

CT PET SCANNING for GIT Malignancies A clinician's perspective

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Case presentation

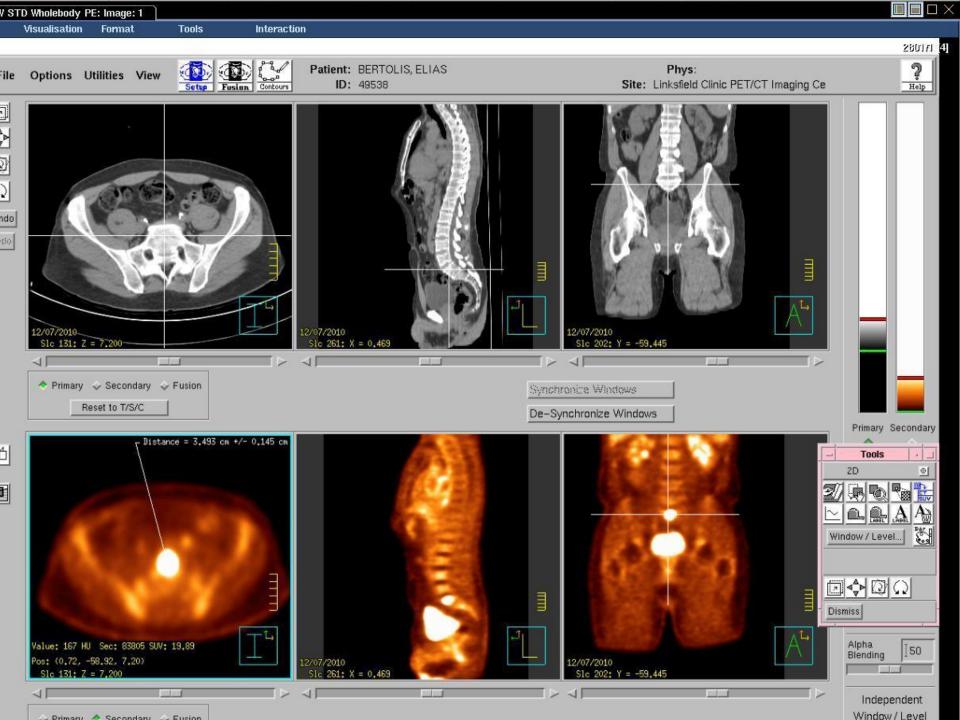
- 54 year old with recent onset of dysphagia and loss of weight.
- Upper endoscopy: circumferential cancer from 36-40 cm=adenocarcinoma
- CT: 6 cm lesion with 2 suspicious nodes in lower mediastinum

CT PET: no distant mets



Further management

- 6 weeks neoadjuvant chemo-radiotherapy
- Tolerated treatment reasonably well
- Dysphagia improved
- Upper endoscopy and biopsy
 - No signs of residual tumour
- CT-PET(whole body)



Review of CT scan- no bony lesion seen

PET hot spot-? Artefact

Bone scan: negative

Axial T2 weighted MRI with fat suppression



Axial T2 weighted MRI with fat suppression



Further management

- Diagnostic laparoscopy –no peritoneal disease
- Extra peritoneal exposure of L1 and bone biopsy:
 - Metastatic adenocarcinoma

Patient counselled and sent for further chemotherapy

Lessons learned

- Believe your tests
- Use all tests at your disposal-
- Consult widely
 - MDT

CT PET applications in oncology

- Tumour detection and differential diagnosis of benign and malignant tumours
- Tumour staging and prognostic stratification
- Evaluation of treatment response
- Restaging and detection of recurrent cancer
- Radiation treatment planning
- Development of new anticancer drugs

CT PET and the gastroenterolgist/surgeon

- GIT lesions picked up on CT PET for other indications
- CT PET for differentiating benign from malignant lesions pancreatic masses, Auto immune pancreatitis
- CT PET in
 - Initial staging
 - Response to treatment
 - Restaging after neoadjuvant treatment
 - Surveillance
- Economics
- Can we do CT and PET at same time and no need for dedicated CT

