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Value of $^{18}$F-FDG PET/CT for prognosis evaluation in small cell lung cancer with normal serum lactate dehydrogenase
Lin Xiaoping, Hu Yingying, Zhang Xu, Liang Peiyian, Fan Wei

Objective: To evaluate the value of $^{18}$F-FDG PET/CT imaging in predicting the prognosis of newly diagnosed SCLC with normal serum LDH (SCLC-nsLDH). Methods: A total of 68 SCLC patients (59 males, 9 females, median age: 58.5 years) proved by pathology between June 2005 and December 2016 were retrospectively analyzed. All patients underwent $^{18}$F-FDG PET/CT. The general information of patients, including LDH, NSE, OS, PFS and SUVmax, were recorded. SUVmax differences were analyzed with Mann-Whitney u test. Life-table method and Kaplan-Meier analysis were used to estimate the survival rate and median survival time. The survival function curve was drawn. Log-rank test was used to analyze whether there existed statistical differences in survival period among different groups. Cox regression analysis was used for screening the influencing factors of prognosis. Results: (1) In 68 SCLC patients, there were 38 cases with limited disease (LD) and 30 cases with extensive disease (ED). There were 3 cases in stage I, 7 cases in stage II, 29 cases in stage III, 29 cases in stage IV. The median SUVmax of the primary tumor was 11.35 (9.90, 13.90). There was no significant difference between the median SUVmax of LD group and that of ED group: 11.05(9.72, 13.60) vs 12.25(10.05, 14.12) months; z=-0.797, P=0.426. The median serum LDH was 195.15(171.00, 220.80) U/L. (2) The median follow-up time was 18(range: 2–101) months. The disease developed in 46 patients and 35 patients died. The median OS was 23 (95% CI: 13.3–32.7) months and median PFS was 17 (95% CI: 11.4–22.6) months. (3) ROC curve showed the optimal SUVmax cutoff value was 10.85. The OS of patients with SUVmax $\leq$10.85 (n=25) and with SUVmax $>$10.85 (n=43) were 40.0(95% CI: 2.5–77.5) months and 18.0(95% CI: 13.3–22.7) months($\chi^2=8.956$, P=0.003), respectively. (4) Weight loss, VALG stage and primary tumor SUVmax were independent prognostic factors for OS (all P<0.05). Only VALG stage was an independent prognostic factor for PFS (P<0.001). Conclusion: $^{18}$F-FDG PET/CT can help to differentiate the different prognosis of SCLC-nsLDH patients, and provide more evidence for the choice of individual treatment strategy.

Prognosis significance of $^{18}$F-FDG PET/CT imaging in patients with postoperative esophageal cancer
Ding Chongyang, Guo Zhe, Yang Wenping, Sun Jin, Li Tianyu

Objective: To investigate the prognostic value of SUVmax, SUVmean, MTV and TLG calculated from $^{18}$F-FDG PET/CT in patients with postoperative esophageal cancer. Methods: Sixty-one patients (51 males, 10 females; age ranged 50–81 (median: 64) years) with esophageal cancer who underwent preoperative $^{18}$F-FDG PET/CT from October 2007 to November 2015 were retrospectively analyzed. The relation of SUVmax, SUVmean, MTV and TLG in primary lesions with clinic pathological factors was analyzed. Differences of metabolic parameters were compared with two-sample t test, one-way analysis of variance, Mann-Whitney u test or Kruskal-Wallis H test. The optimal cutoff points of SUVmax, SUVmean, MTV and TLG for predicting overall survival (OS) were investigated by ROC curve analysis. The Kaplan-Meier method and log-rank test were used to perform univariate survival analysis, and Cox proportional hazards model was used for multivariate analysis. Results: MTV and TLG were associated with tumor length, N stage and clinical stage, while SUVmax and SUVmean were only associated with tumor length ($t=-2.396$, $F=4.206$, 4.471; $z=-3.051$, $\chi^2=8.908$, 9.796; $t=-2.417$, -2.423; all P<0.05). The optimal cutoff points of SUVmax, SUVmean, MTV and TLG were 11.76, 7.06, 24.35 cm3 and 166.84 g, respectively. Univariate analysis of OS showed that the lymphatic metastasis, clinical stage and TLG were all significantly associated with the patient outcome ($\chi^2=14.683$, 7.139, 11.669, all P<0.05). Multivariate analysis showed that lymphatic metastasis and TLG were the independent predictors for OS ($\beta$=-1.472, -1.223; Wald=5.224, 4.668; both P<0.05). Conclusion: For predicting the prognosis of esophageal cancer after operation, TLG of the primary tumor may be more valuable than SUVmax, SUVmean and MTV.

