

# PET/CT in the Management of Colorectal Cancer

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2012 Fall Update in Surgical Oncology:

Malignancies of the Lower GI Tract

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**BC Cancer Agency**

CARE + RESEARCH

An agency of the Provincial Health Services Authority

# Disclosures

🟢 None

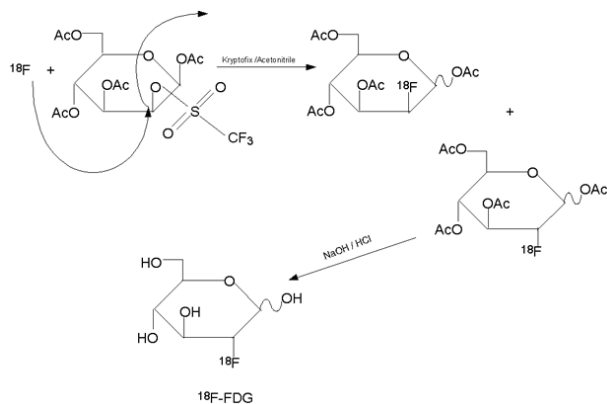
# Objectives

- ◆ Briefly review the fundamentals of Positron Emission Tomography
- ◆ Review the indications for PET/CT in colorectal carcinoma
- ◆ Review the sensitivity/specificity of PET/CT in CRC
- ◆ Review the current availability and usage of PET/CT in BC
- ◆ Questions

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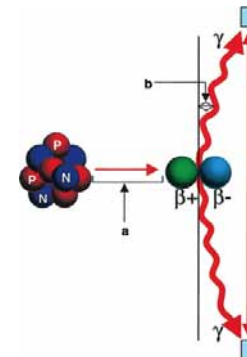
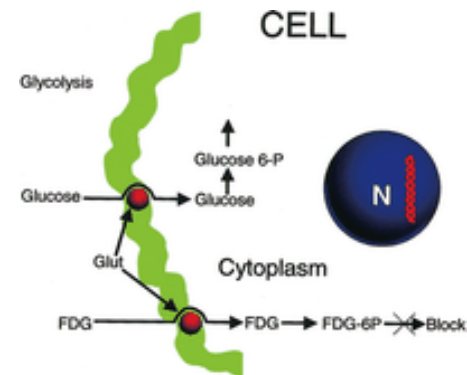
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# Fundamentals of PET imaging



# Fundamentals of PET imaging

- FDG dispensed
- Injected into patient
- 1 hour uptake
- $\beta$  decay with positron emission
- Annihilation with an electron
- Release of 511keV photons at  $\approx 180^\circ$



