2026 Clinical Practice Guideline Update by the Infectious Diseases Society of America and the Pediatric Infectious Diseases Society on The Management of Community-acquired Pneumonia in Infants and Children Older than 3 Months of Age: The Choice of Chest Tube Size

Shawn D. St. Peter[1], Krow Ampofo[2], Thomas Brogan[3], Michael D. Cabana[4], Claudia Espinosa[5], Todd A. Florin[6], Jeffrey S. Gerber[7], Michelle Gill[8], Debra L. Palazzi[9], Mark Sawyer[10], Angela Statile[11], Derek J. Williams[12], Sheena Patel[13], Mark I. Neuman[14*], Samir S. Shah[15*]**

[1]Children's Mercy Kansas City, Kansas, USA; [2]University of Utah, Utah, USA; [3]University of Washington School of Medicine, Seattle Children's Hospital, Washington State, USA; [4]Division of Academic General Pediatrics, Albert Einstein College of Medicine, New York, USA; [5]Division of Pediatric Infectious Diseases, University of South Florida, Florida, USA; [6]Division of Emergency Medicine, Ann & Robert H. Lurie Children's Hospital of Chicago, Department of Pediatrics, Northwestern University Feinberg School of Medicine, Illinois, USA; [7]Division of Infectious Diseases, Children's Hospital of Philadelphia and Department of Pediatrics, Perelman School of Medicine at the University of Pennsylvania, USA; [8]Divisions of Pediatric Allergy & Pulmonary Medicine and Infectious Diseases, Washington University School of Medicine, Missouri, USA; [9]Division of Infectious Diseases, Texas Children's Hospital and Baylor College of Medicine, Texas, USA; [10]Division of Pediatric Infectious Diseases, UC San Diego School of Medicine, California, USA; [11]Division of Hospital Medicine, Cincinnati Children's Hospital, Ohio, USA; [12]Vanderbilt University, Department of Pediatrics, Tennessee, USA; [13]Clinical Affairs and Practice Guidelines, Infectious Diseases Society of America, Virginia, USA [14]Division of Emergency Medicine, Boston Children's Hospital, Massachusetts, USA [15]Divisions of Hospital Medicine and Infectious Diseases, Cincinnati Children's Hospital Medical Center, Ohio, USA

*co-senior authors, **lead methodologist

ABSTRACT.
This paper is part of a larger clinical practice guideline on the diagnosis and management of parapneumonic effusion and empyema in children, developed by the Infectious Diseases Society of America. In this paper, the panel provides recommendations on the appropriate size of thoracostomy tube for drainage. The panel's recommendations are based upon evidence derived from systematic literature reviews and adhere to a standardized methodology for rating the certainty of evidence and strength of recommendation according to the GRADE (Grading of Recommendations Assessment, Development, and Evaluation) approach.

Key words. Chest tube, thoracostomy, pediatric, parapneumonic effusion

In children with parapneumonic effusion, should small bore (≤12Fr) or large bore (≥14Fr) thoracostomy tubes be used for drainage?

Recommendation: In children (3 months to 18 years) with parapneumonic effusion or empyema that necessitate drainage, the panel members suggest the use of small-bore (≤12Fr) thoracostomy tubes over large-bore (≥14FR) tubes *(conditional recommendation, very low certainty of evidence)*

Remark(s):

- Smaller tubes are effective at allowing for adequate drainage and for subsequent fibrinolysis.
- Since the last IDSA update, all published protocols used 12 Fr or smaller thoracostomy tubes.

*A **strong** recommendation means most informed people would choose the recommended course of action and* only a small proportion *would not.*
*A **conditional** recommendation means the majority of informed people would choose the suggested course of action but* many *would not.*

INTRODUCTION

Pleural drainage should be performed once parapneumonic effusions or empyemas become sufficiently large or complex or cause respiratory distress. Drainage may also be performed for diagnostic purposes. The mechanism for fluid drainage can range from thoracentesis to thoracostomy tube placement. Although thoracentesis without thoracostomy tube placement is sometimes performed, chest tube placement is standard following aspiration of fluid from a parapneumonic effusion. Additionally, thoracentesis does not allow for continued drainage should the effusion progress to empyema. Insertion of a thoracostomy tube allows immediate drainage and provides access to the pleural space for further interventions. This question addresses whether the size of the thoracostomy tube has therapeutic impact.

This guideline is part of a larger clinical practice guideline on the diagnosis and management of parapneumonic effusion and empyema in children, developed by the Pediatric Infectious Diseases Society (PIDS) and the Infectious Diseases Society of America (IDSA), and has been endorsed by the Pediatric Infectious Diseases Society (PIDS).