$^{18}$F-FDG PET/CT for restaging, guiding therapeutic strategy and predicting prognosis in patients with postoperative colorectal cancer
Liu Yuqi, Zhang Bin, Deng Shengming, Wang Zhenxin, Sheng Mao

Objective: To evaluate the clinical value of $^{18}$F-FDG PET/CT for restaging, guiding therapeutic strategy and predicting prognosis in patients with postoperative colorectal cancer (PCC). Methods: Records of 91 patients (51 males, 40 females; average age (54.90±11.47) years) in whom PCC were evaluated by $^{18}$F-FDG PET/CT imaging from May
2010 to June 2014 were retrospectively reviewed. All patients underwent evaluation at the First Affiliated Hospital of Soochow University. $^{18}$F-FDG PET/CT results were compared with the results from pathological examination, clinical long-term follow-up (≥6 months) and conventional imaging. Diagnostic efficiency of $^{18}$F-FDG PET/CT in detecting recurrence and metastases of PCC were calculated. The clinical value of $^{18}$F-FDG PET/CT in restaging and guiding therapeutic strategy were analyzed in patients with true positive results. Kaplan-Meier survival analysis was conducted based on the results of PET/CT and the alteration of therapeutic strategy after PET/CT. Results: The sensitivity, specificity, accuracy, positive predictive value and negative predictive value of $^{18}$F-FDG PET/CT were 96.36 (53/55), 83.33% (30/36), 91.21% (83/91), 89.83% (53/59) and 93.75% (30/32), respectively. The median survival time and difference of recurrence and metastasis of PCC were calculated. The 5-year survival rate were 10.00 years and 84% in patients with true negative PET/CT results, tumor restaging was up-regulated in 32 patients and down-regulated in 2 patients. Therapeutic strategies were changed in 33 patients, and compared with the log-rank test. OS and PFS were calculated using Kaplan-Meier analysis. OS and PFS were calculated and compared with the log-rank test. Results: All 13 patients underwent $^{18}$F-FDG PET/CT imaging after 3 chemotherapy cycles and were divided into PET/CT-negative group (7 patients) and positive group (6 patients). ΔSUV<sub>max</sub> of the negative group was higher than that of the positive group: (65.73±5.95)% vs (52.50±1.49)%; t=4.199, P<0.05. Median follow-up period was 26 (9–48) months. The median PFS and median OS of PET/CT-negative group were higher than those of PET/CT-positive group (39 vs 18 months, 44 vs 24 months; χ²=4.521, 4.829, both P<0.05). Conclusion: Interim PET/CT scan could predict the outcome of patients with NK/T cell lymphoma.

