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Value of 99Tc-Tilmanocept and 99Tc sulfur colloid SPECT/CT for the detection of sentinel lymph node in breast cancer patients

Liu Yan, Huo Zongwei, Wang Xiaohui, Kong Qi, Ren Jiazhong, Yang Guoren

Objective: To evaluate the clinical value of 99Tc-Tilmanocept (TMC) SPECT/CT for the detection of SLN by comparing with 99Tc-sulfur colloid (SC) SPECT/CT. Methods: From March 2016 to September 2016, a total of 160 patients (age range: 30-70 years), selected from Breast Surgery Department of Shandong Cancer Hospital, underwent SPECT/CT and planar imaging with either 99Tc-TMC (TMC group, n=76) or 99Tc-SC (SC group, n=84). The results of SLN SPECT/CT and planar imaging were compared. The positive rate of SLN detected in SPECT/CT was higher than that by planar imaging (1.89 vs 2.60; P<0.05). In TMC group, the average number of SLN detected during operation (3.05±1.29 vs 2.57±0.99; t=2.740, P<0.05) was significantly higher than that detected by SPECT/CT for the detection of sentinel lymph node in breast cancer patients.

SPECT/CT evaluation for lumbargo in post-lumbar spinal fusion patients
Zhang Binqing, Guo Hui, Zhang Min

Objective: To evaluate the value of SPECT/CT for detecting the causes of lumbargo in post-lumbar spinal fusion patients. Methods: From January 2009 to December 2015, 53 patients (31 males, 22 females, age: (42.3±5.3) years) with lumbargo after lumbar spinal fusion, without positive CT and digital radiography (DR) findings, were included in this study and were further examined by SPECT/CT imaging. The final diagnosis was made according to clinical symptoms, multimodality imaging findings, and treatment outcome. All patients were followed up for at least 6 months. Results: Thirty-eight patients had positive findings with SPECT/CT imaging, including 23 patients with screw loosening, 6 patients with lumbar fusion cage aseptic inflammation and 9 patients with impingement. The other 15 patients had negative results. The diagnostic sensitivity of SPECT/CT for detecting causes of lumbargo was 71.7% (38/53). The diagnostic sensitivity and positive predictive value of SPECT/CT for complications caused by internal fixators were both 100% (38/38). Conclusion: SPECT/CT scanning could be a clinical valuable tool for inspecting the cause of lumbargo in post-lumbar spinal fusion patients.

Value of 99Tc-MIBI SPECT/CT in pre-operative diagnosis of primary and secondary hyperparathyroidism
Zhong Xiao, Ou Xiaohong, Li lin, Zeng Yu

Objective: To evaluate the value of pre-operative 99Tc-MIBI SPECT/CT in patients with HPT by comparing with planar 99Tc-MIBI and ultrasound imaging. Methods: A total of 57 patients (9 males, 48 females; average age: (52.9±15.5) years) were enrolled into this retrospective study. They all underwent 99Tc-MIBI planar scintigraphy, 99Tc-MIBI SPECT/CT and ultrasound during March to October in 2016. All patients received parathyroidectomy and the surgical pathology was considered as the gold standard. The diagnostic efficacies were compared using χ2 test. Results: A total of 86 HPT lesions were confirmed, including 47 lesions in 46 PHPT patients and 39 lesions in 11 SHPT patients. The sensitivities of SPECT/CT, planar, ultrasound and combined imaging (planar plus ultrasound) were 87.21% (75/86), 69.77% (60/86), 65.12% (56/86) and 84.88% (73/86), respectively. The overall sensitivity of SPECT/CT was significantly higher than that of individual planar imaging and that of ultrasound (χ2 values: 4.691 and 7.818, both P<0.05), but similar to...
that of the combined imaging ($\chi^2=0.044, P>0.05$). No significant difference was observed among the specificities of all these modalities ($\chi^2=2.219, P>0.05$). For PHPT lesions, the sensitivities of SPECT/CT, planar imaging, combined imaging and ultrasound were 95.74% (45/47), 93.62% (44/47), 97.87% (46/47) and 76.60% (36/47), respectively. No statistically significant difference was found in the sensitivity of the former 3 modalities ($\chi^2=1.044, P>0.05$), but the sensitivity of ultrasound was the lowest($\chi^2=16.223, P<0.05$). For SHPT, the sensitivities of the corresponding 4 modalities were 76.92% (30/39), 41.03% (16/39), 51.28% (20/39) and 69.23% (27/39), respectively. SPECT/CT was significantly superior to planar imaging and ultrasound ($\chi^2=5.05, P>0.05$). Only SPECT/CT could accurately localize 5 ectopic HPT lesions. Conclusions: Compared to planar imaging and ultrasound, SPECT/CT could accurately localize ectopic lesions, thus facilitating patient planning for minimally invasive surgery.

