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Technology Review

POSITRON EMISSION TOMOGRAPHY-COMPUTED TOMOGRAPHY (PET/CT) SCAN FOR CANCER

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TECHNOLOGY REVIEW:
POSITRON EMISSION TOMOGRAPHY- COMPUTED TOMOGRAPHY SCANNER (PET-CT SCAN)

1. INTRODUCTION

Positron emission tomography (PET) with 2-[fluorine-18] fluoro-2-deoxy-d-glucose (FDG) has been effective for the diagnosis, staging, and restaging of malignancies. However, lack of anatomic landmarks, variable physiologic uptake, and asymmetric FDG distribution in several altered physiologic states can confound image interpretation. In addition, many benign causes and several artifacts can simulate physiologic or pathologic FDG uptake. Combined PET–computed tomography (CT) is a unique imaging modality that permits anatomic and functional imaging on a single scanner with nearly perfect co-registration. Combined PET-CT provides information that cannot be obtained with PET or CT alone.

2. TECHNICAL FEATURES

PET/CT combines the functional information from a positron emission tomography (PET) examination with the anatomical information from a computed tomography (CT) examination into one single examination.

A PET examination detects changes in cellular function and provides metabolic detail (cellular activity of the tumor, mass, etc.). Since these functional changes take place before physical changes occur, PET can provide information that enables the physician to make an early diagnosis. PET images begin with an injection of 2-[fluorine-18] fluoro-2-deoxy-d-glucose (FDG), an analog of glucose that is tagged to the radionuclide F18. Metabolically active organs or tumors consume sugar at high rates, and as the tagged sugar starts to decay, it emits positrons. These positrons then collide with electrons, giving off gamma rays, and a computer converts the gamma rays into images. These images indicate metabolic "hot spots," often indicating rapidly growing tumors (because cancerous cells generally consume more sugar/energy than other organs or tumors).

A CT scan uses a combination of x-rays and computers to provide anatomical detail (size and location of the tumor, mass, etc.). CT scanners send x-rays through the body, which are then measured by detectors in the CT scanner. A computer algorithm then processes those measurements to produce pictures of the body's internal structures. One advantage of CT is its ability to rapidly acquire multiple two-dimensional image slices of the anatomy. Using a computer, these 2-D images can be presented in 3-D for in-depth clinical evaluation.

When these two scans are fused together, the physician can view metabolic changes in the proper anatomical context of the body.

Risk factors for complications during the procedure include allergies to imaging contrast agents, claustrophobia and kidney disease.

Before the procedure, the patient will be requested to fast overnight. The patient may be asked to eat a high protein, low carbohydrate diet for a day or so prior to

the test, and drink about 3-4 glasses of water prior to the test. Before the scanning procedure is done, an intravenous (IV) line will be placed in the arm. A small quantity of the tracer substance, 18FDG (used for the PET portion of the scan) will be injected through the IV line. The patient will need to wait about 45-60 minutes after this injection before being positioned on a table for the actual scan. Then, the patient will receive another injection of enhancing agent (used for the CT portion of the scan). While the PET/CT images are being taken, the patient will need to lie still for about 35 minutes. The whole procedure takes about a total of two hours to complete.

3. OBJECTIVE

To assess the safety, effectiveness and cost-effectiveness of the combined Positron Emission Tomography- Computed Tomography Scanner (PET-CT Scan) in the management of cancer.

4. METHODOLOGY

A literature search was done using the Medline, TRIP database, EBSCOHost and international HTA databases. The search was limited to only publications from year 2005 onwards since a systematic review and meta-analysis report for PET-CT scan was already published in the year 2004. Keywords used were "PET-CT", "positron emission tomography", (safe* OR "adverse effects" OR toxic OR harm*), (effective* OR efficacy) and "cost-effective*" in various combinations. However, no limitations were applied when retrieving literature for the safety or cost-effectiveness aspects as the retrieved articles were not abundant in number.

Only literatures concerning the combined PET-CT scan were taken, as evidence of the effectiveness for individual PET or CT scan was already established.

5. RESULTS & DISCUSSION

a) Safety

One article considered the safety aspect of the technology; however, it was not on the machine but the aftermath after the use of the technology. In PET/CT scanning, the photons associated with positron decay are much higher energy than other diagnostic radiations. As a result, barrier shielding may be required in floors and ceilings as well as adjacent walls. Since the patient becomes the radioactive source after the radiopharmaceutical has been administered, one has to consider the entire time that the subject remains in the clinic (Madsen et al, 2006 [level 9 evidence]).

b) Effectiveness

There is one systematic review-meta analysis report about the combined Positron Emission Tomography- Computed Tomography Scanner (PET-CT Scan), published in the year 2004. In this report, the authors found that PET/CT is a useful diagnostic technique for detecting malignancy, with a significant reduction of non-conclusive lesions. Other indications included radiotherapy planning, guide for biopsy and therapy assessment. The authors also concluded that PET/CT has some advantages over PET or CT scan alone. The advantages include PET/CT is less time consuming compared to PET alone and that the

simultaneous adquisition of PET and CT images limit the alignment problems and changes of patients position. In a whole, PET/CT scan makes PET centres more efficient (Garrido & Barrio, 2004 level 1 evidence).

In a review paper based on the experience of one institution, whole-body PET/CT imaging allows correct co-registration of morphological and functional images. The review stated that a close collaboration between PET and CT imaging experts is essential, given the complexity of the combined dual-modality tomograph. Misinterpretations of results can be avoided with careful attention to technical factors, knowledge of a patient's clinical history, and direct comparison (easily accomplished with PET/CT) of the PET images with the corresponding CT images (Gorospea et al, 2005 level 9 evidence). Brianzoni et al (2005) in his prospective study to evaluate the role of PET/CT found that this imaging technology is highly sensitive and offers better visualization of local and loco-regional tumour extension. Thus, it confirmed that PET/CT scanning may lead to significant modifications of radiotherapy planning and patient management (Brianzoni et al, 2005 level 4 evidence).