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Significance of Incidental 18F-FDG Accumulations in the Gastrointestinal Tract in PET/CT: Correlation with Endoscopic and Histopathologic Results

Ehab M. Kamel, Miriam Thumshirn; Kaspar Truninger, et al, *University Hospital of Zurich*, THE JOURNAL OF NUCLEAR MEDICINE • Vol. 45 • No. 11 • Nov. 2004

Conclusion:

- Although IDLs of the GIT on 18F-FDG PET/CT scans are found only in about 3% of cases,
- They are associated with a substantial risk of an underlying cancerous or precancerous lesion.
- Early identification of these occult lesions may have a major impact on the patients' management and outcome.

Incidentally detected lesions(IDL)

- 98 (3%) of the 3,281 patients had an IDL of the GIT
- 69 patients had correlative endoscopic findings
 - 13 (19%) were harboring newly occurring cancers of the GIT
 - 12 had pre existing aerodigestive tumors
- 29 (42%) patients had precancerous lesions
 - 27 advanced colonic adenomas
 - 1 Barrett's esophagus,
 - and intestinal metaplasia of the gastric mucosa (n 1).
- 9 (13%) patients, PET/CT was false-positive, showing normal findings in subsequent endoscopic examinations.
- In 20 (28%) of 69 patients, PET/CT findings had a relevant impact on the clinical management.

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Surgery for GIT Malignancies

- Often high risk operations
 - Oesophagectomy
 - Whipple's Procedure
 - Hepatectomy
 - Total gastrectomy and lymphadenectomy
 - Low anterior resections

Palliative surgery decreasing

- Better chemotherapy
- Better pain relief
- Stents for obstruction, perforation
- Bleeding: argon beam, embolization, radiotherapy
- No proven benefit in most cases of debulking surgery in GIT
 - colorectal ?

ROLE OF CT PET

If CT PET shows increased uptake outside proposed radical resection,

AND if this is **PROVEN** to be distant spread

THEN

No point in performing the radical surgery

Why is it important to get pathological proof of metastatic disease?

- Artefacts
- Infection especially TB
- Second malignancy with a different prognosis

Pathological proof often upstages and changes treatment substantially

If cost and availability no object

Diagnosis

Staging

CT PET for ultimate staging

Neoadjuvant therapy

CT PET to assess early response

CT PET 4-6 weeks after completion of neoadjuvant therapy

Surgery

GIT Applications of PET Oesophagus

oesophagus; poor prognosis

- CT, MRI, Endo US- poor assessment of distant disease
- +- 100 % accuracy in detecting primary
 - Small T1 primaries may be missed
- Upgrades staging 20% changed management

GIT Applications of PET Oesophagus

CT –PET poor for loco-regional staging

- Prognostic role??
 - Increased glucose uptake- worse prognosis??
 - Decreased SUV denotes better response to neoadjuvant CRT
 - Decreased SUV denotes good response to Chemo at 14 days

Oesophageal Cancer

Table I. Representative studies regarding sensitivity of primary tumour and stage IV disease of FDG-PET in oesophagus carcinoma

		Primary tumour Sensitivity (%)	Stage IV disease						
			CT			PET			
Author (Reference)	Patients (no.)		Sens. (%)	Spec.	Acc.	Sens. (%)	Spec.	Acc.	
Block (10) Flanagan (Kole (12)	58 36 26	97 100 96	29 0 67*	96* 95*	78* 88*	100 71* 100	100* 90*	94* 92*	
Rankin (13 Luketich (15 Flamen (15 Skehan (16 Kim (17) Kato (18)	4) 91) 74	100 97# 95 91 96 78	46 41	73 83	63 64	69 74 100 [#]	93 90 91 [#]	84 82	

CT = computed tomography; PET = positron emission tomography; Sens. = sensitivity; Spec. = specificity; Acc. = Accuracy.

