*Notice: The diagnosis and management of dengue infection must be made by a physician employing his or her full range of clinical skill including performing a physical examination, carefully obtaining a medical and travel history, reviewing all laboratory examinations, as well as reviewing all of the epidemiologic data with respect to disease prevalence in the area of the patient's exposure. Hematological information including hematocrit and/or hemoglobin concentration, the white blood count, and the platelet count is especially useful when analyzed within this full spectrum of attendant factors, but should not be relied upon independently for the purpose of dengue diagnosis.*

## Abstract

*Dengue infection can lead to serious or fatal complications without proper diagnosis and management. Key to managing dengue is continual monitoring of changes in components of the patient's blood through the use of complete blood count (CBC) analysis. The QBC STAR™, from QBC Diagnostics, offers simple CBC testing directly at the point of care, providing clinicians with critical insight throughout the treatment process.*

## Background

Dengue is a mosquito-borne viral disease that infects an estimated 50 to 100 million people each year.[1] It is one of the fastest growing diseases in the world, with a 30-fold increase in incidence over the past 50 years.[2] Although early stages of dengue often feature no symptoms or simple flu-like symptoms, it can progress to more serious complications and even death without proper treatment.[3] The World Health Organization (WHO) estimates that dengue annually causes approximately 20,000 deaths, mostly children.[4]

A key to treatment of suspected dengue cases involves the regular use of complete blood count (CBC) analysis to monitor changes in components of the patient's blood throughout infection, such as low white blood cell counts, plasma loss manifested by increased hematocrit and hemoglobin concentration, and decreased platelet counts. Unfortunately, most CBC analyzers needed for this task are difficult to use in the point of care setting, as their dependence on liquid reagents necessitates frequent cleaning and user calibration before each run of tests. Instead, clinics must often turn to outside labs for testing, creating unnecessary and dangerous delays in treatment.

The QBC STAR hematology analyzer from QBC Diagnostics represents a simple and effective solution to this problem. The QBC STAR uses FDA approved, patented, dry technology to provide CBC analysis without any liquid reagents. The QBC STAR requires no user maintenance, and can be used and transported anywhere easily, with results available in minutes at the touch of a single button. Thanks to its unmatched ease of use, the QBC STAR can provide results directly at the point of care, providing clinicians with the critical information necessary to diagnose and manage dengue infection.

## The QBC STAR

Samples analyzed with the QBC STAR are collected using the unique, patented STAR blood collection tube. STAR Tubes require just 65 to 75 µL of blood, and can be filled with either venous or capillary samples. Capillary samples can be drawn from finger or heel sticks, providing great flexibility for collection from all ages of patients, including infants and children, and potentially reducing patient discomfort and labor needed for venipuncture. Each STAR Tube is internally coated with fluorescent acridine orange stain, as well as anticoagulants and other reagents to facilitate collection and processing.

To process the tube for CBC testing, simply rock the tube back and forth 4 times to mix the sample with the coating. (Note: Complete instructions for preparation of the STAR Tube can be found in the STAR Tube product insert, as well as the illustrated STAR Tube User Guide available on www.qbcdiagnostics.com.) Once mixed, insert the STAR Tube into the analyzer and press the blue "STAR" button to begin testing.

The QBC STAR analyzer begins its analysis by centrifuging the tube at 11,000 RPM. This process separates the components of the blood sample by density. A precision plastic float inside the tube expands the white blood cell and platelet layers (or "buffy coat"), making review of these smaller layers possible.

After centrifugation is complete, the QBC STAR measures the layers of the varying blood components to compute a precise 9 parameter CBC, including: hematocrit, hemoglobin, MCHC, platelets, total white blood cells, total granulocyte and granulocyte percentage, total lymphocytes/monocytes, and lymphocyte/monocyte percentage. The QBC STAR provides dependable results without the need for user calibration or maintenance. Upon completion, results are displayed on the LCD screen and printed.

## Dengue

The dengue virus has four individual serotypes (DENV-1 to DENV-4). Primary infection by a serotype is generally mild, and results in lifetime immunity to the specific serotype. Patients are not immune to a secondary infection by another serotype, however, and secondary infections may result in life-threatening symptoms.