Other literatures on the use of PET/CT for different cancers were also retrieved. They are as follows:-

i. Ophthalmological cancers

Only a few studies were done regarding the use of PET/CT scan in ophthalmological cancers. In an interventional non-randomized study, it was found that PET/CT is a sensitive tool for the detection and localization of metastatic choroidal melanoma (either hepatic or extra-hepatic), thus helping in the staging of the cancer (Kurli et al, 2005 level 4 evidence). Another retrospective study done by Wild et al (2006) concluded that whole body PET/Ct adds clinically important information to CT or MRI, thus, influencing the treatment (Wild et al, 2006 level 4 evidence).

ii. Head and neck cancer

Goshen et al (2006) reported from a study comparing the findings of PET/CT and CT alone, that PET/CT is highly contributory for initial staging and in the evaluation of patients with suspected recurrent squamous cell cancer of the head and neck. The sensitivity of PET/CT was reported to be 100%, specificity (77%), negative predictive value (100%) and accuracy of PET/CT was 88% (Goshen et al, 2006 level 4 evidence). Similarly, Shah et al (2006) in a retrospective study to detect recurrence in patients with squamous cell cancer of the head and neck, found that the sensitivity of PET/CT was 94.7%, specificity was 14.27%, the positive predictive value was 90%, negative predictive value was 25% and accuracy was 85.94% (Shah et al, 2006 level 4 evidence).

iii. Thyroid cancer

In a prospective study which compared the diagnostic accuracy of PET/CT with ultrasonography (US) and contrast enhanced CT (CECT) in the evaluation of cervical node levels in patients with papillary thyroid carcinoma, found that integrated PET/CT does not provide any additional benefit when compared to the other two technologies (Jeong et al, 2006 level 4 evidence).

iv. Lung cancer

In a prospective study comparing the diagnostic accuracy of helical dynamic CT (HDCT) and integrated PET/CT for pulmonary nodule characterization, it was found that the sensitivity, specificity, and accuracy for malignancy on HDCT were 81%, 93%, and 85% respectively, whereas those on integrated PET/CT were 96%, 88%, and 93% respectively ($p = 0.008$, 0.727, and 0.011, respectively). The authors concluded that integrated PET/CT is more sensitive and accurate than HDCT for malignant nodule characterization. Therefore, PET/CT may be performed as the first-line evaluation tool for solitary pulmonary nodule characterization (Yi Ca et al, 2006 [level 4 evidence])

Clauss et al (2006) reported from a prospective study that the consensus interpretation and decision of PET/CT images between the radiologist and the nuclear medicine physician appears to be the best way to stage lung cancer after the initial CT investigation. In this study, 36% of patients had their staging changed when the CT report was compared to the PET/CT (Clauss et al, 2006 [level 4 evidence]).

v. Gastrointestinal, pancreatic and liver cancers

A prospective study to determine the influence of PET/CT in the management of resectable pancreatic cancer found that the PET/CT represents an important staging procedure prior to pancreatic resection for cancer, as it significantly improves patient selection. In this study, the positive and negative predictive values for pancreatic cancer were 91% and 64%, respectively. PET/CT findings changed the management in 16% of patients with pancreatic cancer deemed resectable after routine staging ($p < 0.031$) (Heinrich et al, 2005 [level 4 evidence]).

Reinhardt et al (2005) reported that PET/CT provided high accuracy for non-invasive detection of perihilar cholangiocarcinoma in extrahepatic bile duct strictures (Reinhardt et al, 2005 [level 4 evidence]). Similarly , Petrowsky et al (2006) found that PET/CT and ceCT provided a comparable accuracy for the primary intra- and extra-hepatic cholangiocarcinomas. In this study, all distant metastases (100%) were detected by PET/CT, but only 25% by ceCT ($p < 0.001$). The regional lymph node metastases were detected by PET/CT and ceCT in only 12% and 24% respectively. It was also noted that PET/CT findings resulted in a change of management in 17% of patients deemed resectable after standard work-up (Petrowsky et al, 2006 [level 4 evidence]).

In an evaluation of patients with primary colorectal carcinoma, it was found that PET/CT altered the management plan in 24% of patients in correct direction (Park et al, 2006). Meanwhile, in a prospective study for evaluation of patients for resection of liver metastases from colorectal cancer found that PET/CT and contrast enhanced CT (ceCT) provide similar information regarding hepatic metastases of colorectal cancer. PET/CT is superior to ceCT for the detection of recurrent intrahepatic tumors after hepatectomy, extrahepatic metastases, and local recurrence at the site of the initial colorectal surgery (Selzner et al, 2004 [level 4 evidence]).

vi. Gynaecological cancers

In cervical cancers, PET/CT proved to be valuable for lymph node staging in patients with early-stage cervical cancer with short-axis diameter greater than 0.5 cm. This is the size threshold for accurate depiction of metastatic nodes. The overall node-based sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy of PET/CT were 72%, 99.7%, 81%, 99.5%, and 99.3% respectively (Sironi et al, 2006 [level 4 evidence]). In late stage cervical cancer, PET/CT was found to be of value for detection of cervical cancer metastases as well as decision-making and planning of irradiation therapy. In late stage ovarian cancer, the correlation with PET/CT examination revealed levels of sensitivity (60%), specificity (94%), positive (90%) and negative predictive values (74%), thus, reducing unnecessary surgical interventions. This help modify radiation fields and change therapeutic approaches (Amit et al, 2006 [level 4 evidence]).

In ovarian cancers, most of the literatures retrieved were regarding the use of PET/CT scan in recurrent ovarian cancer cases. PET/CT provided a good sensitivity (88.2%), specificity (71.4%) and accuracy (85.4%), superior to that reported in literature for traditional radiologic imaging such as ultrasound, CT and MRI in detecting recurrent ovarian carcinoma (Nanni et al, 2005 [level 4 evidence]). Bristowa et al (2005) reported that combined PET/CT demonstrated high positive predictive value in identifying recurrent ovarian cancer in retroperitoneal lymph nodes when conventional CT findings are negative or equivocal (Bristowa et al, 2005 [level 4 evidence]). Similarly, Hauth et al (2005) found the same results from his prospective study, thus recommending that PET/CT should be considered for follow-up of patients with ovarian cancer (Hauth et al, 2005 [level 4 evidence]). In another study it was reported that PET/CT resulted in a major change of management plan in 58% of patients (Simcock et al, 2006 [level 4 evidence]).

vii. Malignant melanoma

There were not many studies regarding the use of PET/CT in malignant melanoma. In a retrospective blinded study by Reinhardt et al (2006), it was reported that PET/CT detected significantly more visceral and non-visceral metastases than PET alone and CT alone (98.7%, 88.8%, and 69.7%, respectively). PET/CT imaging thus provided significantly more accurate interpretations regarding overall N- and M-staging than PET alone and CT alone. Overall N- and M-stage was correctly determined by PET/CT in 97.2% patients (95% CI, 95.2% to 99.4%) compared with 92.8% (95% CI, 89.6% to 96.0%) by PET, and 78.8% (95% CI, 73.7% to 83.9%) by CT. Reinhardt also reported that the accuracy of PET/CT was significantly higher than that of PET and CT for M-staging (0.98 v 0.93 and 0.84) and significantly higher than that of CT for N-Staging (0.98 v 0.86). In this study, the change of treatment according to PET/CT findings occurred in 48.4% of patients.

c) Cost-effectiveness

There is limited literature available which evaluated the cost-effectiveness of using PET/CT scanners. A systematic review concluded that PET/CT scan could

be cost effective because of the reduction of unnecessary diagnostic methods and surgical or other non-effective treatments (Garrido & Barrio, 2004 [level 1 evidence]).

