LABUPDATE no. 54

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THE RATIONAL USE OF BLOOD CULTURES IN ADULT PATIENTS

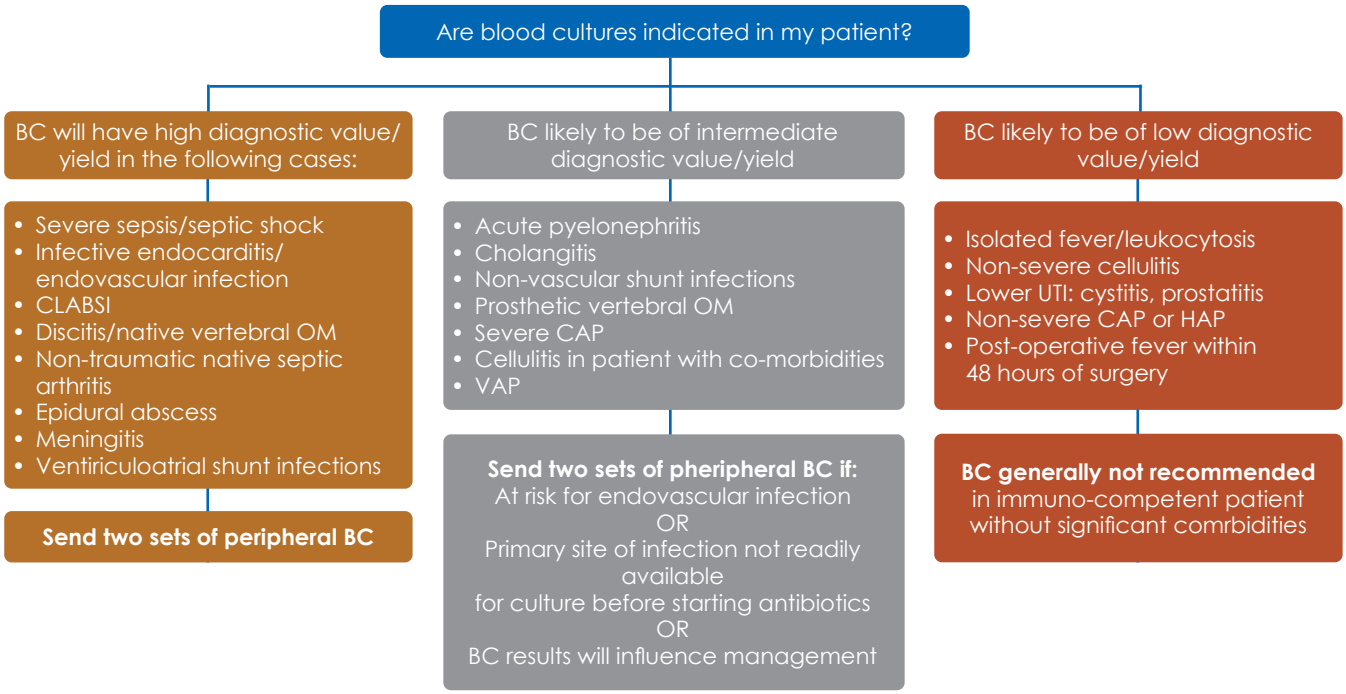
Blood cultures are considered the "gold standard" to diagnose bloodstream infections, a major cause of death worldwide.[1] Ninety percent or more of blood cultures do not grow any organisms, suggesting many of these were likely not indicated.[1] In addition, 30–50% of positive blood cultures recover contaminants, which can result in unnecessary antibiotic use, prolonged hospital stays, additional testing, unnecessary removal of vascular catheters, and increased health care costs.[1] The rational use of blood cultures is thus important. To ensure optimal blood culture utilisation, the following needs to be considered:

- When are primary blood cultures indicated?
- How many sets do I need to send in/request?
- Is the timing of sampling important?
- Is a follow-up blood culture indicated?

WHEN ARE PRIMARY BLOOD CULTURES INDICATED?

Blood cultures should be taken when there is a high likelihood of bacteraemia or for syndromes with a moderate likelihood of bacteraemia when cultures from the primary source of infection are not readily available or will be delayed. Blood cultures are also indicated when the patient is at high risk of endovascular infection as is the case in patients with prosthetic heart valves, vascular grafts, an implantable defibrillator/pacemaker, valvular heart disease or in injection drug users. Blood cultures should also be taken when the results are anticipated to impact patient management, for example, in severe non-purulent cellulitis in an immuno-compromised patient or when a resistant organism is suspected.

Clinical judgement should always be used when deciding whether blood cultures are indicated, especially in the immune-compromised patient or patients with co-morbidities such as diabetes, and end-stage liver and end-stage renal disease. Figure 1 summarises the clinical scenarios where blood cultures may be of value in the non-neutropaenic patient.



