2024
The Asian Society of Nuclear Medicine Technology

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Greetings

Dear and respected members of ASNMT! Greetings!

It is a great honor for me to host the 70th KSNMT and the 12th ASNMT Annual Conference of 2024 at the Healthcare Innovation Park of Seoul National University Bundang Hospital, welcoming members from three countries. I hope this will be a delightful and meaningful time for you, where you can enjoy reconnecting with fellow members after a long time, have pleasant conversations that have been missed, and acquire new skills.

Dear and respected members!

This conference is being held jointly, with ASNMT members from Japan and Taiwan joining us. Please extend your warmest greetings to them. ASNMT was founded in 2011 and has since held the 2012, 2015, 2018, and today, the 12th meeting in 2024 in Korea. We have been continuously enhancing exchanges and cooperation among the three countries—Korea, Japan, and Taiwan—with the goal of advancing the academic development of nuclear medicine technology in the Asian region and sharing information.

Many distinguished guests have gathered here today to honor this occasion with their presence. Among them are our society's history, the former presidents including former President Iltaek Seo, former President Myeongcheol Lee of the Korean Society of Nuclear Medicine, President Geonuk Kang of the Korean Society of Nuclear Medicine, JSNMT President Tomoaki Yamamoto, and TSNM President Hui Ping Chen, as well as many other distinguished guests. I extend my heartfelt gratitude.

Dear and respected members!

I believe the essence of academic conferences lies in vigorous paper activities. We are allocating an unprecedented budget to fully support these efforts. I encourage you to participate voluntarily and reap the rich rewards together. Our 20th executive committee will always maintain a humble attitude, striving to make this society solely for the benefit of its members. We will do our utmost to become a "comfortable society through humility, and a strong society through communication." Until the day we all, as the Korean Society of Nuclear Medicine Technologists, become a global leader, we will continue to move forward without fear of change and innovation.

Dear and respected ASNMT members!

I hope the 12th ASNMT conference will be a beneficial and memorable time for everyone, fostering lasting friendships. I wish you all health and happiness.

October 12, 2024

President of the Korean Society of Nuclear Medicine Technologists, **Lee Kyung Jae**

Time Table

10:30~12:00	ASNMT Steering committees meeting (Board member) & Lunch				
12:00~12:30	Opening ceremony				
13:00~14:30	Lab tour (Seoul National University Bundang Hospital)				
14:30~14:40	Break time				
14:40~17:30	Session1 14:40~ 16:00	The study of Gallium-68 Labelled PET/CT scan parameter optimization	Samsung Medical Center	In Suk KWAK	Jun Young PARK (Korea) Norikazu MATSUTOMO (Japan)
		Usefulness of respiratory motion correction on ^{18}F-FDG PET for cardiac sarcoidosis : A phantom study	Yokohama City University	Ayano ONOMA	
		Evaluation of image for phantom according to normalization, well counter correction in PET/CT	National Cancer Center	Choong Woon LEE	
		Estimation of coincidence counts in brain FDG-PET using machine learning with pre-scan information	International University of Health and Welfare Narita Hospital	Ryu EMURA	
		Compare the differences in digital and analog PET/CT images and quantitative values	Taichung Veterans General Hospital	Pu-Rong HUANG	
		Classification of lung cancer subtypes using FDG PET image features and deep learning	Junshin Gakuen University	Yuji TSUTSUI	
		Evaluation of population distribution shifts caused by alterations in reagents	Asan medical Center	HyeMiPARK	
		Evaluation of variation method to improve the sensitivity of immunoradiometric assay	Seoul National University Bundang Hospital	Won-Hyun KWON	
	16:00~ 16:10	Break Time			
	Session2 16:10~ 17:20	Investigation of personal dosimeter loss case and measures to prevent loss	Seoul National University Bundang Hospital	Seong-Woo PARK	Yong Ho Do (Korea) Hui Ping CHEN (Taiwan)
		Iterative reconstruction with scatter correction in ^{123}I SPECT imaging: comparison of preprocessing and including methods	Kyorin University	Eiji HISANO	
		An incidental finding of breast cancer osteolytic bone metastasis on ^{99m}Tc-TRODAT-1 SPECT image	Hsinchu Mackay Memorial Hospital	Chun-Liang KUO	
		Development of detachable inserts simulating Alzheimer's disease for the 3D Hoffman phantom	Kyorin University	Koya HAYAKAWA	
		Establishing a virtual reality teaching plan for nuclear medicine myocardial perfusion scan	Taichung Veterans General Hospital	Jui-Yin KUNG	
		Validation of the ability of SBR and SUV in ^{123}I-FP-CIT SPECT to differentiate dopaminergic neurodegenerative disease using xSPECT	University of Tokyo Hospital	Tomohiro SATO	
		Clinical value of post-treatment SPECT/CT with Lu-177 DOTATATE for neuroendocrine tumors	National Taiwan University Cancer Center	Wan-Jo CHANG	
	Poster Session 17:20~ 17:30	Bone scan with SPECT/CT demonstrated complex regional pain syndrome	Dalin Tzu Chi Hospital	Shih-Tsung LIN	Jun Young PARK(Korea)
		Competency-based medical education: Constructing a consensus on nuclear medicine milestones in Taiwan	Taitung Christian Hospital	Hui Ping CHEN	
17:30~18:00	Closing ceremony and ASNMT flag passing ceremony				
18:00~20:00	Presidential Reception				