In a study regarding the use of PET/CT scan in the management of pancreatic cancer, Franc$1,066 was saved per patient when PET/CT scan were used in addition to the routine staging investigations. This cost was derived from the pancreatic surgery avoided because of metastasis diagnosed by PET/CT (Heinrich et al, 2005 [level 6 evidence]).

6. CONCLUSION

i. There is limited evidence regarding the safety of using PET/CT scanner.

ii. There is fair level of evidence regarding the effectiveness of PET/CT scan in the management of cancer conditions, particularly in head and neck cancer, ophthalmological cancers, lung cancer, gynaecological cancers, gastrointestinal cancer.

iii. There is limited evidence on the cost-effectiveness of using PET/CT scanner in the management of cancer.

7. APPENDIX

Appendix i: Level of evidence table
Appendix ii: Evidence table

8. REFERENCES

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Appendix i

Levels of Evidence Scale

Level	Strength of evidence	Study design
1	Good	Meta-analysis of RCT, Systematic review
2	Good	Large sample RCT
3	Good to fair	Small sample RCT
4		Non-randomised controlled prospective trial
5	Fair	Non randomised controlled prospective trial with historical control
6	Fair	Cohort studies
7	Fair	Case-control studies
8	Poor	Non-controlled clinical series, descriptive studies multi-centre
9	Poor	Expert committees, consensus, case reports, anecdotes

Adapted from Catalonian Agency for Health Technology Assessment (CAHTA) Spain.

Appendix ii

EVIDENCE TABLE: POSITRON EMISSION TOMOGRAPHY- COMPUTED TOMOGRAPHY SCANNER (PET-CT SCAN)

ASPECT: SAFETY

No	Author, title, Journal, Year, Volume, Page Number	Study Design, Sample Size, Follow up	Outcomes & Characteristics	Grade	Comment
1	Madsen MT, Anderson JA, Halama JR, Kleck J AAPM Task Group 108: PET and PET/CT shielding requirements. Med Phys. 2006 Jan;33(1):4-15.	Guideline	The 0.511 MeV annihilation photons associated with positron decay are much higher energy than other diagnostic radiations. As a result, barrier shielding may be required in floors and ceilings as well as adjacent walls. Since the patient becomes the radioactive source after the radiopharmaceutical has been administered, one has to consider the entire time that the subject remains in the clinic.	Fair	consensus based

ASPECT: EFFECTIVENESS

No	Author, title, Journal, Year, Volume, Page Number	Study Design, Sample Size, Follow up	Outcomes & Characteristics	Grade	Comment
GENERAL					
1	Rodriguez Garrido M, Asensio del Barrio. PET-CT: indications, systematic review and meta-analysis. Agencia de Evaluacion de Tecnologias Sanitarias (AETS), 2004:131.	Systematic review & meta-analysis Medline, EMBASE, CancerLit & Cochrane Library were searched 16 articles selected from 209 retrieved. 6 articles chosen for meta-analysis.	-PET-CT scan is a useful diagnostic technique for malignancy detection, with a significant reduction of non-conclusive lesions. -other indications are: radiotherapy planning, guide for biopsy and therapy assessment. -diagnostic accuracy of PET-CT scan for tumoral re-staging (loco-regional & distant metastases) is a little better than for neoplasm staging. - PET-CT scan could be cost-effective because of the reduction of unnecessary diagnostic methods and surgical or other non effective treatments. - some advantages of PET-CT scan: less time consuming than PET scan alone, simultaneous adquisition of PET and CT images limit the alignment problems and changes of patients position.	Good	

2	Antoch G, Vogt FM, Freudenberg LS, et al. Whole-body dual-modality PET/CT and whole-body MRI for tumor staging in oncology. JAMA, Dec 2003; 290 (24): 3199-3206	Prospective blinded study 98 patients with various oncological diseases who went for both FDG-PET/CT scan and MRI, results interpreted by two blinded reader teams.	-from 98 patients, overall TNM staging was correctly determined in 75 with PET/CT (77%; 95% CI;67-85%) and 53 in MRI (54%, 95% CI; 44-64%) -compared with MRI, PET/CT had direct impact on patient management in 12 patients (MRI had impact on 2 patients) -separate assessment on T-staging in 46 patients-PET/CT accurate in 37 (805, 95% CI, 66-91%) and MRI accurate in 24 (52%, 95% CI, 37-67%) -of 98 patients, N-stage was correctly determined in 91 patients with PET/CT (79%; 95% CI, 86-97%) and 77 in MRI (79%, 95% CI 69- 86%). Conclusion: the feasibility and diagnostic accuracy of the whole-body PET/CT and MRI are established. Superior performance in overall TNM staging suggest the use of FDG-PET/CT scan as a possible first-line modality for whole-body tumor staging.	Fair	
3	Gorospea L, Raman S, Echevestea J et al. Whole-body PET/CT: Spectrum of physiological variants, artifacts and interpretative pitfalls in cancer patients. Nuclear Medicine Communications 2005, 26:671–687.	Review paper based on the experience of one institution and on correlation with surgical pathology, comparison with conventional images, and on other clinical information available in the patient's chart.	Whole-body PET/CT imaging allows correct co-registration of morphological and functional images. Given the complexity of the combined dual-modality tomograph, a close collaboration between PET and CT imaging experts is essential. Misinterpretations can be avoided with careful attention to technical factors, knowledge of a patient's clinical history, and direct comparison (easily accomplished with PET/CT) of the PET images with the corresponding CT images.	Fair	Narrative review

4	Brianzoni E, Rossi G, Ancidei S et al. Radiotherapy planning: PET/CT scanner performances in the definition of gross tumour volume and clinical target volume. Eur J Nucl Med Mol Imaging. 2005 Dec;32(12):1392-9.	Prospective study. The aim of this study was to evaluate the possible role of fused images (anatomical CT and functional FDG-PET), acquired with a dedicated PET/CT scanner, in delineating gross tumour volume (GTV) and clinical target volume (CTV) in selected patients and thus in facilitating RT planning. METHODS: Twenty-eight patients were examined, 24 with lung cancer (17 non-small cell and seven small cell) and four with non-Hodgkin's lymphoma in the head and neck region.	Three patients were excluded from the study owing to change in the disease stage subsequent to the PET/CT study. Among the remaining 25 patients, PET significantly altered the GTV or CTV in 11 (44%) . In five of these 11 cases there was a reduction in GTV or CTV, while in six there was an increase in GTV or CTV. CONCLUSION: FDG-PET is a highly sensitive imaging modality that offers better visualisation of local and locoregional tumour extension. This study confirmed that co-registration of CT data and FDG-PET images may lead to significant modifications of RT planning and patient management.	Fair	
OPHTHALMOLOGICAL CANCERS					

