Laboratory Practices in a Combat Zone

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Providing responsive and reliable clinical laboratory and transfusion services in support of military health care operations is the primary mission of the laboratory and blood bank section of the 325th Combat Support Hospital (CSH). In June 2007, the 325th CSH of the U.S. Army Reserve, headquartered in Independence, MO, was activated for Operation Iraqi Freedom. The section’s primary mission is to provide quality health care for United States and Coalition Service members, Iraqi Army and Security Police, and Iraqi civilians in support of Operation Iraqi Freedom. The 325th CSH, a level III health care facility, provides medical support to multiple military units throughout western Iraq. The 325th CSH laboratory supports the core hospital as well as more than three dozen level I and level II troop medical clinics in its area of operations.

A team of nine military medical laboratory technicians (Image 1) from six different states and multiple different socioeconomic backgrounds deployed as part of the 325th CSH. The group consisted of soldiers from Missouri, Kansas, North Dakota, Maryland, New York, and New Jersey. As Army Reservists from different locations and backgrounds, the soldiers brought different skill sets developed in both the military and civilian sectors. The soldiers also possessed a myriad of prior experience in different laboratory areas such as blood bank operations, laboratory research, clinical diagnostics, and microbiological testing. During the nearly year-long deployment in Al Asad, Iraq, they bonded as a group and took advantage of the breadth of their experience to develop into an efficient laboratory team.

The military laboratory technicians at the 325th CSH are proud of their work during Operation Iraqi Freedom. The laboratory provides a wide variety of services traditionally associated with a Combat Support Hospital laboratory. Their mission requires responsive support for both trauma care and routine health care. This mandated versatility and constant focus, as the mission could change quickly from processing routine clinical chemistry tests in support of sick call to providing blood transfusion workups in support of damage control resuscitative surgery. The laboratory soldiers perform clinical laboratory testing such as electrolyte, metabolic, and lipid panels, blood gas analyses, complete blood cell counts, and basic coagulation testing. The laboratory also manages a robust blood product inventory that includes large volumes of red blood cells, fresh frozen plasma, cryoprecipitate, and aphaeresis platelets. Routine and emergency testing in support of transfusion services includes ABO/Rh typing, antibody screens, and crossmatches. The laboratory also developed and implemented emergency release blood packs in support of severe trauma cases. The quality of their work was evident by an audit by the 62nd Medical Brigade, which concluded that the 325th CSH laboratory excelled in blood banking and transfusion services and suggested that their procedures be used to set the standard for blood operations and patient safety in theatre.

In addition to standard CSH laboratory test services, the 325th CSH laboratory implemented additional testing capabilities to support evolving health care needs. This included but was not limited to aerobic culture capability with identification and susceptibility and serology testing for numerous infectious diseases. The laboratory also established molecular diagnostic

capability by fielding the Joint Biological Agent Identification and Detection System (JBAIDS), which provides polymerase chain reaction (PCR) analysis of clinical and environmental samples.

One of the laboratory’s challenges is that it serves as a reference laboratory for the numerous troop medical clinics in its area of operations as well as serves as a distribution hub for specimens shipped to other military medical laboratories. The laboratory at the 325th CSH handles several hundred samples per month, and either performs the tests in-house or ships them off to the clinical laboratory at the Army’s Landstuhl Regional Medical Center in Germany for further analysis. This service allows health care providers access to test services and results not normally available in a combat zone and helps minimize unnecessary troop evacuations.

The nine soldiers in our laboratory unit provide laboratory support twenty-four hours a day, seven days a week. This requires two to three Soldiers to be on duty every twelve-hour shift. These few technicians are constantly responsible for all clinical testing in urinalysis, hematology, serology, clinical chemistry, special chemistry, rapid serology testing, microbiology, and the blood bank. Each technician must be able to perform multiple laboratory tests at the same time and be proficient enough to cover the laboratory independently. The ability to multitask is a critical factor in running a laboratory with such a small number of technicians. Everyone must be confident that their fellow soldier will be able to handle all tasks necessary to run an entire laboratory and blood bank independently. Without this cross training and level of competency, the daily workload would be unmanageable. It is not unusual for one soldier to run metabolic panels, crossmatch blood units, and maintain crucial communication channels with health care providers and surgical teams, while another soldier on duty receives blood products from the local airstrip, reads culture plates, or gets a quick bite to eat. Meticulous time management and communication skills are essential for the successful operations of the 325th CSH laboratory.

Long shifts become longer when traumas enter the emergency room. It is the value of duty for a soldier to maintain professionalism even in the gravest of situations and the most emotional of stresses. But it is the value of compassion that drives the heart and soul of the combat support hospital, heightening the epitome of operational success. Behind the scenes, but at the core of patient care, the 325th CSH laboratory services team supplies accurate and timely results, irrespective of the patient’s nationality or nature of injury.

