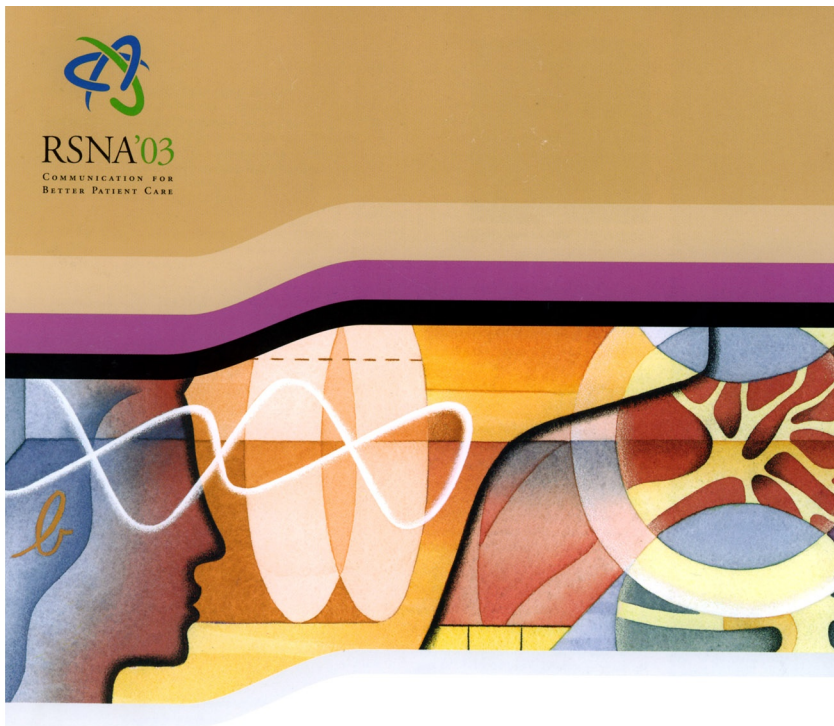

Histopathological Correlation of F-18 FDG PET Scanning in Patients with Non-Small Cell Lung Cancer (NSCLC)



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PURPOSE

Bronchogenic carcinoma is the most frequent malignant tumor in men. Every year in the US approximately 170.000 new cases arise. The rate in men is stable, while the incidence of female bronchogenic carcinoma increases every year about 3%, because cigarette smoking is becoming more and more popular in women. In Germany every year about 39.000 new cases of bronchogenic carcinoma appear, 80% of them non-small cell lung cancer.

The only curative therapy of this entity is surgery including lymph node dissection, which is possible up to N2 disease, while patients with contralateral lymph node or distant metastases do not profit from operation.

CT and MRI are unable to depict metastases in normal sized lymph nodes or to differentiate between inflammatory, unspecific or malignant lymphadenopathy. We wanted to know, whether PET can do this job.

METHODS AND MATERIALS

Patients

83 patients with highly suspected or histological proven non-small lung cancer in a clinical operable situation were examined. Patients with hyperglycaemia, neo-adjuvant chemotherapy or known distant metastases were excluded from this study.

Diagnostic Course

All patients included in this study were evaluated by means of anamnesis, physical examination, complete blood status, abdominal ultrasound, MRI of the brain, test of lung function and bronchoscopy. In case of symptoms suggestive for distant metastases appropriate additional imaging tests and biopsies were performed.

Technique

All patients underwent CT and PET scanning. Computed tomography was performed as spiral CT from the lung apex to the adrenal glands with a slice thickness of 5mm and a pitch of 1.5 in one breathhold. For contrast enhancement usually 100 ml of Ultravist 300 were administered intravenously by a power injector with a flow of 2 ml/s.

A lymph node was interpreted as pathologic depending on its size in different locations according to the criteria of Webb et al. published 1993.

F-18 FDG-PET was performed as whole body examination with a Siemens ECAT Scanner Type 951/31. Emission scanning started 90 minutes after administration of FDG. The acquired data were reconstructed by standard back projection techniques in axial sections, coronal and sagittal views were reformatted. A lesion was interpreted as malignant if the focal uptake was comparable to that of the brain.

The images of both modalities were read in consensus by 2 experienced radiologists, nodal stations were localized according to the American Thoracic Society mapping system. No histopathological data were available at the time of interpretation.

Surgery

All Patients underwent lobectomy or pneumectomy and extensive lymph node sampling. Every by the operative approach attainable lymph node station was inspected. All identifiable lymph nodes were resected independent of their size, labeled separately according to the American Thoracic Society mapping system and histopathologically analysed.

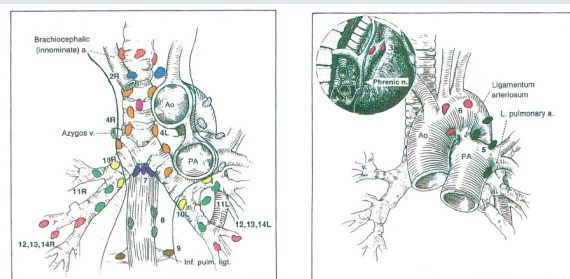
Analysis

PET and CT findings were correlated with histopathologic results on a station-by-station basis. Only histologic examined lymph nodes were considered for analysis.

The sensitivity, specificity, accuracy and predictive values of PET and CT in N-staging were determined. The differences were statistically evaluated.

