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Clinical value of dual-phase $^{18}$F-FDG PET/CT for differentiating pancreatic cancer from pancreatitis
Liu Li, Zhang Jian, Zuo Changjing, Yu Zhongfei, Yang Jian, He Chaofan

Objective: To investigate the value of dual-phase $^{18}$F-FDG PET/CT for differentiating pancreatic cancer from pancreatitis. Methods: Dual-phase $^{18}$F-FDG PET/CT scanning was prospectively performed on patients with suspicious pancreatic lesions. Patients with solid focal pancreatic lesions proved by histopathology or clinical follow-up were enrolled and divided into 3 groups according to the maximum diameter of the focus: ≤2.0 cm (group A), >2.0 cm and ≤4.0 cm (group B), >4.0 cm (group C). SUV$_{max}$ at (60±10) min and (120±15) min after FDG injection was defined as early and delayed SUV$_{max}$ (SUV$_{early}$ and SUV$_{delayed}$), respectively, and retention index (RI) was calculated. The differences of SUV$_{early}$, SUV$_{delayed}$ and RI between pancreatic cancer and pancreatitis were analyzed with Mann-Whitney u test. ROC curve was used to determine the optimal cutoff values of the above three parameters and corresponding diagnostic efficiencies were obtained. The AUC was compared with MedCalc software. Results: A total of 196 patients (152 pancreatic cancers and 44 pancreatic inflammatory lesions) with solid focal pancreatic lesions were enrolled. The AUC of SUV$_{delayed}$ was significantly larger than that of SUV$_{early}$ (0.83 vs 0.79, $z=3.64$, $P<0.01$). Numbers of patients in group A, B and C were 45, 96 and 55 respectively. There was no significant difference of the maximum diameter between pancreatic cancers and pancreatitis lesions in all three groups ($z$ values: from -0.39 to -1.52, -1.41, all $P>0.05$). The SUV$_{early}$, SUV$_{delayed}$ and RI of pancreatic cancers were all higher than those of pancreatitis in group A and B ($z$ values: from -4.59 to -3.00, all $P<0.01$). The diagnostic sensitivity and accuracy of SUV$_{early}>3.6$ combined with RI>0 for diagnosing pancreatic cancer were higher than those of SUV$_{early}>3.6$: 96.4% (27/28) vs 75.0% (21/28), 95.6% (43/45) vs 82.2% (37/45). The AUC of SUV$_{delayed}$ was significantly larger than that of SUV$_{early}$ in group B (0.81 vs 0.77, $z=2.06$, $P<0.05$). The optimal cutoff value of SUV$_{delayed}$ in group B was 5.3, with the corresponding sensitivity, specificity, positive predictive value, negative predictive value, and accuracy were 84.4% (65/77), 13/19, 91.5% (65/71), 52.0% (13/25) and 81.2% (78/96), respectively. RI of pancreatic cancers was significantly higher than that of pancreatitis (25.0% (15.8%–35.7%) vs 14.4% (4.6%–18.7%), $z=-2.39$, $P<0.05$) in group C. The optimal cutoff value of RI in group C was 19.0%, with the corresponding sensitivity, specificity, positive predictive value, negative predictive value, and accuracy were 68.1% (32/47), 7/8, 97.0% (32/33), 31.8% (7/22) and 70.9% (39/55). Conclusions: The SUV$_{delayed}$ and RI of dual-phase $^{18}$F-FDG PET/CT might be useful for diagnosis of pancreatic tumors. SUV$_{early}>3.6$ combined with RI>0 could be helpful to improve the diagnostic sensitivity and accuracy in patients with the maximum diameter of lesions ≥2.0 cm. The diagnostic value of SUV$_{delayed}$ might be better than that of SUV$_{early}$ in patients with the maximum tumor diameter of >2.0 cm and ≤4.0 cm. Only RI could be used for diagnosing pancreatic tumors in patients with the maximum tumor diameter >4.0 cm.