^{*}Calculated data.

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Predictors of complete pathological response after neo-adjuvant chemoradiotherapy in Oesophageal cancer?

- Endoscopy and biopsy
- Endoscopic Ultrasound
- CT- wall thickness
- CT -PET

Rising CEA after CRC resection

- Sensitivity 60-70%
- Specificity 84%
- CT misses 7% liver mets
- CT misses metastases to peritoneum, mesentery and LNs
- CT cannot differentiate tumor from surgical scarring

- Presumed isolated liver metastases
 - Normally referred for resection
 - May have occult metastases in over 30%

- CT PET for CRC
 - Sensitivity 97%
 - Specificity 76%

- CT PET in CRC to liver
- Sensitivity and specificity >97%

Influence in decision making

- Direct influence in MX in 59%(Kalff et al)
- Mx changed in 29-40% of CRC to liver

 ? Use for predicting prognosis or response to therapy

- Rising CEA without a focus on conventional screening
- Differentiating fibrosis from LR recurrence
- Pre-op staging in potentially resectable recurrent CRC
- Staging of CRC (Primary) if CEA raised??

Recurrent colorectal carcinoma

Table II. Adapted from a meta-analysis by Huebner et al. (27): sensitivity, specificity and change of management owing to FDG-PET in recurrent colorectal cancer

Author (Reference no.)	Patients	Sensitivity (n)	Specificity	Change in management
Beets (28)	35			40%
Schiepers (29)	76	96%	97%	
Vitola (30)	24	95%	80%	25%
Lai (31)	34	100%	67%	29%
Delbeke (32)	61	98%	83%	33%
Keogan (33)	18	92%	80%	
Ogunbiyi (34)	47	90%	100%	44%
Ruhlmann (35)	59	100%	69%	
Flanagan (36)	22	100%	71%	
Valk (37)	115	95%	79%	31%
Flamen (38)	103	94%	100%	20%

 $FDG-PET = 2-(^{18}F)$ -fluoro-2-deoxy-D-glucose positron emission tomography.

GIT Applications of PET Pancreatic carcinoma

- Main role to differentiate between "mass forming CP" and pancreatic cancer
 - Diabetes and inflamm a problem
- Can be used to look for hepatic mets
 - ->1cm sens and spec >95%
 - -<1cm, sens 46%, spec 97%</p>
- Prognostic role and monitoring therapy promising
- Differentiating Autoimmune pancreatitis from cancer?

Pancreatic lesions- benign or malignant?

Table III. Sensitivity and specificity of FDG-PET for diagnosis of pancreatic carcinoma in patients with pancreatic lesions

Author (Reference no.)	Patients (n)	Sensitivity	Specificity
Friess (56)	80	94%	88%
Inokuma (57)	46	94%	82%
Stollfuss (58)	73	95%	90%
Zimny (59)	106	85%	84%
Rose (60)	65	92%	65%
Frohlich (61)	168	68%	95%
Imdahl (62)	48	96%	100%
Diederichs (63)	304	81%	83%
Nakamoto (64)	47	96%	75%
Koyama (65)	86	82%	81%
Sperti (66)	56	94%	97%
Papos (67)	22	100%	88%

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Surveillance

- Differentiating scar tissue from recurrent disease
 - Pelvic recurrence
 - Oesophageal cancer
 - Post Whipple's procedure

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Cost effectiveness

Most studies of CT PET report

NOT
Improved patient
outcomes

Cost effectiveness

Studies have been performed, some showing CT PET to be cost effective

e.g. for presumed isolated liver mets in CRC

Such studies will need to be

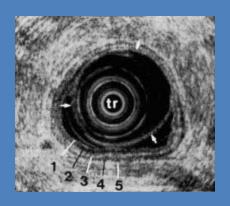
- Scenario specific
- Country /region specific
- Alternative therapy specific

How much anatomical detail should we get from the CT component of a CT PET?

