Supplementary Material for the 2024 Clinical Practice Guideline Update by the Infectious Diseases Society of America on Complicated Intra-abdominal Infections: Diagnostic Imaging of Suspected Acute Intra-abdominal Abscess in Adults, Children, and Pregnant People

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METHODS

Panel formation and conflicts of interest

The chair of the guideline panel was selected by the leadership of IDSA. Fifteen additional panelists comprised the full panel. The panel included clinicians with expertise in infectious diseases, pediatric infectious diseases, surgery, emergency medicine, microbiology, and pharmacology. Panelists were diverse in gender, geographic distribution, and years of clinical experience. Guideline methodologists oversaw all methodological aspects of the guideline development and identified and summarized the scientific evidence for each clinical question. IDSA staff oversaw all administrative and logistic issues related to the guideline panel.

All members of the expert panel complied with the IDSA policy on conflict of interest (COI), which requires disclosure of any financial, intellectual, or other interest that might be construed as constituting an actual, potential, or apparent conflict. Evaluation of such relationships as potential conflicts of interest was determined by a review process which included assessment by the Standards and Practice Guideline Committee (SPGC) Chair, the SPGC liaison to the Guideline panel and the Board of Directors liaison to the SPGC, and if necessary, the Conflicts of Interests Task Force of the Board. This assessment of disclosed relationships for possible COI was 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 independent observer might reasonably interpret an association as related to the topic or recommendation of consideration). The reader of these guidelines should be mindful of this when the list of disclosures is reviewed. See the Notes section at the end of this guideline for the disclosures reported to IDSA.

Practice recommendations

Clinical Practice Guidelines are statements that include recommendations intended to optimize patient care by assisting practitioners and patients in making shared decisions about appropriate health care for specific clinical circumstances. These are informed by a systematic review of evidence and an assessment of the benefits and harms of alternative care options [IOM 2011]. The “IDSA Handbook on Clinical Practice Guideline Development” provides more detailed information on the processes followed throughout the development of this guideline [IDSA CPG Handbook].

Review and approval process

Feedback was obtained from five external individual peer expert reviewers as well as the endorsing organizations. The IDSA Standards and Practice Guidelines Subcommittee (SPGs) and Board of Directors reviewed and approved the guideline prior to publication.

Process for updating

IDSA guidelines are regularly reviewed for currency. The need for updates to the guideline is determined by a scan of current literature and the likelihood that any new data would impact the recommendations. Any changes to the guideline will be submitted for review and approval to the appropriate Committees and Board of IDSA.

Clinical questions

Each clinical question was formatted according to the PICO style: Patient/Population (P), Intervention/Indicator (I), Comparator/Control (C), Outcome (O). For each PICO question, outcomes of interest were identified a priori and rated for their relative importance for decision-making.

Literature search

A medical librarian designed the literature searches for Ovid Medline, Embase, and Cochrane Library, including appropriate MeSH terms, where applicable. Searches were limited to studies published in English. The initial formal literature searches were performed in July to November 2018, and updated literature searches were conducted in March 2021 and October 2022. To supplement the electronic searches, reference lists of related articles and guidelines were reviewed for relevance.

MEDLINE

#1 exp Tomography, X-Ray Computed/

#2 exp Ultrasonography/

#3 (ultraso* or ultra-so* or echograph* or echo-graph* or echotomograph* or echoto-mograph* or sonograph* or sono-graph* or echocardiograph* or echo-cardiograph* or echoencephalograph* or echo-encephalograph* or endosonograph* or endo-sonograph*).tw,kf.

#4 ((tomodensitometr* or (ct or comput* or cat or electron)) adj3 (cine or scan* or xray* or x-ray* or tomograph*)).tw,kf.

#5 (HIDA or ((hepatobiliar* or hepato-biliar*) adj2 (scan* or imag*))).tw,kf.

#6 exp Magnetic Resonance Imaging/

#7 (MRI or MRIs or (magn* adj3 resonanc*) or ((magn* or MR or MRs) adj2 (imaging* or tomograph* or tomo-graph*))).tw,kf,jw.

