

EBM月會

核子醫學科

指導教師

莊雅雯醫師

Presented by 住院醫師 林家揚



- Name: 王X玉
- Chart No: 15564677
- Admission date: 20061130
- Sex: female
- Age: 63 years old
- Rectal cancer (adenocarcinoma, grade II)
- Liver metastasis



問題形成

- P: patients suffering from colorectal cancer with liver metastasis
- I: PET
- C: Other imaging modality
- O: outcome

- ***Ask One-Sentence Question :***
Is PET better than other imaging modalities for evaluation liver metastasis in patients with colorectal cancer?
- ***Type of Question:***
Diagnosis



文獻搜尋

- Key word: PET, colorectal cancer, liver metastasis
- Data base:
 - Cochran library first
 - PubMed
 - Medline



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Colorectal liver metastases: CT, MR imaging, and PET for diagnosis. Meta-analysis (Structured abstract)

Centre for Reviews and Dissemination

Original Author(s): S Bipat, M S van Leeuwen, E F Comans, M E Pijl, P M Bossuyt, A H Zwinderman, J Stoker

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- **Colorectal liver metastases: CT, MR imaging, and PET for diagnosis. Meta-analysis (Structured abstract)**
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- *Database of Abstracts of Reviews of Effects 2008 Issue 2*
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- **Original article:** Bipat S, van Leeuwen M S, Comans E F, Pijl M E, Bossuyt P M, Zwinderman A H, Stoker J. Colorectal liver metastases: CT, MR imaging, and PET for diagnosis. Meta-analysis. *Radiology*. 2005;237(1):123-131.



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Abbreviations:

CI = confidence interval

FDG = fluorine 18
fluorodeoxyglucose

SPIO = superparamagnetic iron
oxide

Colorectal Liver Metastases: CT, MR Imaging, and PET for Diagnosis—Meta-analysis¹

PURPOSE: To perform a meta-analysis to obtain sensitivity estimates of computed tomography (CT), magnetic resonance (MR) imaging, and fluorine 18 fluorodeoxyglucose (FDG) positron emission tomography (PET) for detection of colorectal liver metastases on per-patient and per-lesion bases.

MATERIALS AND METHODS: MEDLINE, EMBASE, Web of Science, and CANCELIT databases and Cochrane Database of Systematic Reviews were searched for relevant original articles published from January 1990 to December 2003. Criteria for inclusion of articles were as follows: Articles were reported in the English, German, or French language; CT, MR imaging, or FDG PET was performed to identify and characterize colorectal liver metastases; histopathologic analysis (surgery, biopsy, or autopsy), intraoperative observation (manual palpation, intraoperative ultrasonography [US]), and/or follow-up US was the reference standard; and data were sufficient for calculation of true-positive and false-negative values. Exclusion criteria

¹From the Department of Radiology

Purpose

- To use meta-analyses to estimate the sensitivities of CT, MRI and FDG PET for the detection of **colorectal liver metastases**, on a per-patient and per-lesion basis.



Material and Method

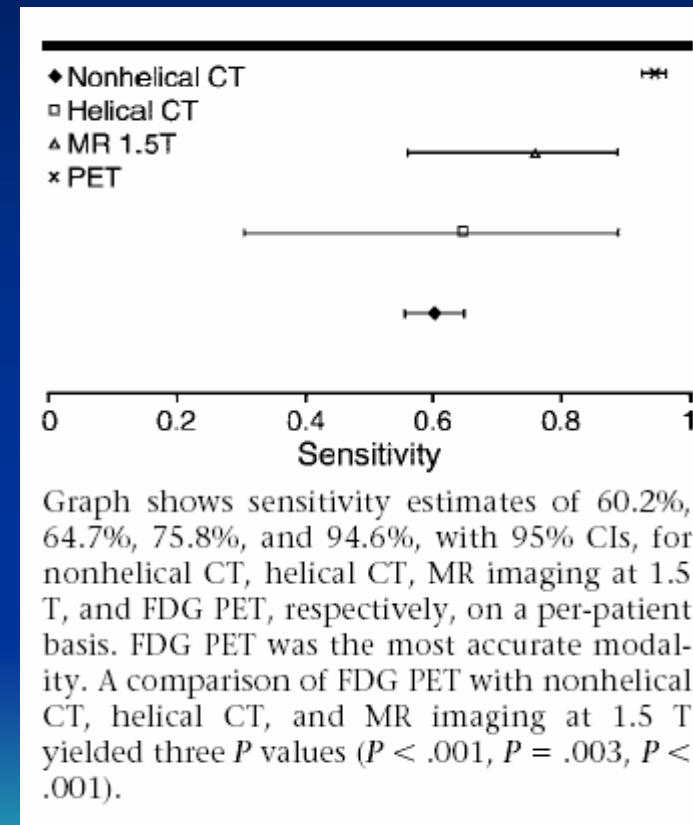
- **MATERIALS AND METHODS:**
- MEDLINE, EMBASE, Web of Science, and CANCELIT databases and Cochrane Database of Systematic Reviews were searched for relevant original articles published from **January 1990 to December 2003**.
- Criteria for inclusion of articles---
 - Reported in the **English, German, or French language**
 - CT, MR imaging, or FDG PET was performed to identify and characterize colorectal liver metastases
 - histopathologic analysis (surgery, biopsy, autopsy), intraoperative observation (manual palpation, intraoperative ultrasonography [US]), and/or follow-up US was the **reference standard**
 - data were sufficient for calculation of true-positive or false-negative values.
 - A random-effects linear regression model** was used to obtain sensitivity estimates in assessment of liver metastases.