This guideline provides recommendations on the appropriate size thoracostomy tubes for drainage. These recommendations replace previous statements in the initial iteration of this guideline [1, 2]. These recommendations are intended for use by healthcare professionals who care for patients with parapneumonic effusion and empyema.

METHODS

The panel's recommendation is based on evidence derived from a comprehensive systematic literature review and adheres to a standardized methodology for rating the certainty of evidence and strength of recommendation according to the GRADE (Grading of Recommendations Assessment, Development, and Evaluation) approach [3]. The recommendations are labeled as "strong" or "conditional" according to an evaluation of the certainty of evidence, the balance between benefits and harms, patients' values and preferences, resources/cost, and other factors such as acceptability, feasibility, and equity. More details about the systematic review and guideline development processes are presented in the Supplementary Material.

A comprehensive literature search (through July 2024) was conducted as part of a systematic review. Key eligibility criteria at both the topic and clinical question levels guided the search and selection of studies for inclusion. For this question, the panel considered patients 3 months to 18 years of age with parapneumonic effusion. Studies with adult populations were excluded, as well as international populations in resource-limited areas. Randomized controlled trials and observational studies were screened for inclusion.

Studies were assessed for risk of bias using the Risk of Bias in Non-randomized Studies of Interventions (ROBINS-1) tool [4]. Included studies underwent critical appraisal according to the GRADE approach. An assessment of the benefits and harms of care options informed the recommendation(s) [3]. Details of the systematic review and guideline development processes are available in the Supplementary material.

SUMMARY OF EVIDENCE

A comprehensive search identified a single observational study addressing the panel's inclusion criteria [5]. In this retrospective cohort study, 20 children were treated with traditional chest tubes (14-16Fr), and 12 were treated with smaller tubes (7-12 Fr). There was no statistically significant difference in length of stay between cohorts with different catheter sizes (12.5 ± 5.6 days vs. 17.3 ± 8.5 days, p=0.13). The authors also found no statistically significant difference in the risk of adverse events or procedure-related complications between groups.

The overall certainty of evidence is very low due to serious risk of bias concerns (according to the ROBINS-I tool) and issues with imprecision resulting from the extremely small sample size.

The current recommendation reinforces the previous recommendation with supplemental and congruent evidence [1, 2].

RATIONALE FOR RECOMMENDATION

Comparative evidence shows similar outcomes between small-bore and large-bore chest tubes, suggesting there are no disadvantages to using smaller tubes to achieve adequate drainage. Since there are no clear benefits to using larger-bore thoracostomy tubes, and because smaller tubes are less invasive and associated with less pain, small-bore thoracostomy tube is recommended.

IMPLEMENTATION CONSIDERATIONS

Smaller chest tubes are readily available in any market. Therefore, there should not be local implementation barriers. A clinical setting with the ability to drain the pleural space should be able to use smaller tubes.

RESEARCH NEEDS

Given the small sample sizes of included studies, larger studies comparing large versus small bore thoracostomy tubes are needed. Additionally, future research should define the smallest bore tube that maintains the same efficacy for drainage and fibrinolytic administration, particularly among infants and young children

Acknowledgments: First, the panel would like to acknowledge the previous panel, under the leadership of John Bradley, for their work on the previous iteration of this larger guideline. The panel would like to acknowledge the contributions of Elena Guadagno, medical librarian, for the creation and execution of PICO-specific literature search(es). Rebecca Goldwater and Loretta Dzanya provided project coordination. The panel would also like to acknowledge the following organizations and selected external reviewers for their review of the draft manuscript: the American Academy of Pediatrics (AAP), the Pediatric Infectious Diseases Society (PIDS), Drs. Annabelle De St. Maurice, Jason Newland, Nanda Ramchandar, Pranavi Sreeramoju, and Surabhi (Sara) Vora.

Samir S. Shah is chair of the pediatric CAP guideline panel. Mark Neuman is the vice-chair of the panel. Shawn St Peter and Krow Ampofo served as clinical leads for the questions addressed in this manuscript. Remaining panelists assisted with conception and design of the analysis, interpretation of data, drafting and revising the recommendations and manuscript, and final approval of the recommendations and manuscript to be published. Nigar Sekercioglu and Sheena Patel, methodologists, were responsible for general project management, designing and performing the systematic review, and leading the panel according to the GRADE process.