#8 or/1-7

#9 Intraabdominal Infections/

#10 exp Abdominal Injuries/

#11 or/9-10

#12 Abscess/

#13 11 and 12

#14 exp Abdominal Abscess/

#15 ((intraabdom?n* or abdom?n*) adj5 (abscess* or abcess*)).tw,kf.

#16 or/13-15

#17 8 and 16

#18 Animals/ not (Animals/ and Humans/)

#19 ((animal or animals or canine* or cat or cats or dog or dogs or feline or hamster* or mice or monkey or monkeys or mouse or murine or pig or pigs or piglet* or porcine or primate* or rabbit* or rats or rat or rodent* or sheep*) not (human* or patient*)).ti,kf.

#20 17 not (18 or 19)

#21 limit 20 to english

EMBASE

#1 exp x-ray computed tomography/

#2 exp echography/

#3 (ultraso* or ultra-so* or echograph* or echo-graph* or echotomograph* or echoto-mograph* or sonograph* or sono-graph* or echocardiograph* or echo-cardiograph* or echoencephalograph* or echo-encephalograph* or endosonograph* or endo-sonograph*).tw,kw,kf.

#4 ((tomodensitometr* or (ct or comput* or cat or electron)) adj3 (cine or scan* or xray* or x-ray* or tomograph*)).tw,kw,kf.

#5 (HIDA or ((hepatobiliar* or hepato-biliar*) adj2 (scan* or imag*))).tw,kw,kf.

#6 exp nuclear magnetic resonance imaging/

#7 (MRI or MRIs or (magn* adj3 resonanc*) or ((magn* or MR or MRs) adj2 (imaging* or tomograph* or tomo-graph*))).tw,kw,jx,kf.

#8 or/1-7

#9 abdominal infection/

#10 exp abdominal injury/

#11 or/9-10

#12 abscess/

#13 11 and 12

#14 abdominal abscess/

#15 ((intraabdom?n* or abdom?n*) adj5 (abscess* or abcess*)).tw,kw,kf.

#16 or/13-15

#17 8 and 16

#18 (exp animal/ or exp juvenile animal/ or adult animal/ or animal cell/ or animal experiment/ or animal model/ or animal tissue/ or nonhuman/) not human/

#19 ((animal or animals or canine* or cat or cats or dog or dogs or feline or hamster* or mice or monkey or monkeys or mouse or murine or pig or pigs or piglet* or porcine or primate* or rabbit* or rats or rat or rodent* or sheep*) not (human* or patient*)).ti,kw,kf.

#20 17 not (18 or 19)

#21 limit 20 to English

COCHRANE

#1 (ultraso* or ultra-so* or echograph* or echo-graph* or echotomograph* or echoto-mograph* or sonograph* or sono-graph* or echocardiograph* or echo-cardiograph* or echoencephalograph* or echo-encephalograph* or endosonograph* or endo-sonograph*):ti,ab,kw

#2 ((tomodensitometr* or (ct or comput* or cat or electron)) NEAR/3 (cine or scan* or xray* or x-ray* or tomograph*)):ti,ab,kw

#3 (HIDA or ((hepatobiliar* or hepato-biliar*) NEAR/2 (scan* or imag*))):ti,ab,kw

#4 (MRI or MRIs or (magn* NEAR/3 resonanc*) or ((magn* or MR or MRs) NEAR/2 (imaging* or tomograph* or tomo-graph*))):ti,ab,kw,so

#5 #1 OR #2 OR #3 OR #4

#6 ((intraabdom?n* or abdom?n*) NEAR/5 (abscess* or abcess*)):ti,ab,kw

#7 #5 AND #6

Study selection

Titles and abstracts were screened in duplicate for all identified citations using Rayyan [Ouzzani 2016]. All potentially relevant citations were subjected to a full-text review, using predefined inclusion and exclusion criteria tailored to meet the specific population, intervention, and comparator of each clinical question. The steps of the literature selection process were supervised and reviewed by a guideline methodologist for the final selection of the relevant articles.

