Obtaining blood cultures from patients with cancer when temperature spikes occur has been surrounded by long-standing controversy and confusion. Observations in clinical practice have revealed that variations exist in clinicians’ perceptions of where, when, and in what manner blood cultures should be obtained.

The Oncology Nursing Society Appropriately Treats Ascribes Quality (ATAQ) program aims to provide oncology nurses with information and strategies to anticipate and manage neutropenia and infection. One debate in the program is about the need for both peripheral and central line cultures when patients with cancer become febrile. Some ATAQ participants suggested eliminating or limiting peripheral blood drawing for blood cultures. One proposal involved drawing blood cultures only from central lines; if a positive culture was obtained, then further investigation would be warranted and peripheral cultures could or could not be drawn. The rationale for the proposal was based on the following considerations:

- The presence of a central line presents a high risk of infection in the target population.
- Blood cultures from a central line can identify colonization from either the line itself or bloodstream infection.
- Regardless of where a microorganism is isolated, treatment (i.e., appropriate antimicrobial treatment) would not change.
- Unnecessary venipunctures in immunocompromised patients (e.g., patients who are anemic, neutropenic, or thrombocytopenic) would be avoided.

Literature Review

A review of the literature revealed limited discussion, recommendations, or evidence-based guidelines about sites and frequency of blood culture sampling and the number of samples that should be drawn. Published studies that included details about how blood cultures were obtained usually were small, nonrandomized, and nonblinded and used limited or various data analysis techniques. Notable, however, were the statistics about how frequently blood cultures drawn from any site actually identified specific microorganisms—only 2%–28% of the time (Smith & Sheperd, 1995).

One study compared 551 central line blood culture results with peripheral blood culture results (obtained by venipuncture) drawn from 185 hospitalized patients with cancer who were suspected to have an infection (DesJardin et al., 1999). Cultures were paired (i.e., drawn within four hours of each other, usually drawn at the same time), and results were as follows:

- Eighty-five percent were catheter-negative/venipuncture-negative.
- Six percent were catheter-positive/venipuncture-positive.
- Three percent were catheter-negative/venipuncture-positive.
- Six percent were catheter-positive/venipuncture-negative.

The researchers suggested that using central venous catheters to obtain blood for cultures may be an acceptable method for ruling out bloodstream infection. However, a positive culture from a central line would warrant further investigation (DesJardin et al.).

Since publication of the DesJardin et al. (1999) study, several authorities have come forth to support or dispute its conclusions. A commentary published in the Annals of Internal Medicine supported the 1990 American College of Physicians guidelines that discouraged the use of central venous catheters for blood culture sampling (Johnson, 2000).


Digital Object Identifier: 10.1188/02.CJON.268-270

Linda M. Penwarden, RN, MN, AOCN®, and Paul G. Montgomery, MD, FACP
In an opposing view, the American Society of Clinical Oncology Online Journal Club reviewed and supported the recommendations by DesJardin et al. The review also suggested that consideration be given to modifying the guidelines previously issued by the American College of Physicians (Weiss, 2002).

Although specific guidelines have not been developed for obtaining blood cultures from patients with cancer who become febrile with no clinically evident source of infection, guidelines for assessing and managing suspected intravascular catheter-related infections have been published by the Infectious Diseases Society of America, the American College of Critical Care Medicine, and the Society for Healthcare Epidemiology of America (Mermel et al., 2001). They recommend that two sets of blood cultures be obtained, with at least one drawn peripherally. Although the recommendation represents a move toward more standardized, evidence-based practice, it can be interpreted to mean two peripheral blood cultures or one peripheral blood culture and one drawn from a central venous catheter.

### Institutional Survey

The authors queried the clinical practice committee of their oncology unit about the indication for, frequency of, and location of blood draws for culture analysis. The researchers quickly realized that no consistent standard of practice existed. Physicians’ orders varied in degree of specificity regarding whether to draw blood from central lines or peripherally. Additional questions were raised regarding when to discontinue sampling if patients spiked fevers repeatedly. A staff survey was suggested to attain baseline data reflecting clinicians’ practices. One was developed for both nursing staff and physicians. Both groups were asked identical questions about interpretation of common orders for blood culture sampling, frequency of sampling, and duration of sampling. The researchers reviewed the survey with the clinical supervisor and an infection control nurse, then it was distributed to all clinical staff on the inpatient oncology unit and the medical and radiation oncologists.

