Imaging of lung cancer with fluorine-18 fluorodeoxyglucose: comparison of a dual-head gamma camera in coincidence mode with a full-ring positron emission tomography system.

Abstract:
Dual-head gamma cameras operated in coincidence mode are a new approach for tumour imaging using fluorine-18 fluorodeoxyglucose (FDG). The aim of this study was to assess the diagnostic accuracy of such a camera system in comparison with a full-ring positron emission tomography (PET) system in patients with lung cancer. Twenty-seven patients (1 female, 26 males, age 62 +/- 9 years) with lung cancer or indeterminate pulmonary nodules were studied on the same day with a full-ring PET scanner (Siemens ECAT EXACT) and a coincidence gamma camera system (ADAC Vertex MCD). Sixty minutes after injection of 185-370 MBq FDG, a scan of the chest was performed with the full-ring system. Approximately 2 h p.i., the coincidence camera study was performed. Coincidence gamma camera (CGC) and PET images with (PETac) and without attenuation correction (PETnac) were analysed independently by two blinded observers. In addition, FDG uptake in primary tumours and involved lymph nodes was quantified relative to normal contralateral lung (T/L ratios). All primary tumours were histologically proven. The lymph node status was histologically determined in 23 patients. In four patients, no lymph node sampling was performed.
because of extensive disease or concurrent illnesses. In the 27 patients, 25 primary lung cancers and two metastatic lesions were histologically diagnosed. The number of coincidences per centimetre axial field of view was 3.33 +/- 0.93 x 10^5 for the CGC and 1.09 +/- 0.36 x 10^6 for the dedicated PET system. All primary tumours (size: 4.6 +/- 2.6 cm) were correctly identified in the CGC and dedicated PET studies. T/L ratios were 4.7 +/- 2.5 for CGC and 6.9 +/- 2.8 for PETnac (P < 0.001).

Histopathological evaluation revealed lymph node metastases in 11 of 88 sampled lymph node stations (size: 2.3 +/- 1.0 cm). All lymph node metastases were identified in the PETac studies, while PETnac detected 10/11 and CGC 8/11. For positive lymph nodes that were visible in CGC and PETnac studies, T/L ratios were 3.7 +/- 2.3 for CGC and 6.6 +/- 3.1 for PETnac (P = 0.02). The diameters of false-negative lymph nodes in the CGC studies were 0.75, 1.5 and 2 cm. False-positive FDG uptake in lymph nodes was found in two patients with all three imaging methods. For all lesions combined, T/L ratios in CGC relative to PETnac studies decreased significantly with decreasing lesion size (r = 0.62; P < 0.001). In conclusion, compared with a full-ring PET system the sensitivity of CGC imaging for detection of lung cancer is limited by a lower image contrast which deteriorates with decreasing lesion size. Nevertheless, the ability of CGC imaging to detect pulmonary lesions with a diameter of at least 2 cm appears to be similar to that of a full-ring system. Both systems provide a similar specificity for the evaluation of lymph node involvement.