Value of $^{18}$F-FDG PET/CT in staging of pancreatic cancer
Yu Jiangyuan, Li Nan, Fan Yang, Chen Puyun, Zhang Yan, Zhao Wei, Yang Zhi

Objective: To evaluate the value of $^{18}$F-FDG PET/CT in tumor staging in patients with pancreatic cancer. Methods: A total 77 patients (from June 2010 to August 2015; 44 males, 33 females, age range 36–83 years) who underwent $^{18}$F-FDG PET/CT examination for pancreatic cancer and confirmed with pathology were enrolled in this retrospective study. All patients had not been treated before the PET/CT scanning and received surgery or biopsy 4 weeks after the scanning. Two-sample $t$ test and ROC curve analysis were used for data analysis. Results: $^{18}$F-FDG uptake was higher in 94.8% (73/77) of pancreatic lesions than that in normal pancreatic tissue. The range of SUV$_{max}$ of pancreatic lesions was 2.4–13.4 (mean: 6.2±2.4). SUV$_{max}$ of patients with smaller primary lesion (minor axis ≤2.0 cm) was significantly lower than that of larger lesion group (minor axis >2.0 cm; $t=-2.661$, $P<0.05$). A total of 46 patients underwent lymph node excision, and the mean number of excised lymph nodes per patient was 13.8±9.2. About 56.5% (26/46) cases with lymph nodes metastases were confirmed with pathology. When the cut-off value of minor axis of regional lymph nodes was 0.45 cm, ROC curve showed that the sensitivity, specificity and AUC were 84.8% (39/46), 65.2% (30/46) and 0.788, respectively. When the cut-off value of SUV$_{max}$ of regional lymph nodes was 2.05, the sensitivity, specificity and AUC were 54.3% (25/46), 80.4% (37/46) and 0.759, respectively. $^{18}$F-FDG PET/CT changed 18.2% (14/77) of patients’ treatment plan. Conclusions: $^{18}$F-FDG PET/CT is a useful tool in pancreatic cancer staging. Though $^{18}$F-FDG
PET/CT has no significant advantages in N-staging, it really helps to make a more accurate M-staging for clinical decision.

Relationship of PET/CT characteristic manifestations and pathology in ovarian sex cord-stromal tumor

Zhang Qian, Xin Jun, Cao Li, Zhao Long

Objective: To investigate the value of PET/CT in the diagnosis of ovarian sex cord-stromal tumor (SCST), and the correlation of PET/CT findings with pathological features.

Methods: PET/CT findings of 40 patients (median age 57 years) with ovarian SCST confirmed by pathology from November 2011 to December 2015 in Shengjing Hospital were retrospectively analyzed. ROI was drawn and SUVmax was calculated. The correlation of imaging features with pathological structural features was analyzed. Two-sample t test and one-way analysis of variance were used.

Results: Pathological results showed 27 patients were ovarian thecoma-fibroma group (20 patients with theca cell tumor, 7 patients with fibroma), 12 patients had granulosa cell tumor and 1 patient had sertoli-lydig cell tumor. Solid mass with or without cystic low-density area was found in 24 patients, 14 cases were cystic-solid tumors, and 2 cases showed cystic mass with irregular and thickened septations. SUVmax between solid and cystic-solid tumors was not significantly different (2.94±1.64 vs 3.77±1.40; t=2.325, P>0.05).

There was no significant difference of SUVmax among theca cell tumors, fibromas and granulosa cell tumors (3.00±1.42, 2.32±1.04 and 3.68±1.65, respectively; F=2.036, P>0.05). Slight or moderate 18F-FDG uptake in solid component was demonstrated in 35 patients (SUVmax 2.96±1.25). Other 5 cases with high 18F-FDG uptake (SUVmax 6.31±0.96) were confirmed malignancy or malignant potential by pathological results, including 2 solid theca cell tumors, 2 cystic-solid granulosa cell tumors and 1 solid sertoli-lydig cell tumor.

Conclusions: There are some features to diagnose ovarian SCST on 18F-FDG PET/CT imaging, which have some correlation with pathological features.

Characteristics of T- and NK/T-cell lymphomas with different pathological subtypes on 18F-FDG PET/CT

Wu Yang, Wu Hubing, Wang Quanshi, Zhou Wenlan, Li Hongsheng, Tian Ying, Dong Ye

Objective: To investigate the imaging presentation of T- and NK/T-cell lymphomas with different pathology subtypes on 18F-FDG PET/CT.

Methods: A total of 95 patients (66 males, 29 females, average age 38.42 years) with T- and NK/T-cell lymphoma proved by pathology from June 2006 to February 2016 were retrospectively analyzed. 18F-FDG uptake (SUVmax), nodal invasion, nodal distribution, extra-nodal involvement and staging were compared among 7 pathological subtypes of T- and NK/T-cell lymphomas. One-way analysis of variance, Fisher exact test and Kruskal-Wallis H test were used for data analysis.