* CLABSI – central line associated blood stream infection, OM – osteomyelitis, CAP – community-acquired pneumonia, HAP – hospital-acquired pneumonia, VAP – ventilator-associated pneumonia, UTI – urinary tract infection, BC – blood culture

FIGURE 1: CLINICAL SCENARIOS WHERE BLOOD CULTURES MAY BE OF VALUE IN THE NON-NEUTROPAENIC PATIENT[2,3]

HOW MANY SETS OF BLOOD CULTURES DO I NEED TO SEND IN/ REQUEST?

The two most important factors that impact the performance of blood cultures are proper skin antisepsis and the volume of blood cultured.[4] Various studies have demonstrated that single blood cultures are inadequate to detect yeast and bacteria in the blood.[1] Single sets can miss as many as 10–40% of pathogens.[1]

Another disadvantage of taking a single blood culture is the inability to distinguish culture contamination from true bacteraemia.[1] Current guidelines recommend that at least two sets of blood cultures should be collected for an adult patient, with each set consisting of 10 mL of blood inoculated into an aerobic and anaerobic blood culture bottle (thus 40 mL of blood collected in total). The yield of detected pathogens increases with each additional set of blood cultures collected: 61.4% with one set, 78.2% with two sets, and 93.1% with three sets (Figure 2).[4]

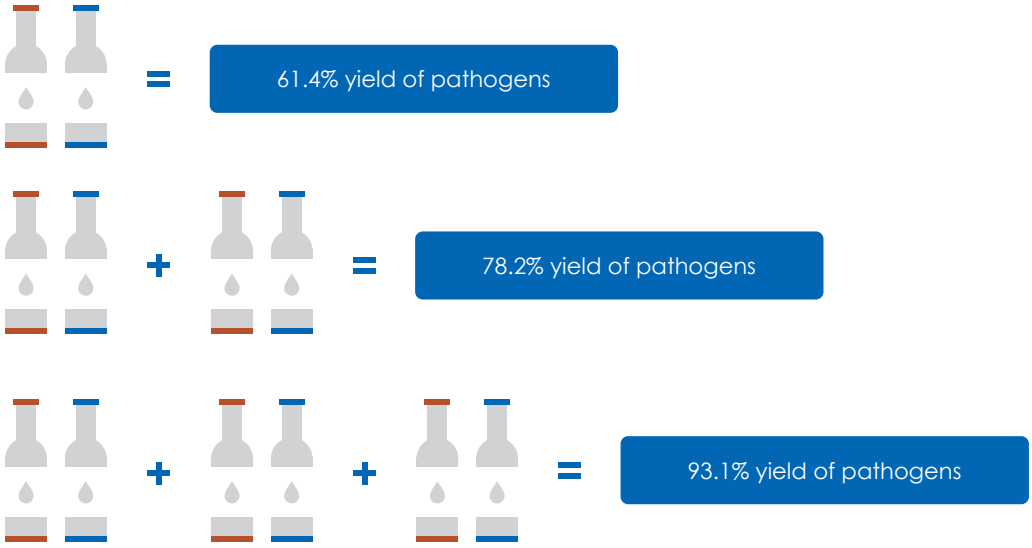


FIGURE 2: THE YIELD OF PATHOGENS FROM BLOOD CULTURE IN RELATION TO THE VOLUME OF BLOOD CULTURED[4]

IS THE TIMING OF SAMPLING IMPORTANT?

With regard to the timing of blood cultures, the only important aspect is to take the blood cultures before the administration of antibiotics. Neither spacing of the blood cultures over a 24-hour period nor the timing of the blood cultures close to a fever spike has any influence on the positivity rate of blood cultures.[1]

IS A FOLLOW-UP BLOOD CULTURE INDICATED?

When considering when to repeat blood cultures, three factors need to be considered:

- The identified pathogen
- The source of infection
- The clinical response and source control

Repeat blood cultures are indicated in the following cases:[1-3]

- To document the clearance of *Staphylococcus aureus* bactereamia
- To document the clearance of *Staphylococcus lugdunensis* bacteraemia
- To document the clearance of candidaemia
- For any organism when there is suspicion of infective endocarditis or endovascular infection
- Where persistent bacteraemia is suspected
- To distinguish contamination from true bacteraemia.

KEY POINTS

- The volume of blood collected for blood culture is the single most important determinant of the ability to detect pathogens.
- At least two to three sets of blood cultures should be collected – with each set consisting of 10 mL of blood inoculated into an aerobic and anaerobic blood culture bottle (thus 40–60 mL of blood collected in total).
- Blood cultures should ideally be collected before the administration of antibiotics.
- Blood cultures should not be spaced over a 24-hour period.
- Blood cultures need not be collected during a fever spike.

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