- **Sixty-one studies** with a total of **3,187** participants were included in the review
- The mean age of the study: **61 years** (range: 12 to 93).
- Gender distribution was approximately **60% male**.



Result

- Of 165 identified relevant articles, 61 fulfilled all inclusion criteria.
- Sensitivity estimates on a per-patient basis for
 - nonhelical CT (60.2%)
 - helical CT (64.7%)
 - 1.5-T MR (75.8%)
 - FDG PET (94.6%)
- FDG PET was the most accurate modality.



- On a per-lesion basis, sensitivity estimates for
- nonhelical CT, 52.3%,
- helical CT, 63.8%,
- 1.0-T MR imaging, 66.1%,
- 1.5-T MR imaging, 64.4%,
- FDG PET 75.9%, respectively;
- **nonhelical CT had lowest sensitivity.**
- Estimates of gadolinium-enhanced MR imaging and superparamagnetic iron oxide (SPIO) enhanced MR imaging were significantly better, compared with nonenhanced MR imaging ($P=0.019$ and $P < 0.001$, respectively) and with helical CT with 45 g of iodine or less ($P= 0.02$ and $P < .001$, respectively).

For lesions of 1 cm or larger,
SPIO-enhanced MR imaging was the most accurate modality
($P < 0.001$)

- Sensitivity estimates for non-helical CT, helical CT, non-enhanced 1.5 T MRI, gadolinium-enhanced 1.5 T MRI and SPIO-enhanced 1.5 T MRI for lesions of 1 cm or larger were 74.3% (95% CI: 66.5, 80.9), 73.5% (95% CI: 62.2, 82.4), 65.7% (95% CI: 56.4, 73.9), 68.8% (95% CI: 61.9, 75.0) and 90.2% (95% CI: 87.5, 92.4)

- **lesions smaller than 1 cm**

Sensitivity estimates for non-helical CT, helical CT, non-enhanced 1.5 T MRI, gadolinium-enhanced 1.5 T MRI and SPIO-enhanced 1.5 T MRI for were 25.3% (95% CI: 15.9, 37.6), 23.1% (95% CI: 7.0, 54.7), 12.6% (95% CI: 8.0, 17.5), 11.6% (95% CI: 9.5, 14.2) and 29.3% (95% CI: 18.2, 43.6), respectively. **no significant differences between imaging modalities**



CONCLUSION

- FDG PET had significantly higher sensitivity on a per-patient basis, compared with that of the other modalities, but not on a per-lesion basis.
- Sensitivity estimates for MR imaging with contrast agent were significantly superior to those for helical CT