Disclaimer: It is important to recognize that guidelines cannot always account for individual variation among patients. They are assessments of current scientific and clinical information provided as an educational service; are not continually updated and may not reflect the most recent evidence (new evidence may emerge between the time information is drafted and when it is published or read); should not be considered inclusive of all proper methods of care, or as a statement of the standard of care; do not mandate any course of medical care; and are not intended to supplant clinician judgment with respect to particular patients or situations. Whether to follow guidelines and to what extent is voluntary, with the ultimate determination regarding their application to be made by the clinician in the light of each patient's individual circumstances. While IDSA makes every effort to present accurate, complete, and reliable information, these guidelines are presented "as is" without any warranty, either express or implied. IDSA (and its officers, directors, members, employees, and agents) assume no responsibility for any loss, damage, or claim with respect to any liabilities, including direct, special, indirect, or consequential damages, incurred in connection with these guidelines or reliance on the information presented.

The guidelines represent the proprietary and copyrighted property of IDSA. All rights reserved. No part of these guidelines may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods, without the prior written permission of IDSA. Permission is granted to physicians and health care providers solely to copy and use the guidelines in their professional practices and clinical decision making. No license or permission is granted to any person or entity, and prior written authorization by IDSA is required to sell, distribute, or modify the guidelines, or to make derivative works of or incorporate the guidelines into any product, including, but not limited to, clinical decision support software or any other software product. Except for the permission granted above, any person or entity desiring to use the guidelines in any way must contact IDSA for approval in accordance with the terms and conditions of third-party use, in particular any use of the guidelines in any software product.

Financial support. This work was supported by the Infectious Diseases Society of America.

Possible conflicts of interest. Evaluation of relationships as potential conflicts of interest is determined by a review process. The assessment of disclosed relationships for possible COIs is based on the relative weight of the financial relationship (i.e., monetary amount) and the relevance of the relationship (i.e., the degree to which an association might reasonably be interpreted by an independent observer as related to the topic or recommendation of consideration). The following panelists have reported relationships with the indicated companies since 2018, when guideline development began; these relationships are **unrelated to the topic of community-acquired pneumonia (CAP)**. **K.K.A.** served as a scientific advisor for Merck; served as an advisor for Janssen Pharmaceuticals; received research funding from the National Institute of Allergy and Infectious Diseases (NIAID), the Centers for Disease Control and Prevention (CDC), and the State Government of Utah; receives research funding from Merck. **M.D.C.** served as an advisor for BioGaia, Thermo Fisher, Genentech, Novartis, and Nestlé; engaged in activities with the International Scientific Association for Probiotics and Prebiotics (ISAPP); served as a member of the U.S. Preventive Services Task Force (USPSTF); served as chair of the American Academy of Pediatrics Committee on Pediatric Research; received research funding from the Agency for Healthcare Research and Quality (AHRQ). **C.E.** served as an advisor for Sanofi, Janssen Pharmaceuticals, and Gilead; received honoraria from Sanofi, Astellas, the Kentucky Rural Health Association and Medavera for collaboration on the writing and publication of a manuscript addressing the use of molecular techniques in respiratory infections; received research funding from AstraZeneca, Merck, Enanta Pharmaceuticals, Clinetic, the National Institutes of Health (NIH), Melinta Therapeutics, Novavax, and Moderna; receives research funding from AHRQ, the Florida Department of Health, and CDC; serves as a member of the American Academy of Pediatrics Committee of Infectious Diseases and as a Board Director (District III) for the AAP Florida Chapter. **T.A.F.** received honoraria from DiaSorin and Medscape/WebMD; served in editorial roles with Pediatric Research and Pediatric Emergency Care; served as a council member for the Society for Pediatric Research; received research funding from the National Heart, Lung, and Blood Institute (NHLBI) and the Patient-Centered Outcomes Research Institute (PCORI); served as strategy and operations officer for the Society for Pediatric Research; serves on the Pediatric Academic Societies Board of Directors. **J.S.G.** received research funding from AHRQ, NIH, CDC, and PCORI. **M.G.** served as president of the Society for Pediatric Research; served as a member of the Society for Pediatric Research Board of Directors; served as a member of the Pediatric Academic Societies Board of Directors; served as ambassador for North American Regional Societies for the Society for Pediatric Research; receives research funding from NIAID; receives research funding from the St. Louis Children's Hospital Foundation. **D.L.P.** received royalties from UpToDate; received honoraria from the American Academy of Pediatrics: Pediatrics Review and Education Program (PREP) for Infectious Diseases, JAMA Pediatrics, and UpToDate; received honoraria from Lurie Children's Hospital and the American Medical Association (AMA); received research funding from AHRQ and the Pew Charitable Trusts; owned intellectual property from Elsevier; served as associate editor for the Journal of the Pediatric Infectious Diseases Society (JPIDS) and the American Academy of Pediatrics PREP ID; serves on the Pediatric Infectious Diseases Society (PIDS) Board of Directors and Executive Committee; serves as president of PIDS. **M.S.** received research funding from the County of San Diego Health and Human Services Agency. **A.M.S.** received research funding from PCORI, the Children and Youth with Special Health Care Needs National Research Network (CYSHCNet), and the Gerber Foundation; reported a family relationship in which a spouse served as a consultant for echocardiography study interpretation for the Midwest Cardiovascular Research and Education (MCORE) Foundation. **D.J.W.** received research funding from AHRQ and NIH for work related to the Seattle-based Pediatric Health Information Partnership (P-HIP) initiative aimed at improving pediatric mental health care; serves on the Executive Council for the Pediatric Research in Inpatient Setting (PRIS) Network; serves on the Editorial Board for the Journal of Hospital Medicine; receives research funding from AHRQ and NIH. **S.S.S.** served in editorial roles with JAMA Pediatrics for the American Medical Association; served as senior deputy editor and then editor-in-chief for the Journal of Hospital Medicine for the Society of Hospital Medicine; served as associate editor for the Journal of the Pediatric Infectious Diseases Society; served as a

