CHOC Children's Nursing Research

CHOC Children's Hospital
Best Evidence and Recommendations

Blood Culture Collection from Central Lines

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PICO: In pediatric patients undergoing blood culture specimen collections from central lines, how does the use of blood waste (discard) in the sample compared to non-waste (current practice) impact the assessment of bloodstream infections?

P (Population/problem): Pediatric patients with central lines undergoing blood culture collection
I (Intervention/issue): Use of initial blood draw waste (discard)
C (Comparison): Use of second draw non-waste (current practice)
O (Outcome): Assessment of bloodstream infection

Background:

Blood cultures are utilized as a frequent laboratory testing method to determine the presence of bacteremia, particularly in populations with an invasive device, such as a central line. This method is an essential diagnostic strategy used in the recovery of a pathogen because it allows for the identification and susceptibility of the organism to optimize treatment (Bard & TeKippe, 2016). Two measures associated with the recovery of bacteria in the blood culture include sensitivity and specificity. Sensitivity refers to the probability of growth if bacteria is present, whereas specificity is the probability that there will be no growth if bacteria is absent (Halm, Hickson, Stein, Tanner & VandeGraaf, 2011).

In pediatrics, central lines are used not only to administer therapeutic agents but also to minimize the trauma associated with venipuncture blood draws. However, unlike central line use in the adult population, there are no standardized guidelines for obtaining blood cultures from central lines in the pediatric population (Bard & TeKippe, 2016; Dwivedi, Bhalla, Hoover, & Weinstein, 2009; Winokur et al., 2014). Standard practices among pediatric populations regarding obtaining blood cultures from central lines include using the initial draw (waste) in specimen collection or the service of the second draw (non-waste) in specimen collection. The rationale for support of the second draw is to remove potential contaminants that may inhibit microbial growth or increase the contamination rate (Dwivedi et al., 2009; Winokur et al., 2014). Although there is evidence to support that diluents can alter laboratory findings associated with hematology, chemistry, and coagulation values, there is a lack of published evidence to support the need to discard blood before obtaining blood cultures (Winokur et al., 2014). Potential benefits of using the initially drawn waste in the blood culture specimen include minimizing blood loss, decreasing iatrogenic anemia and unnecessary blood transfusions and associated risks (Cole et al., 2006; Dwivedi et al., 2009; Winokur et al., 2014).

Ultimately, considerations for specimen collection for a blood culture should include accuracy of diagnosis and time to positivity because these directly impact patient care through treatment and initiation or narrowing of antibiotics. Evidence supports that the increased probability and speed of positivity in the recovery of a pathogen is associated with the volume of blood obtained (Bard & TeKippe, 2016).

The purpose of this evidence-based practice project is to present literature review findings and determine the best practice for central line blood culture collection, specifically related to the use of the initial draw (waste) versus the second draw (current practice). In order to identify best practices, a comprehensive literature search and outreach to reputable institutions were completed.

Search Strategies and Databases Reviewed:

- Databases searched for this review included CINAHL and Pub Med.
- Key search words: pediatric, blood culture, central line, CVC, IVC, CVL, contamination, accuracy, discard, waste, initial aliquot. This search yielded 287 articles, of which 13 were critically reviewed, and two articles were found to be most relevant to this specific PICO question.
- Professional organization websites reviewed included CHOC Children's and Infusion Nurses Society (INS), Nationwide Children's Hospital, and Children's Hospital Colorado.
- A listserv survey through the Association of Pediatric Hematology/Oncology Nurses (APHON) was sent via the open forum to gather responses from members working in other children's hospitals across the nation regarding this topic. This survey yielded eight responses. A similar listserv survey through the Society of Pediatric Nurses (SPN) was sent via the general and hot topic forum, which yielded three responses.
- Communication with personnel at other facilities, including Children's Hospital of Los Angeles, UCLA Mattel Children's Hospital, Texas Children's Hospital, Children's Hospital of Philadelphia, Boston Children's Hospital, Cincinnati Children's Hospital, UPMC Children's Hospital of Pittsburgh, Children's National Medical Center, BC Children's Hospital, and Seattle Children's Hospital.

Synthesis of Evidence:

- From the literature review, only two articles provided relevant research questions in the form of experimental comparative design studies. Each of these studies varies in sample populations, with one adult and the other pediatric.
    - Dwivedi et al. (2009) performed a study completed in the adult inpatient oncology population, in which out of 653 blood culture pairs drawn from central lines, the contamination rate for the initial discard was 10.9% when compared to the standard second draw was 10.5%. Overall, suggesting that discarding the initial aliquot of blood did not reduce contamination rates.
    - Winokur et al. (2014) completed a study on pediatric oncology patients in the emergency department, in which from 186 blood culture pairs drawn from central lines, all positive-positive matches contained the same organism in both the waste and standard care specimen.
- An unexpected finding in the study by Winokur et al. (2014) was that in half of the positive-positive blood culture pairs, the specimen that would have normally been wasted had an earlier time to positivity.
- Winokur et al. (2014) also suggested that blood specimens initially drawn from the central line have a higher specificity and sensitivity when compared to a subsequent blood draw from the central line, and no positive results were identified as contaminants.
- Pediatric hospitals across the country were surveyed regarding their current blood culture specimen collection practice. Of 15 responses, ten facilities practice using the initial draw for specimen sampling. Inconsistencies persist between best practices in drawing blood cultures from

central lines, though those hospitals which use the initial draw in specimen collection often reference the studies previously mentioned to support their current practice.

Practice Recommendations:

- Based on current evidence, though limited, there is support for a practice change that would change the current practice of using the non-waste (second draw) to use of the initial draw (discard) for blood collection from central lines in blood culture specimen collections (Dwivedi et al., 2009; Winokur et al., 2014).
- There is a gap in the literature surrounding the use of waste in specimen collection for blood cultures, which presents an opportunity for further studies to be conducted surrounding blood cultures from central lines and the determination of best practice (Bard & TeKippe, 2016; Dwivedi et al., 2009; Winokur et al., 2014).
- Make recommendations to modify existing policy for blood culture collection from central lines to reflect current evidence.
- Consider conducting research to contribute to the body of knowledge while providing a rationale for a practice change, if indicated.
    - Collect data on blood cultures drawn from central through an experimental comparative design study, looking at initially drawn waste and current practice.
    - Measure the accuracy of identification related to specificity and sensitivity, as well as time to positivity in each positive/positive pair.
    - Review data to determine if the use of initially drawn waste is sufficient for identifying the presence of infection, both timely and accurately compared to current practice.
    - Consider synthesizing data collected for further publication.

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