1	Kurli M, Reddy S, Tena LB et al. Whole Body Positron Emission Tomography/ Computed Tomography Staging of Metastatic Choroidal Melanoma. Am J Ophthalmol .2005; 140:193–199.	Interventional non-randomized clinical study. To evaluate whole-body positron emission tomography/computed tomography in staging of patients with metastatic choroidal melanoma. 20 patients were referred for whole-body (FDG) PET/CT imaging because of suspected metastatic choroidal melanoma. PET/ computed tomography images were studied for the presence and distribution of metastatic melanoma. Subsequent biopsies were performed to confirm the presence of metastatic disease.	Twenty patients underwent PET/computed tomography. Eighteen were imaged because of abnormal clinical, hematologic, or radiographic screening studies during the course of their follow-up after plaque brachytherapy or enucleation. Two were imaged before treatment of their primary tumor. PET/computed tomography revealed or confirmed metastatic melanoma in eight (40%) of these 20 patients. PET/computed tomography imaging also detected benign lesions of the bone and lymph nodes in three patients (15%). PET/computed tomography imaging is a sensitive tool for the detection and localization of hepatic and extra-hepatic (particularly osseous) metastatic choroidal melanoma.	Fair	
2	Damian Wild, Gerold K. Eyrich, Ilja F. Ciernik et al. In-line 18F-fluorodeoxyglucose positron emission tomography with computed tomography (PET/CT) in patients with carcinoma of the sinus/nasal area and orbit. Journal of Cranio-Maxillofacial Surgery (2006) 34, 9–16	A retrospective analysis of the whole body PET/CT studies was done. Images were assessed visually without knowing the results of the other imaging technique. Histology and clinical follow-up served to verify lesions. The clinical impact on therapy was assessed together with the physician in charge. 21 patients.	All patients underwent PET/CT and CT or MRI for staging (n ¼ 9 scans) and restaging (n ¼ 17 scans) without treatment between the examinations. PET/CT changed the treatment protocol in 2 patients at staging and in 7 at re-staging. Distant metastases were found in 5 and a secondary tumour in 1 patient. Conclusions: Whole body PET/CT adds clinically important information to CT or MRI, thus, influencing treatment.	Fair	

HEAD AND NECK CANCER					
1	Shah BC, D'Cruz K, Shah S, Rangarajan V et al. PET-CT in Recurrent Head and Neck Squamous Cancer. Arch Otolaryngol Head Neck Surg. Aug 2006; 132: 875	Retrospective cohort study of 1 year. Specialized referral center. 80 previously treated patients with head and neck squamous cancer underwent 85whole-body PET-CT fusion scans during follow-up for recurrent disease that was clinically considered salvageable. Non-squamous cancers and clinically advanced and all nasopharyngeal tumors were excluded. PET-CT uptake was tested with gold standard positive histopathology.	66 male and 14 female patients with a mean age of 55 years presented with recurrence at a median of 350 days. Thirty-four (42.5%) had oral cancers; 11, base of tongue lesions; 10, oropharyngeal; 16, hypopharynx; 6, larynx; and 3, other. At prior staging, 48 (60%) had stage IV; 16 (20%), stage III; and 16 (20%), stage II. 37 underwent combined surgery with radiation or chemoradiation; 21 received chemoradiation; 19 received radical radiotherapy; and 3 had undergone surgery only before PET-CT. Indications included 26 local and 28 regional recurrences; 21 suspected recurrences; 4 recurrences on follow-up; and 6 recurrences for abnormal imaging results. Of 18 patients with abnormal findings on endoscopy/ examination under anesthesia prior to PET-CT, only 11 were salvageable. Of 47 patients with normal/ equivocal endoscopy, 7 patients (17%) had non-salvageable disease: 25 (31%) with local recurrence had change in plan; 11 (13%) change influenced by CT scan findings and 14 PET findings decisive. An extra investigation was avoided in 17. For PET-CT, sensitivity was 94.7% and specificity was 14.27%. The positive predictive value was 90%; negative predictive value, 25%; and accuracy, 85.94%. Positron emission tomography and computed tomography fusion imaging has a definite role in management of recurrent head and neck squamous cancers.	Fair	

2	Vasanawala MS, Wang Y, Quon A, and Gambhir SS F-18 Fluorodeoxyglucose PET/CT as an Imaging Tool for Staging and Restaging Cutaneous Angiosarcoma of the Scalp. Clin Nucl Med 2006;31: 534–537)	Case report	PET/CT imaging with F-18 FDG demonstrated the extent of the multiple angiosarcomatous lesions, including the possible osseous involvement. The follow-up PET/CT demonstrated resolution of the multiple cutaneous and solitary osseous lesions. FDG PET/CT may be a valuable diagnostic tool in staging of angiosarcomas and even response to Treatment.	Poor	
3	Goshen E, Davidson T, Yahalom R, Talmi YP, Zwas ST PET/CT in the evaluation of patients with squamous cell cancer of the head and neck. Int. J. Oral Maxillofac. Surg. 2006; 35: 332–336.	Retrospective study. Compared the findings of PET with fused PET-CT in patients with suspected loco-regional and distant head and neck cancer and to evaluate the impact of those findings on clinical management. 25 patients were retrospectively evaluated. PET findings were classified as malignant, benign or equivocal. PET/CT findings were then similarly classified and the PET-only results were amended accordingly.	A total of 45 foci of increased 18F-fluorodeoxyglucose (FDG) uptake were noted in 18 patients. PET/CT imaging defined anatomic localization of 41/45 lesions and clarified 6/10 equivocal PET findings. Additional information was provided by PET/CT regarding 9/45 (20%) of the lesions. PET/CT significantly affected patient management in 3/25 patients (12%) by limiting the extent of disease in one and excluding viable disease in two others. The accuracy of PET/CT was 88%, the sensitivity 100% and the specificity was 77%. The negative predictive value was 100% in this combined group of patients with loco-regional and distant head and neck cancer. PET/CT is highly contributory for initial staging and in the evaluation of patients with suspected recurrent SCC of the head and neck, in whom anatomic imaging is inconclusive due to the loco-regional distortions rendered by surgery and radiotherapy.	Fair	