Oral Presentation Session

Poster Presentation Session

Oral Presentation

12th The Asian Society of Nuclear Medicine Technology

The Study of Gallium-68 Labelled PET/CT Scan Parameter Optimization

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[Purpose] Gallium-68 (^{68}Ga) is increasingly being used in nuclear medicine to label tracers such as PSMA (Prostate Specific Membrane Antigen) and DOTA-TOC to detect prostate cancer and neuroendocrine tumors. However, it is characterized by low resolution compared to Fluorine-18 (^{18}F) and relatively higher SBR (Signal to Background Ratio) than FDG (Fluorodeoxyglucose). Therefore, we studied the optimized parameters and reconstruction method of PET/CT examination using 68Ga through phantom image evaluation.

[Material and Method] A NEMA 2007/IEC 2008 PET model was prepared with H/B (Hot vs Background) ratio of 10:1. Images were acquired in list mode for 9 minutes using DMIDR (GE, USA), and reconstructed from 1 to 8 minutes using Ordered Subset Expectation Maximization (OS-EM) + Time of Flight (TOF) + Sharp IR (VPFX-S) and Block Sequential Regularized Expectation Maximization (BSREM) + TOF + Sharp IR (QCFX-S-400), respectively, for comparison. Then, the images of BSREM + TOF + Sharp IR / 2min (QCFX-S-2min) were reconstructed from β-strength 100 to 700, and the image quality was evaluated using AMIDE (freeware, Ver.1.0.1), Advanced Workstation (GE, USA).

[Result] Signal to Noise Ratio (SNR), Standardized Uptake Value (SUV), Contrast Recovery (CR), Background Variability (BV), and Recovery Coefficient (RC) all showed relatively better values with the QCFX-S-400 than with the VPFX-S. SNR peaked at an acquisition time of 5 min/bed, while CR, BV, and SUV did not show any difference with acquisition time. RC peaked at 2 min/bed based on a 10 ㎜ sphere. β-strength showed the highest SNR at 400, while BV was stable above 300. CR and SUV were inversely related to the increase in β-strength. RC was within the error range for 17㎜ spheres and above, but 10㎜ and 13㎜ showed a large variation depending on β-strength.

[Conclusion] The application of BSREM in 68Ga-labeled PET/CT examinations showed high image quality compared to OS-EM. The acquisition time of 2-5 min/bed is considered to be the optimal time to achieve image quality and quantification, but it is effective to select and apply the time according to the purpose of the examination and clinical situation. For β-strength, we consider 400 to be the optimal setting based on the results of SNR, BV, RC, etc.

[Key Words] ^{68}Ga-PSMA, BSREM, OS-EM

Usefulness of Respiratory Motion Correction on ^{18}F-FDG PET for Cardiac Sarcoidosis: A Phantom Study

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[Purpose] This study aims to demonstrate the effect of SUV with and without Respiratory Motion Correction (RMC) on ^{18}F-FDG PET for cardiac sarcoidosis (CS).

[Materials and Methods] The myocardial phantom was used the RH-2 type (Kyoto Kagaku Co., Ltd.) which consists of the pulmonary, mediastinum, myocardium parts. The CS model to simulate the abnormal uptake was created by attaching coin-shaped cavity with a 20 ㎜ diameter and 8 ㎜ thickness on the anterior wall, septal, and inferior wall in the myocardial part. The CS lesion was filled with ^{18}F-FDG solution. The concentration ratios of myocardium, CS lesion, left and right ventricular cavities were 1.0, 2.3, 1.5 and 1.5, respectively. The CS model was moved to cranio-caudal direction by motion platform to represent Respiratory Motion (RM). The RM distances were set at 0 ㎜ (stationary), ±10 ㎜ (RM10), ±20 ㎜ (RM20) and ±30 ㎜ (RM30). The CS model was acquired by Discovery MI PET/CT scanner. All images were reconstructed by Q.Clear. In addition, RMC10, RMC20 and RMC30 data were reconstructed from the exhalation of the RM10, RM20 and RM30, respectively. The variation ratio of SUVmax without RMC with reference to stationary was calculated to evaluate the influence of RM. Moreover, the improvement ratio was calculated from SUVmax with and without RMC.