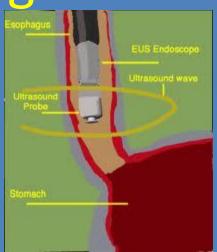
- Higher resolution CT scans may decrease number of additional CT needed but
- Need high resolution CT scanner
- Need expertise and proper protocols
- Radiation increased
- May not be needed for assessing treatment response

Competing technologies

Endoscopic ultrasound









Competing Technologies

- MRI with contrasts, Tin
- Improved CT
- Diagnostic laparoscopy
- Staging laparoscopy

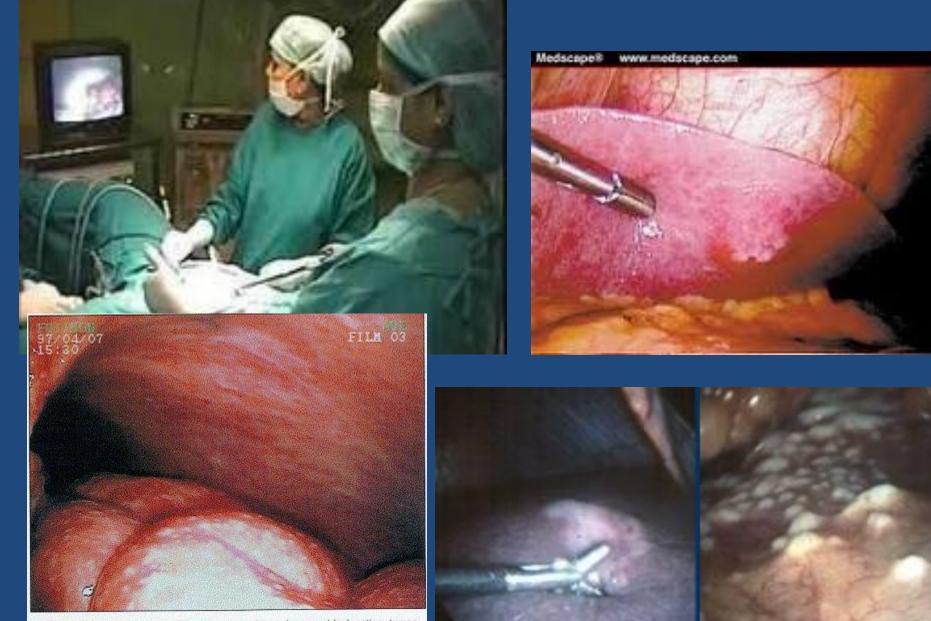


Figure 4: Miliary implants from a recurrent esophogogastric junction tumor. Metastatic disease was discernible only by laparoscopy.

Lessons learned

- CT PET changes decision making in 20-30 percent
- Need to confirm metastatic disease
- CT PET not good for locoregional spread
- CT PET not a good predictor of PCR
- Decreased use of diagnostic laparoscopy

- Many surgeons personalise use of CT PET instead of using it in standardised algorithms
 - Perceived COST
 - Hassle factor of organising CT PET
 - Improved anatomical imaging(CT,MRI,EUS)
 - "routine cases"
 - Doubt re accuracy???
 - Lack of MDTs

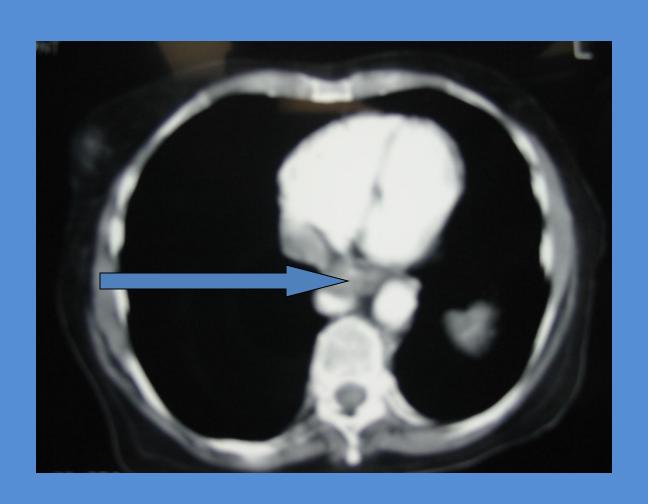
Case 1

- 68 yr old female-previously well
- July 2004 Adenocarcinoma of the distal oesophagus
- CT- Lesion extending to cardia with 1 cm coeliac node
- Decision- Chemoradiotherapy
 (Taxotere, infusional Cisplat and 5 FU +DXT)

