

2024 Clinical Practice Guideline Update by the Infectious Diseases Society of America on Complicated Intra-abdominal Infections: Risk Assessment, Diagnostic Imaging, and Microbiological Evaluation in Adults, Children, and Pregnant People

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As the first part of an update to the clinical practice guideline on the diagnosis and management of complicated intra-abdominal infections in adults, children, and pregnant people, developed by the Infectious Diseases Society of America, the panel presents 21 updated recommendations. These recommendations span risk assessment, diagnostic imaging, and microbiological evaluation. The panel's recommendations are based on 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.

Keywords. intra-abdominal infection; guideline; risk assessment; diagnostic imaging; microbiological evaluation.

BACKGROUND

A complicated intra-abdominal infection extends beyond the hollow viscus of origin into the peritoneal space or an otherwise sterile region of the abdominal cavity and is associated with peritonitis with or without abscess formation. This terminology is not meant to describe the infection's severity or anatomy. An uncomplicated intra-abdominal infection involves only intramural inflammation of the gastrointestinal tract without

extension into the peritoneal space and can progress to a complicated infection if not adequately treated.

Complicated intra-abdominal infection is a commonly encountered clinical situation, with appendicitis alone affecting ~670 000 patients per year worldwide [1]. Intra-abdominal infection is the second most common cause of infectious morbidity and mortality in the intensive care unit. The requirement for intervention in most cases and the controversies surrounding the choice and nature of surgical procedures performed add layers of complexity to the management of these infections.

Guideline Scope

The scope of this guideline includes acute appendicitis, acute cholecystitis (both acalculous and calculous), acute cholangitis, acute diverticulitis, abdominal abscess, secondary bowel perforation, and acute necrotizing pancreatitis. Where relevant, available evidence for children, pregnant adults, and non-pregnant

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adults with community-acquired or hospital-acquired infections was reviewed. For the purposes of this guideline, the following conditions were excluded: cancer, solid organ or bone marrow transplant, tubo-ovarian abscess, spontaneous bacterial peritonitis, liver cirrhosis, continuous ambulatory peritoneal dialysis-associated infections, inflammatory bowel disease (including Crohn's disease and ulcerative colitis), non-perforated primary enteritis and/or colitis, or perforations resulting from diseases that are rare in North America (eg, intra-abdominal tuberculosis, histoplasmosis, strongyloidiasis).

This guideline is intended for use by healthcare professionals who care for patients with complicated intra-abdominal infections, including but not limited to specialists in infectious diseases, emergency care clinicians, hospitalists, surgeons, and intensivists.

Publication Scope

The last iteration of this guideline was published in 2010 [2]. The goals of this update were to incorporate contemporary evidence and apply the GRADE approach for the evidence appraisal process. Because of the wide scope and breadth of this guideline, a decision was made to split the guideline into several distinct parts to facilitate more timely completion. Eight manuscripts and their corresponding supplementary materials comprise the first part of the series [3–9]; subsequent parts will cover antimicrobial therapy and source control.

The focus of the guideline is primarily complicated intra-abdominal infection; however, because many questions covered in this publication pertain to the initial diagnosis of intra-abdominal infection, the panel provided recommendations for both complicated and uncomplicated intra-abdominal infection. The intended population for each recommendation is explicitly stated within each statement.

Many existing related guidelines from other medical associations were reviewed during the development process [10–21].

METHODS

The panel included clinicians with expertise in infectious diseases, pediatric infectious diseases, surgery, emergency medicine, microbiology, and pharmacology. Selected reviewers included clinicians with expertise in radiology, infectious diseases, and microbiology. Relevant recommendations have been reviewed and endorsed by the European Society of Clinical Microbiology and Infectious Diseases (ESCMID), the American Society for Microbiology (ASM), and the Pediatric Infectious Diseases Society (PIDS).

The panel's recommendations are based on 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 approach [22]. Strong recommendations

are made when the recommended course of action would apply to most people with few exceptions. Conditional recommendations are made when the suggested course of action would apply to the majority of people with many exceptions and shared decision making is important. Details of the systematic review and guideline development processes are available in the supplementary materials for each included manuscript.

