***Mini Review***

# Diagnostic accuracy of pelvic imaging for acute pelvic inflammatory disease in an emergency care setting: a systematic review and meta-analysis

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The aim of this review is to investigate the diagnostic accuracy or performance of contrast-enhanced computed tomography (CT) and magnetic resonance imaging (MRI) for acute pelvic inflammatory disease (PID) in an emergency care setting. We searched for studies on the diagnostic test accuracy of contrast-enhanced CT or MRI for women of reproductive age with acute abdominal pain using MEDLINE, Embase, Cochrane Central Register of Controlled Trials, International Clinical Trials Registry Platform, and ClinicalTrials.gov. The reference standard was gynecological examinations by gynecologists using standard diagnostic criteria with or without laparoscopy or transcervical endometrial biopsy. Two reviewers undertook screening of records, data extraction, and assessment of the risk of bias in each included study using the Quality Assessment of Diagnostic Accuracy Studies-2 tool. A bivariate model was used for the meta-analysis. Of 2,619 screened studies, three studies investigating contrast-enhanced CT and one study investigating MRI were eligible, including a total 635 patients and with a median prevalence of acute PID of 29%. All of the included studies had a high risk of bias for a reference standard and had some applicability concerns. Contrast-enhanced CT had a pooled sensitivity of 0.79 (95% confidence interval [CI], 0.52–0.93) and specificity of 0.99 (95% CI, 0.94–1.00). Magnetic resonance imaging had a sensitivity of 0.95 (95% CI, 0.76–1.00) and specificity of 0.89 (95% CI, 0.52–1.00). Contrast-enhanced CT might serve as a practical alternative to gynecological examination in the diagnosis of acute PID in an emergency care setting, however, the evidence was uncertain. The evidence on MRI was also very uncertain.

**Key words:** Acute pelvic inflammatory disease, contrast-enhanced computed tomography, diagnostic accuracy, magnetic resonance imaging, systematic review and meta-analysis

## INTRODUCTION

PELVIC IN flammatory disease (PID) is an infection of the female upper reproductive tract,[1] and is one of the most common causes of acute abdomen at an emergency department.[2] Gynecological examination (e.g., pelvic examination or speculum examination) is the gold standard for the

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diagnosis of acute PID.[3] However, this usually requires a gynecologist, which may be difficult to implement in an emergency care setting. In such cases, emergency physicians need to assess and diagnose this condition.[4] It is difficult to accurately diagnose PID because of the wide variation and severity of symptoms.[5] Furthermore, delayed care of PID has been associated with worse long-term outcomes.[6–8] Thus, useful methods that can accurately and immediately diagnose PID in any setting should be established.

Pelvic imaging such as computed tomography (CT) and magnetic resonance imaging (MRI) can investigate not only causes of acute abdominal pain but also acute PID. This is also useful in a setting where a gynecological examination is not available, when it takes time to consult a gynecologist at an emergency department, and when a consultation is not available in limited settings (e.g., in rural areas[9] or nighttime emergency room). However, although transabdominal or transvaginal ultrasonography usually plays an important role for a diagnosis in patients with acute abdominal pain, including acute PID, because these techniques are easier, more available, and less costly than CT or MRI, evidence regarding their diagnostic accuracy for acute PID is not established.[10]

There are no systematic reviews on pelvic imaging for acute PID. Moreover, current guidelines do not touch upon this topic. The established evidence of this topic is also scant. Thus, it is necessary to clarify and establish the current evidence on whether pelvic imaging can diagnose acute PID. If pelvic imaging such as CT and MRI can accurately identify acute PID, it is possible to diagnose this condition using pelvic imaging without a gynecological examination. In an emergency care setting where a gynecological examination is not always available, pelvic imaging could replace a gynecological examination as a diagnostic method of acute PID.

We undertook a systematic review and meta-analysis to determine the diagnostic accuracy of pelvic imaging in the diagnosis of acute PID among women of reproductive age. Our objective was to determine whether pelvic imaging is likely to become an alternative diagnostic tool to gynecological examination in the diagnosis of acute PID.

## METHODS

THIS STUDY WAS a systematic review and meta-analysis of diagnostic test accuracy (DTA). We adhered to the methodological standards outlined in the Cochrane Handbook for Systematic Reviews of Diagnostic Test Accuracy[11] and used the Preferred Reporting Items for Systematic Reviews and Meta-Analysis of Diagnostic Test Accuracy (PRISMA-DTA) guidelines (Table S1).[12] This study was registered at protocols.io in June 13, 2021.[13] We described the methods in the supplementary file because of the limited number of words, in addition to the figures and Tables.