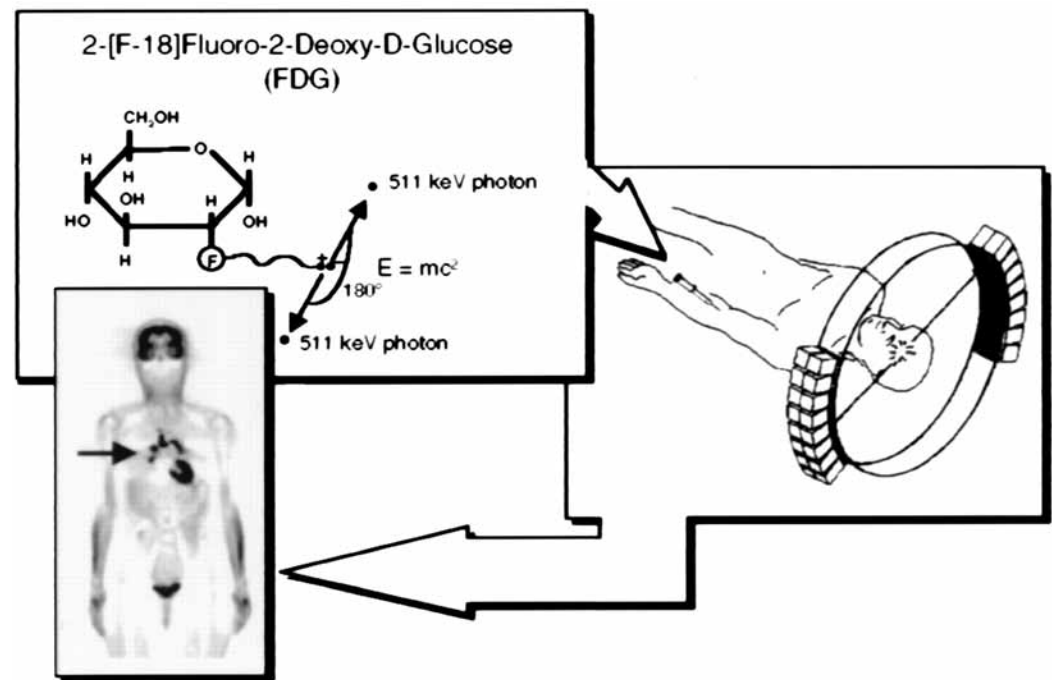
# Fundamentals of PET imaging

- ◆ Patient positioned

- ◆ Coincidence detection

- ◆ Image reconstruction

- ◆ Patients are in the department for  $\approx 2\text{h}$



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# PET/CT Worldwide

Cancer Indication	Canada <sup>1</sup>	United States <sup>2</sup>	Europe	Australia
Brain - primary	CTA	YES		YES
Breast	YES	YES		
Cervix	CTA	YES		YES
Colorectal	YES	YES	YES	YES
Esophagus	CTA	YES		YES
Head and Neck	CTA	YES	YES	
Lung	YES	YES	YES	YES
Lymphoma	CTA	YES	YES	
Melanoma	CTA	YES	YES	
Ovary	CTA	YES		YES
Stomach	CTA	YES		YES
Testicular	CTA	YES		
Thyroid	CTA	YES		

Table adapted from Demeter et al., 2009

<sup>1</sup>YES – based on approved indications for five Health Canada approved FDG products circa January 2008

<sup>2</sup>Since 2006, the CMS will cover PET scanning for almost any malignancy if the appropriate paperwork is submitted

# Funded indications for PET/CT in Colorectal Carcinoma: BCCA

## Colorectal Carcinoma

- ◆ Determination of stage in patients with potentially resectable recurrence (including rising CEA)

<http://www.bccancer.bc.ca/PPI/PET/indications.htm>

# Current BCCA Indications for PET/CT

- ◆ **Other cancers given specific clinical indications, as approved by the BC Cancer Agency, on an individual basis.**
- ◆ It is recognized in clinical practice that there may be clinical scenarios that do not meet specific guidelines but where expert medical opinion indicates the procedure could have a major impact on patient management. PET scan referrals in these cases will be reviewed on an individual basis and if approved by consensus, the patient will be offered participation in the study.

<http://www.bccancer.bc.ca/PPI/PET/indications.htm>

# Funded indications for PET/CT in Colorectal Carcinoma: Ontario

## Colorectal Carcinoma

- ♦ determining management and prognosis if conventional imaging is equivocal for the presence of metastatic disease
- ♦ to determine the site of recurrence in the setting of rising CEA when a conventional workup fails to unequivocally identify metastatic disease
- ♦ in the preoperative management assessment of colorectal cancer liver metastases prior to surgical resection

# Funded indications for PET/CT in Colorectal Carcinoma: USA

## 💧 Colorectal carcinoma

Preoperative evaluation of patients with potentially resectable metastatic disease

Determining location of tumours when rising CEA level suggests recurrence

# Funded indications for PET/CT in Colorectal Carcinoma: Australia

## 💧 Colorectal carcinoma

Prior to resection of primary or limited metastatic disease

Suspected recurrence or residual on structural imaging after  
definitive therapy

# Current UK Indications for PET/CT in Colorectal Carcinoma

## Colorectal carcinoma

- Staging of patients with synchronous metastases at presentation suitable for resection or patients with equivocal findings on other imaging; for example, pulmonary or liver lesions.
- Restaging of patients with recurrence being considered for radical treatment and/or metastatectomy.
- Detection of recurrence in patients with rising tumour markers and/or clinical suspicion of recurrence with normal or equivocal findings on other imaging.
- Evaluation of indeterminate pre-sacral masses post-treatment.

The Royal College of Physicians and The Royal College of Radiologists. *Evidence-based indications for the use of PET-CT in the United Kingdom 2012*. London: The Royal College of Physicians and The Royal College of Radiologists, 2012.

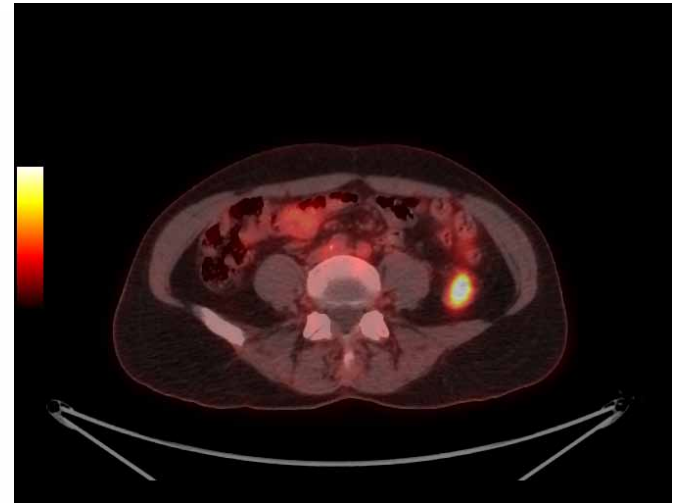
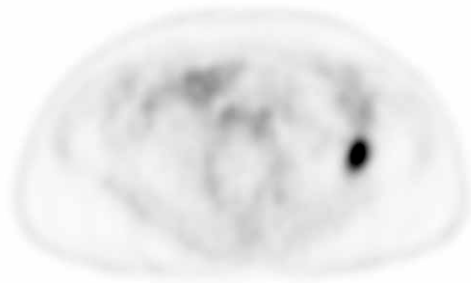
# Colorectal Carcinoma