The following eligibility criteria were used:

Inclusion criteria:

- *Patient population*- Adults, children, or pregnant people with suspected intra-abdominal abscess; Pre-op or post-op
- *Intervention (diagnostic imaging modalities)*- Ultrasound, CT (including contrast), MDCT, MRI, HASTE and DWI (MR sequences), quick MRI, CT enterography (as an approximation for CT, given our lack of direct evidence), MR enterography (as an approximation for MRI, given our lack of direct evidence)
- *Comparator*- Another imaging modality, surgical findings (e.g., histopathology)
- *Outcomes*- Diagnostic accuracy (e.g., sensitivity, specificity)
- *Study design*- Randomized controlled trials (RCTs) with no date limit, observational studies published 2010-present.

Exclusion criteria:

- *Patient population*- Liver abscess, tubo-ovarian abscess, myeloidosis
- *Intervention*- Contrast-enhanced US, POCUS
- *Study design*- Observational trials older than 2010, abstracts and conference proceedings, letters to the editor, editorials, and review articles

Data extraction and analysis

A guideline methodologist in conjunction with panelists extracted the data for each pre-determined patient-important outcome. If a relevant publication was missing raw data for an outcome prioritized by the panel, an attempt was made to contact the author(s) for the missing data. Where applicable, data were pooled using random-effects model (fixed effects model for pooling of rates) using RevMan [RevMan].

Evidence to decision

Guideline methodologists prepared the evidence summaries for each question and assessed the risk of bias and the certainty of evidence. Risk of bias was assessed by using the QUIPS tool for studies addressing risk/prognostic factors [Hayden 2013] and the QUADAS-2 tool for diagnostic test accuracy studies [Whiting 2011]. The certainty of evidence was determined first for each critical and important outcome and then for each recommendation using the GRADE approach for rating the confidence in the evidence [Guyatt 2008, GRADE Handbook]. Evidence profiles were developed using the GRADEpro Guideline Development Tool [Guyatt 2008] and reviewed by panel members responsible for each PICO.

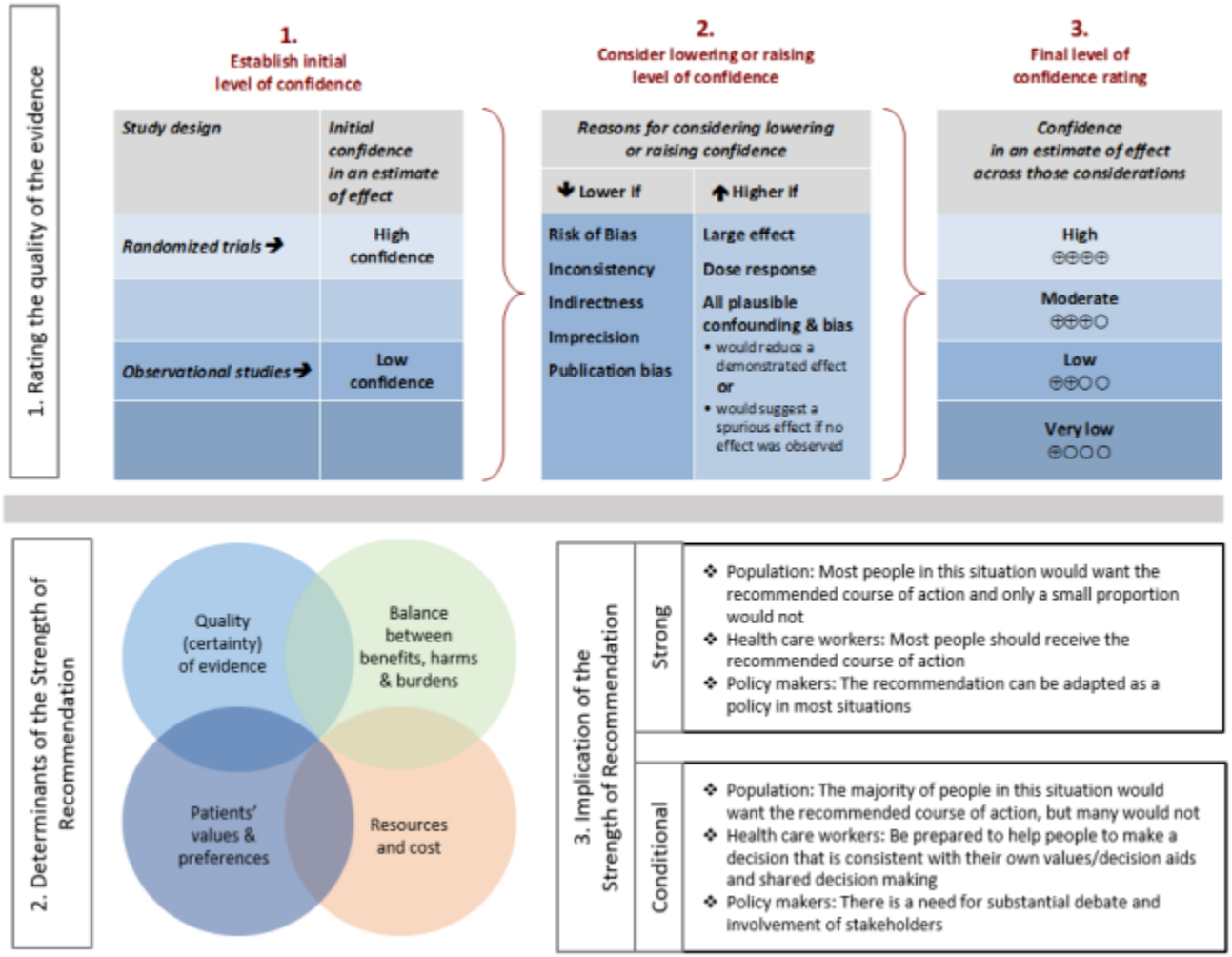
The Evidence to Decision framework [GRADEpro] was used to translate the evidence summaries into practice recommendations. All recommendations were labeled as either “strong” or “conditional” according to the GRADE approach [IDSA CPG Handbook]. The words “we recommend” indicate strong recommendations and “we suggest” indicate conditional recommendations. Supplementary Figure 1 provides the suggested interpretation of strong and conditional recommendations for patients, clinicians, and healthcare policymakers. For recommendations where the comparator treatment or tests