Members of the nursing staff completed the survey in February 2000. Thirty surveys were completed and returned. Table 1 depicts the discrepancies between physician intent and staff interpretation of blood culture orders. The staff interpreted orders for blood cultures to involve both central lines and peripheral sites, even when not overtly stated. The staff continued to draw from both sites as long as patients’ temperatures were spiking. Nurses often decided to reduce the frequency of cultures drawn when patients consistently spiked fevers.

Many staff members wrote comments to clarify their survey answers. For example, one staff nurse wrote:

> It depends on how long it has been since the last cultures were drawn. If the patient has been getting cultures every day, I do one from each line; if they have single lumen, I do a peripheral and central line draw.

### The Protocol

The authors presented survey results and a draft of a proposed protocol for blood culture drawing to the clinical practice committee and, subsequently, the department of oncology, which consists primarily of medical and radiation oncologists. Both groups agreed that a protocol was well advised and long overdue. The draft protocol was finalized by two medical oncologists, a pediatric oncologist, the hospital’s infection control physician, and a clinical nurse specialist. The highlights of the protocol follow.

- Blood cultures will be drawn within 30 minutes of the order.
- An aerobic and an anaerobic blood culture comprise a set of blood cultures.
- Initial blood cultures will be drawn in the following order:
  - One set of peripheral cultures
  - One set of cultures drawn from each lumen of a central line with no blood discarded (total volume 10 cc per culture bottle).
- Acetaminophen 650 mg may be given orally every six hours, unless contraindicated.
- Subsequent blood cultures will be drawn within 30 minutes for any temperature spike of 101.5°F orally for the following 48 hours.
  - No further peripheral sampling will occur if a patient has a central line.
  - Blood cultures will be drawn from every lumen of a multilumen central line.
- After 48 hours, blood cultures will be limited to one via a central line in a 24-hour period, regardless of persistent temperature spikes.

To facilitate success of this new process, two supportive measures were implemented. First, a set of preprinted physician orders was created. This enables ordering physicians to easily institute the protocol, saves time in writing the protocol’s individual steps, and clearly outlines the key steps in the protocol. Secondly, two sets of stickers were created for labeling the care management plan, giving nurses direction about timing and frequency of blood cultures for any given patient. When the protocol is initiated, the first sticker is placed on the care plan to signify the beginning date and time. The second sticker is placed 48 hours ahead to signify the point in time when blood culture sampling is reduced to once per 24 hours.

### Table 1. Survey Results

<table>
<thead>
<tr>
<th>INTERPRETATION OF BLOOD CULTURE ORDERS</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physicians (N = 4)</td>
<td></td>
</tr>
<tr>
<td>Draw one culture from the central line</td>
<td></td>
</tr>
<tr>
<td>Draw one culture peripherally</td>
<td></td>
</tr>
<tr>
<td>Draw two cultures from the central line</td>
<td></td>
</tr>
<tr>
<td>Draw one culture from the central line</td>
<td>2</td>
</tr>
<tr>
<td>and one peripherally</td>
<td></td>
</tr>
<tr>
<td>Nurse (N = 30)</td>
<td></td>
</tr>
<tr>
<td>Draw one culture from the central line</td>
<td>2</td>
</tr>
<tr>
<td>Draw one culture peripherally</td>
<td></td>
</tr>
<tr>
<td>Draw two cultures from the central line</td>
<td></td>
</tr>
<tr>
<td>Draw one culture from the central line</td>
<td>16</td>
</tr>
<tr>
<td>and one peripherally</td>
<td></td>
</tr>
<tr>
<td>Call and clarify</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

Acetaminophen 650 mg may be given orally every six hours, unless contraindicated. Subsequent blood cultures will be drawn within 30 minutes for any temperature spike of 101.5°F orally for the following 48 hours. After 48 hours, blood cultures will be limited to one via a central line in a 24-hour period, regardless of persistent temperature spikes.