- 57 yo female, colon CA with potentially resectable hepatic mets on CT



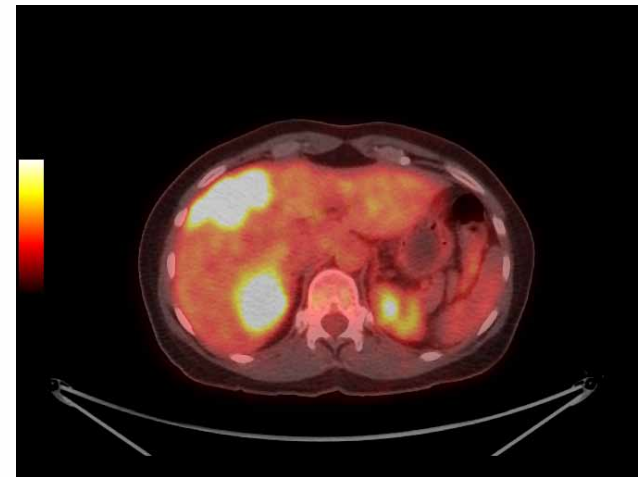
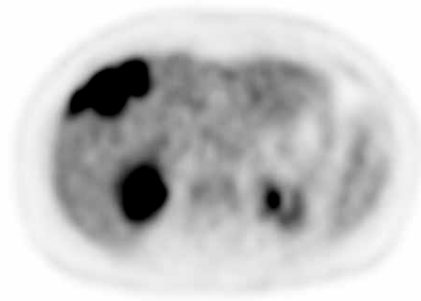
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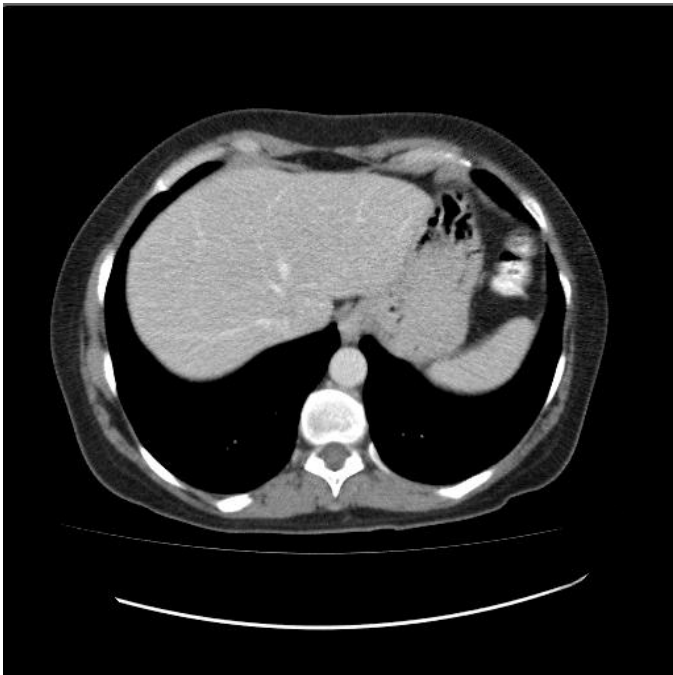
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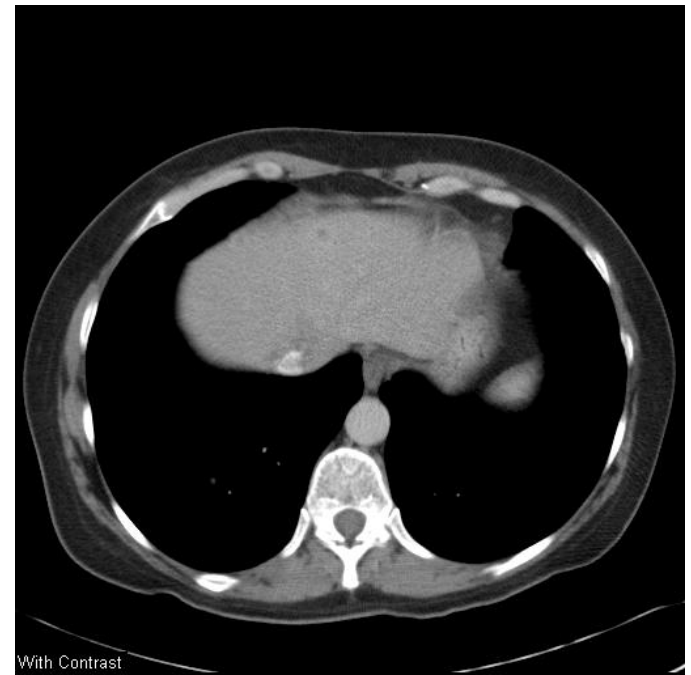
# Colorectal Carcinoma