are not formally stated, the comparison of interest is implicitly referred to as “not using the intervention” (either not using a specific treatment or a diagnostic test).

All members of the panel participated in the preparation of the draft guideline and approved the recommendations.

TABLES AND FIGURES

Supplementary Figure 1. Approach and implications to rating the quality of evidence and strength of recommendations using GRADE methodology (unrestricted use of figure granted by the U.S. GRADE Network)



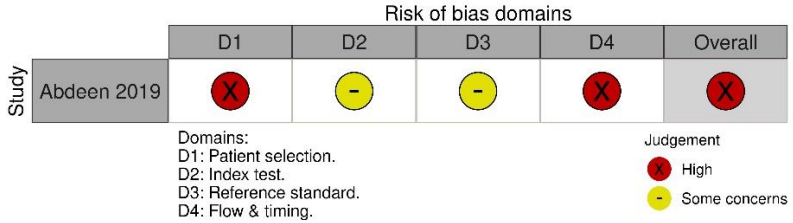
CHILDREN

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?

Supplementary Table 2. Characteristics of included study on acute intra-abdominal abscess in children

Author, year of publication	Location, years of data collection	Study design	Number of patients, diagnosis, and age / Pre-test probability	Population included	Index test	Reference standard	Flow and timing
Abdeen 2019	Canada 2013-2018	Retrospective cohort study	82 children Mean age 12.3 years (range 4-17)	Children <18 years with suspected appendiceal abscess confirmed on US and MRI	MRI, US	Imaging confirmation	Patients underwent both US and MRI to identify a safe drainage pathway for suspected abscess

Supplementary Table 8. Risk of bias for included study on acute intra-abdominal abscess in children



Supplementary Table 3. MRI and US to establish a safe drainage pathway for intra-abdominal abscess in children (indirect evidence for MRI and US diagnostic accuracy)

Imaging modality	Presence of safe drainage pathway
US (Abdeen 2019)	75-81%
MRI (Abdeen 2019)	86-98%