Results: There were significant differences in terms of 18F-FDG uptake, nodal invasion, nodal distribution, extra-nodal involvement and staging among different pathological subtypes of T- and NK/T-cell lymphomas (F=2.937, P<0.05; Fisher exact test, all P<0.01; H=19.883, P<0.01). NK/T-cell lymphoma was found to be prone to invade the nasal cavity and nasopharynx, enteropathic type T-cell lymphoma was specific to the intestine, and subcutaneous panniculitis-like T-cell lymphoma presented with subcutaneous infiltration. All those 3 subtypes were quite specific in their extra-nodal involvement. Most patients with angioimmunoblastic T-cell lymphoma (ATCL), peripheral unspecified T-cell lymphoma (PUTCL) and T immunoblastic lymphoma (TIBL) presented as stage IV disease. Widespread lymph node disease associated with splenic, parotid and serous membrane involvement were often seen in ATCL patients (most commonly to involve the parotid glands and serous membrane among the 7 subtypes). Nodal involvement was found in PUTCL patients, but extranodal involvement was rather non-specific. TIBL had a non-specific pattern of nodal involvement with low 18F-FDG uptake, lower than ATCL and the other 5 subtypes. Anaplastic large cell lymphoma subtypes had the highest 18F-FDG uptake when compared with the other 6 subtypes, but were less often to manifest as stage IV disease despite their preponderance for narrow and nodal infiltration.

Conclusions: Different pathological subtypes of T- and NK/T-cell lymphoma manifest different imaging presentations on 18F-FDG PET/CT, which are useful for understanding their biological characteristics.

Combined impacts of blood glucose level and glucose metabolism-related factors on liver 18F-FDG uptake

Hu Yan, Liu Guobing, Li Yanli, Xiao Jie, Shi Hongcheng

Objective: To evaluate the combined impacts of blood glucose and its related metabolic factors on 18F-FDG uptake by liver.

Methods: A total of 544 subjects (384 males and 160 females, age range 24–73 years) undergoing 18F-FDG PET/CT were recruited in this retrospective study. SUVmean of the right lobe of liver was calculated. Two-sample t test and one-way analysis of variance were performed to compare SUVmean between patients with different genders and BMI levels. Linear correlation analysis, partial correlation analysis and multiple linear regression analysis were conducted to evaluate the relationship between age, injected 18F-FDG dose, blood glucose, serum T3, T4, FT3, FT4, BMR, BMI and liver SUVmean.

Results: The SUVmean of the liver in males and females were 1.89±0.42 and 1.92±0.38 (t=0.693, P>0.05), but it was significantly different among BMI groups (F=3.056, P<0.05). Age, blood glucose and FT3 were significantly associated with liver SUVmean (r values:
0.108, 0.140 and 0.105, all \( P<0.05 \) and were independent factors that indicated variation of liver SUV\(_{\text{mean}} \) (\( \beta \) values: 0.006, 0.070 and 0.088, all \( P<0.05 \)). Blood glucose was the strongest powerful predicting variable of liver SUV\(_{\text{mean}} \) (\( \beta' =0.154, P<0.001 \)). **Conclusions:** Blood glucose and its related metabolic factors can affect the liver \(^{18}\text{F}-\text{FDG} \) uptake. Age, \( \text{FT}_3 \), blood glucose are independent factors predicting variation of liver SUV\(_{\text{mean}} \). The impact of glucose metabolism status should be considered when assessing liver \(^{18}\text{F}-\text{FDG} \) uptake.

**Impact of point spread function on image quality and SUV in FDG PET imaging**

**Xie Xiaofen, Mou Tianlian, Li Junqi, Wang Qian, Mi Hongzhi**

**Objective:** To discuss the impact of an iterative reconstruction algorithm (True X) implemented with point spread function (PSF) on image quality and SUV in \(^{18}\text{F}-\text{FDG} \) PET, and compare with other reconstruction algorithms. **Methods:** A total of 79 hypermetabolic lesions from 37 cancer patients (23 males, 14 females, age (63.38±15.25) years) were retrospectively studied. The PET images were reconstructed using the following six reconstruction algorithms, including FBP, FBP+TOF, iteration, iteration+TOF, True X, True X+TOF. Paired t test was used for statistical analysis. **Results:** All six reconstruction algorithms showed significant difference in lesion SUV\(_{\text{max}} \). The adoption of PSF increased SUV\(_{\text{max}} \) by 15%–16%, and decreased the dispersion of SUV in the liver parenchyma remarkably. **Conclusions:** Lesion SUV\(_{\text{max}} \) calculated from different reconstruction algorithms has significant differences. Caution should be taken in using PSF, as it can improve image quality but may also increase lesion SUV\(_{\text{max}} \).