THYROID CANCER					
1	Han-Sin Jeong, Chung-Hwan Baek, Young-Ik Son, Joon-Young Choi et al. Integrated 18 F-FDG PET/CT for the initial evaluation of cervical node level of patients with papillary thyroid carcinoma: comparison with ultrasound and contrast-enhanced CT. Clinical Endocrinology (2006) 65, 402–407	Prospective study. To compare the diagnostic accuracy of integrated 18-FDG PET/CT with ultrasonography (US) and contrast enhanced CT (CECT) alone in the initial evaluation of cervical lymph node levels of patients with papillary thyroid carcinoma. From July 2004 to March 2005, 26 consecutive patients with papillary thyroid carcinoma, confirmed by aspiration cytology analysis, underwent US, CECT and PET/CT.	At all lymph node levels (levels I–VI), PET/CT showed a sensitivity of 30·4%, a specificity of 96·2% and a diagnostic accuracy of 86·9%. The corresponding values for US and CECT were 41·3%, 97·4%, 89·1% (US) and 34·8%, 96·2%, 87·2% (CECT). Considering only the lateral cervical node group (levels I–V), PET/CT showed a sensitivity of 50·0%, a specificity of 97·0% and a diagnostic accuracy of 92·3%. The corresponding values for US and CECT were 53·9%, 97·9%, 93·5% (US) and 42·3%, 96·6%, 91·2% (CECT). The diagnostic results for US, CECT and PET/CT upon initial evaluation of the cervical lymph nodes did not differ significantly on a level-by-level basis. Conclusion: Integrated PET/ CT does not provide any additional benefit when compared to US and CECT for the initial evaluation of cervical node levels in patients with papillary thyroid carcinoma.	Fair	

2	Mitchell JC, Grant F, Evenson AR, Parker JA, Hasselgren PO, Parangi S Preoperative evaluation of thyroid nodules with 18FDG-PET/CT. Surgery. 2005 Dec;138(6):1166-74; discussion 1174-5	To determine whether (18) FDG-PET/CT improves the preoperative diagnosis of thyroid nodules. METHODS: A total of 31 patients with 48 lesions underwent fine-needle aspiration and (18)FDG-PET/CT before surgical resection of thyroid nodules. PET/CT images were obtained 1 hour after intravenous administration of (18) FDG.	Fifteen of 48 lesions were malignant and 33 were benign. Nine of 15 malignant lesions were (18)FDG-avid (sensitivity 60%). Thirty of 33 benign lesions were (18)FDG-cold (specificity 91%). Positive and negative predictive values were 75% and 83%, respectively. CONCLUSIONS: (18)FDG-PET/CT provides a high negative predictive value for malignancy, making this a potentially useful tool in the evaluation of thyroid nodules with indeterminate fine-needle aspiration. However further studies with larger sample sizes are needed to determine the true efficacy of this test.	Fair	
LUNG CANCER					

1	Ga´mez C, Rosell R, Ferna´ndez A et al, PET/CT Fusion Scan in Lung Cancer: Current Recommendations and Innovations J Thorac Oncol. 2006;1: 74–77)	Narrative review	PET/CT is superior to PET alone, CT alone, and visual correlation of both techniques separately. In particular, it improves T3 and T4 staging and delineation of tumors associated with atelectasis. CT contrast media enhancement is probably only still needed when a substantial mediastinal tumor component is present and delineation of tumor from vascular structures is relevant. PET/CT is very accurate in detecting mediastinal nodal disease, but false-positive results are sufficiently frequent to require sampling in some positive cases. Whole-body PET/CT is the most sensitive technique for detecting extracranial metastatic disease, unexpected additional primary malignancies, and recurrence. Conclusion: Combined fluorodeoxyglucose-positron emission tomography (PET)/ computed tomography (CT) imaging has the potential to become the new standard imaging modality for the staging and restaging of patients with lung cancer.	Poor	

2	Clauss, RP, McAvinchey R, Illsley M et al. Staging of lung cancer by CT, PET and PET/CT in the same patients. Nuclear Medicine Communications. March 2006; 27(3): 298-299	Twenty-two (12 male/10 female) adult patients with clinically diagnosed lung cancer underwent a PET /CT scan as part of their work-up. The CT scan was reported by a radiologist and the PET scan by a nuclear medicine physician. The PET/CT report was a consensus read between the radiologist and the nuclear medicine physician.	When the CT report was compared to the PET report, 9/22 (41%) patients had their staging changed (7 upgrades and 2 downgrades). When the CT report was compared to the PET/CT consensus read, 8/22 (36%) patients had their staging changed (6 upgrades and 2 downgrades). There were 4/22 (18%) discrepancies between PET and PET/CT reports, resulting 1 upgrade and 3 downgrades after the PET/CT consensus read. Conclusion: The PET/CT consensus read appears the best way to stage lung cancer with 36% of patients restaged after the initial CT investigation.	Fair	
3	Yi Ca, Lee KS, Kim BT et al. Tissue characterization of solitary pulmonary nodule: comparative study between helical dynamic CT and integrated PET/CT. J Nucl Med. 2006 Mar;47(3):443-50	Cohort study Compared the diagnostic accuracy of helical dynamic (HD) CT (HDCT) and integrated PET/CT for pulmonary nodule characterization. One hundred nineteen patients with an SPN underwent both HDCT (unenhanced scans, followed by series of images at 30, 60, 90, 120 s and at 5 and 15 min after intravenous injection of contrast medium) and integrated PET/CT.	There were 79 malignant and 40 benign nodules. The sensitivity, specificity, and accuracy for malignancy on HDCT were 81% (64/79 nodules), 93% (37/40), and 85% (101/119), respectively, whereas those on integrated PET/CT were 96% (76/79), 88% (35/40), and 93% (111/119), respectively (P = 0.008, 0.727, and 0.011, respectively). All malignant nodules were interpreted correctly on either HDCT or PET/CT. CONCLUSION: Integrated PET/CT is more sensitive and accurate than HDCT for the malignant nodule characterization; therefore, PET/CT may be performed as the first-line evaluation tool for SPN characterization. Because HDCT has high specificity and acceptable sensitivity and accuracy, it may be a reasonable alternative for nodule characterization when PET/CT is unavailable.	Fair	
GASTROINTESTINAL, PANCREATIC, AND LIVER CANCER					

