Do All Children Hospitalized With Community-Acquired Pneumonia Require Blood Cultures?

The 2011 pediatric community-acquired pneumonia (CAP) management guideline released jointly by the Infectious Diseases Society of America and the Pediatric Infectious Diseases Society recommends blood cultures for children with moderate to severe CAP requiring hospitalization. However, the study featured in this issue of *Hospital Pediatrics* by Heine et al concludes otherwise, suggesting that a more restricted approach may be best.

The authors examined >300 children from a single institution with a primary diagnosis of pneumonia; 60% required hospitalization. Among all children with a blood culture obtained (n = 155 [47%]), the prevalence of true bacteremia was only 3% (n = 5 [3 *Streptococcus pneumoniae*, 1 each of *Escherichia coli* and *Streptococcus pyogenes*]), although just as many positive culture results were attributed to non-causative organisms (ie, contaminants). All 5 children with true bacteremia had severe illness on presentation; all were hospitalized with radiographic evidence of parapneumonic effusion, and 4 required critical care admission. Given the low prevalence of documented bacteremia and the obvious illness severity among those with bacteremia detected, the authors concluded a relative lack of clinical utility for routine blood cultures in children with CAP. Retrospectively comparing clinical management against a local practice guideline that recommends more restricted use of blood cultures (based on age, comorbid conditions, immunization status, and illness severity), the authors noted that 45% of those with cultures obtained were considered “low risk” for bacteremia; none of these children had true bacteremia detected. Of course, it is difficult to estimate the true prevalence of bacteremia because only one-half of children had cultures obtained, a limitation acknowledged by the authors. Although the prevalence may be lower, it almost certainly is not zero. It is possible that some children in the low-risk group could have had detectable levels of bacteremia had cultures been performed.

The Infectious Diseases Society of America/Pediatric Infectious Diseases Society guideline committee’s recommendation to obtain blood cultures among children hospitalized with moderate to severe pneumonia was rated as a “strong recommendation” but based on “low quality evidence.” One assumes this means that although the committee was generally in support of the recommendation (due to strong potential benefits with little perceived risks), it was supported by a paucity of evidence. The major benefit of obtaining blood cultures in children with pneumonia centers on the potential to identify a causative organism. Isolating a pathogen allows the clinician to provide targeted antimicrobial therapy while minimizing the use of unnecessary broad-spectrum agents. For instance, a child presenting to our institution with pneumonia complicated by a sizeable parapneumonic effusion is...
likely to receive broad-spectrum antimicrobial agents targeting resistant pneumococci (eg, third-generation cephalosporin) as well as methicillin-resistant *Staphylococcus aureus* (eg, clindamycin or vancomycin). Without an isolated pathogen, this empirical regimen is typically continued for the duration of the treatment course. However, identifying the causative pathogen often results in narrowing of therapy to a single agent. This strategy is important not only for providing the most effective treatment of that child but also for helping to slow the spread of antimicrobial resistance so that effective therapies remain for other children. Culture data are also used for national disease surveillance, such as the Centers for Disease Control and Prevention’s Active Bacterial Core surveillance program. This program uses culture data collected from clinical laboratories to provide epidemiologic information (eg, trends in disease incidence and antimicrobial resistance patterns) for selected bacterial pathogens.² Thus, culture data have the potential to be enormously beneficial.

Unfortunately, 1 fact has prevented us from realizing the enormity of the perceived benefits outlined here: blood culture results are rarely positive among children with pneumonia. With the notable exception of complicated pneumonia, most studies, including that of Heine et al, report positivity rates of <5% for blood cultures obtained among children with pneumonia.³⁻⁸ Even when culture results reveal a potential pathogen, the proportion identified as contaminants often approaches or even exceeds that of true pathogens. Contaminated cultures may lead to unnecessary switching of antibiotics (often to broader-spectrum therapy), may prolong hospitalization, and certainly contribute to increased costs.⁹ As a result, as long as the potential of culture contamination remains a significant threat, obtaining blood cultures is not without “risk.” Results are also mixed as to whether positive culture results for true pathogens lead to substantive changes in management.⁵⁻⁸ Empirical use of narrow-spectrum antimicrobial therapy (eg, ampicillin) as outlined in the Infectious Diseases Society of America/Pediatric Infectious Diseases Society guideline provides effective therapy for the vast majority of cases of uncomplicated bacterial CAP. Consequently, adherence to the guideline further reduces the prospect that culture data will influence management in the absence of severe or complicated disease.

Pros and cons notwithstanding, blood cultures remain our best and often only practical hope of identifying a bacterial pathogen in children with pneumonia. Sputum cultures are often helpful in adults and even older children (and should be performed), although the majority of children presenting with pneumonia are <5 years of age and cannot reliably produce an adequate sample. A number of novel diagnostic techniques that are under development, including polymerase chain reaction and rapid antigen detection tests,¹⁰ hopefully will improve detection of bacterial pathogens from blood and other sterile sites; however, these tests are currently not widely available.

So, what’s a hospitalist to do? Is it possible to improve the clinical utility of blood cultures? The work by Heine et al highlights 1 example of how we might do that: target a population of children at higher risk for bacteremia and other complications (ie, those at risk for more severe disease). Unfortunately, few data are available to guide clinicians on how to define moderate or even severe disease. Although it seems reasonable to presume that disease severity among children hospitalized with pneumonia should never be categorized as mild, clinical experience tells us otherwise. Thus, perhaps hospitalization alone is not the best predictor of disease severity. Studies also suggest that clinical judgment alone is often a poor predictor of future outcomes.¹¹ Objective measures of severity have proven useful in adults with pneumonia. A number of prognostic scoring systems have been developed that predict mortality among adults with pneumonia based on a varying number of demographic and clinical factors. Two well-known examples include the Pneumonia Severity Index and the CURB-65 score.¹²⁻¹³ Both have been extensively validated and demonstrate clinical utility, including assisting clinicians with site-of-care decisions and antimicrobial selection.¹⁴⁻¹⁵ Regrettably, disease-specific severity measures have yet to be developed for pediatric pneumonia, a critical research need highlighted by the guideline committee. Similar to adult pneumonia, such measures could prove useful for clinicians caring for children by improving risk assessments and outcome prediction, and in the case of blood cultures, improving their clinical utility.

Although few single studies are sufficient to change clinical practice or guideline recommendations, the current study is a good example of the type of research needed to inform the next iteration of the guideline. The forthcoming Etiology of Pneumonia in the Community (EPIC) Study,¹⁶ a population-based surveillance of pneumonia hospitalizations among children in 3 US cities, should also provide much-needed
data on pneumonia epidemiology in the conjugate vaccine era, including microbiologic etiology, as well as the prevalence and risk factors for severe outcomes, including bacteremia. In addition, strategies to standardize clinical management, through local practice guidelines as suggested by Heine et al as well as quality improvement efforts (eg, initiatives to reduce blood culture contaminants) are also critically important for optimizing care and outcomes. These are all areas in which hospitalists can and should lead.

REFERENCES


16. Jain S. Findings from the Etiology of Pneumonia in the Community (EPIC) Study; Pediatric Academic Societies Oral abstract presented at the 2012 Pediatric Academic Societies Annual Meeting; April 30, 2012, Boston, MA.