Clinical incremental values of extraosseous findings on CT during bone SPECT/CT imaging

Zhu Xiangyun, Zhao Hongqing, Zhao Yanjun, Tang Ping, Ni Jianming

Objective: To evaluate the prevalence of extraosseous findings on integrated CT images of routine SPECT/CT bone imaging and its clinical incremental values. Methods: A total of 843 patients (470 males, 373 females, age range: 26-92 years) who underwent SPECT/CT bone imaging during May 2013 to December 2015 were enrolled in this retrospective study. A modified C-RADS was used to classify the extraosseous findings to E1, E2, E3 and E4. $\chi^2$ test was used for data analysis. Results: The CT images in 78.6% (663/843) of patients were normal or with no additional clinical significance (E1 and E2), and those in 21.4% (180/843) of patients might need further assessment (E3 and E4). The rate of E4 extraosseous findings in patients with malignancy was higher than that in patients without malignancy: 9.5% (59/622) vs 5.0% (11/221); $\chi^2=4.352, P<0.05$. There was no significant difference of the rate between genders: 8.5% (40/470) in males vs 8.0% (30/373) in females; $\chi^2=0.510, P>0.05$. With age increasing, the prevalence of E4 finding increased and the rate was the highest in the patients over 80 years old (12.5%, 16/128). Seventy patients had E4 findings and chest masses and nodules were the most common, followed by the abdominal or pelvis lymph node enlargements. Conclusions: Potentially important extraosseous findings are common on SPECT/CT. Systematic reviewing CT images and communicating the important unexpected findings to clinical physicians could enhance its clinical incremental values.

Influence of gender, age and weight on the cardiac functional parameters determined by gated myocardial SPECT imaging in patients with low-likelihood coronary heart disease

Li Jiajun, Guo Feng, Tian Yueqin, He Zuoxiang

Objective: To derive reference limits of cardiac functional parameters (CFP) determined by gated myocardial SPECT imaging, and to analyze the influence of gender, age and weight on CFP. Methods: One hundred and seventy-five consecutive outpatients (89 males with age of (48.3±10.7) years and 86 females with age of (49.8±10.4) years) were defined as patients with low-likelihood coronary heart disease (LCHD). All patients underwent adenosine or exercise stress $\text{Tc}^{99m}$-MIBI G-MPI from February 2008 to April 2011. The EF, EDV and ESV of the left ventricle were measured by quantitative gated SPECT (QGS) software. The reference limits were derived by means of Gaussian distribution or percentiles. The influence of gender, age and weight on CFP was analyzed by multiple regressions for linear models. Two-sample t test was used to analyze data of 2 groups. Parameters between different age groups were compared by one-way analysis of variance. Results: The lower reference limit of EF for males was 50%, the upper limit of EDV and ESV was 112 ml and 49 ml respectively. For females, the corresponding reference limits were 54%, 77 ml and 49 ml respectively. No statistically significant difference was found in the EF, EDV and ESV of the left ventricle between different age groups (F values: 1.106, 0.954, 1.029, all $P>0.05$). For PHPT lesions, the sensitivities of SPECT/CT, planar imaging, combined imaging, and to analyze the influence of gender, age and weight on CFP. Methods: One hundred and seventy-five consecutive outpatients (89 males with age of (48.3±10.7) years and 86 females with age of (49.8±10.4) years) were defined as patients with low-likelihood coronary heart disease (LCHD). All patients underwent adenosine or exercise stress $\text{Tc}^{99m}$-MIBI G-MPI from February 2008 to April 2011. The EF, EDV and ESV of the left ventricle were measured by quantitative gated SPECT (QGS) software. The reference limits were derived by means of Gaussian distribution or percentiles. The influence of gender, age and weight on CFP was analyzed by multiple regressions for linear models. Two-sample t test was used to analyze data of 2 groups. Parameters between different age groups were compared by one-way analysis of variance. Results: The lower reference limit of EF for males was 50%, the upper limit of EDV and ESV was 112 ml and 49 ml respectively. For females, the corresponding reference limits were 54%, 77 ml and 49 ml respectively. No statistically significant difference was found in the EF, EDV and ESV of the left ventricle between different age groups (F values: 1.106, 0.954, 1.029, all $P>0.05$). For females, EDV was not different ($F=1.748, P>0.05$), while ESV and EF were significantly different among 3 groups (F values: 5.010, 6.229, both $P<0.05$). Conclusions: The CFP determined by G-MPI in LCHD patients are significantly affected by gender and age. The age-related changes of CFP in males are different from those in females.