### Population, index test, target condition, and reference standard

The target population were women of reproductive age with acute lower abdominal pain suspicious for acute PID and who required gynecological examinations. We excluded pregnant and postmenopausal women. The index test of interest was a contrast-enhanced CT and MRI judged by any physician. The target condition was defined as acute PID (i.e., any combination of endometritis, salpingitis, tubo-ovarian abscess, and pelvic peritonitis within 30 days of abdominal pain).[3,5] Perihepatitis (i.e., Fitz–Hugh–Curtis syndrome) was excluded because of differences in clinical manifestation. The reference standard was defined as gynecological examinations by gynecologists using standard diagnostic criteria with or without laparoscopy or transcervical endometrial biopsy. Although gynecologists usually use transvaginal ultrasonography for investigating acute PID, this diagnostic tool is not necessary to diagnose this condition.[3] Thus, in this review, the findings of transvaginal ultrasonography were not adopted as part of the reference standard. In addition, we also accepted other diagnostic criteria for acute PID used in primary studies.

### Study eligibility and selection

We included all studies investigating the diagnostic accuracy of pelvic imaging for detection of acute PID in any setting. Two pairs of four review authors independently screened the abstracts and titles according to the review inclusion criteria, followed by full-text screening of those ruled eligible.

### Electronic searches

We searched MEDLINE, Embase, Cochrane Central Register of Controlled Trials, International Clinical Trials Registry Platform, and ClinicalTrials.gov, according to the search strategy (Table S2) built by the authors, who included those with experience in building search strategies for systematic reviews. We did not restrict language, year of publication, or publication status.

### Data extraction and quality assessment

Two pairs of four review authors independently extracted data from each included study. The Quality Assessment of Diagnostic Accuracy Studies (QUADAS-2) tool[14] was

independently used to evaluate the risk of bias and applicability. The signaling question in the QUADAS-2 tool was revised according to the review question. We did not perform a statistical assessment of publication bias due to the lack of evidence of publication bias in DTA studies and the absence of reliable methods for such assessment.[11]

## Statistical analysis and data synthesis

The diagnostic accuracy of contrast-enhanced CT and MRI was evaluated separately. In the meta-analysis, we used a bivariate model to calculate the point estimate of sensitivity and specificity with 95% confidence intervals (CIs), and a hierarchical summary receiver operating characteristic (ROC) nonlinear mixed model to report the summary ROC. We assumed four scenarios for the prevalence of acute PID: expected prevalence for an emergency department in Japan[15,16] and lowest prevalence, median prevalence, and highest prevalence in the included studies. All analyses were undertaken using MetaDTA[17] and Review Manager 5.4.1 (Cochrane Collaboration, London, UK). All statistical analyses were undertaken with a two-sided alpha error of 5%.

## Sensitivity analysis

We assessed the robustness of the results by excluding studies with different criteria of the index test. We carried out an ad hoc sensitivity analysis excluding studies that we were not able to evaluate using only one positive finding, not overall positive findings of the index test because of available data from only one positive finding.

## Differences between protocol and review

We undertook a meta-analysis of the results on contrast-enhanced CT and MRI separately in terms of clinical heterogeneity. Under the assumption that the findings for a diagnosis were the same within a technique, we pooled results using a bivariate model to increase the ease of interpretation. We could not carry out the planned subgroup analyses due to limited data and the small number of included studies.

# RESULTS

A TOTAL OF 2,619 studies were screened, leaving 41 full-text studies for assessment of eligibility. Four studies met the eligibility criteria and were included in the quality assessment and meta-analysis (Fig. 1). We described the reasons why 37 studies were excluded from full-text screening (Table S3).

## Study characteristics

The characteristics of the four included studies are summarized in Table 1. Three studies retrospectively investigated the diagnostic accuracy of contrast-enhanced CT,[18–20] and one study retrospectively investigated that of MRI.[21] All three studies investigating contrast-enhanced CT were set at an emergency department. One study investigating MRI was set at an obstetrics and gynecology department. Positive findings of the index test were interpreted by a radiologist in all studies. Data of diagnostic performance in Jung *et al.*[18] was solely obtained from each positive finding for acute PID; we used right and left tubal thickening as positive criteria of the index test for acute PID because this finding was clinically specific to the diagnosis of acute PID.[22] The reference standard was either gynecological examination or invasive procedures in three studies,[18–20] or both in one study.[21]

## Risk of bias assessment

Figure 2 shows the results of the methodological quality assessment of the included studies using the QUADAS-2 tool. For patient selection, we evaluated one study as having a high risk of bias and high concern in applicability because it was a case–control study.[19] For the index test, all of the included studies were evaluated as having low risk of bias, while for reference standard, all of the included studies were evaluated as having a high risk of bias. For flow and timing, three of four studies were evaluated as having high risk of bias because the time between the index test and reference standard was not reported and all patients in these studies did not receive the same reference standard.[18–20] In addition, we evaluated three studies investigating contrast-enhanced CT at an emergency department as having some concerns in applicability due to patient selection and interpretation of the index test, while one study investigating MRI was evaluated as having high concern in applicability because the setting was a gynecological department. The details of the assessment are shown in Table S4.

