NEWSLETTER

MAY 2013

Best Practices in Blood Culture Collection

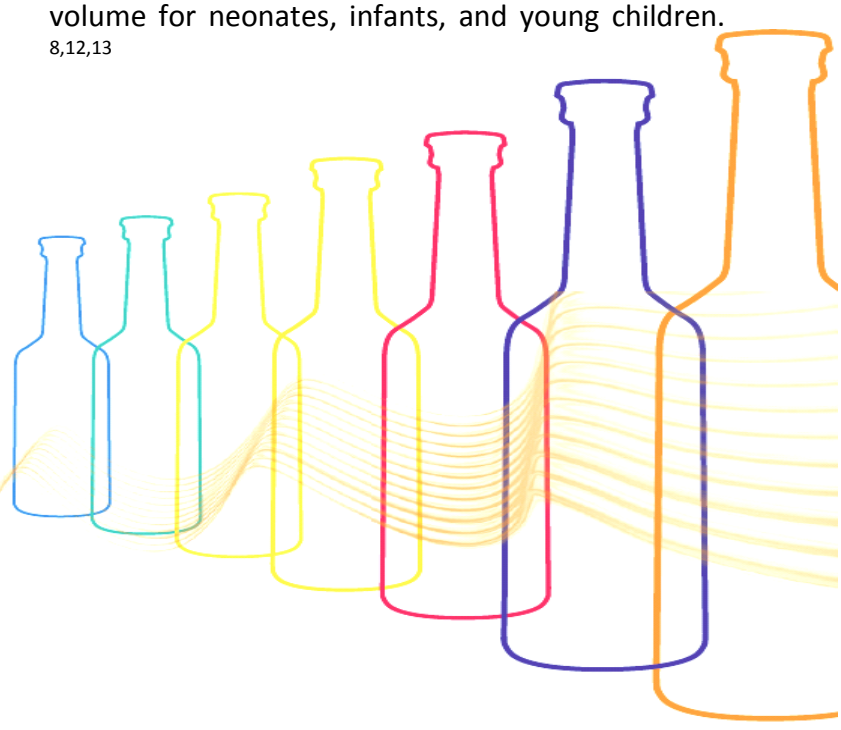
05/2013

VOLUME OF BLOOD CULTURES

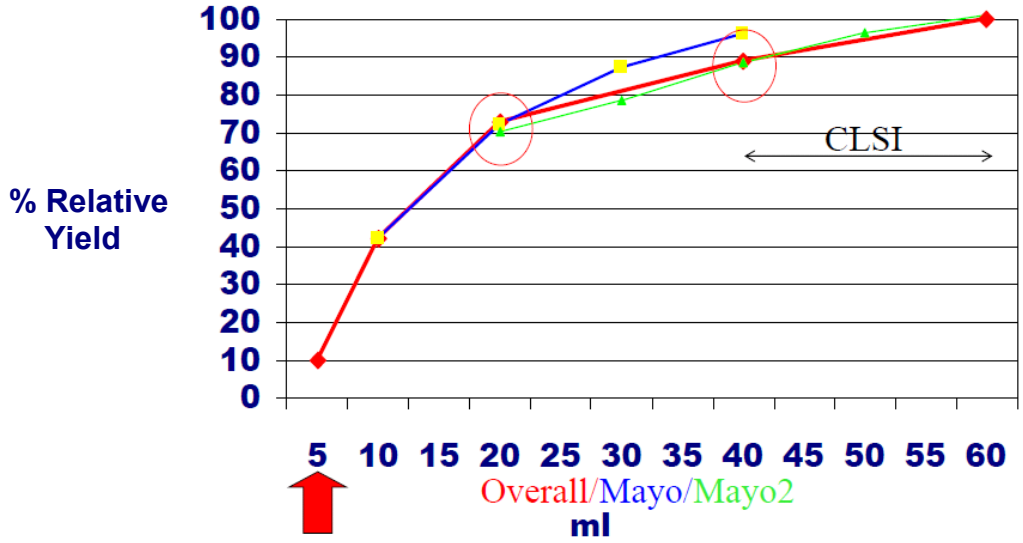
Despite the fact that newer blood culture (BC) media and improved automated, continuous-monitoring blood culture systems (CMBCS) detect organisms faster and more frequently, common consensus remains that the volume of blood collected is the single most important variable predicting one's ability to detect bacteremia. Most bacteremias in adults have a low density of microorganisms (often ≤1 CFU/ml).[1] Studies in the 1970s and 1980s investigated this relationship between blood volume and rate of organism recovery, supporting the conclusions that 20–30 ml blood should be collected from a venipuncture to ensure a high likelihood of detecting bacteremia.[2-4] With further evolving continuous-monitoring BC technology, interest in investigations of the relationship between blood volume and culture yield has recently re-emerged. Bouza et al.[5] concluded in their study that the volume of blood collected is still an important variable for the ability to detect a bloodstream infection (BSI), even when using automated CMBCS. Several other recent studies have demonstrated that as many as four BC sets collected over a 24-h period are necessary to achieve >99% sensitivity for the detection of a BSI.[6,7] In addition, the Clinical and Laboratory Standards Institute (CLSI) guidelines recommend four 10-mL bottles of blood be taken for the initial evaluation in order to detect about 90-95% of patients with documented bacteremia; and a 95-99% detection rate would require 60 mL of blood to be cultured. [8,9]

