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Appropriate Protocols of Blood Sample Collection for Accomplishing Accurate Results from Blood Culture and Sensitivity

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Abstract:

A Published report by world health organization (WHO) and Elsevier for the year 2023, concluded that sepsis in intensive care settings is the main reason for high mortality in hospital. Besides that addition of anti-microbial resistance (AMR) had worsened up the scenario. In this state, blood culture plays a pivotal role to appropriately provide details for microbial etiology along with their susceptibility pattern. Therefore, this current short commentary has been planned to shed light on most appropriate blood sample collection techniques and precautions. It is concluded that blood sample should be collected for culture prior the start of antibiotics. Ideally two sets of blood samples i.e 20 to 30 ml should be collected at one time from one site. Strict infection prevention and control guidelines should be adhered. Thus, chances of false positive results and their disastrous outcomes can be minimized.

Key words: protocols and appropriate technique; blood sample collection; blood culture and sensitivity; central line–associated bloodstream infection (clabsi); blood sample should be collected from central vascular access device (cvad); intensive care units (icus)

Introduction

Over View: A latest published report by Elsevier for the year 2023, clearly concluded that sepsis in intensive care units (ICUs) is the main reason for mortality. A gold standard in microbiological lab diagnosis is a blood culture and sensitivity. It is a main surrogate to identify causative pathogens. [1]

Factors Playing Key Role In Getting True Positive Results: The highlighted factors interfering with the positivity rate of blood culture results includes the timing of sample collection, skin antiseptic preparation, number of blood culture sets, and blood volume inoculated in individual culture bottles. Therefore, due care should be given to all these factors, which are playing a key role in getting true positive results. [1,2]

The key advise for all health care providers was that, blood sample should be collected prior the start of antibiotics. Especially if a patient starts to experience the signs and symptoms of sepsis. The relevant feature of sepsis comprises of fever with rigors and chills, along with evidence of deranged inflammatory markers on lab investigations. Incase patient has started antibiotics, than the lab personnel must be intimated, so that they can use additives to

contravene the antibiotic's effect. Moreover, the specific antibiotic will be careful applied for getting susceptibility results. [2]

Literature Review

Specification of Blood Culture Bottle: It is always strongly recommended that two sets of blood sample should be collected. One for aerobic microbes in aerobic culture bottle and the other one for anaerobes and in anaerobic culture bottle. Ensure the intact seal having preservative in blood culture bottle prior pouring the sample in it. [3]

Site for Blood Sample Collection: Preferably for two samples, blood should be drawn from the cubital veins of both arms. In cases of central line–associated bloodstream infection (CLABSI), blood

sample should be collected from central vascular access device (CVAD). [4] In that scenario, one set of blood specimen should be acquired from venipuncture, and the other one from the distal lumen of the CVAD i.e suspected of being infected. [4,5] In situations where venipuncture is impossible, CVAD is available than two different sites of it's lumen should be used to get the blood sample. [6] Afterwards clear notes should be added on the bottle regarding site of sample collection. [1] In another report, it is recommended to take three blood culture samples, which should be drawn at least 1 hour apart upon commencement of signs of sepsis. [2,6]

Significance of Drawing Two Blood Samples for Blood Culture: The yielded growth on culture plates helps to differentiate between skin contaminants and true CLABSI. Second confirmation can be done, if samples from both sites yield same microbial growth. [2]

Blood Sample Collection Technique: The blood sample can be drawn either by using a hollow bore needle and syringe or vacuum-sealed blood culture bottles by using vacuum-extraction collection system. A butterfly needle having short tubing is also recommended for sample collection especially in younger ages or patients with collapsed veins. However, proper disinfection and sterilization techniques should be ensured to minimize chances of skin contamination. This will help in reducing chances of false-positive test results. Provision of false positive report, might expose the patient to excessive antibiotics, which even can become the reason for prolonged hospital stay. [1,2] If multiple tests are advised along with blood culture than firstly the sample should be collected in blood culture bottle. This will help in reducing chances of cross contamination form the additives present in other sample collection bottles. [1]

Volume of Blood Sample for Both Culture Bottles*:* For adult BactT alert adult culture bottle having 40ml BHI, 8-10ml of blood can suffice the requirement.[7] Literature review supports the evidence that 20 to 30 ml of blood sample should be collected from the cubital veins of both arms.[3] For the children weighing <11 kg, blood sample of 1–1.5 mL should be sufficient. While ones weighing between 11-17 kg, 7.5 mL blood will be appropriate for one BC bottle.[8] A published report for the year 2021, by Journal of clinical microbiology recommended that for pediatric BactT alert culture bottle having 20ml brain heart infusion (BHI), 4ml of blood can suffice the requirement.[9] In view of patient's condition especially severe anemia, sample must be collected be trained staff to ensure avoiding double prick and excessive loss of blood. As per guidelines of infection prevention and control single use of tourniquet should be preferred to avoid contamination from skin flora i.e *Staphylococcus aureus*. [5,10] The application of tourniquet time should not exceed to one minute. Otherwise, it may lead to stasis and hemoconcentration. [4]

Providing Comfort to Patient For Reducing Their Anxiety: Patients used to be in agony, pain and discomfort due to their illness. Their added anxiety and fear comes up while encountering a painful venipuncture procedure. Keeping in view their agony, it's the responsibility of health care providers to opt a skillful and calm approach, which will limit abhorrence to venipuncture. Counselling the patient prior procedure, taking their consent, utility of getting their blood samples and effect on treatment plan, will further helps to reduce their agony. [1]

Conclusion: Blood sample should be collected for culture prior the start of antibiotics. Ideally two sets of blood samples i.e 8-10 ml should be collected at one time from one site. Strict infection prevention and control guidelines should be adhered. Thus, chances of false positive results and their calamitous outcomes can be minimized.

Recommendations:

1. Blood sample for blood culture must always be drawn prior the start of antibiotics
2. Incase patients had started antibiotics, than that should be notified to microbiology lab for minimizing chances of false positive results.
3. Ideally two blood samples should be collected from two different sites, preferably cubital veins i.e. for aerobic and anaerobic culture bottles.
4. Three blood culture samples should be drawn at least 1 hour apart preferably at the beginning of signs of sepsis.
5. In situations where venipuncture is impossible, CVAD is available than two different sites of its lumen should be used to get the blood sample.
6. For pediatric BactT alert culture bottle having 20ml BHI, 4ml of blood can suffice the requirement.
7. For adult BactT alert adult culture bottle having 40ml BHI, 8-10ml of blood can suffice the requirement.

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