- Rectal CA, staging Abd/Pel CT July 4, diversion ileostomy July 20, Chest CT Aug. 24 to complete staging, PET/CT Sept. 6

July 4



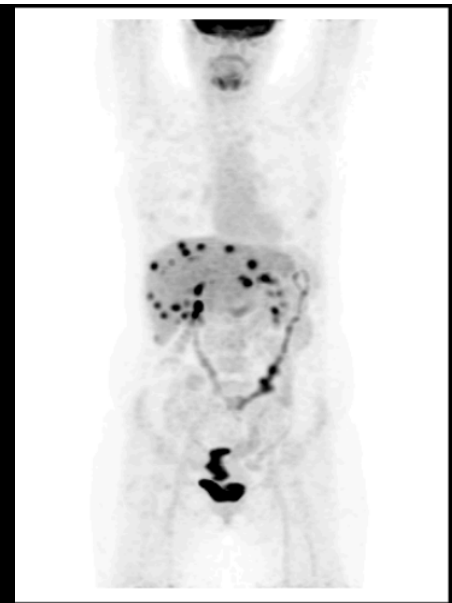
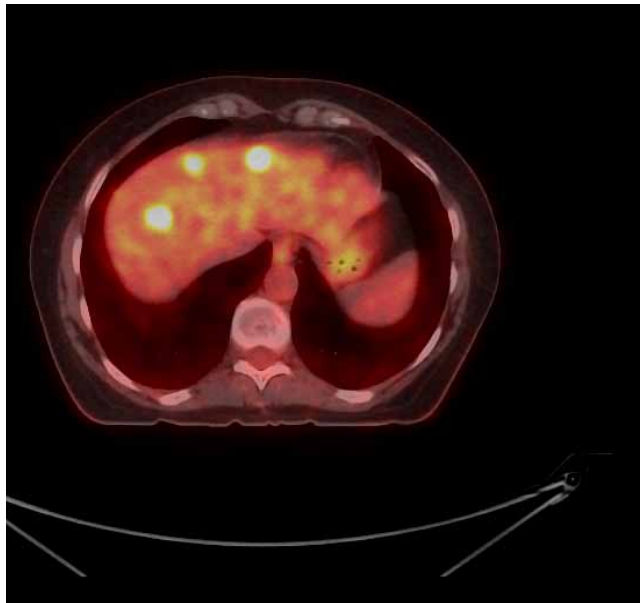
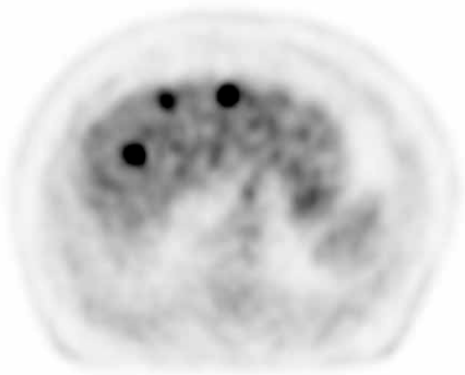
Aug 24



# Colorectal Carcinoma

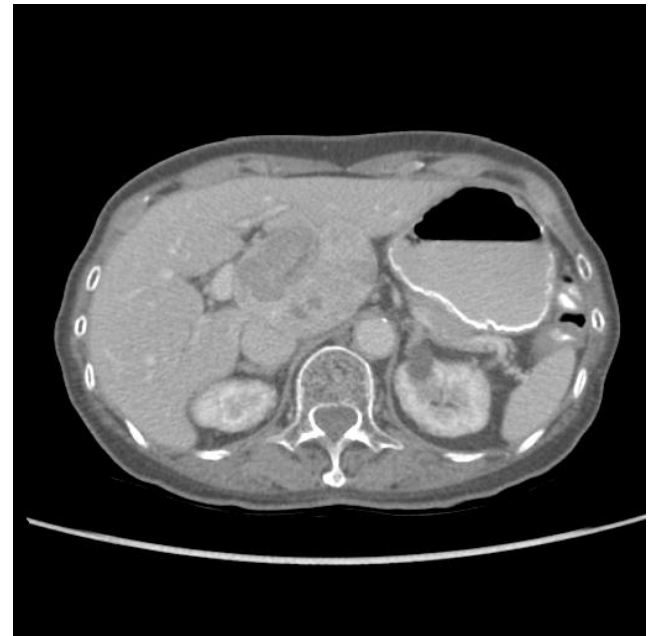
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PET/CT Sept. 6