However, collection of just one BC is considered insufficient for diagnosis of a BSI and with new evidence could possibly miss approximately 35-40% of bacteremic episodes. [8]

Unfortunately, fewer data are available for pediatric BCs. BSI in young children are presumed to have a much higher magnitude (often >100 CFU/ml) than bacteremia in adults.[10] Earlier expert recommendations for BCs in infants and children stated a need to collect 1–2 ml for neonates, 2–3 ml for infants (age 1–24 months), 3–5 ml for older children, and 10–20 ml for adolescents.[11] However, more recent recommendations, including those based on the results of the study by Kellogg et al., suggest that the volume for pediatric BCs should be based on body weight and the estimated total blood volume in each individual child, suggesting the collection of no more than 1% of the total blood volume for neonates, infants, and young children. [8,12,13]



Effect of Blood Volume in Adults



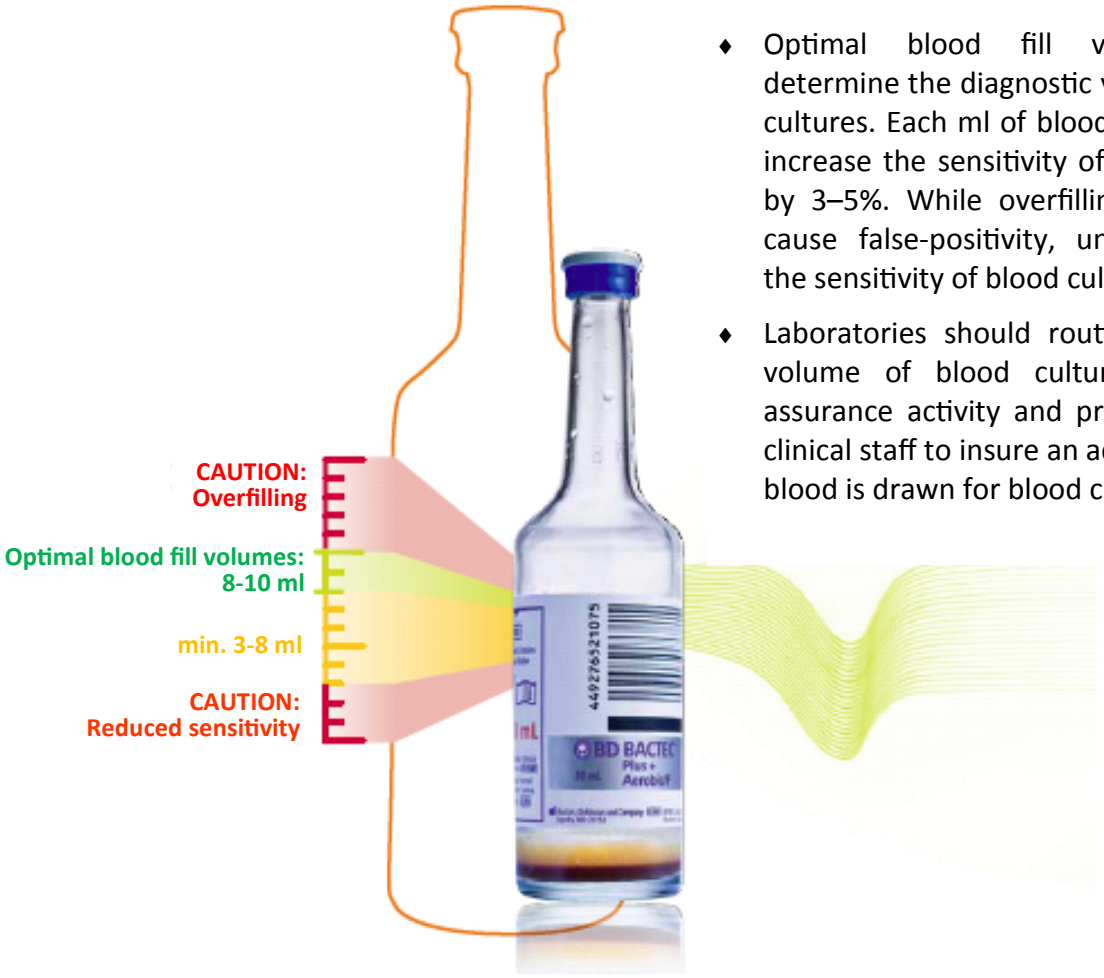
Dr. Michael Towns (Worldwide Vice-President of Medical Affairs for BD Diagnostics Systems) presented the effects of blood volume collected from adults against the relatively yield rate of pathogens based on the graph above. The graph shows that, as the volume of blood cultured increased, the yield of pathogens also increased. A relatively low yield rate of 10% were obtained when a volume of 5ml was collected. Increasing cultured volume from 20 to 40 ml increased yield by about 20%. Increasing cultured volume from 40 to 60 ml