## Findings in primary analysis and sensitivity analysis

Table 2 shows a summary of the findings in this review. Figure 3 shows forest plots and summary ROC plots with the sensitivity and specificity in all of the four included studies. Regarding contrast-enhanced CT, the pooled sensitivity and specificity was 0.79 (95% CI, 0.52–0.93) and 0.99 (95% CI, 0.94–1.00), respectively. Regarding MRI, the sensitivity and specificity was 0.95 (95% CI, 0.76–1.00) and 0.89 (95% CI,

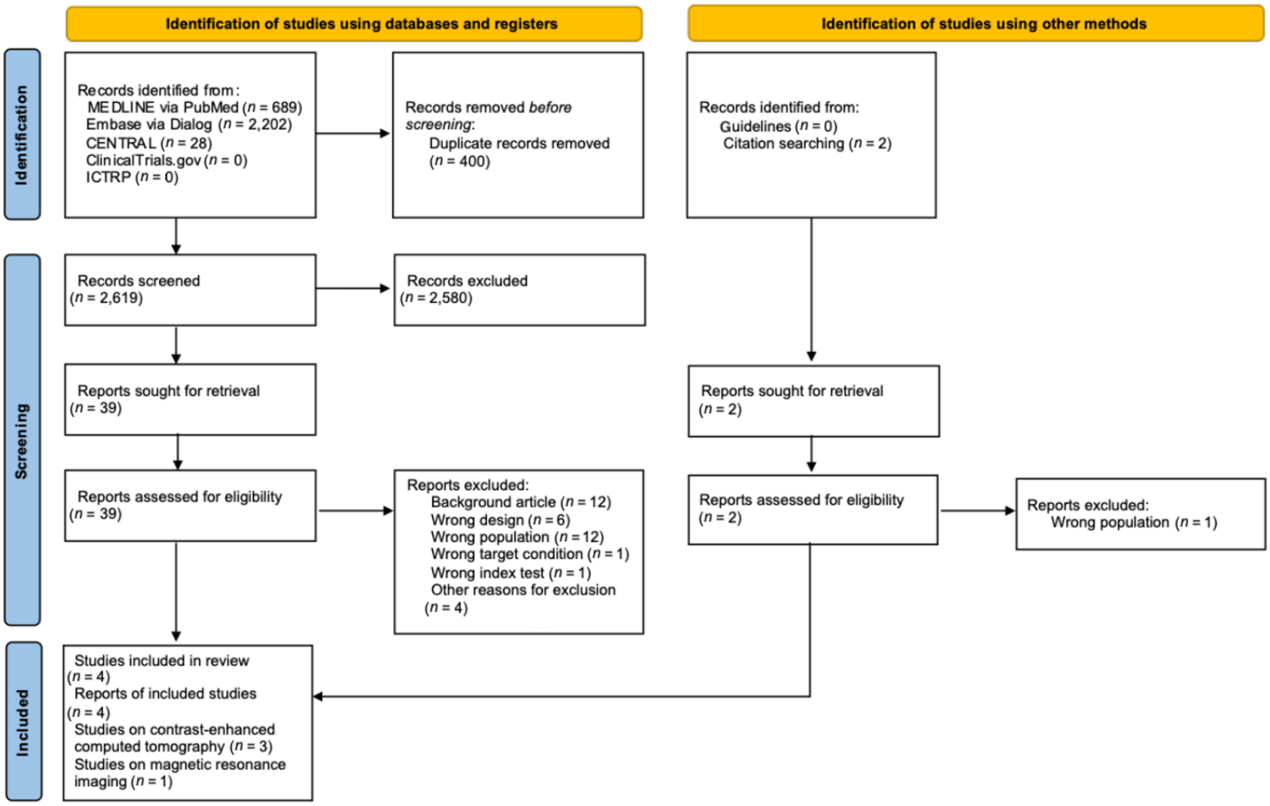


**Fig. 1.** Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) flow diagram in this review of reports to determine the diagnostic accuracy of pelvic imaging for acute pelvic inflammatory disease in an emergency care setting.