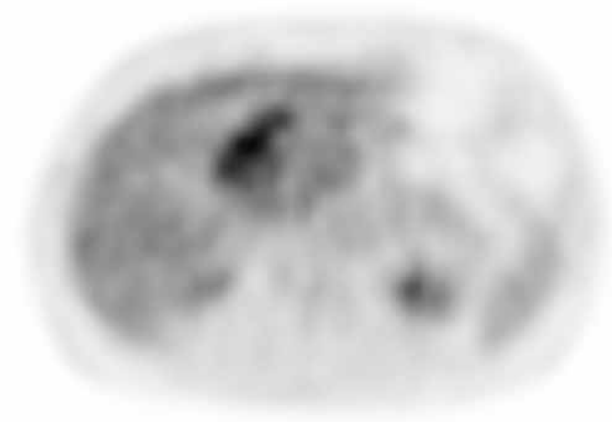
# Colorectal Carcinoma

- 81 yo female, limited colon CA resected in 2011 with 0/31 nodes positive, ? isolated hepatic metastasis



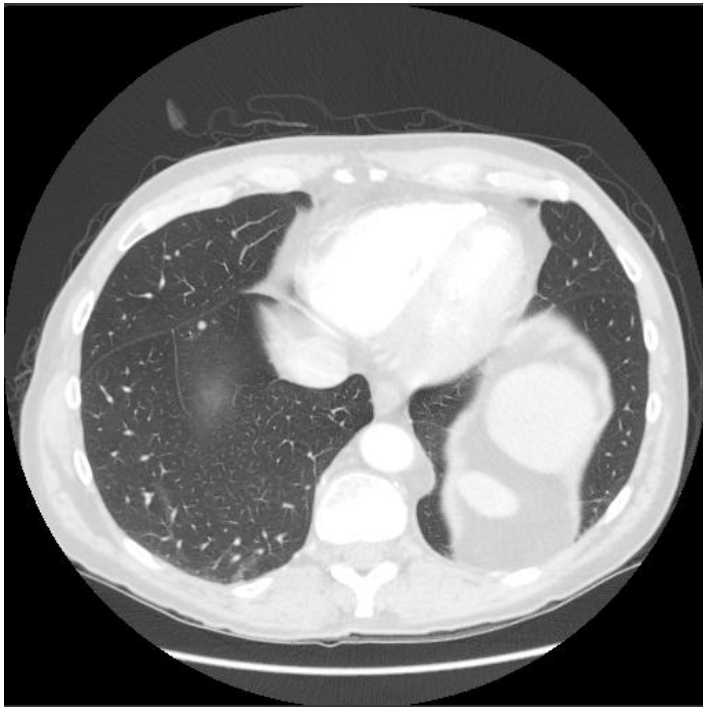
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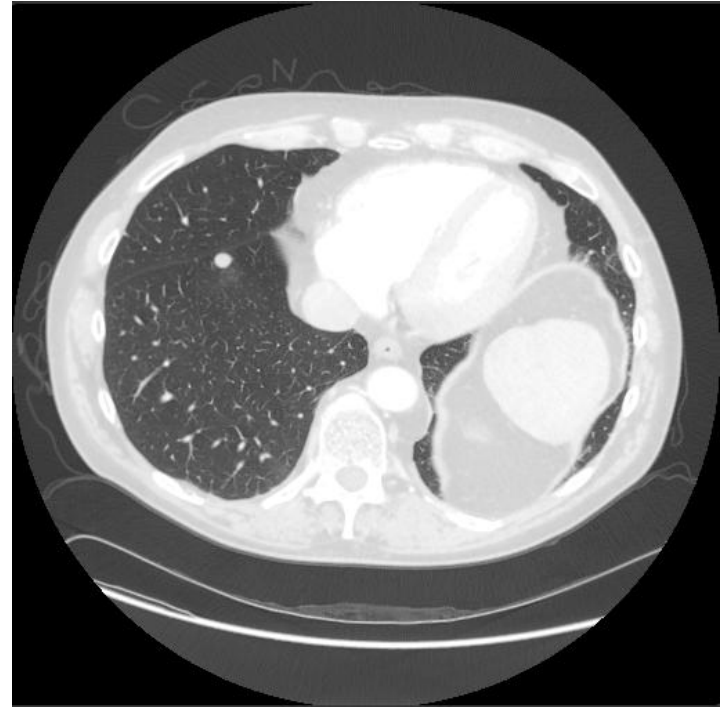