ADULTS

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

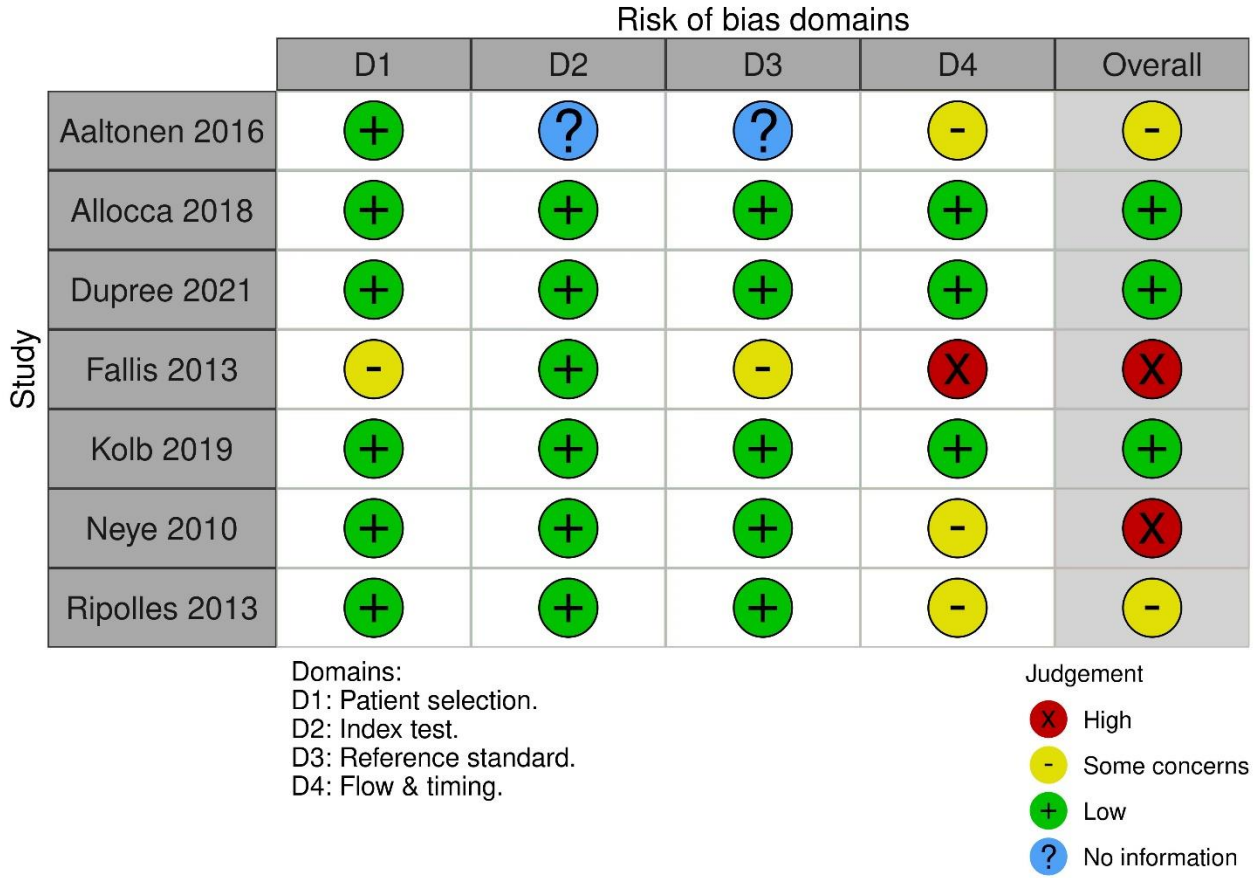
In adults with suspected acute intra-abdominal abscesses, if initial imaging is inconclusive, should MRI be obtained for subsequent imaging?

Supplementary Table 1. Characteristics of included studies for acute intra-abdominal abscess in adults

