Clinical practice guideline by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America: 2021 guideline on diagnosis and management of acute hematogenous osteomyelitis in pediatrics.

Guideline ID: 2641 Published: 2021 Aug

Pediatric Infectious Diseases Society (PIDS) | Infectious Diseases Society of America (IDSA)

Woods CR, Bradley JS, Chatterjee A, et al. Clinical practice guideline by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America: 2021 guideline on diagnosis and management of acute hematogenous osteomyelitis in pediatrics. J Pediatric Infect Dis Soc. 2021 Aug;10(8):801-844. [243 references] PubMed

View Original Guideline

Overview

Guideline Objective

To provide recommendations for the diagnosis and treatment of acute hematogenous osteomyelitis (AHO) in children

Patient Population

Children 1 month to <18 years old in North America with suspected or confirmed AHO

Note: Neonates are excluded due to important differences in pathogenesis, management, and outcomes compared with older infants and children. These include differences in bacterial pathogens, sites and progression of infection, immunologic immaturity inherent in the neonate, lack of robust antimicrobial pharmacokinetic data for neonates of various gestational and postnatal ages, and increased risk of poor long-term outcomes based on neonatal bone anatomy. It is reasonable to apply this guideline to infants

beyond the neonatal period (4 to 8 weeks of age), including preterm infants who are older than 44 to 48 weeks corrected age at the onset of infection.

Recommendations

Recommendation Statements

Diagnosis and Management of Acute Hematogenous Osteomyelitis (AHO) in Pediatrics

I. What noninvasive diagnostic laboratory tests should be performed in children with suspected AHO?

1. In children with suspected AHO, we recommend performing blood culture prior to the administration of antimicrobial therapy. (**Strong recommendation; Moderate certainty of evidence**)

2. In children with suspected AHO, we suggest performing a serum C-reactive protein (CRP) on initial evaluation. (**Conditional recommendation; Very low certainty of evidence**)

   Comment: Serum CRP has a low accuracy to establish the diagnosis of AHO, but in situations where AHO is confirmed, the serum CRP performed on initial evaluation can serve as the baseline value for sequential monitoring.

3. In children with suspected AHO, we suggest against using serum procalcitonin (PCT). (**Conditional recommendation; Low certainty of evidence**)

II. What imaging studies should be performed in children with suspected AHO?

1. In children with suspected AHO, we recommend obtaining plain radiography of the potentially infected bone(s) rather than not performing plain radiographs. (**Strong recommendation; Moderate certainty of evidence**)

Comment: Despite the low sensitivity of plain radiography for detecting AHO on initial presentation, other important diagnoses may be ruled out by this simple, quick, safe, and relatively inexpensive imaging test.

2. In children with suspected AHO requiring further imaging studies to confirm the diagnosis, we suggest magnetic resonance imaging (MRI) rather than scintigraphy (bone scan), computerized tomographic (CT) scan, or ultrasound (US). (**Conditional recommendation; Very low certainty of evidence**)

   Comment: For children suspected to have uncomplicated AHO, imaging may not be required to establish or confirm the diagnosis. However, if a child does not respond to medical therapy within 24 to 48 hours or signs and symptoms suggest a potential role for surgical debridement, MRI may be performed to better define the location and extent of infection or to evaluate for an alternative diagnosis such as a malignancy. In children with suspected AHO who have associated joint effusion or other concern for the spread of infection into an adjacent joint (or soft tissues), US evaluation may provide valuable diagnostic guidance for further management. Refer to the IDSA/PIDS *Guidelines for Diagnosing and Managing Acute Bacterial Arthritis in Pediatrics*.

III. What is the role of invasive procedures in the diagnosis of children with suspected AHO?

1. In children with suspected AHO, we suggest performing invasive diagnostic procedures to collect aspirates and/or biopsy specimens of bone and/or associated purulent fluid collections for routine microbiological studies (aerobic bacteriologic culture and Gram stain) rather than only performing noninvasive diagnostic tests. (**Conditional recommendation; Moderate certainty of evidence**)

   Comment: This recommendation places a high value on confirming the microbiological diagnosis to allow optimization of the spectrum and duration of antimicrobial therapy. The decision to implement this recommendation and its timing may be influenced by factors such as local feasibility of obtaining invasive diagnostic procedures (by interventional radiology [IR] or in the operating room), individual clinical situations (e.g., need for therapeutic surgical intervention and concerns regarding procedural risks or sedation), positive results of prior noninvasive diagnostic tests (e.g., blood culture), and duration of any prior antimicrobial therapy.

IV. For children who require empiric antimicrobial therapy for AHO, should antibiotics be initiated before invasive diagnostic procedures or can they be withheld until after these procedures are performed?