# Colorectal Carcinoma

- 55 yo male, T3 N0 rectal carcinoma with pulmonary nodules on CT  
Aug 2011

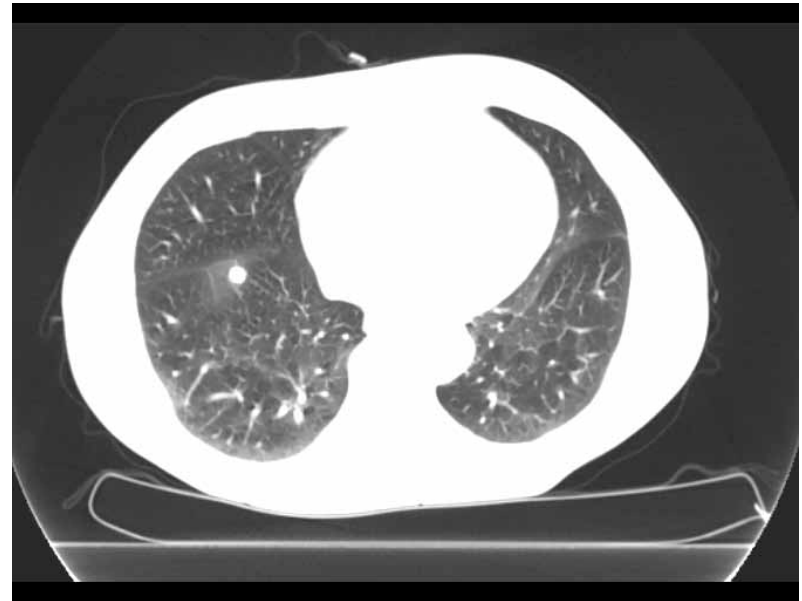
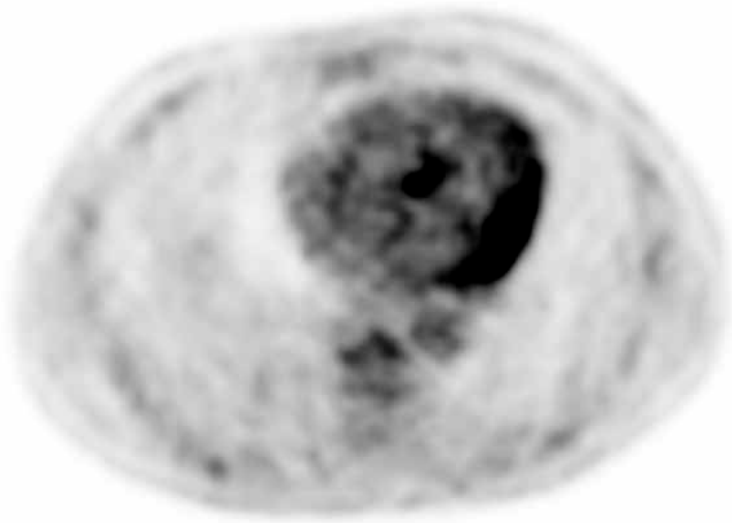


August 2012



# Colorectal Carcinoma

- 55 yo male, T3 N0 rectal carcinoma with pulmonary nodules on CT, PET/CT shows no apparent activity



# Colorectal Carcinoma

- 55 yo male, T3 N0 rectal carcinoma with pulmonary nodules on CT, PET/CT shows no apparent activity

respiratory motion artifact



# PET/CT **not** recommended in :

- ◆ Diagnosis or staging of clinical stage I-III colorectal cancers
- ◆ The routine surveillance in patients with colorectal cancer treated with curative surgery at high risk for recurrence

# PET/CT **not** recommended in :

- ◆ The measurement of treatment response in locally advanced rectal cancer before and after preoperative chemotherapy

# Treatment response

## Monitoring and Predicting Response to Therapy with $^{18}\text{F}$ -FDG PET in Colorectal Cancer: A Systematic Review

Lioe-Fee de Geus-Oei<sup>1</sup>, Dennis Vriens<sup>1</sup>, Hanneke W.M. van Laarhoven<sup>2</sup>, Winette T.A. van der Graaf<sup>2</sup>, and Wim J.G. Oyen<sup>1</sup>

**- therapy response assessment with  $^{18}\text{F}$ -FDG PET remains a very worthwhile research topic.**

J Nucl Med 2009; 50:43S–54S

# Treatment response

## Prognostic Ability of $^{18}\text{F}$ -FDG PET/CT in the Assessment of Colorectal Liver Metastases

Vijayaragavan Muralidharan<sup>1</sup>, Marco Kwok<sup>1</sup>, Sze Ting Lee<sup>2,3</sup>, Lawrence Lau<sup>1</sup>, Andrew M. Scott<sup>\*2,3</sup>, and Christopher Christophi

- **Maximum and mean standardized uptake value did not show any significant predictive ability.**
- **...volumetric  $^{18}\text{F}$ -FDG PET parameters.... may enable better risk stratification of patients.**

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# Colorectal Carcinoma

## Detection of Recurrence in Patients With Rectal Cancer: PET/CT After Abdominoperineal or Anterior Resection

Even-Sapir, E., Parag, Y., Lerman, H.

“PET/CT was used to distinguish benign and malignant presacral abnormalities with a sensitivity, specificity, positive predictive value, and negative predictive value of 100%, 96%, 88%, and 100%, respectively.”