0.52–1.00), respectively. We presented the different scenarios of acute PID and the consequences of the test in 1,000 patients with each prevalence (5%,[15,16] 10%, 29% [median of prevalence in included studies], and 70%) of acute PID (Table S5). In sensitivity analysis, we excluded one study with different positive criteria of the index test[16] to assess the robustness of the results regarding contrast-enhanced CT. When the hierarchical summary ROC curve of the sensitivity analysis was compared with that of the primary analysis, the diagnostic accuracy of the sensitivity analysis improved (Fig. S1).

## DISCUSSION

THIS SYSTEMATIC REVIEW and meta-analysis evaluated the diagnostic accuracy of pelvic imaging for acute PID in three studies investigating contrast-enhanced CT and one study investigating MRI. In an emergency care setting, contrast-enhanced CT might replace to gynecological examination with acceptable false negative and false positive cases in the diagnosis of acute PID. However, the evidence was uncertain. Also, the evidence was uncertain whether MRI can be used for this purpose. Our results should be interpreted with caution due to the high risk of bias and high applicability concerns.

Emergency physicians could accurately rule in acute PID using contrast-enhanced CT and provide early treatment with antibiotics without gynecological examination based on high specificity with a narrow CI. As an example, suppose we diagnose a cohort of 1,000 women of reproductive age with acute lower abdominal pain and the prevalence of acute PID is 29%, which is the median of the included studies, and contrast-enhanced CT resulted in seven false positives and 61 false negatives. This result implies that it is possible for emergency physicians to treat patients with acute PID even in scenarios such as holidays and a nighttime emergency room where consultation with gynecologists is not available. Delaying treatment for 2–3 days after the initiation of symptoms for acute PID increases the risk of infertility and ectopic pregnancy.[23] Thus, early treatment with antibiotics according to contrast-enhanced CT could be reasonable in these settings. This review could provide

**Table 1.** Characteristics of included studies to determine the diagnostic accuracy of pelvic imaging for acute pelvic inflammatory disease (PID) in an emergency care setting

| Author | Country | Age (years) | Methods | Time between index test and reference standard |
|---|---|---|---|---|
| Jung *et al*. 2011[18]<br>*N* = 190 | Korea | Mean 29.3 (SD 7.6) | Design: Retrospective<br>Setting: ED<br>Study period: January 2007 to November 2007 | Not reported |
| El Hentour *et al*. 2018[19]<br>*N* = 327 | France | Median 28 (IQR 22–39) | Design: Retrospective<br>Setting: General or gynecological emergency department<br>Study period: January 2005 to October 2015 | Within 5 days |
| Brikshavana *et al*. 2019[20]<br>*N* = 88 | Thailand | Mean 29.3 (range 15–45) | Design: Retrospective<br>Setting: ED or outpatient department<br>Study period: January 2012 to December 2016 | Not reported |
| Tukeva *et al*. 1999[21]<br>*N* = 30 | Finland | Mean 37.1 (SD 11.8) | Design: Retrospective<br>Setting: Department of obstetrics and gynecology<br>Study period: December 1994 to August 1998 | Immediately after MRI |

| Criteria for participation | Index test | Reference standard |
|---|---|---|
| Inclusion criteria:<br>Nontraumatic acute lower abdominal pain with a duration of up to 1 week, each patient underwent an abdominopelvic CT examination to exclude surgical conditions.<br>Exclusion criteria:<br>Intrauterine device, inflammatory bowel disease or gynecological illness, or had undergone pelvic or abdominal surgery, termination of pregnancy or delivery in the previous 90 days | Method: Contrast-enhanced CT<br>Judge: Radiologist<br>Positive findings:<br>Pelvic peritonitis; increased attenuation and marked stranding of the pelvic fat with peritoneal enhancement at the level from the sacroiliac joint to the acetabular roof.<br>Salpingitis; tortuous tubal thickening with an axial diameter >5 mm.<br>Oophoritis; a polycystic-like ovary with the presence of multiple, small (2–10 mm) follicles scattered within an enlarged ovary with a short axis diameter >3 cm.<br>Endometritis; abnormal endometrial enhancement of more than the surrounding inner myometrium.<br>Free fluid: fluid attenuation in the pelvis with no enhancing rim | Gynecological examination: Bimanual pelvic examination<br>Invasive procedure: Laparoscopy<br>Blind: Not reported |
| Inclusion criteria:<br>Presenting with acute lower abdominal pain, who had undergone abdominopelvic contrast-enhanced helical CT examination, and who were subsequently diagnosed with acute PID (N70–N74) or acute appendicitis (K35–K37) according to International Classification of Diseases-10 codes.<br>Exclusion criteria:<br>Prior appendectomy, termination of pregnancy <3 months, gynecologic malignancy, prior hysterectomy, >57 years old | Method: Contrast-enhanced CT<br>Judge: Radiologist<br>Positive findings:<br>Tubal thickening, considered as moderate if 5 mm ≤ axial tubal diameter <10 mm, and as marked if axial tubal diameter ≥10 mm, and/or in the presence of fluid contents within the fallopian tube.<br>Anterior pelvic fat stranding, qualified as symmetrical or asymmetrical.<br>Uterine serosal enhancement.<br>Inner myometrial enhancement.<br>Intraperitoneal pelvic fluid. | Gynecological examination: Microbiologic examination<br>Invasive procedure: Surgery<br>Blind: Not reported |