Author, year of publication	Location, years of data collection	Study design	Number of patients, diagnosis, and age / Pre-test probability	Population included	Index test	Reference standard	Flow and timing
Aaltonen 2016	Finland 2011-2015	Retrospective chart review	55 patients with known Crohn's Disease Median age 45 years (range 17-82) 5 abscesses diagnosed; pre-test probability: 9.09%	Adult patients with Crohn's Disease presenting as candidates for elective surgery	MRE	Intraoperative findings	MRE conducted pre-operatively at most 4 months before surgical procedure
Allocca 2018	Italy 2015-2017	Prospective cohort study	60 patients with ileal and/or colonic Crohn's Disease with at least 6 months history of diagnosis Mean age at diagnosis 29 years (range 20-36); no data provided for age of patients at time of study participation 1 abscess diagnosed; pre-test probability: 1.67%	Adult (>18 years) patients with a minimum 6 month history of ileal and/or colonic Crohn's Disease who reported to a tertiary referral center for routine disease monitoring	US	MRE	MRE and US were performed within 1 week of each other in no specific order
Dupree 2021	Germany 3-year period (years not stated)	Retrospective review	73 adults Median age 43.6 years (range 19-68) 5 abscesses diagnosed; pre-test probability: 6.85%	Patients who underwent CT scans for suspected intra-abdominal or pulmonary complication post-bariatric surgery	CT	Final diagnosis	CT with oral and IV contrast was performed for patients with suspected intra-abdominal or pulmonary complication
Fallis 2013	United Kingdom 2007-2012	Prospective and retrospective cohort study (first 18 patients retrospective,	51 patients with Crohn's Disease Mean age 41.3 years (range 17-79)	Adults undergoing planned laparotomy for Crohn's Disease	MRE	Intraoperative findings + pathology	Surgery performed a mean 10.8 weeks after imaging (median 7 weeks, range 1-52 weeks)

		subsequent 37 prospective)	9 abscesses diagnosed; pre-test probability: 17.65%				
Kolb 2019	2009-2010	Retrospective review	51 patients who underwent contrast-enhanced CT for suspected appendicitis, 7 of whom had confirmed abscess Mean age 41.0 years for entire data set 7 abscesses diagnosed; pre-test probability: 13.7%	Adults	CT	Surgical findings and histopathology or 3-month follow-up	Contrast-enhanced CT performed for suspected appendicitis
Neye 2010	Germany 2003-2009	Prospective cohort study	58 patients with known Crohn's Disease Mean age 36.3 years (range 13-86) 10 abscesses diagnosed; pre-test probability: 17.24%	Patients with known Crohn's Disease presenting for routine follow-up and disease monitoring	US	Clinical data and surgical findings + other imaging (MRI and/or CT and/or enteroclysis, and/or endoscopy with biopsy)	Additional imaging performed within at least 2 weeks after US
Ripolles 2013	Spain 2006-2012	Retrospective chart review	50 patients with inflammatory masses (71 masses but only 57 analyzed) Subset of the patient population had a diagnosis of Crohn's Disease Mean age 38.94 years (range 21-67) 35 abscesses diagnosed; pre-test probability 100%	Patients who underwent CEUS who had the terms "inflammatory mass", "phlegmon", or "abscess" in the sonographic reports	CE-US	CT, MRI, surgery and/or percutaneous drainage within 2 weeks of CE-US	Every patient with acute or subacute abdominal pain is admitted for US which is always initially performed to rule out the presence of complications in patients with Crohn's Disease and clinical relapse. CEUS is always performed if an inflammatory mass is detected on US.

Supplementary Table 4. Risk of bias assessment for included studies on acute intra-abdominal abscess in adults



Supplementary Table 5. GRADE Evidence Profile: Should CT be used to diagnose intra-abdominal abscess in adults?

CT vs. reference standard (Dupree 2021, Kolb 2022)	
Sensitivity	1.00 (95% CI: 0.48 to 1.00) (Dupree 2021, Kolb 2019)
Specificity	1.00 (95% CI: 0.95 to 1.00) (Dupree 2021)

Prevalences	7% (Dupree 2021)	14% (Kolb 2019)

Outcome	№ of studies (№ of patients)	Study design	Factors that may decrease certainty of evidence					Effect per 1,000 patients tested		Test accuracy CoE
			Risk of bias	Indirectness	Inconsistency	Imprecision	Publication bias	pre-test probability of 7%	pre-test probability of 14%	
True positives (patients with intra-abdominal abscess)	2 studies 80 patients	cross-sectional (cohort type accuracy study)	not serious	serious[a]	not serious	serious[b,c]	none	70 (34 to 70)	140 (67 to 140)	⨁⨁◯◯ LOW
False negatives (patients incorrectly classified as not having intra-abdominal abscess)								0 (0 to 36)	0 (0 to 73)	
True negatives (patients without intra-abdominal abscess)	2 studies 80 patients	cross-sectional (cohort type accuracy study)	not serious	serious[a]	not serious	serious[b]	none	930 (884 to 930)	860 (817 to 860)	⨁⨁◯◯ LOW
False positives (patients incorrectly classified as having intra-abdominal abscess)								0 (0 to 46)	0 (0 to 43)	

Explanations

a. Indirect comparisons
b. Small sample size
c. Wide CIs

Supplementary Table 6. GRADE Evidence Profile: Should US be used to diagnose intra-abdominal abscess in adults?