**Value of lactulose hydrogen breath test combined with radionuclide imaging in the diagnosis of small intestinal bacterial overgrowth**

**Hou Ni, Ning Yanli, Chen Dongfang, Lou Cen**

**Objective:** To compare the tracing effects of radionuclide and barium sulfate on lactulose hydrogen breath test (LHBT), and to explore the value of LHBT combined with radionuclide imaging in the diagnosis of small intestinal bacterial overgrowth (SIBO) in patients with irritable bowel syndrome (IBS). **Methods:** From November 2010 to November 2012, 89 patients (47 males, 42 females; mean age (45.7±12.9) years) with IBS and 13 healthy volunteers (9 males, 4 females; mean age (43.3±8.6) years) were enrolled in this prospective study. All the subjects underwent LHBT combined with radionuclide imaging. Recording the time when the increment of H2 value >0.005% and the OCTT of the radionuclide. Four healthy volunteers also underwent LHBT combined with barium sulfate 1 week after radionuclide imaging. The location of barium sulfate was recorded when H2 value increment >0.020%. Patients with SIBO received rifaximin treatment, and the effect was observed. \( \chi^2 \) test, Pearson correlation analysis and Wilcoxon rank sum test were used to analyze the data. **Results:** (1) In LHBT combined with barium sulfate test, barium sulfate was found still stagnating in small intestine by abdominal X-ray when H2 value increment >0.020% in 4 healthy volunteers, and barium sulfate didn’t reach the colon in delayed imaging in 1 patient. (2) The rates of SIBO detected by LHBT in IBS patients and healthy volunteers were significantly different (43.8% (39/89) vs 5/13; \( \chi^2 =0.133, P=0.716 \)), and those detected by LHBT combined with radionuclide imaging were also significantly different (39.3% (35/89) vs 1/13; \( \chi^2 =4.970, P=0.026 \)). (3) The time of H2 value increased >0.005 % correlated well with OCTT in 13 healthy volunteers ((73±31) and (50±19) min; \( r=0.871, P<0.001 \)) and 54 IBS patients without SIBO ((83±34) and (66±28) min; \( r=0.735, P<0.001 \)), but there was no correlation in 35 IBS patients with SIBO ((36±30) and (75±30) min; \( r=0.304, P=0.076 \)). (4) A total of 34 SIBO-positive patients received a rifaximin treatment, with a significant improvement in the frequency of abdominal pain and abdominal distension after the treatment according to Rome III diagnostic criteria: 5(4, 6) vs 4(3, 5), 4(1, 6) vs 0(0, 4); \( z \) values: -4.842 and -5.388, both \( P<0.001 \). **Conclusions:** LHBT alone is not a valid test for SIBO, and LHBT combined with radionuclide imaging is a good candidate for SIBO diagnosis.

**Preparation of folate-NOTA-\(^{18}\text{F} \) targeting folate receptor and its microPET/CT imaging**

**Chen Zele, Yin Jilin, Wang Cheng, Wang Xinlu, Jiang Lisha, Zhang Rongqin**

**Objective:** To prepare PET molecular probe folate-NOTA-\(^{18}\text{F} \)-FNA) and to explore its feasibility as an imaging agent in folate receptor positive KB tumor. **Methods:** \(^{18}\text{F} \)-FNA was prepared by the method of aluminum fluoride coordination labeling, and the effect of phase transfer catalyst K2.2.2 on the labeling yield was evaluated. Biological distribution was carried out at 10, 30 and 90 min after injection of 3.7 MBq \(^{18}\text{F} \)-FNA in nude mice (n=20) xenographed with KB tumor, and the radioactive uptake (%ID/g) and T/NT ratios were then calculated in different organs or tissues. MicroPET imaging was performed at 40 min after injection of \(^{18}\text{F} \)-FNA (3.7 MBq). **Results:** The labeling yield of \(^{18}\text{F} \)-FNA increased with the presence of K2.2.2. The radiochemical yield was above 98%. The radiochemical purity was above 99%, and still above 98% after maintained in PBS and FBS at 37°C for 4 h. The biodistribution showed that the blood clearance of the probe was slow, and the uptakes
in kidneys and tumor which overexpressed folate receptor were significantly high (5.12±0.58) %ID/g and (1.37±0.20) %ID/g). The high radioactive uptake was observed in KB xenografted mice using microPET imaging. **Conclusions:** The labeling yield of $^{18}$F-FNA could increase with the presence of K2.2.2. Furthermore, the encouraging biological distribution and microPET imaging results indicate that $^{18}$F-FNA may be a candidate for PET imaging in targeting folate receptor.