Many differences are evident when comparing a laboratory in the United States with a laboratory in a combat support hospital. The combat laboratory runs at a much faster pace than a stateside laboratory. This is not only obvious given the CSH’s mission statement, but it is also evident in the turnaround times met for each result. Stat results are usually reported within 5 to 20 minutes, often being hand delivered by the technician to the operating room, emergency room, or intensive care unit. This is different from the standard one-hour stat turnaround time used in hospitals in the United States, where results are often provided electronically. Here, the results of stat tests performed on severe trauma cases give the physician critical information needed to treat the patient. Our routine results are usually reported within an hour, depending on the testing procedure requested. This timing is critical when military servicemen and women are conducting continuous and critical mission assignments. Waiting one day could mean a clinical difference in treatment of an infectious disease like influenza. With respect to turnaround times, our laboratory team treats the least urgent requests in a similar capacity that stateside hospitals treat stat requests, placing priority and urgency to our critically injured or ill. Minimizing laboratory test turnaround times is critical to facilitating rapid responsive health care treatment and allowing military servicemen and women to quickly return to duty and focus on their military mission. Thus, the clinical laboratory is an integral part of the military health care team and functions as a combat multiplier.
In a stateside hospital, laboratory personnel often appear to be more behind-the-scenes players, supplying vital information in times of immediate need. During combat operations, laboratory personnel are key players in the emergency room and at the point of patient care. Laboratory technicians are part of trauma teams, reporting results of a CBC, PTT, aPTT, and blood gases directly to the doctors and surgeons within 15 minutes of the sample draw. Blood resources are limited in theater, and timing is critical because of the need to type and crossmatch the patient and possibly thaw fresh frozen plasma and cryoprecipitate. The laboratory plays a vital role in the delivery of blood component therapy. The laboratory is able to track the type and numbers of components issued as well as important laboratory values such as PT/INR, pH, hematocrit, and platelet count, and the laboratory is able to use this data to optimize the delivery of blood components. These duties require them to work in multiple areas of the hospital such as the emergency room, operating room, or intensive care unit where they are constantly exposed to casualties. Laboratory soldiers also report patient triage and prognosis from other parts of the hospital directly to the blood bank in order to anticipate blood supply levels based on patient status. SGT Andrea Valleroy, the blood bank assistant noncommissioned officer in charge (NCOIC) says, “We are always on our toes since we never know what the next helicopter will bring.” In cases of multiple traumas, the blood bank becomes one of the critical sections of the hospital. The blood supply becomes a focus of all hospital staff when a critical patient needing blood arrives in the emergency room.
Another important difference between stateside and our deployed laboratories are the harsh desert working conditions. The dust and extreme heat require the soldiers to continuously monitor equipment for temperature, optical, and electrical problems. Sandstorms are especially harsh on laboratory equipment and can adversely affect analyzer performance and reagent integrity. Temperatures in the desert can range from below freezing during the winter months to over 130°F during the summer. These environmental fluctuations make it a constant battle to control internal temperatures of the deployed laboratory. The laboratory assets are in a semi-fixed shelter known as an “ISO”—essentially, a retractable modular trailer type facility that facilitates mobility if the hospital should need to relocate (Image 6). Such containment devices are used widely in CSH units and many combat medical laboratories are housed in them. The ISO shelter has environmental control capabilities and is able to provide some protection from extreme climate variations and harsh desert weather. Severe sandstorms, however, remain a challenge. Similar to a violent thunderstorm forming in the American Midwest, sandstorms appear quickly on the horizon immediately before they strike. The pervasive dust associated with these storms presents a challenge as the dust can enter the ISO ventilation systems, allowing sand and dust infiltration into the laboratory. As such, increased levels of operator maintenance are vital to protecting the electrical circuitry and optical measuring devices found in most laboratory equipment.

In addition to working as laboratory technicians, these soldiers perform other traditional military duties. It is typical for a laboratory soldier to guard the hospital one minute and perform a manual blood differential the next. Battles drills are conducted on a regular basis and add to the stress of running a laboratory and blood bank. Responses to critical situations must be rehearsed over and over, so that actions and reactions are second nature. When an actual event occurs, wasted minutes could mean the difference between life and death for a trauma case entering the hospital. All laboratory technicians must be able to respond quickly and efficiently in emergency situations. Everyone carries a weapon at all times and must be prepared to use it if the security situation deteriorates. “Regardless of how quiet each moment may seem, we are always in a war zone.” says SPC Aaron Lester, who is also part of the hospital’s force protection team. “Everyone must remain vigilant. We all have dual roles, as a soldier and as a clinical laboratory scientist.”

Image 6. Picture of the laboratory ISO.