

## Diagnosis

# Review: Imaging techniques have similarly high accuracy for diagnosing cancer in solitary pulmonary nodules

Cronin P, Dwamena BA, Kelly AM, Carlos RC. Solitary pulmonary nodules: meta-analytic comparison of cross-sectional imaging modalities for diagnosis of malignancy. *Radiology*. 2008;246:772-82.

Clinical impact ratings: HO ★★★★★☆ PM ★★★★★☆

### Question

In patients with a solitary pulmonary nodule, how accurate are imaging techniques for diagnosing cancer?

### Review scope

Studies selected evaluated dynamic contrast-enhanced computed tomography (CT), dynamic contrast-enhanced magnetic resonance imaging (MRI), fluorine 18 fluorodeoxyglucose positron emission tomography (FDG-PET), or functional technetium 99m depreotide single-photon emission CT (SPECT) for assessment of solitary pulmonary nodules in  $\geq 10$  patients. The reference standard was histologic diagnosis in  $> 50\%$  of patients (with clinical follow-up for the remainder). Outcomes were pooled sensitivity, specificity, diagnostic odds ratio, and area under the receiver-operating characteristic curve.

### Review methods

MEDLINE (1990 to 2005) was searched for studies published in English (or with an English abstract) as peer-reviewed, full-length articles. 44 studies ( $n = 2867$ , mean age 60 y, mean nodule size 19 mm) met the selection criteria, 24 of which were prospective. 19 studies used histologic diagnosis for all patients, and 19 studies reported blinded interpretation of test results.

### Main results

The Table shows the diagnostic test characteristics for the 4 techniques.

### Conclusion

Dynamic contrast-enhanced computed tomography and magnetic resonance imaging, fluorine 18 fluorodeoxyglucose positron emission tomography, and technetium 99m depreotide single-photon emission computed tomography have similar sensitivity and specificity for diagnosing cancer in solitary pulmonary nodules.

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### Commentary

Although the review by Cronin and colleagues tells us that each of the 4 modalities evaluated has similar operating characteristics, this finding does not mean that they should be used interchangeably.

A recent guideline from the American College of Chest Physicians (ACCP) recommends that, for patients with normal renal function and an indeterminate solitary pulmonary nodule on chest x-ray or high-resolution CT scan, CT with dynamic contrast enhancement should be performed (1).

FDG-PET is also recommended for patients with low-to-moderate (5% to 60%) pretest probability for cancer and is often used to complement dynamic CT in patients with multiple pulmonary nodules. FDG-PET should not be used when nodules are  $< 8$  to 10 mm because of decreased sensitivity.

Patients with low pretest probability for cancer ( $< 5\%$ ) can be followed with serial high-resolution CT scans. When the probability of cancer is high ( $> 60\%$ ) or a nodule is hypermetabolic by FDG-PET, surgical diagnosis is recommended.

The ACCP guideline does not endorse the use of MRI or technetium 99m SPECT. The quality of the MRI studies in the Cronin review was only moderate. Technetium 99m SPECT seems promising, but accuracy data, experience, and availability are limited.

The extent to which the moderate specificity of all 4 imaging techniques leads to morbidity and perhaps mortality is not known. Randomized controlled trials comparing the effect of different diagnostic strategies on clinical outcomes in patients with pulmonary nodules are needed.

Until such data are available, ACCP guideline-directed imaging of solitary pulmonary nodules, with emphasis on pretest probability determination, Bayesian interpretation of study results, and shared decision-making with patients, is the best approach.

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### Reference

1. Gould MK, Fletcher J, Iannettoni MD, et al. Evaluation of patients with pulmonary nodules: When is it lung cancer? ACCP evidence-based clinical practice guidelines (2nd edition). *Chest*. 2007;132:108S-30S.

### Test characteristics of 4 imaging techniques for diagnosing cancer in solitary pulmonary nodules\*

Imaging technique	Number of studies (n)	Sensitivity (95% CI)	Specificity (CI)	Diagnostic odds ratio (CI)	Area under ROC curve (CI)
Dynamic contrast-enhanced computed tomography	10 (1066)	93% (88 to 97)	76% (68 to 97)	40 (1.2 to 81)	0.93 (0.81 to 0.97)
Dynamic contrast-enhanced magnetic resonance imaging	6 (284)	94% (91 to 97)	79% (73 to 86)	61 (5.6 to 116)	0.94 (0.83 to 0.98)
Fluorine 18 fluorodeoxyglucose positron emission tomography	22 (901)	95% (93 to 98)	82% (77 to 88)	97 (6.3 to 188)	0.94 (0.83 to 0.98)
Technetium 99m depreotide single-photon emission computed tomography	7 (440)	95% (93 to 97)	82% (78 to 85)	85 (34 to 135)	0.94 (0.83 to 0.98)

\*ROC = receiver-operating characteristic; diagnostic terms and CI defined in Glossary.