US vs. reference standard (Alloca 2018, Neye 2010)	
Sensitivity	0.90 to 1.00
Specificity	0.97 to 0.99

Prevalences	2% (Alloca 2018)	17% (Neye 2010)

Outcome	№ of studies (№ of patients)	Study design	Factors that may decrease certainty of evidence					Effect per 1,000 patients tested		Test accuracy CoE
			Risk of bias	Indirectness	Inconsistency	Imprecision	Publication bias	pre-test probability of 2% (Allocca 2018)	pre-test probability of 17% (Neye 2010)	
True positives (patients with intra-abdominal abscess)	2 studies 138 patients	cross-sectional (cohort type accuracy study)	serious[a]	very serious[b]	not serious	serious[c]	none	18 to 20	153 to 170	⨁◯◯◯ VERY LOW
False negatives (patients incorrectly classified as not having intra-abdominal abscess)								0 to 2	0 to 17	
True negatives (patients without intra-abdominal abscess)	2 studies 138 patients	cross-sectional (cohort type accuracy study)	serious[a]	very serious[b]	not serious	serious[c]	none	951 to 970	805 to 822	⨁◯◯◯ VERY LOW
False positives (patients incorrectly classified as having intra-abdominal abscess)								10 to 29	8 to 25	

Explanations

a. Per QUADAS-2 assessment
b. Indirect comparisons, indirect population (patients with Crohn's disease)
c. Small sample size

Supplementary Table 7. GRADE Evidence Profile: Should MRI be used to diagnose intra-abdominal abscess in adults?

MRI vs. a reference standard (Aaltonen 2016, Fallis 2013)	
Sensitivity	0.80 to 0.90
Specificity	0.90 to 0.98

Prevalences	9% (Aaltonen 2016)	18% (Fallis 2013)

Outcome	№ of studies (№ of patients)	Study design	Factors that may decrease certainty of evidence					Effect per 1,000 patients tested		Test accuracy CoE
			Risk of bias	Indirectness	Inconsistency	Imprecision	Publication bias	pre-test probability of 9%	pre-test probability of 18%	
True positives (patients with intra-abdominal abscess)	2 studies 110 patients	cross-sectional (cohort type accuracy study)	serious[a]	very serious[b]	not serious	serious[c]	none	72 to 81	144 to 162	⨁◯◯◯ VERY LOW
False negatives (patients incorrectly classified as not having intra-abdominal abscess)								9 to 18	18 to 36	
True negatives (patients without intra-abdominal abscess)	2 studies 110 patients	cross-sectional (cohort type accuracy study)	serious[a]	very serious[b]	not serious	serious[c]	none	819 to 892	738 to 804	⨁◯◯◯ VERY LOW
False positives (patients incorrectly classified as having intra-abdominal abscess)								18 to 91	16 to 82	

Explanations

a. Per QUADAS-2 assessment
b. Indirect comparisons, indirect population (patients with Crohn's disease), indirect intervention (MRE)
c. Small sample size

Supplementary Table 9. GRADE Evidence Profile: Should MRI or US be used to diagnose intra-abdominal abscess in children?