Feasibility of $\text{Tc}^{99m}$-3P4-RGD, SPECT/CT imaging in evaluation of arterial plaque stability after atorvastatin intervention in rabbits

Han Jie, Zhang Ying, Wang Qian, Mi Hongzhi, Su Hang, Mou Tiantian, Xie Xiaofen, Li Quan, Zhang Yehong

Objective: To investigate the feasibility of a novel molecular probe $\text{Tc}^{99m}$-3P4-RGD, in evaluating arterial plaque stability after atorvastatin intervention in rabbits with SPECT/
CT. **Methods:** Eighteen male New Zealand rabbits were randomly divided into group A (stable plaque), group B (vulnerable plaque), and group C (vulnerable plaque with statin intervention). All rabbits were fed with high-fat food for 12 weeks. After high-fat feeding for two weeks, sham surgery was performed on group A. In the meantime, abdominal aorta injury was performed on group B and group C. After that, rabbits of group C were given oral atorvastatin (2.5 mg·kg⁻¹·d⁻¹). ⁹⁹Tc⁶-3P4-RGD₂ SPECT/CT imaging was performed on each group at the end of 4, 8 and 12 weeks. T/NT ratios were calculated. Animals were sacrificed at the end of 12 week after imaging studies. The abdominal aortas were collected, imaged with SPECT/CT, and evaluated by pathological HE staining and immunohistochemical analysis. MVD was calculated. Differences among 3 groups were analyzed using one-way analysis of variance. **Results:** There was no significant radioactive uptake in the abdominal aortas of three groups on the 4th week’s imaging. The radioactive uptake in abdominal aortas increased slightly on the 8th week, with the highest radioactive uptake in group B. The radioactivity in abdominal aortas of the 3 groups maintained increasing on the 12th week, with T/NT ratios of 1.579±0.217, 1.873±0.226 and 1.524±0.237, respectively (F=8.984, P<0.05). In ex vivo abdominal aorta images, especially images of group B, radioactivity in lesion sites was higher than that in normal tissue. Accordingly, results of HE staining showed that artery plaques of group A and group C were grade Ⅱ and group B was grade Ⅳ. The MVD of group A, B and C was 8.17±1.17, 15.86±1.07 and 7.17±1.60, respectively (F=90.36, P<0.05). **Conclusions:** ⁹⁹Tc⁶-3P4-RGD₂ SPECT/CT imaging has a high sensitivity in the evaluation of arterial plaque stability after statin intervention in rabbits.

**PET reporter gene imaging in cellular immunotherapy for cancer**

*Li Xiaofeng, Xu Wengui*

**Abstract:** As an important in vivo noninvasive molecular imaging modality, PET imaging can quantify and visualize the serial trafficking, tumor targeting, cell number maintenance, cell expansion, activation and immunological function of adoptive immune cells in cancer cell therapy. Thereby it may play a significant role in the treatment options and efficacy evaluation for cellular immunotherapy in cancer. This review focuses on PET reporter gene imaging which has been studied intensively and applied widely in the research on imaging monitoring of cellular immunotherapy for cancer, with the purpose to provide innovative clues for the preclinical study and clinical translation research.

**Estimation of patient radiation dose and risk from whole body ¹⁸F-FDG PET/CT examination**

*Cheng Yuan, Wang Zhenguang*

**Abstract:** Patients are exposed to both the internal radiation from radiopharmaceutical and the external radiation from the X-rays during PET/CT examination. Estimating patients’ radiation dose from whole body PET/CT examination could eliminate their apprehension and give clinical physicians guidance about whether the patients need to perform PET/CT examination. The calculation methods, influencing factors, cancer risk of PET/CT imaging and how to reduce the radiation dose are reviewed in this paper.