RESULTS: RECOMMENDATIONS AND REMARKS

High-quality evidence was lacking for all recommendations. Where there were knowledge gaps, the panel opted to provide limited clinical guidance for reasonable approaches rather than no guidance at all, and these statements are specifically labeled as knowledge gaps.

In adults and children with complicated intra-abdominal infection, which severity of illness score for risk stratification calculated within 24 hours of hospital or ICU admission best predicts 30-day or in-hospital mortality?

Recommendation: Risk stratification according to severity of illness is important for management of complicated intra-abdominal infection. For adults with complicated intra-abdominal infection, if a severity of illness score is used, the panel suggests APACHE II; (<http://www.globalrph.com/apacheii.htm>) as the preferred severity of illness score for risk stratification within 24 hours of hospitalization or ICU admission (*conditional recommendation, low certainty of evidence*).

Remarks:

- Because the World Society of Emergency Surgery Sepsis Severity Score is specific to complicated intra-abdominal infection and performs well, it is an acceptable alternative to APACHE II for adults with complicated intra-abdominal infection.
- No severity of illness scoring system specific to complicated intra-abdominal infection can be recommended to guide management of pediatric patients with complicated intra-abdominal infection at present.

In adults with suspected acute appendicitis, should ultrasound (US), computed tomography (CT), or magnetic resonance imaging (MRI) be obtained as the initial imaging modality?

In adults with suspected appendicitis, if initial imaging is inconclusive, should US, CT, or MRI be obtained for subsequent imaging?

Recommendation: In non-pregnant adults with suspected acute appendicitis, the panel suggests obtaining an abdominal

CT as the initial imaging modality to diagnose acute appendicitis (*conditional recommendation, very low certainty of evidence*).

Remarks:

- Intravenous (IV) contrast is usually appropriate whenever a CT is obtained in adults with suspected acute appendicitis; however, CT without IV contrast also has high diagnostic accuracy in detecting acute appendicitis and may be appropriate [10].
- Because of CT's accuracy, immediate additional imaging studies beyond CT are usually not necessary. If a CT is negative but clinical suspicion for acute appendicitis persists, consider observation and supportive care, with or without antibiotics; if clinical suspicion is high, consider surgical intervention.
- US, when definitively positive or definitively negative, and MRI are also reasonably accurate and may precede CT, depending on the patient and clinical circumstances.

In children with suspected acute appendicitis, should US, CT, or MRI be obtained as the initial imaging modality?

In children with suspected appendicitis, if initial imaging is inconclusive, should US, CT, or MRI be obtained for subsequent imaging?

Recommendation: In children and adolescents with suspected acute appendicitis, the panel suggests obtaining an abdominal US as the initial imaging modality to diagnose acute appendicitis (*conditional recommendation, very low certainty of evidence*).

Remarks:

- US is generally readily available but is also operator-dependent and can yield equivocal results. MRI is not always readily available, and sedation may be required for young children. CT is generally readily available but involves radiation exposure and may require use of IV contrast or sedation.

Recommendation: In children and adolescents with suspected acute appendicitis, if initial US is equivocal/non-diagnostic and clinical suspicion persists, the panel suggests obtaining an abdominal MRI or CT as subsequent imaging to diagnose acute appendicitis rather than obtaining another US (*conditional recommendation, very low certainty of evidence*).

Remarks:

- US is generally available but is also operator-dependent and can yield equivocal results. MRI is not always readily available, and sedation may be required for young children. CT is generally readily available but involves radiation exposure and may require use of IV contrast or sedation.
- CT with IV contrast is usually appropriate when performed in children with suspected acute appendicitis after equivocal

ultrasound; however, CT without IV contrast may be appropriate [11].

- Depending on the clinical situation, observation may be appropriate instead of subsequent imaging.
- If there is a strong clinical suspicion for appendicitis after equivocal imaging, exploratory laparoscopy or laparotomy may also be considered if subsequent imaging delays appropriate management.

In pregnant people with suspected acute appendicitis, should US or MRI be obtained as the initial imaging modality?