**Effects of miR106a on the proliferation, apoptosis and invasion of thyroid cancer cells in vitro**

Shen Chentian, Qiu Zhongling, Wei Weijun, Song Hongjun, Luo Quanyong

**Objective:** To investigate the effects of microRNA (miR)106a on the proliferation, apoptosis, migration and invasion of thyroid cancer cells in vitro. **Methods:** 8505C and CGTH-W3 cell lines were used in the study. Overexpression and inhibition of miR106a were achieved by transfection of lentiviral vectors. The changes of gene expression were detected by quantitative real-time PCR (qRT-PCR) and Western blot analysis. Cell viability and apoptosis were evaluated by MTT assay and flow cytometry analysis, respectively. The caspase-9 activities in parental CGTH-W3 and 8505C cells and transfected sublines were measured. Wound healing and Transwell invasion assays were performed to determine cell migration and invasion. Two-sample $t$ test and one-way analysis of variance were used to analyze the data. **Results:** The level of miR106a in 8505C was up-regulated when compared to that in CGTH-W3 cells ($t = 10.28, P < 0.01$). Scrambled control and miR106a(-) were also successfully transfected into cells. Inhibition of miR106a suppressed cell viability, migration and invasion while promoted apoptosis and caspase-9 activity of 8505C cells, with significant differences among 8505C, 8505C-control, 8505C-miR106a(-) cells ($F = 147.0, 19.2, 100.3, 537.8, 804.3$; all $P < 0.01$). Overexpression of miR106a promoted cell viability, migration and invasion while inhibited apoptosis and caspase-9 activity of CGTH-W3 cells, with significant differences among CGTH-W3, CGTH-W3-control, CGTH-W3-miR106a(+) cells ($F = 9.2, 13.3, 622.8, 12.3, 19.6$, all $P < 0.01$). In addition, miR106a may up-regulate the expression of MEKK2 and p-ERK1/2. **Conclusions:** Acting as an onco-miR, miR106a might promote the proliferation, migration and invasion of thyroid cancer cells and inhibit their apoptosis in vitro.

**Application of $^{18}$F-FDG PET/CT and other conventional imaging technologies in carcinoma of unknown primary site**

Liu Honghong, Lan Xiaoli

**Abstract:** Carcinoma of unknown primary (CUP) is a diagnostic and therapeutic challenge in oncology. The early and correct detection of the primary tumors of CUP is very important to its diagnosis, treatment, therapeutic response evaluation and prognosis prediction. This review summarizes the implications and development of the imaging technologies, especially $^{18}$F-FDG PET/CT scan, in the diagnosis, treatment and prognosis prediction of CUP patients.

**Benefits of patients with differentiated thyroid carcinoma in different risk stratification from $^{131}$I therapy**

Li Xiao, Lin Yansong

**Abstract:** As an important postsurgical adjuvant treatment for DTC, radioactive iodine (RAI) is administered to eliminate residual thyroid tissue as well as the potentially persistent or distant metastatic lesions. It plays a significant role in reducing disease recurrence and tumor-related mortality. The major challenge at present in RAI treatment decision-making is how to achieve optimum clinical outcome with minimal radiation exposure. ATA guidelines recommends a postsurgical recurrence-risk adapted approach to RAI treatment management based on the clinicopathological features. However, RAI therapy is not beneficial to all DTC patients. The potential benefits from RAI therapy in DTC patients with different risk stratification have attracted much attention, and are reviewed in this article in order to provide more evidence-based basis for clinical decision-making.

**Experimental researches and immunoassay influence factors of calcitonin**

Shan Fengling, Lu Hankui

**Abstract:** Calcitonin participates in physiological regulation of calcium metabolism, but it might not be the key factor. Multiple immunoassay methods have been developed for serum calcitonin detection. However, significant differences exist among the methods, and the results of immunoassay are affected by many factors. This paper mainly discusses some major advances in experimental researches of calcitonin and the influence factors of immunological measurement.