1	Heinrich S, Goerres GW, Scha¨fer M et al. Positron Emission Tomography/Computed Tomography Influences on the Management of Resectable Pancreatic Cancer and Its Cost-Effectiveness. Ann Surg 2005;242: 235–243)	Patients with suspected pancreatic cancer who had a PET/CT between June 2001 to April 2004 were entered into a prospective database. Routine staging included abdominal CT, chest x-ray, and CA 19-9 measurement. FDG-PET/CT was conducted according to a standardized protocol, and findings were confirmed by histology. Cost benefit analysis was performed based on charged cost of PET/CT and pancreatic resection and included the time frame of staging and surgery.	Fifty-nine patients with a median age of 61 years (range, 40–80 years) were included in this analysis. Fifty-one patients had lesions in the head and 8 in the tail of the pancreas. The positive and negative predictive values for pancreatic cancer were 91% and 64%, respectively. PET/CT detected additional distant metastases in 5 and synchronous rectal cancer in 2 patients. PET/CT findings changed the management in 16% of patients with pancreatic cancer deemed resectable after routine staging ($P < 0.031$) and was cost saving. Conclusions: PET/CT represents an important staging procedure prior to pancreatic resection for cancer, since it significantly improves patient selection and is cost-effective.	Fair	

2	Reinhardt MJ, Strunk H, Gerhardt T et al. Detection of Klatskin's Tumor in Extrahepatic Bile Duct Strictures Using Delayed 18F-FDG PET/CT: Preliminary Results for 22 Patient Studies. J Nucl Med 2005; 46:1158–1163	Prospective study. To evaluate the effectiveness of dual-modality PET/CT using 18FFDG for noninvasive differentiation of extrahepatic bile duct strictures. Twenty-two PET/CT studies were performed on 20 patients (10 women, 10 men; mean age ±SD,63 ±14 y) with extrahepatic bile duct strictures on endoscopic retrograde cholangiography.	Final diagnosis was histologically proven cholangiocarcinoma in 14 cases and benign causes of strictures in 8 cases without evidence of malignancy during a follow-up of 18 ± 3 mo. All patients with cholangiocarcinoma presented with focal increased uptake in the liver hilus with an SUV of 6.8 ± 3.3 (range, 3.9 –15.8), compared with 2.9 ± 0.3 (range, 2.5–3.3) in patients with benign causes of strictures (P ≤ 0.003). There was a clear cutoff SUV of 3.6 for detection of malignancy in the liver hilus. Conclusion: 18F-FDG PET/CT provided high accuracy for noninvasive detection of perihilar cholangiocarcinoma in extrahepatic bile duct strictures. *Klatskin's tumor=perihilar cholangiocarcinoma involving the bifurcation of the hepatic duct, accounts for approximately 70% of all bile duct cancers	Fair	

3	Selzner M, Hany TF, Wildbrett P et al. Does the Novel PET/CT Imaging Modality Impact on the Treatment of Patients With Metastatic Colorectal Cancer of the Liver? Annals of Surgery. Dec 2004; 240 (6): 1027–1036	Retrospective study. Patients evaluated for resection of liver metastases from colorectal cancer were entered into a prospective database. Each patient received a ceCT and a PET/CT, and both examinations were evaluated independently by a radiologist/nuclear medicine physician without the knowledge of the results of other diagnostic techniques.	Seventy-six patients with a median age of 63 years were included in the study. ceCT and PET/CT provided comparable findings for the detection of intrahepatic metastases with a sensitivity of 95% and 91%, respectively. However, PET/CT was superior in establishing the diagnosis of intrahepatic recurrences in patients with prior hepatectomy (specificity 50% vs. 100%, $P < 0.04$). Local recurrences at the primary colorectal resection site were detected by ceCT and PET/CT with a sensitivity of 53% and 93%, respectively ($P < 0.03$). Extrahepatic disease was missed in the ceCT in one third of the cases (sensitivity 64%), whereas PET/CT failed to detect extrahepatic lesions in only 11% of the cases (sensitivity 89%) ($P < 0.02$). New findings in the PET/CT resulted in a change in the therapeutic strategy in 21% of the patients. Conclusion: PET/CT and ceCT provide similar information regarding hepatic metastases of colorectal cancer, whereas PET/CT is superior to ceCT for the detection of recurrent intrahepatic tumors after hepatectomy, extrahepatic metastases, and local recurrence at the site of the initial colorectal surgery.	Fair	

4	Park IJ , Kim HC, Yun CS et al. Efficacy of PET/CT in the accurate evaluation of primary colorectal carcinoma. EJSO xx (2006) 1-7	One hundred patients with primary colorectal carcinoma were evaluated during 2004. All patients underwent PET/CT when their preoperative serum carcinoembryonic antigen was ≥10 ng/mL or when CT showed equivocal findings.	PET/CT more detected 15 intra-abdominal metastatic lesions than abdomino-pelvic CT scan. PET/CT showed true negative findings in 13 patients and false positive or negative findings in 10. Due to PET/CT results, management plans were altered in 27 patients; 9 had inter-modality changes, 10 received more extensive surgery, and 8 avoided unnecessary procedures. Conclusions: PET/CT altered management plan in 24% of patients with primary colorectal carcinoma in correct direction. These findings suggest that PET/CT should be considered a part of standard work up for preoperative evaluation in a subset of patients with colorectal carcinoma	Fair	

5	Petrowsky H, Wildbret P, Husarik DB et al. Impact of integrated positron emission tomography and computed tomography on staging and management of gallbladder cancer and cholangiocarcinoma. Journal of Hepatology 45 (2006) 43–50	Pr5ospective study. From January 2001 to March 2005, each patient who was treated for a malignancy of the biliary tract underwent PET/CT examination in addition to the standard work-up imaging. Data were prospectively collected and analyzed in comparison with contrast-enhanced CT (ceCT)	Sixty-one patients with malignancies of the biliary tract were included into the study. Diagnosis was proven in all patients either by histology or cytology. PET/CT detected all gallbladder cancers (n = 14). PET/CT and ceCT provided a comparable accuracy for the primary intra- (n = 14) and extra-hepatic cholangiocarcinomas (n = 33). All distant metastases (12/12) were detected by PET/CT, but only 3/12 by ceCT ($p < 0.001$). Regional lymph node metastases were detected by PET/CT and ceCT in only 12% vs. 24%. PET/CT findings resulted in a change of management in 17% of patients deemed resectable after standard work-up. Conclusions: PET/CT is particularly valuable in detecting unsuspected distant metastases which are not diagnosed by standard imaging. Thus, PET/CT staging has an important impact on selection of adequate therapy.	Fair	
GYNAECOLOGICAL CANCERS					