# Colorectal Carcinoma

**PET changes management and improves prognostic stratification in patients with recurrent colorectal cancer: results of a multicenter prospective study.**

[Scott AM](#), [Gunawardana DH](#), [Kelley B](#), [Stuckey JG](#), [Byrne AJ](#), [Ramshaw JE](#), [Fulham MJ](#).

# Colorectal Carcinoma

Group A – structural lesion suggestive of recurrence

- Additional disease in 48.4%; change in management in 65.6%

Group B – resectable pulmonary or hepatic metastases

- Additional disease in 43.9%; change in management in 49%

# Colorectal Carcinoma

## **The Value of FDG Positron Emission Tomography/ Computerised Tomography (PET/CT) in Pre-Operative Staging of Colorectal Cancer: A Systematic Review and Economic Evaluation**

*Health Technology Assessment, No. 15.35, September 2011*

J Brush, K Boyd, F Chappell, F Crawford, M Dozier, E Fenwick, J Glanville, H McIntosh, A Renehan, D Weller, and M Dunlop.

# Colorectal Carcinoma

UK based, systematic review of published and unpublished articles  
“colorectal”, “neoplasm”, “FDG/PET”

3933 titles/abstracts identified by search words; 3431 excluded

Of the remaining 502, only 30 met the inclusion criteria

Brush J, Boyd K, Chappell F, Crawford F, Dozier M, Fenwick E, et al. The value of FDG positron emission tomography/computerised tomography (PET/CT) in pre-operative staging of colorectal cancer: a systematic review and economic evaluation. Health Technol Assess 2011;15(35).

# Colorectal Carcinoma

- 2 studies looked at primary CRC – insufficient data to support
- 5 studies looked at detection of recurrent disease

Sensitivity 91%    Specificity 91%

- 23 studies looked at detection of metastatic disease

Sensitivity 91%    Specificity 76%

# Objectives

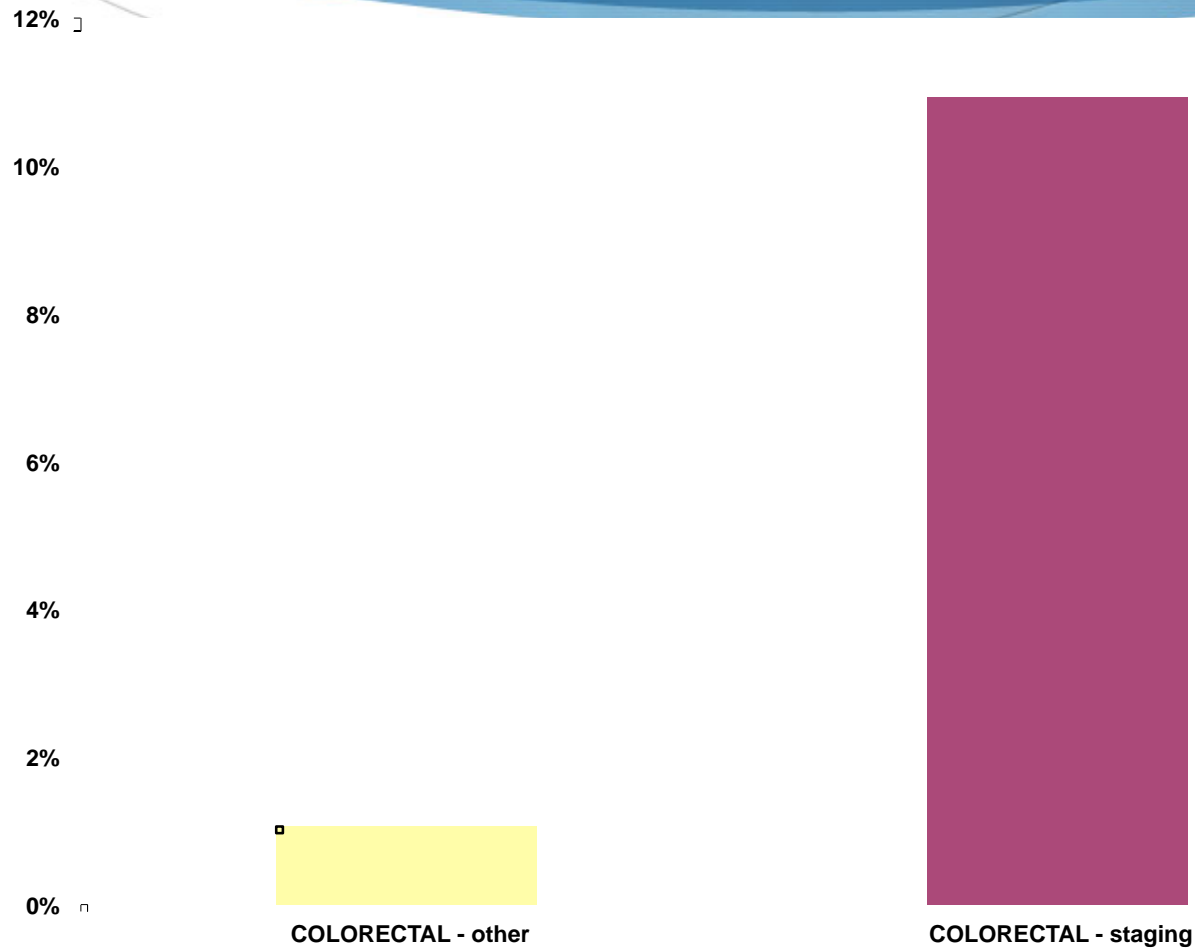
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# PET/CT in BC