**Table 1.** (Continued)

| Criteria for participation | Index test | Reference standard |
|---|---|---|
| | Intraperitoneal extrapelvic fluid, qualified as moderately or very abundant<br>Pelvic peritoneal enhancement.<br>Thickening of the uterosacral ligaments.<br>Obliteration of presacral and perirectal fascial planes.<br>Loss of definition of the uterine border.<br>Ileocecal lymph node(s) ≥ 5 mm | |
| Inclusion criteria:<br>Female patients, aged 15–45 years, who presented at our emergency department or outpatient department with abdominal pain.<br>Exclusion criteria:<br>Incomplete medical records | Method: Contrast-enhanced CT<br>Judge: Radiologist<br>Positive findings:<br>Thick-walled, low-attenuation adnexal mass with thick septations.<br>Dilated, pus-filled fallopian tube.<br>Thickening of the uterosacral ligaments.<br>Increased attenuation of the presacral fat secondary to edema.<br>Indistinct margins of adjacent bowel loop | Gynecological examination: Not reported<br>Invasive procedure: Surgery<br>Blind: None |
| Inclusion criteria:<br>A history of acute pelvic pain (less than 3 weeks duration, with or without fever), lower abdominal tenderness, bilateral adnexal tenderness and cervical motion tenderness, an elevated C-reactive protein concentration (>10 mg/L), and negative pregnancy test.<br>Exclusion criteria:<br>Not reported | Method: MRI<br>Judge: Radiologist<br>Positive findings:<br>A fluid-filled tubal lumen<br>Dilated tubes<br>Adnexal mass<br>Polycystic-like ovaries<br>Free pelvic cavity | Gynecological examination: Not reported<br>Invasive procedure: Laparoscopy<br>Blind: Not reported |

CT, computed tomography; ED, emergency department; IQR, interquartile range; MRI, magnetic resonance imaging; SD, standard deviation.

information on the utility of contrast-enhanced CT for acute PID.

It should be noted that 21% of patients with acute PID would be missed by diagnosis with contrast-enhanced CT. The sensitivity of contrast-enhanced CT provided in this review was inadequate for excluding acute PID. There are two reasons for the relatively low sensitivity. First, in the study by Jung *et al*.,[18] we used the diagnostic performance of one positive finding to perform the meta-analysis because there was available data for only one positive finding. Second, contrast-enhanced CT might not detect the mild severity of acute PID and the disease at an early stage of onset. If contrast-enhanced CT could not identify causes of acute abdominal pain, appropriate follow-up will be required. Furthermore, we should carefully adapt results of this review to clinical practice because of the following concerns: exposure to radiation is a disadvantage of CT for young women, and radiologists judged the results of contrast-enhanced CT in the all of the included studies.

It was uncertain whether MRI can replace a gynecological examination to rule in acute PID in an emergency care setting. In one included study matched to the scope,[21] the 95% CIs of specificity (0.52–1.00) were wide. Magnetic resonance imaging is often used in settings where contrast-enhanced CT is not preferred (e.g., radiation exposure and allergy to contrast media). As such, further studies are needed to confirm whether MRI can be an alternative diagnostic method for acute PID instead of gynecological examination in order to address settings where contrast-enhanced CT is not readily available.