RESULTS

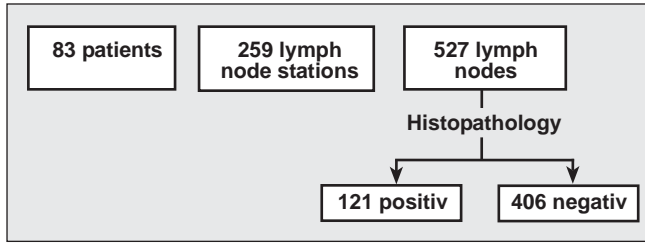
Lymph Nodes Specimens in 83 Patients With Bronchogenic Carcinoma



Regional nodal stations for lung cancer staging. American Journal Of Respiratory And Critical Care Medicine, 1997, Vol. 156: 328

Nodal Station		Lymph Nodes Sampled	Nodal Station Sampled
1	● Highest Mediastinal	0	0
2R	● Upper Paratracheal	12	6
2L		1	1
3	● Pre-vascular and Retrotracheal	0	0
4R	● Lower Paratracheal (incl. Azygos Nodes)	58	31
4L		11	8
5	● Subaortic (A-P window)	77	33
6	● Para-aortic (ascending aorta or phrenic)	24	10
7	● Subcarinal	64	30
8	● Paraesophageal (below carina)	68	35
9	● Pulmonary Ligament	46	27
10R	● Hilar	77	34
10L		66	29
11R	● Interlobar	13	8
11L		9	6
12R	● Lobar	0	1
12L		1	0
13R	● Segmental	0	0
13L		0	0
Total		527	259

527 lymph nodes from 259 stations of 83 patients with non-small lung cancer were sampled, 121 histologically positive, the rest negative.



Sensitivity of PET for the staging of hilar and mediastinal lymph nodes was 92%, sensitivity of CT 68%; specificity was 96% and 78%, respectively.

Findings in 527 Mediastinal Lymph Nodes	PET	CT
Sensitivity (%)	92	68
Specivity (%)	96	78
Positive predictive value (%)	86	51
Negative predictive value (%)	97	89
Accuracy (%)	95	77

PET correctly staged all patients with N3-disease.

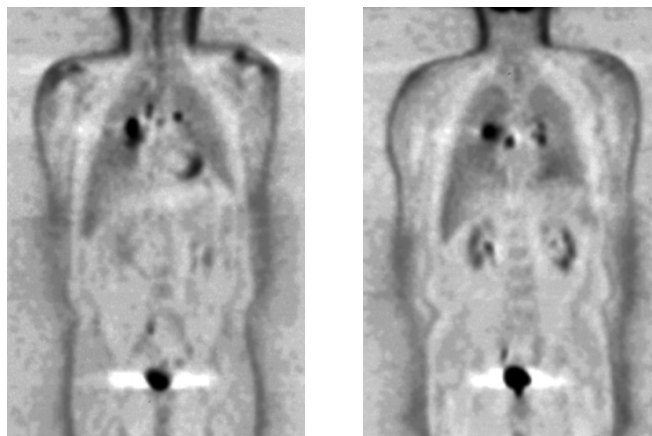
PET found primary unknown distant metastases in 3 Patients, which was with histopathologically proven. These Patients were excluded from the study and didn't underwent thoracotomie.

CONCLUSION

- 1) PET has a very high sensivity and specificity in the detection of lymph node and distant metastases of non-small cell lung cancer.
- 2) Correct differentiation between N2 and N3 disease can be achieved, which is important for the therapeutic procedure.

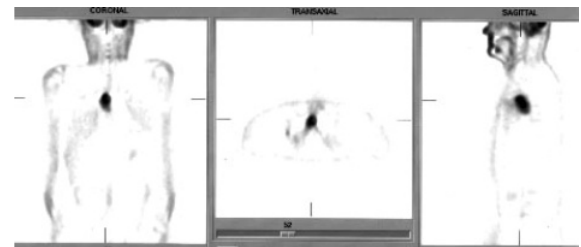
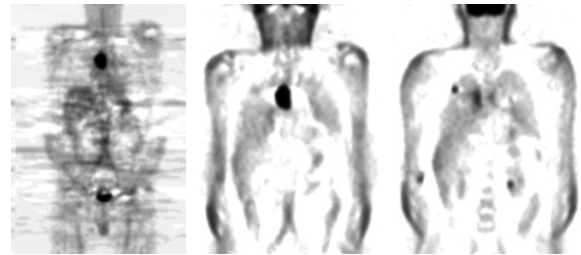
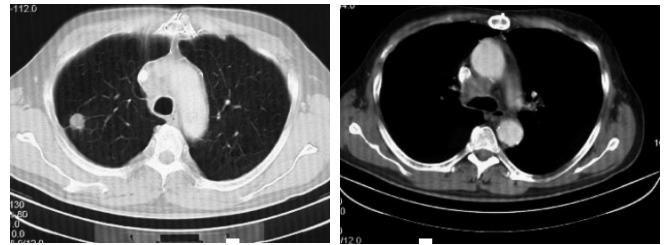
Cases

Whole body PET of a Patient with N3 - disease. You can see the central right lung tumor with bimedastinal and bihilar lymph node metastases.



CT understaged ↔ PET correct

In this case CT shows a lower paratracheal lymph node metastasis, which was interpreted as ipsilateral N2 disease. PET resolved to a N3 - stage, which was surgically proven.



CT overstaged ↔ PET correct

PET and CT-Scans show primary tumor in the left lung, on CT right mediastinal lymphadenopathy indicating N3-disease is seen, while PET is negative. Thoracotomy and histopathologic examination proved N0-disease!