1. In children with presumed AHO who are ill-appearing or have rapidly progressive infection, we recommend starting empiric antimicrobial therapy immediately rather than withholding antibiotics until invasive diagnostic procedures are performed. (**Strong recommendation; Moderate certainty of evidence**)

   Comment: The yield of positive cultures from specimens collected by invasive diagnostic procedures (bone biopsy and aspirate), when obtained within 24 to 48 hours after initiation of antibiotic therapy, is similar to the yield when these cultures are obtained prior to the administration of antibiotics.

2. In children with presumed AHO who are not clinically ill and for whom an aspirate or biopsy by invasive diagnostic procedure is being planned prior to initiating antibiotics, we suggest withholding antibiotics for no more than 48 to 72 hours. (**Conditional recommendation; Very low certainty of evidence**)

   Comment: The decision to implement this recommendation incorporating a reasonable delay may be influenced by local accessibility to experts and resources to perform invasive diagnostic procedures or the time required for transport to a higher level of care if appropriate. For children likely to have AHO, it is advisable that children remain hospitalized for observation while withholding antibiotics until cultures can be obtained.

V. In children with suspected AHO, how should empiric antimicrobial therapy be selected?

1. In children with suspected AHO, we recommend using empiric antimicrobial therapy active against *Staphylococcus aureus* (*S. aureus*). (**Strong recommendation; Moderate certainty of evidence**)

   Comment: Antimicrobials with activity against community-acquired methicillin-resistant *S. aureus* (CA-MRSA) should be considered based on local susceptibility data and patient history with regard to previous CA-MRSA infections and/or colonization. In the presence of a clinical presentation, physical examination, exposure history, or other risk factors that either are inconsistent with *S. aureus*

infection or suggest need for coverage for other organisms, additional empiric antimicrobial coverage for pathogens other than *S. aureus* may be warranted (such as younger age for Kingella kingae or children with underlying hemoglobinopathies who have increased risk for Salmonella spp. infection).

VI. In children with AHO, in whom should invasive therapeutic procedures be performed at the time of diagnosis?

1. In children with AHO who present with sepsis or have a rapidly progressive infection, we recommend debridement of the infected bone and any associated abscesses as soon as possible after diagnosis, rather than treating with medical therapy alone. (**Strong recommendation; Moderate certainty of evidence**)

2. In a child with AHO who is clinically stable but is documented to have a substantial abscess (greater than 2 cm), we suggest debridement rather than treating with medical therapy alone. (**Conditional recommendation; Very low certainty of evidence**)

VII. In children with AHO, should surgical-site antimicrobial agents be added to systemic antimicrobial therapy?

1. In children with AHO requiring a surgical procedure, we recommend against routine use of surgical-site (i.e., instilled or implanted) antimicrobial agents. (**Strong recommendation; Very low certainty of evidence**)

   Comment: This recommendation places a high value on avoiding unnecessary harm and cost associated with this intervention.

VIII. In children with suspected or confirmed AHO who responds to initial empiric therapy, how should definitive parenteral and oral therapy be selected?

1. In children with confirmed AHO, selection of a definitive antibiotic regimen should be based on the principles of selecting an effective agent against the identified pathogen, with the narrowest spectrum, lowest adverse effect profile, and most favorable host tolerance. (**Good Practice Statement**)

2. In children with suspected AHO without an identified bacterial cause, selection of a definitive antibiotic regimen should be based on the principles of selecting an effective agent based on the most likely causative organism(s), with a spectrum comparable to that on which the patient demonstrated clinical and laboratory improvement, and with the lowest adverse effect profile and most favorable host tolerance. (**Good Practice Statement**)

IX. In children with suspected or confirmed AHO, what clinical and laboratory criteria should be used to assess the response to treatment?

1. In children with suspected or confirmed AHO receiving antimicrobial therapy, we suggest performing sequential monitoring of CRP in addition to serial clinical evaluation to assess response to therapy, rather than relying solely on clinical evaluation. (**Conditional recommendation; Low certainty of evidence**)

   Comment: Serial clinical examinations that assess the febrile response, pain, and musculoskeletal function are important clinical parameters to monitor response to treatment.

X. In hospitalized children with suspected or documented AHO responding well to initial intravenous therapy and deemed ready for hospital discharge, should they be (1) be transitioned to oral therapy or (2) outpatient parenteral antibiotic therapy (OPAT)?