TABLE 1
Results of Distribution of Study Design Characteristics in 61 Studies

Question about Study Design Characteristic	Response*	
	Yes	No
1. Was the spectrum of patients representative of the patients who receive the test in practice?	50	11
2. Were selection criteria clearly described?	36	25
3. Is the reference standard likely to help correctly classify the target condition?	55	6
4. Is the time between performance of reference standard and index test short enough?	20	41
5. Did the whole sample or a random selection of the sample receive verification by using a reference standard?	52	9
6. Did patients undergo examination with the same reference standard regardless of the index test result?	36	25
7. Was the reference standard performed independently of the index test?	52	9
8a. Was the execution of the index test described in sufficient detail to permit replication of the test?	49	12
8b. Was the execution of the reference standard described in sufficient detail to permit replication of the test?	22	39
9a. Were the index test results interpreted without knowledge of the results of the reference standard?	36	25
9b. Were the reference standard results interpreted without knowledge of the results of the index test?	6	55
10. Were the same clinical data available when test results were interpreted as would be available in practice?	18	43
11. Were uninterpretable and/or intermediate test results reported?	1	60
12. Were withdrawals from the study explained?	15	46
13. Were the data collected after the research question was defined?	36	25

* Data are the numbers of responses from the QUADAS tool. The numbers indicate how many articles were assigned a score of "yes" (for the QUADAS tool) and how many articles were assigned a score of "no." The responses of "no" and "unclear" were summarized together.

- The **QUADAS** quality assessment tool was used to assess the methodological validity of the included studies.
- The **QUADAS** tool was developed and validated specifically **for the quality assessment of diagnostic accuracy studies** in systematic reviews.



TABLE 2
Study Characteristics of Included Data Sets for Each Imaging Modality

Modality	No. of Data Sets and Articles	No. of Patients in Study	Reference Nos.
Nonhelical CT	58, 28	1915	10, 24–50
Helical CT	53, 15	621	51–65
1.0-T MR imaging	34, 5	173	57, 66–69
1.5-T MR imaging	102, 12	391	27, 51, 53, 54, 70–77
FDG PET	26, 21	1058	41–50, 52, 59, 64, 77–83

TABLE 4
Sensitivity Estimates for Nonhelical CT, Helical CT, 1.0-T MR Imaging, 1.5-T MR Imaging, and FDG PET on a Per-Lesion Basis

Modality and Subgroup	Sensitivity Estimate (%)*
Nonhelical CT, overall	52.3 (52.1, 52.5)
Helical CT	
Overall	63.8 (54.4, 72.2) [†]
Section thickness of 5 mm	68.2 (50.5, 81.9)
Section thickness of >5 mm	69.1 (59.8, 77.1)
Amount of iodine of ≤ 45 g	61.4 (43.5, 76.6)
Amount of iodine of >45 g	64.0 (55.1, 72.0)
Two phases (arterial and portal phases)	65.7 (56.8, 73.7)
One phase (portal phase only)	71.4 (57.7, 82.1)
1.0-T MR imaging, overall	66.1 (65.9, 66.3) [†]
1.5-T MR imaging	
Overall	64.4 (57.8, 70.5) [†]
Nonenhanced MR imaging	59.8 (49.0, 69.7)
Gadolinium-enhanced MR imaging	78.2 (63.0, 88.3) [‡]
SPIO-enhanced MR imaging	73.2 (62.3, 81.9) [‡]
FDG PET, overall	75.9 (61.1, 86.3) [†]

* Sensitivity estimates were obtained by means of a logit-transformed data analysis, and percentages were not calculated with raw numbers. Numbers in parentheses are 95% CIs expressed as percentages.

[†] Significantly higher compared with nonhelical CT.

[‡] Significantly higher compared with nonenhanced MR imaging and amount of iodine of 45 g or less.

Result of the review valid?

- addressed a clearly stated question, which was defined by appropriate inclusion criteria
- An extensive literature search was conducted, though the language restrictions applied might have resulted in the loss of some relevant data.
- **QUADAS quality assessment tool**



- **Medical Subject Headings (MeSH)/ text word**

Colorectal Neoplasms [pathology];
Fluorodeoxyglucose F18 [diagnostic use];
Gadolinium [diagnostic use]; Liver Neoplasms
[diagnosis; pathology; secondary]; Magnetic
Resonance Imaging; Positron-Emission
Tomography; Sensitivity and Specificity;
Tomography, Spiral Computed; Tomography, X-
Ray Computed



- Appropriate methods were used to avoid the introduction of error and bias during the review process and these were clearly reported.
- Heterogeneity—by random-effect approach
- Blinding of test interpretation
CT& MRI& PET/ CT, MRI, PET
- The regression model used was generally considered to be the most appropriate for this type of analysis and its application was clearly described.

Apply to patient

- FDG PET had significantly higher sensitivity on a per-patient basis, compared with that of the other modalities
- Thus, FDG PET is suitable for this patient with colorectal liver metastasis