In pregnant people with suspected appendicitis, if initial imaging is inconclusive, should US or MRI be obtained for subsequent imaging?

Recommendation: In pregnant people with suspected acute appendicitis, the panel suggests obtaining an abdominal US as the initial imaging modality to diagnose acute appendicitis (*conditional recommendation, very low certainty of evidence*).

Remarks:

- It would also be reasonable to initially obtain an MRI in pregnant people with suspected acute appendicitis if access to MRI is readily available. The conditional imaging strategy suggested (US, then MRI for equivocal results) would likely yield the same results as an MRI only.

Recommendation: In pregnant people with suspected acute appendicitis, if initial US is equivocal/non-diagnostic and clinical suspicion persists, the panel suggests obtaining an MRI as subsequent imaging to diagnose acute appendicitis (*conditional recommendation, very low certainty of evidence*).

Remarks:

- It would also be reasonable to initially obtain an MRI in pregnant people with suspected acute appendicitis if access to MRI is readily available. The conditional imaging strategy suggested (US, then MRI for equivocal results) would likely yield the same results as an MRI only.

In adults with suspected acute cholecystitis or acute cholangitis, should abdominal US or CT be obtained as the initial imaging modality?

In adults with suspected acute cholecystitis or acute cholangitis, if initial imaging is inconclusive, should CT, MRI/MRCP (magnetic resonance cholangiopancreatography), or HIDA (hepatobiliary iminodiacetic acid) be obtained for subsequent imaging?

Recommendation: In non-pregnant adults with suspected acute cholecystitis or acute cholangitis, the panel suggests abdominal US as the initial diagnostic imaging modality (*conditional recommendation, very low certainty of evidence*).

Remarks:

- The diagnosis of acute cholangitis should include clinical signs (jaundice, fever, chills, and right upper quadrant [RUQ] abdominal pain), laboratory findings (indicators of inflammation and biliary stasis), and imaging findings (biliary dilatation or evidence of an etiology [eg, stricture, stone, obstructing mass]).
- The panel did not identify any studies assessing the accuracy of abdominal US or CT for the diagnosis of acute cholangitis and relied on indirect evidence from acute cholecystitis.
- Because acute cholecystitis and acute cholangitis are uncommon in children, evidence in children was not systematically reviewed; however, it would be reasonable to mirror the imaging pathway for adults in children.

Recommendation: In non-pregnant adults with suspected acute cholecystitis or acute cholangitis, if initial US is equivocal/non-diagnostic and clinical suspicion persists, the panel suggests obtaining an abdominal CT scan as subsequent imaging to diagnose acute cholecystitis or acute cholangitis (*conditional recommendation, very low certainty of evidence*).

Remarks:

- The diagnosis of acute cholangitis should include clinical signs (jaundice, fever, chills, and RUQ abdominal pain), laboratory findings (indicators of inflammation and biliary stasis), and imaging findings (biliary dilatation or evidence of an etiology [eg, stricture, stone, obstructing mass]).
- CT with IV contrast is preferable and usually appropriate when CT is obtained for subsequent imaging [12].
- The panel did not identify any studies assessing the accuracy of abdominal US or CT for the diagnosis of acute cholangitis and relied on indirect evidence from acute cholecystitis.
- Because acute cholecystitis and acute cholangitis are uncommon in children, evidence in children was not systematically reviewed; however, it would be reasonable to mirror the imaging pathway for adults in children.

Recommendation: In non-pregnant adults with suspected acute cholecystitis, if both US and CT are equivocal/non-diagnostic and clinical suspicion persists, the panel suggests obtaining either an abdominal MRI/MRCP or HIDA scan as subsequent imaging to diagnose acute cholecystitis (*conditional recommendation, low certainty of evidence for HIDA, knowledge gap for MRI/MRCP*).

Remarks:

- If both abdominal US and CT are inconclusive but acute cholangitis is suspected, MRI/MRCP is a reasonable option.