**Evaluation of relationship between myocardial injury and left ventricular mechanical dyssynchrony using $^{99}$Tc-MIBI myocardial perfusion SPECT and $^{18}$F-FDG myocardial metabolic PET imaging**

Li Shuheng, Tian Yueqin, Sun Xiaoxin, Guo Feng, Zhang Hailong, He Xiaoxian, Fang Wei

**Objective:** To investigate the relationship between myocardial injury and damage of mechanical synchrony in the left ventricle of patients with ischemic cardiomyopathy (ICM) using $^{99}$Tc-MIBI MPI and gated $^{18}$F-FDG myocardial metabolic PET imaging. Methods: A total of 113 ICM patients (100 males, 13 females; average age (58±10) years) underwent $^{99}$Tc-MIBI MPI and gated $^{18}$F-FDG myocardial metabolic PET imaging from July 2015 to December 2015 in Fu Wai Hospital were retrospectively analyzed. Three-point scoring system was used for quantitative assessment of myocardial ischemia and myocardial infarction in each segment. Total ischemic score (TIS) and total scar score (TSS) of 17 segments were calculated in each patient. The phase bandwidth (BW) and phase SD were derived from phase analysis. Pearson correlation analysis and logistic regression analysis were used. Results: TSS were correlated with BW and SD in all 93 patients with myocardial infarction (r values: 0.517, 0.470, both P<0.01) and also in a subgroup of 34 patients with myocardial infarction and without myocardial ischemia (r values: 0.647, 0.578, both P<0.01). There were significant correlations between TIS and BW, SD in 79 patients with myocardial ischemia (r values: 0.392, 0.378, both P<0.01), but no significant correlation was found in a subgroup of 20 patients with myocardial ischemia and without myocardial infarction (r values: 0.002, -0.003, both P>0.05). Logistic regression analysis showed that the number of myocardial infarction segments and TSS were associated with mechanical dyssynchrony. Conclusion: Myocardial infarction is the main factor of left ventricular mechanical dyssynchrony in ICM patients, but chronic myocardial ischemia has no significant influence on mechanical dyssynchrony.

**Prognostic value of interim $^{18}$F-FDG PET/CT in patients with natural killer/T cell lymphoma**

Huang Qin, Liu Hong, Yang Xiaofeng, Li Yan, Zhang Xiaoyan, Wang Xiaomin

**Objective:** To investigate the prognostic value of interim $^{18}$F-FDG PET/CT scan in patients with natural killer (NK)/T cell lymphoma. Methods: From January 2012 to May 2015, thirteen patients (10 males, 3 females; mean age (43.85±7.66) years) underwent methotrexate + ifosfamide + etoposide + p redimose acetate + L-asparaginase (SMILE) chemotherapy. All patients underwent pre-, mid-treatment (after 3 cycles of SMILE) PET/CT scan, and 9 of them further underwent end-treatment (after 6 cycles of SMILE) PET/CT scan. View analysis and ΔSUV<sub>max</sub> (%) were used to interpret $^{18}$F-FDG PET/CT images. Two-sample t test was used to analyze the difference of ΔSUV<sub>max</sub> between PET/CT positive group and PET/CT-negative group. Survival curves were obtained using Kaplan-Meier analysis. OS and PFS were calculated and compared with the log-rank test. Results: All 13 patients underwent $^{18}$F-FDG PET/CT imaging after 3 chemotherapy cycles and were divided into PET/CT-negative group (7 patients) and positive group (6 patients). ΔSUV<sub>max</sub> of the negative group was higher than that of the positive group: (65.73±5.95)% vs (52.50±1.49)%; t=4.199, P<0.05. Median follow-up period was 26 (9–48) months. The median PFS and median OS of PET/CT-negative group were higher than those of PET/CT-positive group (39 vs 18 months, 44 vs 24 months; χ²=4.521, 4.829, both P<0.05). Conclusion: Interim PET/CT scan could predict the outcome of patients with NK/T cell lymphoma.
Protective effect of curcumin on glucose metabolism evaluated by $^{18}$F-FDG microPET/CT in rat models of intracerebral hemorrhage

Yang Fanhui, Cao Lingzhi, Huang Xiaohong, Yang Chaoshian, Feng Yue, Zhang Chunyin