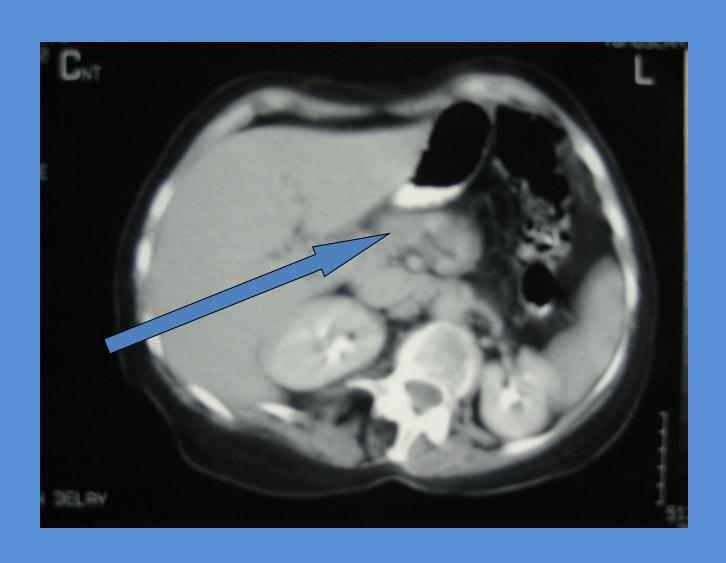
Case 1 ctd

- Jan 2005- rescope- no residual tumor
- Feb 2005- UK
 - Endoscopic ultrasound (radial)
 - FDG PET with CT anatomical fusion
 - No lesions found
- March 2005 2 stage oesophagectomy
- Histology- Small Residual TX- no nodes
- DVT and PE 2 months later