[Results] The SUVmax was reduced by RM compared with stationary. The maximum change ratio in SUVmax was -35% at RM20 in the anterior wall, -26% at RM30 in the septum and -36% at RM20 in the inferior wall, respectively. The maximum improvement ratio in SUVmax was 34% at RMC10 for the anterior wall, 24% at RMC30 for the septum and 34% at RMC10 for the inferior wall, respectively. The effect of RMC was more pronounced in the anterior and inferior walls.

[Conclusion] SUVmax was reduced by RM and then was improved by RMC. It was suggested that the effects of RMC depend on the location of the CS lesion and the size of the RM.

Evaluation of Image for Phantom according to Normalization, Well Counter Correction in PET/CT

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[Purpose] PET-CT imaging require an appropriate quality assurance system to achieve high efficiency and reliability. Quality control is essential for improving the quality of care and patient safety. Currently, there are performance evaluation methods of UN2-1994 and UN2-2001 proposed by NEMA and IEC for PET-CT image evaluation. In this study, we compare phantom images with the same experiments before and after PET-CT 3D normalization and well counter correction and evaluate the usefulness of quality control.

[Material and Method] Discovery 690 (General Electric Healthcare, USA) PET-CT equipment was used to perform 3D normalization and well counter correction as recommended by GE Healthcare. Based on the recovery coefficients for the six spheres of the NEMA IEC Body Phantom recommended by the EARL. 20 ㎏q /mL of F-18 was injected into the sphere of the phantom and 2 ㎏q/mL of F-18 was injected into the body of phantom. PET-CT scan was performed with a radioactivity ratio of 10:1. Images were reconstructed by applying TOF+PSF, TOF, OSEM+PSF, OSEM and Gaussian filter 4.0, 4.5, 5.0, 5.5, 6.0, 6.5 ㎜ with matrix size 128×128, slice thickness 3.75 ㎜, iteration 2, subset 16 conditions. The PET image was attenuation corrected using the CT images and analyzed using software program AW4.7 (General Electric Healthcare, USA). The ROI was set to fit 6 spheres in the CT image, RC (Recovery Coefficient) was measured after fusion of PET and CT. Statistical analysis was performed Wilcoxon signed rank test using R.

[Result] Overall, after the quality control items were performed, the recovery coefficient of the phantom image increased and measured. Recovery coefficient according to the image reconstruction increased in the order TOF+PSF, TOF, OSEM+PSF, before and after quality control, RCmax increased by OSEM 0.13, OSEM+PSF 0.16, TOF 0.16, TOF+PSF 0.15 and RCmean increased by OSEM 0.09, OSEM+PSF 0.09, TOF 0.106, TOF+PSF 0.10. Both groups showed a statistically significant difference in Wilcoxon signed rank test results ($P<0.001$).

[Conclusion] PET-CT system require quality assurance to achieve high efficiency and reliability. Standardized intervals and procedures should be followed for quality control. We hope that this study will be a good opportunity to think about the importance of quality control in PET-CT

[Key Words] Normalization, Well Counter Correction, PET-CT

Estimation of Coincidence Counts in Brain FDG-PET Using Machine Learning with Pre-Scan Information

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[Purpose] Positron emission tomography (PET) with ^{18}F-fluorodeoxyglucose (FDG) is a valuable tool for visualizing brain glucose metabolism and diagnosing conditions such as epilepsy, dementia, encephalitis, and brain tumors. Brain FDG-PET scans are influenced by various factors including fasting time, blood glucose levels, dose, body weight, visual and auditory stimuli, and aging. These factors impact brain radioactivity concentration and distribution, making patient management and pre-examination information essential for maintaining image quality. This study aimed to predict the actual count from pre-examination information obtained on the day of the scan.

[Materials and Methods] This study analyzed data from 119 consecutive patients who underwent whole-body glucose metabolism PET/computed tomography (CT) scans. FDG, with an average dose of 3.42 MBq/kg, was administered after at least 15 min of rest with eyes closed. Pre-examination information included age, gender, height, weight, and blood glucose level, diabetes status, waiting time after injection, fasting time, and dose. PET data were collected using Canon Medical Systems' Cartesion Prime, and head scans were performed 50 minutes after injection. Machine learning techniques, including multiple regression, decision trees, random forest, and gradient boosting, were applied using Orange software to predict Total Prompt, True Coincidence + Scatter Coincidence (T+S), and Noise Equivalent Count Rate (NECi). Prediction accuracy was evaluated using mean squared error, root mean squared error, mean absolute error, and R-squared (R2).