- ◆ Two scanners located at BCCA
- ◆ 6000 scans per year
- ◆ 4100 Jan-Sept 2012
- ◆ 500 related to colorectal carcinoma
- ◆ Urgent scans can currently be completed within 2 weeks

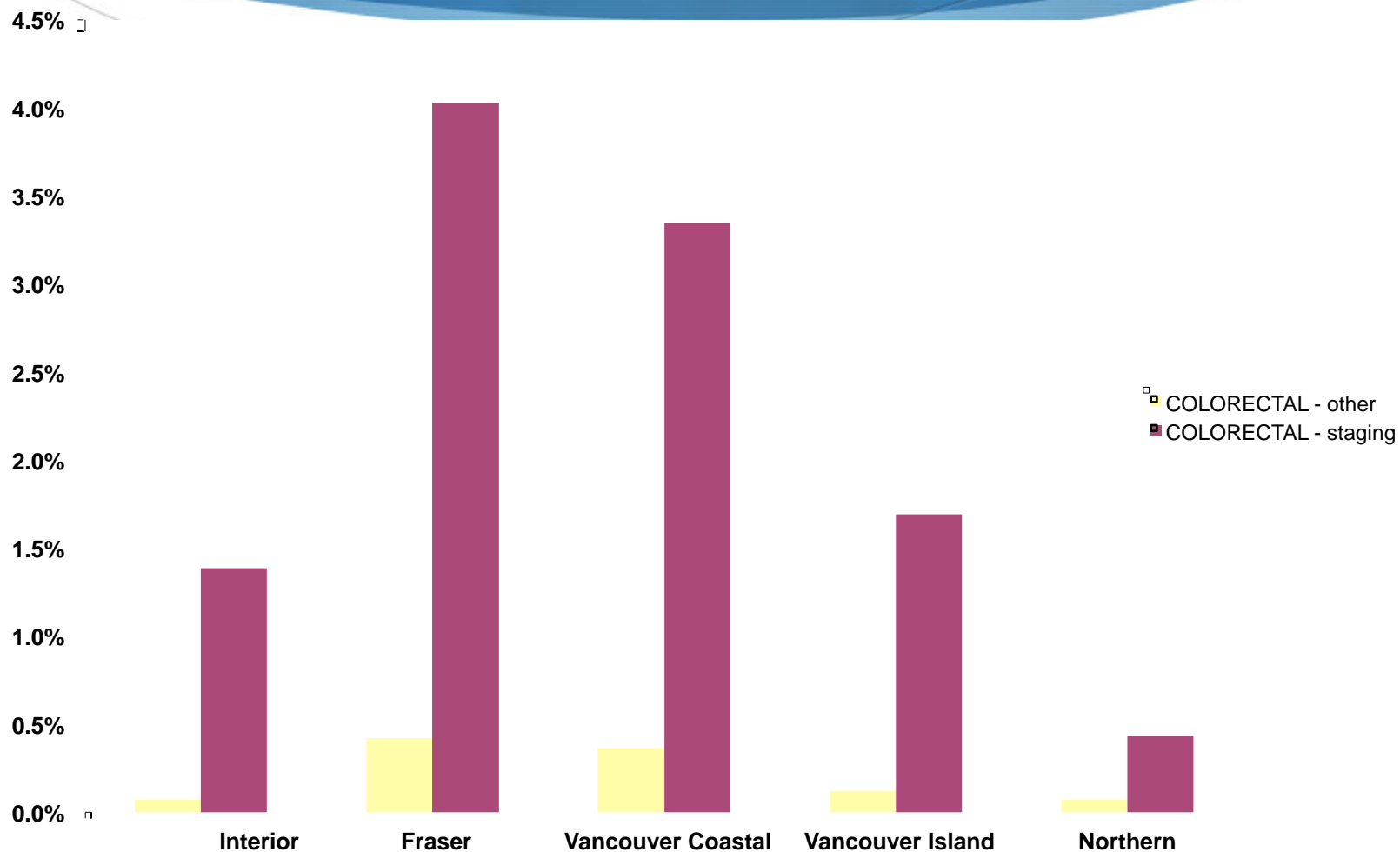
# PET/CT in BC

## Colorectal Cancer PET/CT Scans



# PET/CT in BC

## Colorectal Cancer PET/CT Scans by Health Authority



# Current Indications for PET/CT in Colorectal Carcinoma

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