- The diagnosis of acute cholangitis should include clinical signs (jaundice, fever, chills, and RUQ abdominal pain), laboratory findings (indicators of inflammation and biliary stasis), and imaging findings (biliary dilatation or evidence of an etiology [eg, stricture, stone, obstructing mass]).
- Because acute cholecystitis and acute cholangitis are uncommon in children, evidence in children was not systematically reviewed; however, it would be reasonable to mirror the imaging pathway for adults in children.

In pregnant people with suspected acute cholecystitis or acute cholangitis, should abdominal US or MRI be obtained as the initial imaging modality?

Recommendation: In pregnant people with suspected acute cholecystitis or suspected acute cholangitis, US or MRI can be considered as the initial diagnostic imaging modality; however, the panel is unable to recommend one imaging modality versus the other (*knowledge gap*).

Remarks:

- The diagnosis of acute cholangitis should include clinical signs (jaundice, fever, chills, and RUQ abdominal pain), laboratory findings (indicators of inflammation and biliary stasis), and imaging findings (biliary dilatation or evidence of an etiology [eg, stricture, stone, obstructing mass]).

In adults with suspected acute diverticulitis, should CT, US, or MRI be obtained as the initial imaging modality?

Recommendation: In non-pregnant adults with suspected acute diverticulitis, the panel suggests obtaining an abdominal CT as the initial diagnostic modality (*conditional recommendation, very low certainty of evidence*).

Remarks:

- IV contrast is usually appropriate whenever a CT scan is obtained and can be helpful to characterize and detect subtle bowel wall abnormalities and complications of diverticulitis; however, CT without IV contrast may be appropriate [13].

Recommendation: In non-pregnant adults with suspected acute diverticulitis, if CT is unavailable or contraindicated, the panel suggests obtaining an US or MRI as the initial diagnostic modality (*conditional recommendation, very low certainty of evidence*).

In pregnant adults with suspected acute diverticulitis, should CT, US, or MRI be obtained as the initial imaging modality?

Recommendation: In pregnant adults with suspected acute diverticulitis, US or MRI can be considered for imaging; however,

the panel is unable to recommend one imaging modality versus the other (*knowledge gap*).

In adults with suspected acute intra-abdominal abscesses, should abdominal US or CT be obtained as the initial imaging modality?

In adults with suspected acute intra-abdominal abscesses, if initial imaging is inconclusive, should MRI be obtained for subsequent imaging?

Recommendation: In nonpregnant adults and adolescents with suspected acute intra-abdominal abscess, the panel suggests obtaining an abdominal CT scan as the initial diagnostic imaging modality (*conditional recommendation, very low certainty of evidence*).

Remarks:

- When CT is obtained, the use of IV contrast may improve visualization of the abscess wall [13].
- Because of CT's accuracy, immediate additional imaging studies beyond CT are usually not necessary.

In children with suspected acute intra-abdominal abscesses, should abdominal US or CT be obtained as the initial imaging modality?

In children with suspected acute intra-abdominal abscesses, if initial imaging is inconclusive, should MRI be obtained for subsequent imaging?

Recommendation: In children with suspected acute intra-abdominal abscess, the panel suggests obtaining an abdominal US as the initial diagnostic imaging modality (*conditional recommendation, very low certainty of evidence*).

Remarks:

- At least 1 study [23] suggests MRI as a reasonable option for initial imaging of suspected acute intra-abdominal abscess in children.
- US is generally available but is also operator-dependent and can yield equivocal results. MRI is not always readily available, and sedation may be required for young children. CT is generally readily available but involves radiation exposure and may require use of IV contrast or sedation.

Recommendation: In children with suspected acute intra-abdominal abscess, if initial US is negative-equivocal/non-diagnostic and clinical suspicion persists, the panel suggests either CT or MRI as subsequent imaging to diagnose acute intra-abdominal abscess (*conditional recommendation, very low certainty of evidence*).

Remarks:

- US is generally available but is also operator-dependent and can yield equivocal results. MRI is not always readily

available, and sedation may be required for young children. CT is generally readily available but involves radiation exposure and may require use of IV contrast or sedation.

In pregnant people with suspected acute intra-abdominal abscesses, should abdominal US or MRI be obtained as the initial imaging modality?