Objective: To investigate the effect of curcumin on brain glucose metabolism in rat models of intracerebral hemorrhage (ICH), and evaluate the therapeutic effect of curcumin. Methods: Twenty-four healthy adult male SD rats were randomly divided into 4 groups (6 rats/group) by simple random sampling method: normal group (group A), ICH + curcumin group (group B), ICH + vehicle group (group C), and sham operated group (group D). ICH model was made by injecting collagenase (2 μl) into the right caudate nucleus of rat. $^{18}$F-FDG with a dose of (17.8±0.4) MBq was injected through caudal vein at 6 h, 24 h, 48 h, 3 d, 5 d, 7 d, 14 d after the model was built successfully. $^{18}$F-FDG microPET/CT was performed 30 min post injection at each time point. ROI in the hematoma and peri-hematoma brain tissue was drawn, and its volume and SUV$_{max}$ were measured and analyzed. Meanwhile, each rat was evaluated by neurological severity scores (NSS). Analysis of variance for repeated measurement data and Pearson correlation analysis were used. Results: NSS in group B were lower than those in group C from 6 h to 5 d ($F = 183.26, P < 0.01$). MicroPET/CT showed decreased glucose uptake in the hematoma and peri-hematoma brain tissue after cerebral hemorrhage. In group B, the $^{18}$F-FDG uptake in peri-hematoma brain tissue of ICH decreased after 6 h, and reached the minimum at 24 h (1.20±0.08), and then increased. The glucose metabolism in group B was significantly lower than that in group D at each time point ($F = 306.74, P < 0.01$), and significantly higher than that in group C ($F = 471.50, P < 0.01$). SUV$_{max}$ within ROI had a significantly negative correlation with both ROI volume and NSS in group B at each time point (r values: -0.672 and -0.727, both $P < 0.05$). Conclusion: MicroPET/CT might visualize decreased glucose uptake of hematoma and peri-hematoma brain tissue after cerebral hemorrhage. Curcumin might have a neuroprotective effect on ICH, and improve the glucose uptake in hematoma and peri-hematoma brain tissue.

Preparation of $^{18}$F-DPA-714 and its biodistribution in rodents

Hu Wei, Zhao Jun, Yang Min, Guan Yihui, Zuo Chuantao, Hua Fengchun, Pan Donghui

Objective: To synthesize $^{18}$F-DPA-714 and to study its labeling rate, radiochemical purity, stability and biological characteristics. Methods: $^{18}$F- was reacted with K$_2$CO$_3$/K2.2.2 and then engaged in nucleophilic substitution with DPA-714. The crude product was purified by aluminum column and semi-preparation HPLC. The stability of $^{18}$F-DPA-714 was identified in PBS and plasma. The lipid-water partition coefficient (LogP) was determined. Biodistribution analysis and microPET imaging were performed on mice and rats respectively. Results: It took about 25 min for synthesizing $^{18}$F-DPA-714, the radiochemical yield was 31.6% (decay not corrected), and the radiochemical purity was ≥99%. The product remained stable within 4 h. The LogP of $^{18}$F-DPA-714 was 2.71. Pharmacokinetics of $^{18}$F-DPA-714 was more in line with the two compartment model, with the distribution half-life ($T_{1/2}$,a) of 2.40 min and the elimination half-life($T_{1/2}$,b) of 69.15 min. $^{18}$F-DPA-714 was quickly uptaken by tissues after the tail vein injection. It mainly distributed in the lungs, kidneys, and heart, with the radioactive uptake values of (17.85±7.52) %ID/g, (15.41±1.80) %ID/g and (10.56±0.94) %ID/g at 30 min post-injection, respectively. $^{18}$F-DPA-714 was mainly metabolized through the liver, and excreted by the kidneys. The uptake in bones was stable. PET dynamic scanning showed that $^{18}$F-DPA-714 accumulated in the brain of aged rats and cleared slowly within 60 min. Conclusion: $^{18}$F-DPA-714 prepared in this study has high labeling rate, short synthesis time and small precursor dosage. It displays good biological distribution and blood-brain barrier permeability characteristics.