1	Amit A, Beck D, Lowenstein L, Lavie O et al. The role of hybrid PET/CT in the evaluation of patients with cervical cancer. Gynecologic Oncology 100 (2006) 65 – 69	75 patients divided into 3 groups. Group 1 consisted of 16 patients prior to radical surgery. Group 2 consisted of 31 patients prior to pelvic radiotherapy. Group 3 had 28 patients who underwent the examination secondary to suspected recurrent disease. Whole body PET and CT were performed respectively on the same device 1 h after injection of 10 mCi FDG. PET/CT results were correlated to histological, radiological and clinical follow-up data. Only women with >6 months follow-up were included.	In 33 patients, patho-histological examinations for extra cervical lesions were obtained. Correlation with PET/CT examination revealed levels of sensitivity (60%), specificity (94%), positive (90%) and negative predictive values (74%). The examination indicated 21 patients with extra-pelvic and/or metastatic disease. The follow-up data of this group revealed that 20 patients either died or were alive with active disease, and only one patient was in clinical remission. PET/CT yielded an improved diagnosis for both PET and CT in 43% of the cases by providing better localization and definition of abnormal FDG uptake. Conclusion: Hybrid PET/CT was found to be of value for detection of cervical cancer metastases, decision-making and planning of irradiation therapy. Using this modality may reduce unnecessary surgical interventions, help modify radiation fields and change therapeutic approaches. Detection of advanced diseases on PET/CT correlates with poor prognosis. However, this examination is less accurate in detecting microscopic diseases and lesions smaller than 1.5 cm.	Fair	

2	Sironi S, Buda A, Picchio M et al. Lymph node metastasis in patients with clinical early-stage cervical cancer: detection with integrated FDG PET/CT. Radiology. 2006 Jan; 238 (1) : 272-9.	Forty-seven consecutive women aged 29-71 years with clinical stage IA or IB cervical carcinoma were included in the study. All 47 patients were scheduled for radical hysterectomy with pelvic lymph node dissection. Before surgery, all patients underwent fluorine 18 fluorodeoxyglucose (FDG) PET/CT. PET/CT findings were interpreted by two readers in consensus and then compared with histopathologic results.	The overall node-based sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy of PET/CT were 72% (13 of 18), 99.7% (1060 of 1063), 81% (13 of 16), 99.5% (1060 of 1065), and 99.3% (1073 of 1081), respectively. Corresponding values for PET/CT-based diagnosis of lymph nodes larger than 0.5 cm in diameter were 100% (13 of 13), 99.6% (675 of 678), 81% (13 of 16), 100% (675 of 675), and 99.6% (688 of 691), respectively. The overall patient-based sensitivity, specificity, PPV, NPV, and accuracy of PET/CT were 73% (11 of 15), 97% (31 of 32), 92% (11 of 12), 89% (31 of 35), and 89% (42 of 47), respectively. CONCLUSION: PET/CT proved to be valuable for lymph node staging in patients with early-stage cervical cancer, with short-axis diameter greater than 0.5 cm being the size threshold for accurate depiction of metastatic nodes.	Fair	

3	Bristowa RE, Giuntoli RL, Pannu HK et al. Combined PET/CT for detecting recurrent ovarian cancer limited to retroperitoneal lymph nodes. Gynecologic Oncology 99 (2005) 294 – 300	Retrospective study. Fourteen patients (median age = 53 years) with rising serum CA125 levels, and negative or equivocal conventional CT imaging ≥ 6 months after primary therapy were retrospectively identified as having recurrent disease limited to retroperitoneal lymph nodes by combined PET/CT and underwent surgical reassessment of targeted nodal basins.	There were 29 target nodes in 15 nodal basins identified with increased metabolic uptake on combined PET/CT. Eleven patients (78.6%) had recurrent ovarian cancer in retroperitoneal lymph nodes targeted by PET/CT. Of 143 nodes retrieved, 59 contained recurrent ovarian cancer (median nodal diameter = 2.5 cm, range = 0.8–5.2 cm). For all target nodal basins, the sensitivity, specificity, positive and negative predictive values, and accuracy for recurrent ovarian cancer in dissected lymph nodes were: 40.7% (24/59), 94.0% (79/84), 82.8% (24/29), 69.3% (79/114), and 72.0% (103/ 143) (P < 0.001). PET/CT failed to identify microscopic disease in 59.3% of pathologically positive nodes. Conclusion: Combined PET/CT demonstrates high positive predictive value in identifying recurrent ovarian cancer in retroperitoneal lymph nodes when conventional CT findings are negative or equivocal.	Fair	

4	Hauth EAM, Antoch G, Stattaus J et al. Evaluation of integrated whole-body PET/CT in the detection of recurrent ovarian cancer. European Journal of Radiology 56 (2005) 263–268	Integrated whole-body PET/CT imaging was performed in 19 patients with suspected ovarian cancer recurrence. CT, PET and fused PET/CT images were evaluated separately and imaging results were compared with pathological findings and clinical follow-up after 6 months.	Of the 19 patients studied, 11 were found to have recurrent cancer. In 8 of these 11 patients, recurrence was diagnosed by CT, PET and fused PET/CT. In the remaining three patients, only PET and PET/CT showed a recurrent tumour, while CT was negative. Twelve localizations of ovarian cancer recurrence could be detected by CT, 17 by PET and 18 by PET/CT. In one patient with pulmonary metastases in CT and in the CT component of PET/CT, PET was negative. In the case of three metastases in the diaphragm, the spleen and the thoracic wall, respectively, the determination of the exact localization was only possible by fused PET/CT. Conclusion: In patients with recurrent ovarian cancer, PET/CT detects more lesions than PET or CT alone. PET/CT permits the exact anatomical localization of pathologic tracer uptake and can thus direct further treatment to the precise site of tumour recurrence. Hence, PET/CT should be considered for follow-up of patients with ovarian cancer.	Fair	

5	Nanni C, Rubello D, Farsad M, De Iaco P et al. 18F-FDG PET/CT in the evaluation of recurrent ovarian cancer: a prospective study on forty-one patients. EJSO (2005) 31, 792–797	Prospectively evaluated 41 patients with a mean age of 59.4 years who had been previously treated for ovarian cancer with surgery and radio-chemotherapy or radio-chemotherapy alone. Following the performance of traditional radiologic imaging (US, CT, MRI) and Ca125 measurement, all patients underwent additional 18F-FDG PET/CT. PET/CT results were compared with histologic findings or clinical, laboratory and repeated traditional imaging techniques during subsequent follow-up data.	Of 41 patients 32 had a positive PET-CT (30 true positive, two false positive) whereas nine a negative PET/CT (five true negative, four false negative). Overall, in our experience 18F-FDG PET/CT provided a good sensitivity (88.2%), specificity (71.4%) and accuracy (85.4%), superior to that reported in literature for traditional radiologic imaging. Conclusions: It can be concluded that 18F-FDG PET/CT appears to be a useful and accurate tool in disclosing early recurrent ovarian cancer.	Fair	