MRI vs. a reference standard (Abdeen 2019)	US vs. a reference standard (Abdeen 2019)
Safe drainage pathway: 86-98%	Safe drainage pathway: 75-81%

Prevalence	100% (Abdeen 2019)

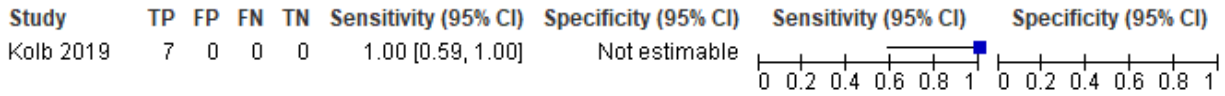
Outcome	№ of studies (№ of patients)	Study design	Factors that may decrease certainty of evidence					
			Risk of bias	Indirectness	Inconsistency	Imprecision	Publication bias	
True positives (patients with intra-abdominal abscess)	1 study 82 patients	cohort study	serious[a]	very serious[b]	N/A	serious[c]	none	⨁◯◯◯ VERY LOW
False negatives (patients incorrectly classified as not having intra-abdominal abscess)								
True negatives (patients without intra-abdominal abscess)	1 study 82 patients	cohort study	serious[a]	very serious[b]	N/A	serious[c]	none	⨁◯◯◯ VERY LOW
False positives (patients incorrectly classified as having intra-abdominal abscess)								

Explanations

a. Per QUADAS-2 assessment
b. Indirect outcomes (ability to establish a safe drainage pathway)
c. Small sample size

Initial imaging in adults with suspected appendiceal abscess

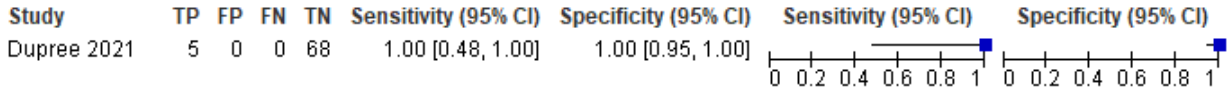
Supplementary Figure 2. Initial CT in adults with suspected appendiceal abscess



Total n: 1 study, 7 patients

Initial imaging in adults with suspected postoperative abscess

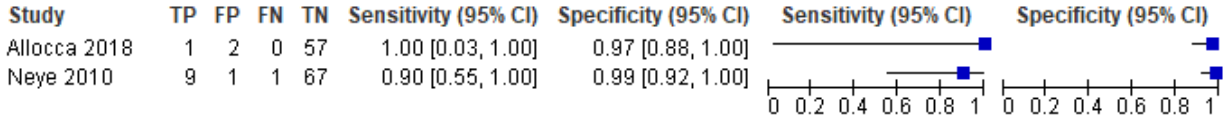
Supplementary Figure 3. Initial CT in adults with suspected postoperative abscess



Total n: 1 study, 73 patients

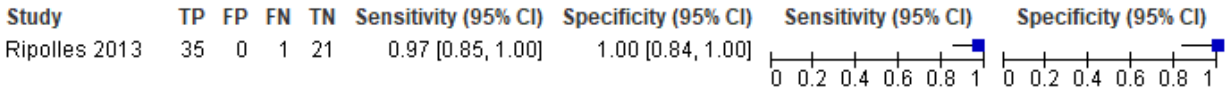
Initial imaging in adolescents/adults with known Crohn's Disease and suspected abscess

Supplementary Figure 4. Initial US in adolescents/adults with known Crohn's disease and suspected abscess



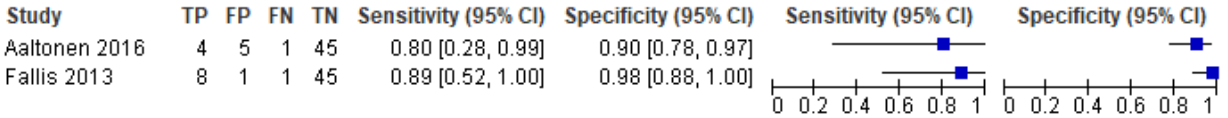
Total n: 2 studies, 138 patients
Median (range) sensitivity: 0.95 (0.90-1.00); Median (range) specificity: 0.98 (0.97-0.99)

Supplementary Figure 5. Initial CE-US in adolescents/adults with known Crohn's disease and suspected abscess



Total n: 1 study, 57 patients

Supplementary Figure 6. Initial MRE in adolescents/adults with known Crohn's disease and suspected abscess



Total n: 2 studies, 110 patients
Median (range) sensitivity: 0.85 (0.80-0.89); Median (range) specificity: 0.94 (0.90-0.98)

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