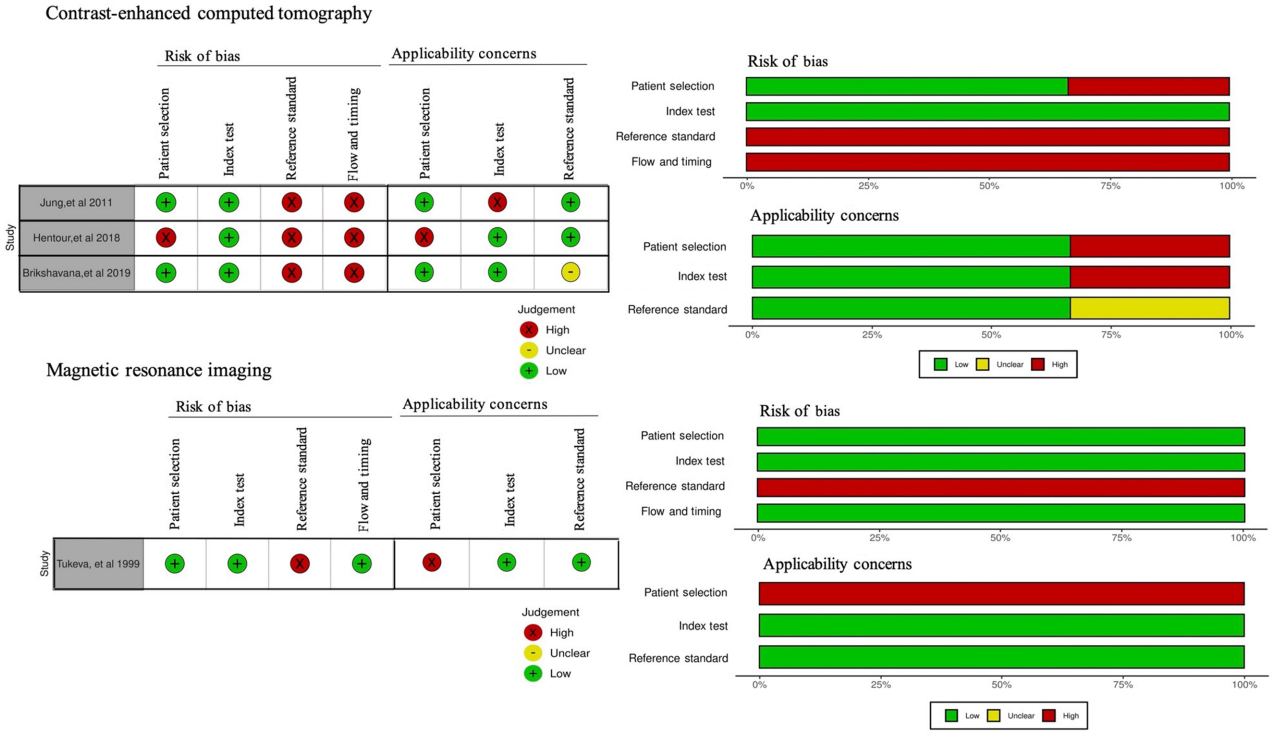


**Fig. 2.** Summary of risk of bias assessment with Quality Assessment of Diagnostic Accuracy Studies (QUADAS-2) tool to determine the diagnostic accuracy of pelvic imaging for acute pelvic inflammatory disease in an emergency care setting.

Several limitations in this review should be acknowledged. First, we could not undertake the planned subgroup analyses due to limited data including the setting (inpatient or outpatient) and the severity of acute PID. Additionally, we could not show the point estimate of sensitivity and specificity using the planned methods (i.e., a hierarchical summary ROC model). The severity of patients with acute PID was not described in the characteristics of participants in the included studies investigating contrast-enhanced CT, whereas all of the patients in the included study investigating MRI were hospitalized to treat acute PID (i.e., moderate to severe conditions). The findings of pelvic imaging are likely to be different between patients with mild PID and those with severe PID. Thus, investigating the heterogeneity of the diagnostic accuracy of pelvic imaging as to the severity of acute PID is warranted. Second, the generalizability of results in this review may be low. There are three reasons for this concern. One, the results of this meta-analysis might be optimistic because it included two-gate studies.[19] However, the risk of bias in the domain of patient selection and applicability concerns were assessed to be high. Based on the quality assessment, readers should be cautious in interpreting the results of this review. It should also be taken into account that radiologists interpreted the index tests in all included studies. In the real world, radiologists might not always be available to interpret imaging during a night shift in the emergency department or in rural areas. Additionally, the reference standard used in this review varied within and across the studies. Pelvic examination is recommended to be carried out in all patients with suspected PID to evaluate cervical motion, uterine, and/or adnexal tenderness, and an invasive procedure such as a laparoscopy is not readily available in many settings, and is not routinely performed as a reference standard.[3] If a similar reference standard is used within and across the studies, the methodological assessment in the QUADAS-2 tool and the certainty of the results of this review would be improved. Third, there was inconsistency of sensitivity of contrast-enhanced CT because of one study with a different positive criteria of the index test.[18] However, we could confirm the robustness of the results regarding contrast-enhanced CT in the sensitivity analysis. Fourth, the diagnostic accuracy of both contrast-enhanced CT and MRI was imprecise because of the wide range of CIs. Thus, it is necessary to undertake more primary studies on the diagnostic accuracy of pelvic imaging for acute PID in order to confirm the results of this review. Finally, it is unclear whether the use of pelvic imaging instead of gynecological examination will impact clinical outcomes (e.g., morbidity, treatment