Committee on Infectious Diseases member for the American Academy of Pediatrics; served as vice-chair for Pediatric Research in Inpatient Settings; received honoraria from the Society of Hospital Medicine; received research funding from NIAID, NHLBI, PCORI, and the Ohio Department of Public Health. **M.N.** served as associate editor for Pediatrics for the American Academy of Pediatrics; received research grants from Harvard University; serves as Co-Editor-in-Chief of Pediatric Emergency Care; receives honoraria from Wolters Kluwer for editorial roles with UpToDate and Pediatric Emergency Care; provides medical expert consultation, including medical record review and expert testimony in legal cases for law firms on issues not related to pneumonia.

The following panelists have reported relationships with the indicated companies since 2018, when guideline development began; these relationships are **related to the topic of community-acquired pneumonia (CAP)**. **K.K.A.** served in advisory roles involving patient enrollment for clinical trials with Johnson & Johnson and Merck related to lumicitabine, tedizolid, ceftolozane/tazobactam, and bezlotoxumab (all such relationships are no longer active). **D.L.P.** served on a data safety monitoring board for Pfizer for a trial related to azithromycin; received honoraria from Medscape related to an educational podcast (relationship ended in 2024); owns intellectual property related to educational materials for Elsevier; receives other remuneration from the AMA. **D.J.W.** received research funding from NIH/NIAID for work related to Vanderbilt/ICE-CAP/R01AI125642 and Vanderbilt/VTEU/HHSN272201300023I, CDC for work related to Vanderbilt/NVSN/U01IP001063 and AHRQ for work related to R01HS029331, the Reducing Overuse of Antibiotics with Decision Support (ROADS) study aimed at testing the safety and effectiveness of clinical decision support to promote antibiotic stewardship in lower respiratory tract infections in children; received in-kind research support from bioMérieux for procalcitonin assays related to CAP decision-making (this relationship is no longer active); reported a family relationship in which a spouse is employed by Pfizer and the funds are paid directly to them. **M.N.** served as a member of the Guideline Development Group of the World Health Organization for the Diagnosis and Management of Pneumonia and Diarrhea in Children. **All other authors reported no disclosures**.

Additional Information: More detailed information on the analysis and development of recommendations is available in the Supplementary file.

REFERENCES

1. Bradley JS, Byington CL, Shah SS, et al. Executive summary: the management of community-acquired pneumonia in infants and children older than 3 months of age: clinical practice guidelines by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America. Clin Infect Dis **2011**; 53(7): 617-30.
2. Bradley JS, Byington CL, Shah SS, et al. The management of community-acquired pneumonia in infants and children older than 3 months of age: clinical practice guidelines by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America. Clin Infect Dis **2011**; 53(7): e25-76.
3. Guyatt GH, Oxman Ad Fau - Vist GE, Vist Ge Fau - Kunz R, et al. GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. **2008**; (1756-1833 (Electronic)).
4. Sterne JA, Hernán MA, Reeves BC, et al. ROBINS-I: a tool for assessing risk of bias in non-randomised studies of interventions. BMJ **2016**; 355.
5. Lin CH, Lin Wc Fau - Chang J-S, Chang JS. Comparison of pigtail catheter with chest tube for drainage of parapneumonic effusion in children. **2011**; (2212-1692 (Electronic)).