NEWSLETETTER

Best Practices in Blood Culture Collection

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Routine Use of *Anaerobic Blood Cultures* in Septicemia

Anaerobes can cause infections at virtually all anatomic sites as well as bacteremia. These organisms remain as an important cause of bloodstream infections and account for 1-17% of positive blood cultures. Anaerobic bacteremia can occur in newborns, children, adults and in patients undergoing dental procedures as well (1).

Blood culture is a useful tool in diagnosing a variety of infectious diseases. Commonly, blood specimens are collected and separated into aerobic and anaerobic bottles for cultures, and this procedures is frequently referred to as a "blood culture set." (2)

Anaerobic blood cultures are routinely obtained in many developed countries such as Japan and US. In Malaysia, practice of 2-bottle system (paired aerobic/anaerobic bottles) has become a common sight due to the increased of awareness on the significant role of anaerobic blood cultures in sepsis management.

The Importance of Routine Anaerobic Blood Cultures

Recovery of Obligate Anaerobic Bacteria	Anaerobic bacteria are important clinical pathogens and these organisms can only be recovered by anaerobic blood cultures. The isolation and identification of certain *Clostridium* species and other anaerobes, including unusual species, in the blood stream calls for need to perform routine anaerobic blood culture. *Clostridium septicum* is highly associated with malignancy (3); *Clostridium sordellii* can be associated with childbirth or abortion, with up to a 100% case-fatality rate (4); *Clostridium novyi* is associated with injection of drug use (5); and several *Clostridium* species are associated with intra-abdominal or pelvic infection that might not be obvious clinically (6).
Re-emergence of Anaerobic Bacteremia	During the last several decades, the incidence of anaerobic bacteremia has declined significantly, probably due to early diagnosis and treatment of focal infections, which could otherwise have lead to bacteremia (2). However, recent studies have documented resurgence in anaerobic bacteremia. A study from Mayo Clinic has reported that the mean incidence of anaerobic bacteremia increase from 53 cases/year during 1993-1996 to 75 cases/year during 1997-2000 to 91 cases/year during 2001-2004 (an overall increase of 74%). The total number of cases of anaerobic bacteremia per 100,000 patient-days increase by 74% ($p<0.001$). The number of anaerobic blood cultures per 1000 cultures performed increase by 30% (7).
Faster Detection of Facultative Anaerobes	Most aerobic bacteria that are clinically significant are facultative anaerobes. These organisms such as streptococci and *Enterobacteriaceae* simply grow better and faster in anaerobic conditions (2, 8). This means that blood cultures for these organisms are frequently positive earlier or sometimes only in the anaerobic blood culture bottle. A review of the experience at John Hopkins indicates that 16% of streptococci and 17% of *Enterobacteriaceae* were recovered only in anaerobic bottle (8).
High Mortality Caused by Anaerobic Bacteremia	In general, infection-related mortality due to obligate anaerobes was 50% (2). The overall mortality noted in newborns was 26% (9). In older children and adults, the mortality ranged from 15-35% (1).

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Increase of Sensitivity of Blood Culture

The Clinical and Laboratory Standards Institute (CLSI) guidelines recommend four 10-mL bottles (2 sets) should be used for the initial evaluation to detect about 90-95% of bacteremia and six 10-mL bottles (3 sets) should be used to detect about 95-99% of bacteremia (10). Recent study at Mayo Clinic revealed that paired aerobic/anaerobic blood culture bottles yielded more pathogens than two aerobic bottles. They also claimed that an anaerobic bottle should be included in blood culture sets (11).

Predictable Empirical Antimicrobial Therapy, Antibiotic Resistance & Improved Patient Management

Is antibiotic resistant correlated with worse clinical outcome for anaerobic bacteremia? A landmark article by Nguyen et. al in 2000 clearly answered this question. In the study, Nguyen and colleagues observed that clinical failure occurred more frequently among patients who did not receive an appropriate antibiotic treatment for resistant members of *B. fragilis* group (12). David WH stated in this article, knowledge of the susceptibility of anaerobic antibiotics at individual hospital is important in the selection of empirical antimicrobial therapy when anaerobic blood culture results are positive. The lack of predictability in antibiotic selection may be just as important for anaerobic bacteria as it is for aerobic and facultative anaerobes, but without any culture results, antibiotics selection would not be possible (6).

Solonen and colleagues examined the impact of culture results on patients' outcome at a university hospital in Finland. For a 6-year study period, patients with blood culture positive for AB were reviewed. The overall mortality was 25%. The mortality for group of patients who received microbiological ineffective antimicrobial treatment was 55% whereas those who treatment was changed appropriately after results of blood cultures was 17% (13). The study showed that altering treatment regimen based on culture results greatly improves the patient outcomes.

CLSI recommends routine susceptibility testing for anaerobic bacteremia. Susceptibility testing has to be performed on at least 100 anaerobic bacteria annually, if possible (14).

Cost Saving

Cost of empirical treatment is high. Identifying anaerobic infection can potentially save, instead of increase, cost of care by rapid implementation of an antibiotic specific regimen and thus, shorten the length of hospital stay.

Some studies had proposed the selective use of anaerobic blood cultures. However, identification of those who need anaerobic blood cultures can be difficult. Ortiz and Sande suggested that anaerobic blood cultures could be restricted to patients with "an identified source of, or risk factors for, anaerobic infections", such as gastrointestinal, gynaecologic, or obstetrical disease, surgery, trauma, malignancy, immunosuppression, diabetes, or vascular insufficiency. These groups, however, seem to account for most hospitalized patients (15).

Anaerobic Blood Cultures in Pediatrics

The practice of obtaining routine anaerobic bottles in pediatric patients started in the 1970s because of reports citing a 10% to 20% proportion of anaerobic bacteremia among all positive blood cultures in adults. The routine use of anaerobic blood cultures in pediatric patients has become common practice despite some studies reported that anaerobic bacteria are rarely recovered in pediatric patients. A recent study in University of Malaya Medical Centre revealed that omitting the anaerobic bottle in pediatric blood cultures would have decreased the isolation rate from 11.7% to 10.3% (16). The result was in total agreement with a previous study by Riley and Parasakthi (17).

The awareness of the role of anaerobic bacteria in neonatal bacteremia and sepsis has increased in recent years. The incidence of recovery of anaerobes in neonatal bacteremia ranges between 1.8% and 12.5%. The most common causative organisms reported were *Bacteroides* spp., *Clostridium* spp., *Peptostreptococcus* spp., *P. acnes*, *Veillonella* spp., *Fusobacterium* spp. and *Eubacterium* spp (1).

Is Anaerobic Blood Culture Necessary?

In summary, it is time for us to put to rest on the debate pertaining to routine anaerobic blood cultures. Anaerobes appear to be increasing in frequency in hospitals where patients with complex underlying disease and who often are immunocompromised are treated. This observation, along with the increasing frequency of antibiotic resistant and/or highly virulent organisms, worse outcomes when the appropriate antibiotic is not given, and lack of predictability in the clinical setting strongly argue the need of routine anaerobic blood cultures (6).

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