increased yield by an additional 10%. At Mayo Clinic, Rochester, MN, the routine practice is to inoculate two 30-ml culture sets (i.e., 60 ml in total volume) in order to detect about 100% of bacteremias. They reported that collection of two aerobic and one anaerobic blood culture bottle per blood culture set resulted in improved pathogen detection compared to collection of two bottles per set.[14] The CLSI guidelines recommend paired culture sets to help discriminate between contaminant organisms and true pathogens; four 10-ml bottles (2 sets) should be used for the initial evaluation to detect about 90-95% of bacteremias and six 10-ml bottles (3 sets) should be used to detect about 95-99% of bacteremias. [8]

Optimal Blood Volume

The volume of blood drawn for culture is the most important variable in detecting bacteremia or fungemia.[2-4,6,15]

Aerobic	Anaerobic	Peds	Myco/F Lytic
			
8 - 10 ml	8 - 10 ml	1 - 3 ml	3 - 5 ml

More or less blood volumes really matters!



- Optimal blood fill volumes critically determine the diagnostic yield of your blood cultures. Each ml of blood, up to 10 ml, can increase the sensitivity of the blood culture by 3–5%. While overfilling of bottles may cause false-positivity, underfilling reduces the sensitivity of blood cultures.
- Laboratories should routinely monitor the volume of blood cultured as a quality assurance activity and provide feedback to clinical staff to insure an adequate volume of blood is drawn for blood culturing.

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