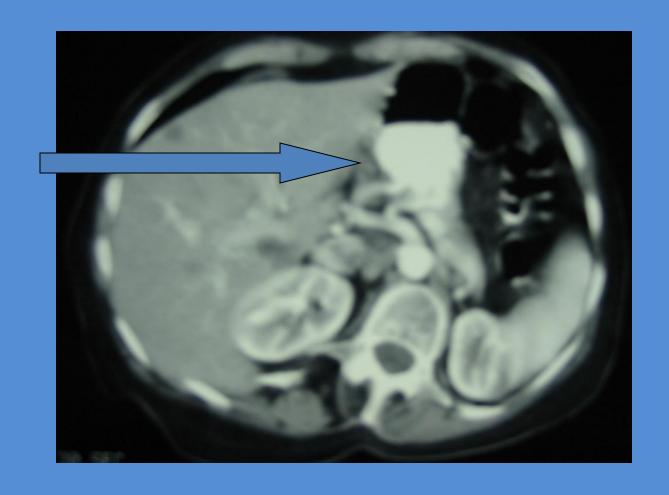
Initial CT Chest

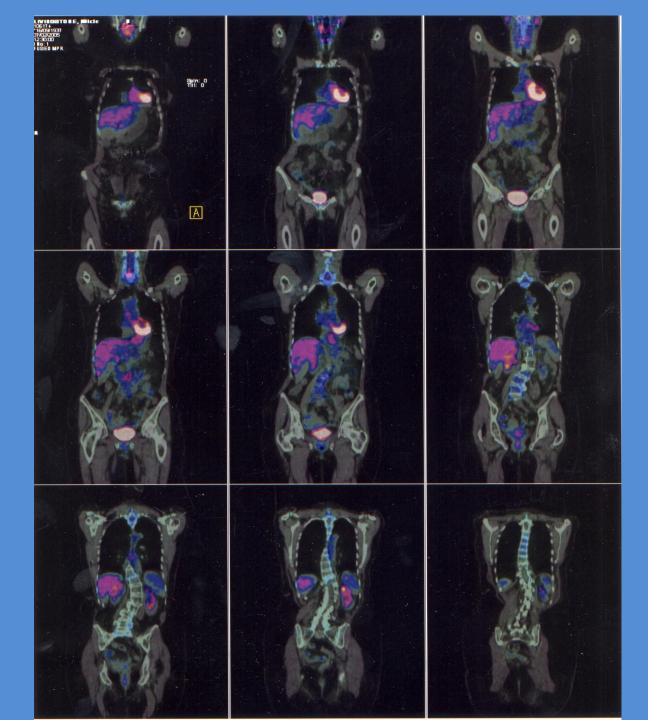


Initial CT- Pre CRT



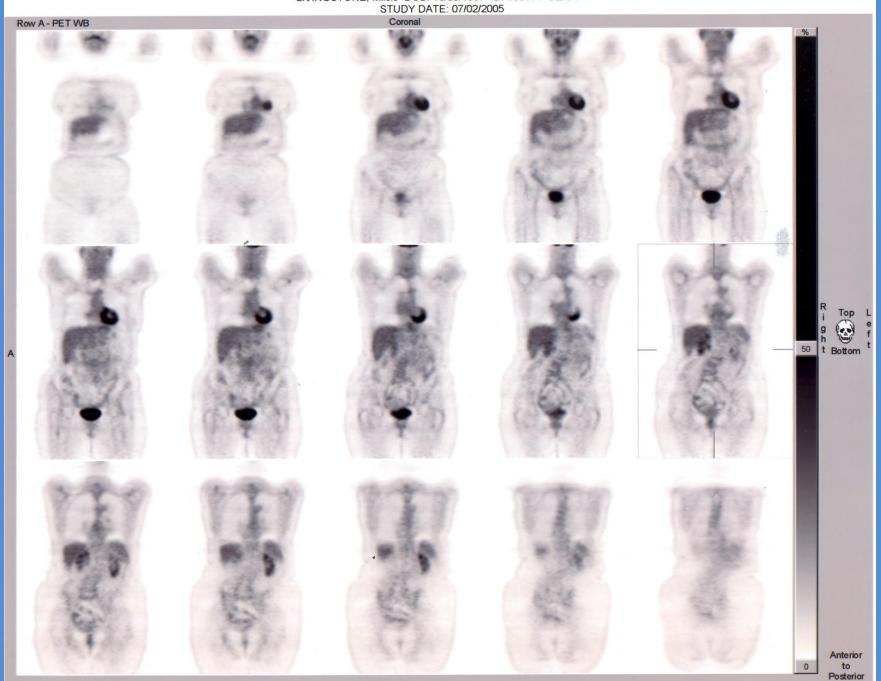
Initial CT







ALLIANCE MEDICAL IMAGING CENTRE LONDON LIVINGSTONE, Milcie DOB: 16/09/1937 ID: 106174 SEX: F





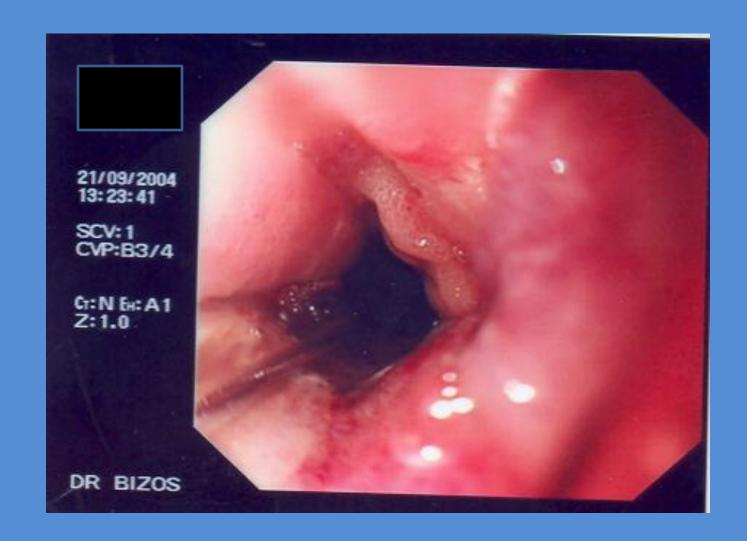


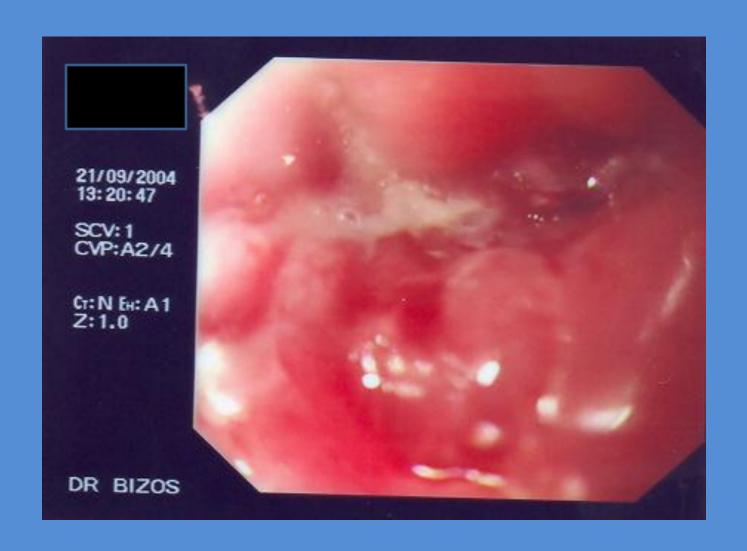
Case 2

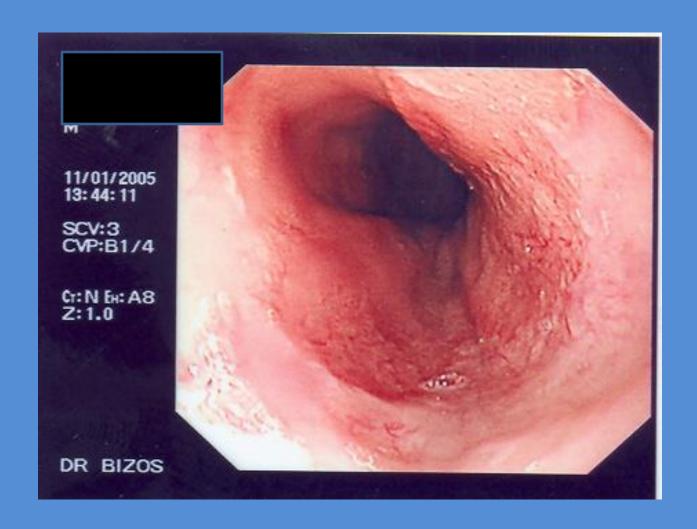
- 68 yr old hypertensive, RIH
- Sept 2004- referred with adenocarcinoma distal oesophagus
- CT: Large long (7cm) lesion
- Decision to give neo-adjuvant CRT
- Jan 2005 rescope: no malignancy seen

Case 2(ctd)

- CT chest and upper abdomen
 - lesion smaller and no evidence of Mets
- CT PET in London
 - UPTAKE IN PELVIC bones!!!!
 - MRI: lesions in iliac bones (PSA normal)
 - biopsied adenocarcinoma







Case 2(ctd)

- Decision to give DXT to pelvis
- Incarcerated RIH and small bowel radiation enteritis
 - Emergency operation 17 March 2005
 - Prolonged hosp stay(ileus/enteritis)
- Palliative care