1. For children with suspected or documented AHO who respond to initial intravenous antibiotic therapy, we recommend transition to an oral antibiotic regimen rather than OPAT when an appropriate (active against the confirmed or presumed pathogen(s)) and well-tolerated oral antibiotic option is available. (**Strong recommendation; Low certainty of evidence**)

   Comment: This recommendation places a high value on avoidance of harms and costs as well as on the improvement of acceptability, feasibility, and equity.

2. For children with suspected or documented AHO who respond to initial parenteral antibiotic therapy but for whom oral antimicrobial therapy is not feasible, we suggest transition to OPAT, rather than remaining in an acute-care hospital for the total duration of therapy. (**Conditional recommendation; Very low certainty of evidence**)

Comment: This recommendation places a high value on avoiding harms and costs associated with unnecessary and prolonged hospital stay. The decision to implement this recommendation and the selection of the type of OPAT (home, intermediate care facility, and clinic) may be influenced by the availability of local resources.

XI. In children with AHO presumed or proven to be caused by *S. aureus* who have had an uncomplicated course and responded to initial therapy, is a 3- to 4-week total duration of antibiotics (parenteral plus oral) recommended over a longer course?

1. In children with AHO presumed or proven to be caused by *S. aureus* who have had an uncomplicated course and responded to initial therapy, we suggest a 3- to 4-week duration of antibiotics rather than a longer course. (**Conditional recommendation; Very low certainty of evidence**)

   Comment: Although the optimal duration of therapy is best described for uncomplicated courses of AHO due to methicillin-susceptible *S. aureus* (MSSA), longer duration may be necessary for other pathogens, including more virulent strains of *S. aureus* (such as USA 300 and Panton Valentine leucocidin + [PVL+], whether CA-MRSA or MSSA), and for complicated courses.

XII. In children with AHO, should end-of-therapy imaging studies be routinely obtained?

1. In children with uncomplicated AHO that does not involve the physis, we recommend against obtaining end-of-therapy MRI (**Strong recommendation; Low certainty of evidence**) and suggest against routine end-of-therapy plain radiographs. (**Conditional recommendation; Very low certainty of evidence**)

2. In children with complicated AHO or with involvement of the physis, we suggest end-of-therapy imaging studies (plain radiographs and/or MRI). (**Conditional recommendation; Very low certainty of evidence**)

XIII. For children who do not respond to therapy, or relapse following completion of therapy, which interventions are appropriate to optimize

outcomes?

1. For children either experiencing primary treatment failure or early or late recurrence of AHO:

    a. Clinicians should assess the adequacy of the antimicrobial regimen (spectrum of activity, dosage and penetration to the site of infection, and adherence) before deciding on the need to broaden the spectrum or to restart antimicrobials. (**Good Practice Statement**)

    b. Clinicians should reassess the need for surgical intervention for therapeutic and/or diagnostic purposes. (**Good Practice Statement**)

    Comment: The accuracy of the diagnosis of AHO may need to be reconsidered, especially in culture-negative cases.

XIV. For children who have successfully completed antimicrobial therapy for documented or suspected AHO, in what situations is long-term follow-up required to address potential sequelae?

1. In children with AHO who are determined to be at risk of long-term adverse outcomes, we suggest a follow-up period of at least 1 year by specialists with experience treating children with AHO. (**Conditional recommendation; Low certainty of evidence**)

Evidence Rating Scheme

Scheme not provided.

Recommendation Rating Scheme

Scheme not provided.

Related Content

Supporting Documents

- Supplemental Material.
- IDSA Handbook for Clinical Practice Guidelines Development; 2018.

Implementation Tools

- Podcast; 2021 May 20.

Patient Education

No patient education materials available.

Disclaimer

If you desire to use content from the original clinical practice guideline cited herein, you must contact the guideline developer directly to obtain permission rights.

ECRI's Guideline Profiles are designed to provide information and assist decision-making. Variations in practice will inevitably, and appropriately, occur when clinicians take into account the needs and preferences of individual patients, available resources, and limitations unique to an institution or type of practice. Every healthcare professional using these Guideline Profiles is responsible for evaluating the appropriateness of applying them in a clinical setting.

TRUST Scorecard

Composition of Guideline Development Group (GDG)

Multidisciplinary GDG Members	**Yes**
Methodologist Involvement	**Yes**
Incorporation of Patient and Public Perspective	

Systematic Review of Evidence

Literature Search	
Study Selection	
Evidence Synthesis	

Foundations for Recommendations

Strength of Evidence Grade	
Description of Benefits and Harms of Recommendations	
Summary of Evidence Supporting Recommendations	
Strength of Recommendations Rating	
Clear Articulation of Recommendations	

Funding Source

Yes

Disclosure and Management of Financial Conflicts of Interests



External Review



Updating



Copyright © 2025 ECRI