Preparation and characteristics analysis of 5-carboxy fluorescein-dextran-coated superparamagnetic iron oxide nanoparticle

Zhou Jia, Li Min, Xia Yang, Wang Zheng, Zheng Xinfa, Huang Suwen

Objective: To investigate the physical and magnetic properties and cytotoxicity of 5-FAM-dextran-coated superparamagnetic iron oxide nanoparticles (5-FAM-dextran-Fe$_3$O$_4$), and to observe the cell-labeling character of these nanoparticles. Methods: 5-FAM-dextran-Fe$_3$O$_4$ were prepared by ultrasonic and chemical coprecipitation method and the characteristics were evaluated. The size and distribution of 5-FAM-dextran-Fe$_3$O$_4$ were measured by transmission electron microscope (TEM) and Malvern Zetasizer. The organic structure of the coating was characterized by fourier translation infrared spectroscopy. The optical imaging ability was measured by ultraviolet visible spectrometer and the susceptibility was measured by vibrating sample magnetometer. In vitro cytotoxicities of 5-FAM-dextran-Fe$_3$O$_4$, dextran-Fe$_3$O$_4$ and Fe$_3$O$_4$ were detected by MTT assay. The area of labeled neuronal cells was observed by confocal microscopy after incubated with nanoparticles under different magnetic intensities. One-way analysis of variance was used. Results: The size of 5-FAM-dextran-Fe$_3$O$_4$ was homogeneous under TEM, and the diameter ranged from 15 to 25 nm (average ± 22 nm) by Malvern Zetasizer. The organic structure of the coating of Fe$_3$O$_4$ was confirmed by fourier translation
infrared spectroscopy. Ultraviolet visible spectrometer observation showed that the nanoparticles expressed unanimous green fluorescence under ultraviolet activation. The saturation magnetization, residual magnetization and coercivity of the nanoparticles by magnetometer detection were 86.02 A·m²·kg⁻¹, 15.05 A·m²·kg⁻¹ and 5 414.01 A/m respectively, showing superparamagnetic character. MTT assay results showed that 5-FAM-dextran-Fe₃O₄ had no obvious cytotoxicity. The confocal microscopy observation indicated that the cell-labeled area reached the maximum under the magnetic field intensity of 500 mT ((0.880±0.146) mm², F = 320.298, P < 0.05). Conclusion: 5-FAM-dextran-Fe₃O₄ prepared by ultrasonic coprecipitation method have the advantages of small size, good homogeneity and magnetic property. Therefore, they might be used as the fluorescent magnetic bio-probe in laboratory and clinical studies.

Application and comparison of PET/CT, contrast enhanced CT and MRI in the clinical management of pancreatic cancer
Chong Huanhuan, Lan Xiaoli
Recently, either in the field of preoperative differential diagnosis and staging, or in the diagnosis of postoperative recurrence and distant metastasis, the application of PET/CT in pancreatic cancer attracts more and more attention. Combining the precise anatomical information of CT with the functional metabolic information of PET, ¹⁸F-FDG PET/CT can not only accurately locate the T staging, but also detect regional or distant metastasis, which make the early diagnosis and staging of pancreatic cancer easier. This review summarizes the recent progress of PET/CT imaging in the clinical application of pancreatic cancer by comparison of the contrast enhanced CT and MRI, trying to analyze different imaging modalities in clinical management of pancreatic cancer.

Application of PET/CT in targeted therapy of breast cancer
Lei Xiao, Zhao Wenrui, Liang Yingkui
Breast cancer is one of the most common malignant tumors in women, and its morbidity is increasing gradually in recent years. Precision treatment has been developed with individualized and standardized protocols according to the molecular classification of breast cancer. Targeted therapy is one of the most important methods. How to evaluate targeted therapy is the focus of attention. PET/CT plays an important role in the diagnosis, staging, treatment plan and evaluation of therapeutic effect and prognosis, especially in targeted therapy of breast cancer. This review summarizes the applications of PET/CT in targeted therapy of breast cancer.