Dengue virus is transmitted to humans through bites from the *Aedes* mosquito, most prominently *Aedes aegypti,* which is found in tropical areas around the world. As expected, dengue is similarly concentrated in tropical areas. In the continental United States, nearly all reported dengue cases were acquired by travelers.[1] However, Puerto Rico, the U.S. Virgin Islands, Samoa,

and Guam are within dengue endemic areas, and dengue outbreaks have been reported in both Hawaii and Florida.[1,5,6]

The onset of dengue occurs 3-14 days after a bite from an infected mosquito. The early, febrile stage of dengue infection is characterized by the presence of a high-grade fever, and other flu-like symptoms. After 3-7 days, the fever will break, and the patient's condition may improve. Alternately, he or she may enter the critical phase, in which a reduction in platelet production and an increase in the permeability of capillaries leads to the loss of blood plasma. If sufficient plasma is lost, the patient may experience severe dengue symptoms, including shock, fluid accumulation, organ impairment/failure, hemorrhaging, and/or death.

Successful treatment of dengue can be highly dependent on early diagnosis and continued monitoring of plasma leakage throughout the course of the illness. Early replacement of plasma losses with appropriate solution therapy often results in a favorable outcome. However, if a patient experiences significant losses of plasma or blood, he or she will likely require emergency rehydration and/or transfusions to retain adequate circulation.

## Using the QBC STAR in the Management of Dengue Fever

These steps have been prepared with reference to the WHO's comprehensive guide: "Dengue: Guidelines for Diagnosis, Treatment, Prevention and Control," available for download at http://www.who.int/topics/dengue/en. If discrepancies are discovered between the WHO guide and this application note, please strictly adhere to the WHO instructions.

### *Presumptive Diagnosis*

The WHO calls for the presumptive diagnosis of dengue in cases where the patient presents with a high grade fever; lives in, or travels to, a dengue-endemic area; and has two or more of the following conditions: anorexia/nausea, rash, myalgia, a positive tourniquet test (used to gauge capillary fragility as well as decreased platelet counts), and leukopenia (decrease in the number of white blood cells). Since the QBC STAR provides the white blood cell count and the platelet count, as well as the hematocrit and hemoglobin, it may be used to help diagnose and manage patients with dengue.

### *Clinical Management*

A CBC taken early during the febrile stage establishes the patient's baseline hematocrit, platelet, and indirectly the plasma levels. As the disease progresses, clinicians should continue to take the patient's CBC daily with the QBC STAR, paying particular attention to hematocrit and platelet levels. If a patient's hematocrit levels remain stable, the WHO guidelines state that the patient can still continue to be sent home, assuming no other warning signs or coexisting conditions are present. However, if hematocrit levels increase against the baseline, with a parallel decrease in platelet levels, this is a warning sign that the patient has entered the critical phase, and should be checked into a hospital or care center for observation.

### *Hospital/Care Center Treatment*

If a patient is admitted to a hospital or care center for dengue with warning signs of plasma leakage, the WHO recommends beginning a course of intravenous fluid therapy. Use the QBC STAR before beginning this treatment to obtain a reference hematocrit level. The guidelines suggest checking the patient's hematocrit again immediately afterward, and approximately every 6-12 hours thereafter until plasma leakage has decreased. The WHO guidelines note that a decrease in plasma leakage is indicated when the patient's hematocrit level has fallen below the original baseline value.

If plasma leakage results in the onset of severe dengue, including shock or hemorrhaging, more intense fluid therapy and blood transfusions may be necessitated. Consult the WHO guidelines for more specific directions in treating these patients.

## Conclusion

The QBC STAR provides CBC results quickly and easily at the point of care. Because of its unmatched convenience and functionality, the QBC STAR can be an important tool in the diagnosis and management of dengue infection.

## Notes and References


*1. Centers for Disease Control Website. Centers for Disease Control, 2009. Web. 2 June 2011. (http://www.cdc.gov/Dengue/faqFacts/fact.html)*

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*5. The Observatory. Medical Laboratory Observer, 43 (5), 6.*

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