**Table 2.** Summary of findings of this meta-analysis of the diagnostic accuracy of pelvic imaging for acute pelvic inflammatory disease (PID) in an emergency care setting

A. Contrast-enhanced CT

| | | | | |
|---|---|---|---|---|
| Patients/cohorts | Women of reproductive age with acute lower abdominal pain | | | |
| Prior testing | History and physical examination with or without abdominal ultrasonography | | | |
| Settings | Emergency department, outpatient department, and gynecological emergency department | | | |
| Index test | Contrast-enhanced CT | | | |
| Importance | The index test could indicate the need for early treatment without carrying out a gynecological examination even in limited settings | | | |
| Reference standard | Clinical and microbiological criteria with or without surgery (e.g., laparoscopy) | | | |
| Studies | Two retrospective studies and one case–control study were included<br>One study provided diagnostic performance of one CT finding for the target condition | | | |
| Summary accuracy (95% confidence interval) | No. of participants (studies) | Prevalence median | (interquartile range) | Implications |
| Quality and comments | | | | |
| Sensitivity 0.79 (0.52–0.93)<br>Specificity 0.99 (0.94–1.00) | 605 (3) | 29% (21%–52%) | With a prevalence of 29%, 61 of 1,000 patients will have missed diagnosis of PID by contrast-enhanced CT and have possible delay in the treatment initiation; 7 patients will be given unnecessary treatment | It was unclear whether the reference standard was blinded or not in all of the studies. The time between the index test and reference standard was also not reported.<br>Applicability was of low concern except for one case–control study and one study with different criteria for the index test |

B. MRI

| | | | | |
|---|---|---|---|---|
| Patients/cohorts | Women of reproductive age with acute lower abdominal pain | | | |
| Prior testing | History and physical examination with transvaginal ultrasonography | | | |
| Settings | Department of obstetrics and gynecology | | | |
| Index test | MRI | | | |
| Importance | The index test could indicate the need for early treatment without performing a gynecological examination even in limited settings | | | |
| Reference standard | Clinical and microbiological examinations with laparoscopy | | | |
| Studies | One retrospective study was included | | | |
| Summary accuracy (95% confidence interval) | No. of participants (studies) | Prevalence median (interquartile range) | Implications | Quality and comments |
| Sensitivity 0.95 (0.76–1.00)<br>Specificity 0.89 (0.52–1.00) | 30 (1) | 29% (21%–52%) | With a prevalence of 29%, 15 of 1,000 will have missed diagnosis of PID by MRI and have possible delay in the treatment initiation; 78 will be given unnecessary treatment | Reference standard was not blinded to results of index test.<br>Study setting was not supposed to be an emergency department |

CT, computed tomography; MRI, magnetic resonance imaging.