6	Simcock B, Neesham D, Quinn M et al. The impact of PET/CT in the management of recurrent ovarian cancer. Gynecologic Oncology xx (2006) xxx–xxx (ARTICLE IN PRESS)	January 2002 to July 2003, all women undergoing either surveillance or investigation of possible recurrent ovarian cancer at the Centre for Molecular Imaging, The Peter MacCallum Cancer Centre, were invited to take part in a prospective evaluation of the clinical impact of PET/CT.	Fifty-six women having 66 scans were available for analysis. All patients had at least 12months follow-up after the PET/CT unless they died before that time. Apart from one equivocal scan, all scans performed in women with a CA125 higher than 35IU/ml had a positive PET/CT. PET/CT altered the known disease distribution in 40 scans (64%). Overall, PET/CT showed less disease in six scans (9%) and more disease in 34 scans (52%). Regardless of the value of CA125, PET/CT identified a sub group of women with apparently localized disease or no definite evidence of disease. This group showed improved survival compared with women shown to have systemic disease. PET/CT resulted in a major change of management plan in 34 patients (58%). Conclusion. PET/CT modifies the assessment of the distribution of recurrent ovarian cancer and alters patient management in a substantial proportion of patients. PET/CT appears to offer prognostic information.	Fair	
MALIGNANT MELANOMA					

1	Reinhardt MJ, Joe AY, jaeger U et al. Diagnostic performance of whole body dual modality 18F-FDG PET/CT imaging for N- and M-staging of malignant melanoma: experience with 250 consecutive patients. J Clin Oncol. 2006 Mar 1;24(7):1178-87	Retrospective and blinded study of 250 consecutive patients (105 women, 145 men; age 58 +/- 16 years) who underwent FDG-PET/CT for staging of cutaneous melanoma at different time points in the course of disease. Whole-body FDG-PET/CT was performed 101 +/- 21 minutes postinjection of 371 +/- 41 MBq FDG. Diagnostic accuracy for N- and M-staging was determined for CT alone, PET alone, and PET/CT.	PET/CT detected significantly more visceral and non-visceral metastases than PET alone and CT alone (98.7%, 88.8%, and 69.7%, respectively). PET/CT imaging thus provided significantly more accurate interpretations regarding overall N- and M-staging than PET alone and CT alone. Overall N- and M-stage was correctly determined by PET/CT in 243 of 250 patients (97.2%; 95% CI, 95.2% to 99.4%) compared with 232 patients (92.8%; 95% CI, 89.6% to 96.0%) by PET, and 197 patients (78.8%; 95% CI, 73.7% to 83.9%) by CT. All differences were significant. Accuracy of PET/CT was significantly higher than that of PET and CT for M-staging (0.98 v 0.93 and 0.84) and significantly higher than that of CT for N-Staging (0.98 v 0.86). Change of treatment according to PET/CT findings occurred in 121 patients (48.4%). CONCLUSION: The diagnostic performance of FDG-PET/CT for N- and M-staging of melanoma patients suggests its use for whole-body tumor staging, especially for detection or exclusion of distant metastases.	Fair	

ASPECT: COST-EFFECTIVENESS

No	Author, title, Journal, Year, Volume, Page Number	Study Design, Sample Size, Follow up	Outcomes & Characteristics	Grade	Comment
1	Rodriguez Garrido M, Asensio del Barrio. PET-CT: indications, systematic review and meta-analysis. Agencia de Evaluacion de Tecnologias Sanitarias (AETS), 2004:131.	Systematic review & meta-analysis Medline, EMBASE, CancerLit & Cochrane Library were searched 16 articles selected from 209 retrieved. 6 articles chosen for meta-analysis.	- PET-CT scan could be cost-effective because of the reduction of unnecessary diagnostic methods and surgical or other non effective treatments.	Good	

2	Heinrich S, Goerres GW, Scha¨fer M et al. Positron Emission Tomography/Computed Tomography Influences on the Management of Resectable Pancreatic Cancer and Its Cost-Effectiveness. Ann Surg 2005;242: 235–243)	Cohort study Patients with suspected pancreatic cancer who had a PET/CT between June 2001 to April 2004 were entered into a prospective database. Routine staging included abdominal CT, chest x-ray, and CA 19-9 measurement. FDG-PET/CT was conducted according to a standardized protocol, and findings were confirmed by histology. Cost benefit analysis was performed based on charged cost of PET/CT and pancreatic resection and included the time frame of staging and surgery. All costs are in Swiss Franc.	The median length of stay on the intensive care unit (ICU) was 1 day (range, 1–3 days), and the median length of hospital stay including 1 preoperative day was 15 days (range, 10–40 days). The cost analysis of pancreatic resections for cancer at our hospital revealed mean costs of $37,700 per case, whereby each post-operative day on the floor accounted for $1,200. Costs of PET/CT amounted to $1,925 ($425 for FDG, $1,500 for PET/CT scanning; Metastases detected by PET/CT were cytologically confirmed by ultrasound (US)-guided biopsy (n = 3), CT-guided biopsy (n = 1), and thoracoscopic wedge resection (n = 1). US-guided FNA amounted for $193, CT-guided FNA for $474, and thoracoscopic wedge resection for $10,960 (overall costs). Total cost for these 5 interventions including cytologic processing amounted for $12,010. On the basis of our series of 59 patients with suspected pancreatic cancer, 5 patients were excluded from pancreatic surgery because of metastasis diagnosed by PET/CT. Therefore, $188,500 could be saved by avoiding 5 pancreatic resections. Total cost of PET/CT for all 59 patients amounted to $125,588 (including cost for biopsies). The amount of $62,912 was finally saved by the additional use of PET/CT, which accounts for $1,066 per patient. Conclusion: In patients with suspected pancreatic cancer, PET/CT was cost saving by excluding patients from resection because of metastasis.	Fair	

SEARCH STRATEGY

Date	Database	Keywords	Year Publications	Other limit	No of search	No of relevant title	No of relevant abstract	No of full article used	Notes
11/9/06	PubMed	#1: pet-ct			852				
		#2: #1 OR "positron emission tomography-computed tomography"			891				
		#3: cancer OR carcinoma OR tumour OR tumor			2065634				
		#4:safe* OR "adverse effects" OR toxic OR harm*			468572				
		#5: effective* OR efficacy			842982				

		#6: cost OR cost-effective*			321174				
		#2 AND #3 AND #4			7	2			
		#2 AND #3 AND #5			56	39			
		#2 AND #3 AND #6			24	3			
12/9/06	Trip Database	pet-ct OR “positron emission tomography –computed tomography”			12				