To facilitate success of this new process, two supportive measures were implemented. First, a set of preprinted physician orders was created. This enables ordering physicians to easily institute the protocol, saves time in writing the protocol’s individual steps, and clearly outlines the key steps in the protocol. Secondly, two sets of stickers were created for labeling the care management plan, giving nurses direction about timing and frequency of blood cultures for any given patient. When the protocol is initiated, the first sticker is placed on the care plan to signify the beginning date and time. The second sticker is placed 48 hours ahead to signify the point in time when blood culture sampling is reduced to once per 24 hours.
Both measures have facilitated the implementation of the protocol and improved communication among the staff. Patients placed on the protocol are identified during shift reports, indicating that the information is being documented properly on the care management plan and, therefore, communicated appropriately.

Implications for Practice

The use of a defined protocol for blood culture sampling has several implications for practice. Patients with cancer who present with or develop fever commonly are cared for in oncology units. Rapid isolation and identification of the microorganisms causing infection are critical to ensure prompt and appropriate treatment. Specific blood sampling guidelines help ensure that patients are managed appropriately.

Use of a protocol for drawing blood cultures reduces and has the potential to eliminate inconsistency in blood drawing procedures that often exists in clinical practice settings. The reliability of the process for obtaining blood cultures in patients with suspected infections also may be improved when a protocol is used to guide blood culture sampling. Specifying time frames for drawing blood cultures and what routes to draw from (peripheral or central line) improves the likelihood that organisms will be isolated. The delay time between a temperature spike and blood drawing decrease, also improving the chances that organisms will be identified.

Communication between nurses about what has been done for patients and what needs to be done is important to continuity of care. The protocol the authors developed for drawing blood cultures is defined clearly and communicated easily. This eliminates redundancy, such as drawing blood cultures when they already have been done, and confusion about when they should be done again.

Patients benefit from the use of a standardized protocol. First, per the protocol that the authors implemented, when a patient has a central line, he or she only has to undergo a single peripheral blood draw for blood cultures, unless strong suspicion exists that the central line is infected. This leads to cost savings because fewer procedures are performed. The authors did not evaluate costs or cost savings in developing the protocol but encourage other nurses who are implementing standardized protocols to include costs in their outcome measures. Finally, as noted earlier, with a more rapid time to blood culture sampling and fewer delays caused by obtaining or clarifying individual orders, the likelihood of isolating infectious organisms may increase and patient outcomes may improve.

Summary

A consistent method or set of guidelines for drawing blood cultures from febrile patients with cancer is not well addressed in the published literature. At the authors’ institution, variation in practice was discovered, so physicians and staff created and implemented a protocol to standardize the practice of blood culture collection. Utilizing the few recommendations from the literature, as well as opinions of experts within the organization, a team developed a protocol that currently is in use. Positive outcomes of implementation of the protocol include improvement in patient care, standardization of the procedure for obtaining blood cultures, and reduction of time spent in nonpatient care activities, such as clarifying orders, tracking culture specimens, and communicating clinical findings and laboratory reports.

The protocol for obtaining blood cultures from febrile patients with cancer described in this article reflects the opinions and practice within one organization. It is not based on rigorous or formal study data but rather on an institutional survey, staff and physician preferences, and the limited research data available. Further research is needed, and the authors encourage other organizations to develop their own protocols using a similar process of protocol development and implementation.

The authors would like to recognize Tom Coffman, MD, for his expertise and recommendations on this project. Coffman is chairperson of the Infection Control Committee and Antibiotic Subcommittee at St. Lake’s Mountain States Tumor Institute in Boise, ID. The authors also acknowledge the assistance of Dave Wilson, RPh, Nancy Salyer, RN, and Sue Swanson, RN, in proofing and editing this manuscript.

Author Contact: Linda M. Penwarden, RN, MN, AOCN®, can be reached at penwardl@slrmc.org.

References


Rapid Recap

Developing a Protocol for Obtaining Blood Cultures From Central Venous Catheters and Peripheral Sites

- Evidence-based recommendations for drawing blood cultures from febrile patients with cancer (without suspected catheter-related infection) are lacking.

- A standardized protocol accompanied by preprinted orders for drawing blood cultures was developed at the authors’ institution.

- The goals of the protocol were to improve patient care, reduce time spent in nonpatient care activities, and standardize the sequence for drawing blood cultures.

- Other institutions can use a similar process to identify areas of clinical practice variation and implement standardized protocols.