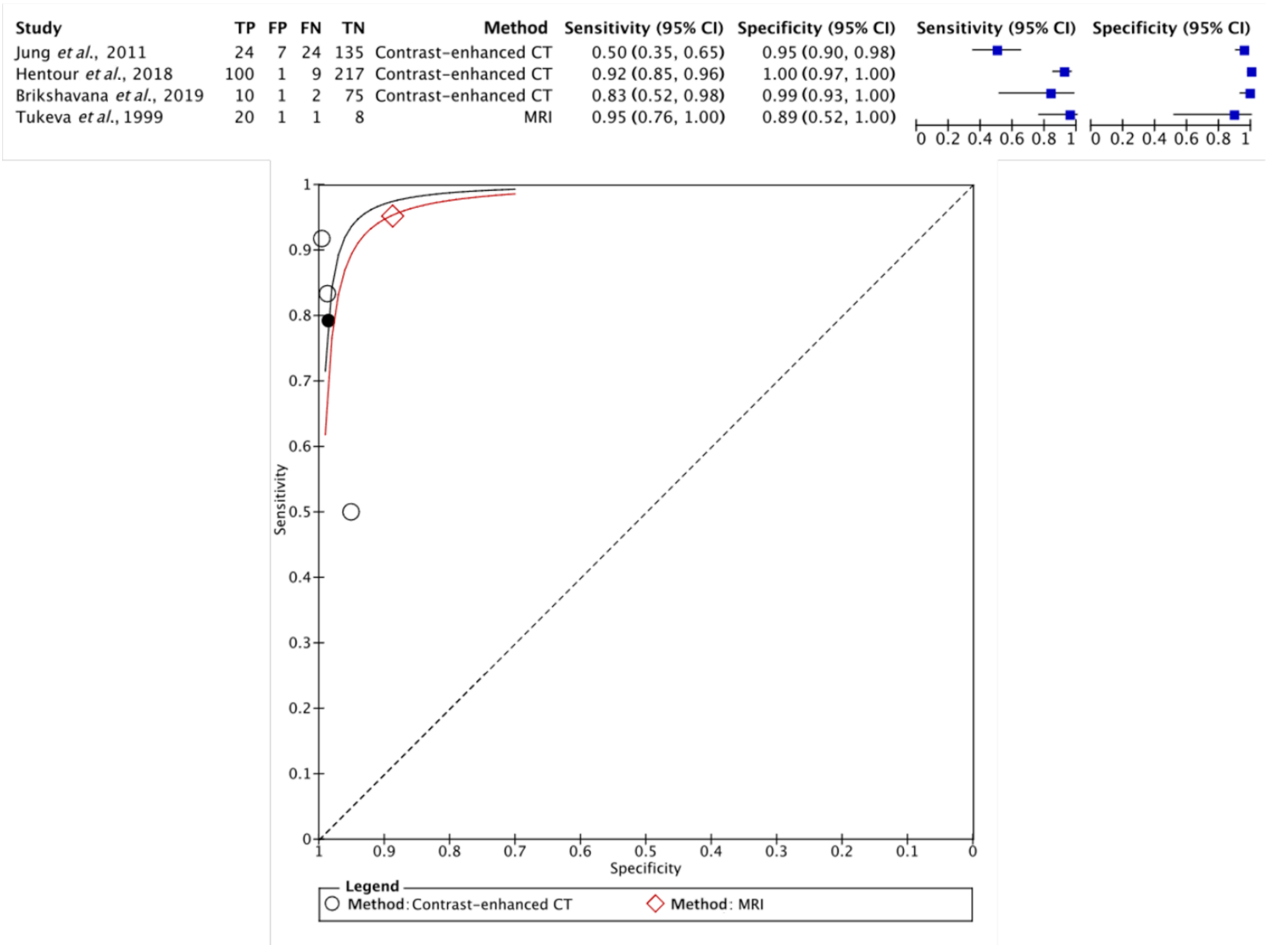


**Fig. 3.** Forest plot and summary receiver operating characteristic (ROC) plot with sensitivity and specificity of all four included studies of pelvic imaging for acute pelvic inflammatory disease (PID) in an emergency care setting. We show the sensitivity, specificity, and 95% confidence interval (CI) from Tukeva *et al.*[21] for magnetic resonance imaging (MRI) as it was the sole study to examine the test accuracy of MRI for acute PID. The sensitivity and specificity in Jung *et al.*[18] were obtained from one computed tomography (CT) finding (right and left tubal thickening) for acute PID. FN, false negative; FP, false positive; TN, true negative; TP, true positive.

failure, or infertility) because the aim of this review was to investigate the diagnostic accuracy of pelvic imaging. Thus, future studies need to compare the clinical outcomes of treatment based on pelvic imaging with that of treatment based on gynecological examination.

Despite the limitations above, our study was the first to systematically investigate the diagnostic test accuracy of contrast-enhanced CT and MRI for acute PID in an emergency setting. We followed a prespecified protocol with a rigorous methodology including the Cochrane Handbook and PRISMA-DTA guideline.[11,12] This review provided new evidence of the utility of pelvic imaging for the diagnosis of acute PID among women of reproductive age.

## CONCLUSION

CONTRAST-enhanced CT could rule in acute PID without gynecological examination in an emergency care setting, however, the evidence remains uncertain. Also, it is unclear whether MRI can be a substitute. Further studies with the same severity of acute PID and reference standard should be carried out to confirm the results of this review.

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## DISCLOSURE

APPROVAL OF THE research protocol with approval number and committee name: N/A.

Informed consent: N/A

Registry and registration number of the study or trial: This study was registered at protocols.io (https://www.protocols.io/view/diagnostic-accuracy-of-pelvic-imaging-for-acute-pe-bvsdn6a6).

Animal studies: N/A.

Conflict of interest: None.

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## SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

**Table S1.** Preferred Reporting Items for Systematic Review and Meta-Analysis of Diagnostic Test Accuracy (PRISMA-DTA) checklists.
**Table S2.** Search strategy.
**Table S3.** Excluded reports by full-text screening.
**Table S4.** Details of risk of bias assessment with Quality Assessment of Diagnostic Accuracy Studies (QUADAS-2) Tool.
**Table S5.** Number of effects per 1,000 patients tested by pelvic imaging for acute pelvic inflammatory disease.
**Figure S1.** Forest plot and summary receiver operating characteristic plot with the sensitivity and specificity in sensitivity analysis excluding studies with different positive criteria of index test.