A blood culture is defined as culture of blood obtained from a single venipuncture, whether that blood is inoculated into one or more bottles. If more than one receptacle is inoculated with each venipuncture, this is referred to as a ‘blood culture set’. This consists normally of an aerobic and anaerobic bottle.

Twenty to forty percent of positive blood culture isolates are not clinically significant. Contamination of blood cultures is an important problem. This article looks at ways of maximising the yield from blood cultures and reducing potential contamination.

Timing of blood cultures
An initial blood culture set should be taken on first review of the patient with suspected infection. The best time for collecting blood cultures is when the fever is rising or when there is a rigor. Bacteraemia is intermittent in cases of bacterial shedding from an extravascular source such as an abscess, but is continuous in cases of intravascular infections such as endocarditis and sepsis. Spacing of collections, beyond the initial collection, increases the yield in the first case and confirms the diagnosis in the second. As such, three collections within the first twenty-four hours, at intervals no closer than an hour, are recommended.

In cases of suspected bacteraemia in patients already on antibiotic therapy, cultures should be drawn immediately before the next antibiotic dose. Modern blood culture systems also contain resins to reduce the antibiotic effect. In sepsis, urgency of treatment demands that cultures be collected as quickly as possible prior to antibiotic administration. It is advisable to collect separate blood cultures a few minutes apart from alternate arms.

Number of blood cultures
Ninety-six percent of organisms are detected in the first 3 sets of blood cultures, hence the recommendation for 3 sets from each patient.

Volume of blood
Adults
The greater the volume of blood cultured, the greater is the likelihood of pathogen recovery. Contamination rate is not affected by specimen volume, supporting the theory that most bloodstream culture contaminants arise outside of the bloodstream from skin or other environmental sources. However, the ratio of blood to broth in the bottle is important as natural inhibitory and antimicrobial factors in the blood need to be diluted. Hence we recommend a total of 20 mL of blood, divided equally between the two blood culture bottles.

When only lesser volumes of blood can be obtained, the following recommendations apply. When approximately 10 mL of blood is as much as can be obtained, this should be inoculated into an aerobic bottle only. This maintains the broth:blood ratio and maximises detection of the more likely aerobic pathogen. If 4 mL or less is collected, inoculate a paediatric bottle only; this will maintain optimal ratios of broth to blood. Ideally this situation should be avoided because of the importance of the relationship between volume and yield mentioned above.

Children
Children (< 12 years old) have a higher level of bacteria per unit blood volume compared to adults. As such, less volume of blood is required. A paediatric bottle needs to be inoculated with a minimum of only 1 mL and a maximum of 4 mL of blood.

Blood culture bottles
Most media are soybean casein digest with blood heart infusion or peptones. Additives to the bottles prevent clotting, absorb antibiotics and enhance the growth of organisms. Paediatric bottles support the growth of H.influenzae. If mycobacteria is suspected, a lithium heparin tube should be collected for later inoculation into specialised mycobacterial liquid media in the laboratory. Wampole isolator tubes should be requested and inoculated for fastidious organisms such as yeast, dimorphic fungi, mycobacteria, Bartonella spp and Legionella spp. Finally, if leptospirosis is suspected, blood must be inoculated into specialised media at the time of collection. A pathologist should be contacted to arrange the media.

Site
It is often recommended that separate sites be utilised when taking separate blood culture sets at the same time. This may help interpretation of the significance of the growth of an organism that can be both a pathogen and colonise the skin.

Increased contamination rates and detection of line colonisation, rather than true bacteraemia, occur when blood cultures are obtained from central access alone.
Skin disinfection
Evidence regarding the efficacy of various disinfectants is scant. However, for maximal effect, it is important to allow adequate drying time, whatever the disinfectant used. In the past, to avoid cross-contamination by skin flora, it was the practice to change the needle after collecting a blood culture and before inoculating it into blood culture media. However, studies on this have been inconclusive. As the risk for needle-stick is increased by this procedure, we would not recommend it.

Finally, good clinical notes on the request form alert the laboratory to set up additional specialised media which can enhance the likelihood of growing fastidious organisms. This applies particularly to Bartonella spp, Legionella spp, Malassezia furfur, Gardnerella and mycobacteria. For example, a febrile patient on total parenteral nutrition may be at risk for a bacteraemia with Malassezia, or a patient with culture-negative endocarditis and a history of close association with felines may have a bacteraemia secondary to Bartonella spp.

SUMMARY GUIDE TO TAKING BLOOD CULTURES

Timing of collection
- When fever is rising or there is a rigor is best.
- 3 sets over 24 hours, each set no closer than an hour apart.
- If on antibiotic therapy: cultures should be drawn immediately before the next antibiotic dose.
- In sepsis, collect three sets a few minutes apart from alternate arms prior to starting antibiotic therapy.

Number of blood cultures
- Three spaced blood culture sets.

Volume of blood
Adults
- 20 mL divided between the two blood culture bottles.
- If only 10 mL can be obtained, inoculate into aerobic bottle preferably.
- If 4 mL or less is obtained, inoculate into paediatric bottle.

Children (< 12 years)
- 1 mL – 4 mL of blood in a paediatric bottle

Additional blood culture media
- lithium heparin tube – mycobacteria
- Wampole isolator media – fastidious bacteria
- leptospirosis media

Skin disinfection
- Allow adequate drying time after applying disinfectant.
- Needles should not be changed during collection process.

References