>
- Schieffelin JS, Shaffer JG, Goba A, et al. Clinical illness and outcomes in patients with Ebola in Sierra Leone. *N Engl J Med*. 2014; 371:2092–2100. [PubMed: 25353969]
- Bah EI, Lamah MC, Fletcher T, et al. Clinical presentation of patients with Ebola virus disease in Conakry, Guinea. *N Engl J Med*. 2015; 372:40–47. [PubMed: 25372658]
- Chertow DS, Kleine C, Edwards JK, et al. Ebola virus disease in West Africa—clinical manifestations and management. *N Engl J Med*. 2014; 371:2054–2057. [PubMed: 25372854]
- Sueblinvong V, Johnson DW, Weinstein GL, et al. Critical care for multi-organ failure secondary to Ebola virus disease in the United States. *Crit Care Med*. 2015 in press.
- 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]
- Martines RB, Ng DL, Greer PW, et al. Tissue and cellular tropism, pathology and pathogenesis of Ebola and Marburg viruses. *J Pathol*. 2015; 235:153–174. [PubMed: 25297522]
- Torabi-Parizi P, Davey RT Jr, Suffredini AF, et al. Ethical and practical considerations in providing critical care to patients with ebola virus disease. *Chest*. 2015; 147:1460–1466. [PubMed: 25764372]
- Kraft CS, Hewlett AL, Koepsell S, et al. The Use of TKM-100802 and Convalescent Plasma in 2 Patients With Ebola Virus Disease in the United States. *Clin Infect Dis*. 2015 Apr 22. pii: civ334. [Epub ahead of print].
- Varkey JB, Shantha JG, Crozier I, et al. Persistence of Ebola Virus in Ocular Fluid during Convalescence. *N Engl J Med*. 2015; 372:2423–7. [PubMed: 25950269]

11. Liddell AM, Davey RT Jr, Mehta AK, et al. Characteristics and Clinical Management of a Cluster of 3 Patients With Ebola Virus Disease, Including the First Domestically Acquired Cases in the United States. *Ann Intern Med*. 2015 May 12. [Epub ahead of print]. 10.7326/M15-0530
12. Clark DV, Kibuuka H, Millard M, et al. Long-term sequelae after Ebola virus disease in Bundibugyo, Uganda: a retrospective cohort study. *Lancet Infect Dis*. 2015 Apr 21. pii: S1473-3099(15)70152-0. [Epub ahead of print]. 10.1016/S1473-3099(15)70152-0
13. 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]
14. 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*. 2015; 385:1428–1435. [PubMed: 25534190]
15. McKay, B. [accessed on June 4, 2015] Ebola's Long Shadow: West Africa Struggles to Rebuild Its Ravaged Health-Care System. *Wall Street Journal*. 2015. <http://www.wsj.com/articles/africa-struggles-to-rebuild-its-ravaged-health-care-system-1433457230>