Recommendation: In pregnant people with suspected acute intra-abdominal abscess, US or MRI can be considered as the initial diagnostic imaging modality; however, the panel is unable to recommend one versus the other (*knowledge gap*).

In adults and children with known or suspected intra-abdominal infection (uncomplicated or complicated), should blood cultures be obtained to effect a meaningful change in antimicrobial therapy?

Recommendation: In adults and children with suspected intra-abdominal infections who have an elevated temperature AND: hypotension and/or tachypnea and/or delirium, OR there is concern for antibiotic-resistant organisms that would inform the treatment regimen, the panel suggests obtaining blood cultures (*conditional recommendation, very low certainty of evidence*).

Remarks:

- Direct evidence on obtaining blood cultures in patients with intra-abdominal infections is lacking.
- Concern for antibiotic-resistant organisms includes high rates of regional resistance to commonly used agents administered as empiric treatment for intra-abdominal infections, patient history of any colonization or infection with organisms not susceptible to commonly used empiric regimens within the previous 90 days, antibiotic treatment within the previous 90 days, elderly or immunocompromised patients or patients with other significant comorbidities, and/or healthcare-associated infection.

Recommendation: In non-immunocompromised adults and children with suspected intra-abdominal infections who have a normal/elevated temperature but do not have hypotension, tachypnea, or delirium, and there is no concern for antibiotic-resistant organisms that would inform the treatment regimen, the panel suggests not routinely obtaining blood cultures (*conditional recommendation, very low certainty of evidence for adults/low certainty of evidence for children*).

Remarks:

- Direct evidence on obtaining blood cultures in patients with intra-abdominal infections is lacking.
- Clinicians should use their best judgment considering the benefits and risks of performing blood cultures. In select cases (eg, concern for antibiotic-resistant organisms, concern

for ascending cholangitis, complex intra-abdominal abscess), blood cultures may be helpful to assist with clinical decision making and further management. Concern for antibiotic-resistant organisms includes high rates of regional resistance to commonly used agents administered as empiric treatment for intra-abdominal infections, patient history of any colonization or infection with organisms not susceptible to commonly used empiric regimens within the previous 90 days, antibiotic treatment within the previous 90 days, elderly or immunocompromised patients or patients with other significant comorbidities, and/or healthcare-associated infection.

In adults and children with known or suspected intra-abdominal infection (uncomplicated or complicated), should cultures of intra-abdominal fluid be obtained to effect a meaningful change in antimicrobial therapy?

Recommendation: In adults and children with complicated intra-abdominal infection who are having a procedure for source control, the panel suggests obtaining intra-abdominal cultures to guide antimicrobial therapy (*conditional recommendation, moderate certainty of evidence*).

Remarks:

- When obtaining intra-abdominal cultures, fluid inoculation is the preferred method of collection.

Recommendation: In adults and children with uncomplicated appendicitis undergoing an appendectomy, the panel suggests not routinely obtaining intra-abdominal cultures (*conditional recommendation, low certainty of evidence*).

Remarks:

- Immunocompromised patients are at increased risk for antibiotic-resistant organisms and intra-abdominal cultures are generally warranted.
- At the time of surgery, if complicated disease is suspected/recognized, intra-abdominal cultures may be advised.

Notes

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Dr. Robert A. Bonomo is chair of the panel. In addition to Robert Bonomo, Drs. Anthony Chow, Morven Edwards, Romney Humphries, and Pranita Tamra served as leads for the topics covered in this first part of the series. Remaining panelists are leads for topics yet to be completed. Jennifer Loveless, lead methodologist, and Katelyn Donnelly, methodologist, were responsible for project management and designing and performing the data analyses. Dimpleen Kaur and Sarah Pahlke, methodologists, contributed to the analyses on risk assessment and whether to perform blood cultures, respectively. The entire panel was involved in the development of clinical questions, discussions of the literature, drafting of recommendations, and editing of the manuscript.

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All authors have submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Conflicts that the editors consider relevant to the content of the manuscript have been disclosed.

Additional information. The rationale for each recommendation is detailed in each individual manuscript. More detailed information on the analysis and development of recommendations is available in each manuscript's Supplementary material.

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