Global Health in the Clinical Laboratory

How Emory prepared for and treated U.S. healthcare workers with the Ebola virus

By Emily Lu Ryan, PhD
Clinical laboratory testing is the lifeblood of medical practice in the United States. Nonspecific testing, like a complete blood count (CBC) and differential, is performed on almost everyone who seeks emergency medical care. Testing has become so ubiquitous that point-of-care glucose meters are standard of care in most hospital settings. Can you imagine a medical setting without testing? How would you monitor electrolytes and fluids? What would happen if you removed the glucometers from your hospital?

As difficult as it is for us to imagine, this situation is not uncommon in many other parts of the world. As recently as May 2013 in West Africa, the region currently dealing with an Ebola epidemic, there was only one clinical laboratory, located in Mali. In many countries, in fact, it is not unusual for treatment to be administered without clinical testing. That’s one of the reasons American healthcare workers infected with Ebola were flown back to the United States for treatment.

On Thursday, July 31, 2014, the Emory Serious Communicable Diseases Unit (SCDU) at Emory Healthcare in Atlanta was called upon to receive and treat the first of these Ebola patients. Preparations began immediately and we had only 48 hours to ready the facility. We verified calibrations, collected sufficient reagents and materials, revised protocols, and reviewed the test menu with the clinicians. The SCDU
had specific point-of-care instruments reserved for labora-
tory testing for patients admitted to the unit, and while these
instruments had been maintained with proficiency testing
and comparison testing every six months, they otherwise
had rarely been used. Laboratory professionals brushed up
on safety and personal protective equipment (PPE) training
and procedures. The original SCDU group had been preparing
for years, with drills every six months.

There was a possibility that a second patient could arrive (the
unit had previously treated only one patient at a time), and a
group of us were introduced to these activities for the first
time. Saturday morning we learned how to properly put on
and remove all the required PPE; training included learning
to take off paint-covered gloves under black light without
splashing paint anywhere. Because of the complicated PPE,
every laboratory professional was assigned a safety buddy to
help with donning and doffing the PPE as well as supervising
testing. As always, the first tools in a laboratory’s arsenal are
excellent technicians, but even the best can sometimes forget
and put things on the grate in front of the biosafety cabinet
instead of all the way inside; this tiny disruption in airflow
renders that protective engineering control ineffective. It was
therefore the safety buddy’s job to make sure such simple
actions were properly performed to maximize the safety of
all involved. The mantra of “safety first” was applied at every
step of the process.

Our testing menu has always been minimal but sufficient for
our infectious disease physicians. It historically consisted of
a blood gas analyzer with electrolyte measurements via ion-
selective electrodes, a Piccolo chemistry analyzer, a standard
dipstick urinalysis reader, and a hematology analyzer. Early in
our preparation for the Ebola patients we discovered our orig-
inal hematology analyzer had developed a leak and stopped
working. Through a series of discussions with the care team
and tech support, we decided the physicians would work with
the hemoglobin and hematocrit from the blood gas analyzer
and the international normalized ratio (INR) value from the
CoaguChek until we could get a new hematology analyzer for
the rest of the CBC. Our infectious disease physicians were
thankful for every test we could offer these healthcare work-
ers, and let us know what was needed as first, second, and
third priorities once the patients arrived.

Patient in Residence

Things went well—even better than we could have
dreamed—two days later when the first patient arrived.
Our hematology analyzer arrived a few days later and
began operation after we made sure it functioned within
parameters, performing a short validation study and review
of instrument comparison data. An added benefit of the
new analyzer was that it was a completely closed system; it
could sit on the counter and free up precious space inside the
4-foot-wide biosafety cabinet. Once it was up and running, a
CBC was added to the daily laboratory workup.

Our initial procedure dictated that laboratory professionals
would run the INR analyzer, a requirement that became
problematic. If a physician ordered an INR to check the
patient’s clotting time, the unit’s nurse coordinator had to
call the laboratory professional on duty, who then had to
call his or her safety buddy, and they both had to get to the
unit (one or both may not have been on-site), gown up, enter
the lab, and perform the test. This process could take more
than two hours, severely delaying patient care. To resolve this problem, we trained and fully assessed competency of the SCDU nursing staff, who agreed to run the point-of-care INR (which they do at other locations in Emory Hospital) for the rest of the patients’ visits. Situations such as this required flexibility, creative problem solving, and a clear understanding of regulations, all essential skills in laboratory management.

A few days into treatment, there were discrepant potassium results between the blood venous ion-selective electrode (ISE) value and the enzymatically derived chemistry value on the Piccolo. The on-call physician asked me which measurement he should use for treatment. Given the slight hemolysis (2+) and my familiarity with ISE methods, I determined the blood gas value was more reliable. This exchange made me wonder how these questions are answered in field hospitals in Africa that may not have running water, let alone sufficient air conditioning to keep instruments within specifications. There they can treat only the symptoms they can see, such as vomiting and diarrhea, and do not always have the capacity to test for issues such as organ failure or DIC.

Staff at each U.S. institution that treated Ebola patients made different decisions about which tests to offer, how often to test, and which instruments to use. These decisions were driven by the availability of instrumentation, the physical setup of the hospital and laboratory, the clinical history of the patient, and the acuity of illness. What all these sites had in common was the availability of laboratory testing to inform and support the clinicians treating these patients. This illustrates a stark difference between Ebola treatment here and in West Africa. It is amazing that people survive this devastating disease with the minimal testing and intervention available in most field hospitals. There is ongoing conversation in popular media and medical literature about health disparities and how this current Ebola epidemic is a global issue (as of January 10, 2015, 8,000 lives have been lost to Ebola). As a clinical laboratory professional in the U.S., what can we contribute to the fight against Ebola? Shipping off instruments and reagents to help would be useless; these instruments require stable electricity and are too sensitive to dirt, dust, and heat.

But it’s important to educate people about the trials we faced and the resources we used to treat individuals with Ebola here, and ask people to consider the great difficulties and challenges healthcare workers encounter when treating Ebola elsewhere. Technology is always improving, and one day there may be laboratory instruments robust enough to work in the sort of environment these workers face. But, until then, we can rely only on the knowledge gained through this process of treating patients with a devastating disease like Ebola, and share our insight with others.

**References**


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