[Results] Prediction of Total Prompt showed the highest accuracy, with R^2 values ranging from 0.51 to 0.72, followed by T+S and NECi. Gradient boosting achieved the highest accuracy for Total Prompt and NECi, while the random forest method was most accurate for T+S. Although this study successfully predicted Total Prompt, T+S, and NECi, the impact of these factors on image quality remains unclear, and the exploration of optimal machine learning parameters was not conducted. Further research is needed to better understand the relationship between these predictions and image quality.

[Conclusion] This study suggests that predicting counts using pre-examination information is feasible.

Compare the Differences in Digital and Analog PET/CT Images and Quantitative Values

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[Purpose] When replacing PET/CT equipment, the correlation between calibration values and image uniformity between the old and new machines is of paramount importance. Our team conducted scan analysis on both digital and analog PET/CT by using phantoms to determine the differences between two systems.

[Materials and Methods] Cylindrical water phantom and Jaszczak phantom were used. After injecting 2.43 to 3.98 mCi of F-18 FDG and allowing for uniform drug distribution, phantom was placed in analog PET/CT (Philips Gemini TF) and digital PET/CT (Philips Vereos) for imaging. Routine protocols (matrix size 256) were used with different scan time (1, 10 minutes). The middle section of the cylindrical water phantom image was acquired for SUVmax value. Cold Rods and Cold Spheres section of the Jaszczak phantom was used to evaluate resolution.

[Results] No matter which device is used, the longer imaging time, the better image uniformity and resolution (visual inspection). Regardless of the length of imaging time, the SUVmax value of digital equipment is higher than that of analog equipment. The SUVs for digital device are 2.71 (1 minutes) and 2.31 (10 minutes), while the SUVs for analog device are 2.34 (1 minutes) and 1.99 (10 minutes).

[Conclusion] This study found digital device have better resolution and higher SUV than analog device. It is recommended that such tests be included as mandatory items for future equipment replacement.

[Key Words] Analog PET/CT, Digital PET/CT, SUV

Classification of Lung Cancer Subtypes Using FDG PET Image Features and Deep Learning

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[Purpose] Lung cancer subtype classification has the potential to significantly improve disease prognosis and develop individualized patient management. In this study, we present the image features based approach to predict classification of lung cancer subtypes using FDG PET (Fluorodeoxyglucose Positron emission Tomography) image and deep learning.

[Materials and Methods] FDG PET images of 120 lung cancer patients - including adenocarcinoma and squamous cell carcinoma - were assembled from open data of The Cancer Imaging Archive. A total 134 features were measured from each lesion using 3D-VOI on PET images. The accuracy of predict classification of lung cancer subtypes was evaluated based on the classifier models as follows, Neural Network, Support Vector Machine and Random Forest.

[Results] The precisions of predict based on Neural Network, Support Vector Machine and Random Forest were 0.740, 0.826 and 0.755, respectively. And the classifier model based on Support Vector Machine resulted the accuracy levels of 82.4% for the case of adenocarcinoma, and the accuracy levels of 83.3% for the case of squamous cell carcinoma.

[Conclusion] Our findings provided the possibility to predict classification of lung cancer subtypes with high accuracy based on FDG PET image features and deep learning.

[Key Words] FDG PET Image Feature, Deep Leaning, Lung Cancer

Evaluation of Population Distribution Shifts Caused by Alterations in Reagents

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Hye-Mi PARK, Soo-Yeon LIM, Sun-Hee YOO and Sun-Ho LEE

[Purpose] The nuclear medicine specimen laboratory is continuously conducting comprehensive quality management (TQM) to ensure reliable test results. This study aims to verify the accuracy and improve the reliability of test results by analyzing the monthly population distribution change of test items before and after reagent change using standard deviation index (SDI) analysis.

[Material and Method] Among the test items conducted by the nuclear medicine specimen laboratory at Asan Medical Center in Seoul, 10 test items, including CA19-9, CA15-3, Testosterone, PTH, Calcitonin, AFP, CEA, CA72-4, PSA, and Estradiol, were compared and analyzed for monthly percentages and SDI before and after reagent change. Each item was analyzed by dividing into two groups within or exceeding the reference value according to the reference value, and detailed reference values were applied to hormone test items with various reference values according to gender and age. The continuity and accuracy of PSA items were carefully reviewed, and the SDI tolerance range set as the evaluation criteria for the analysis results was set from -2.0 to 2.0 according to the guidelines of the Korean Society of Nuclear Medicine

[Result] In the five items of CA19-9, CA15-3, AFP, CEA, and Calcitonin, SDI remained stable within the allowable range even after reagent change. However, items CA72-4, PSA, Testosterone, PTH, and Estradiol showed fluctuations in SDI exceeding ±2.0. In particular, CA72-4 recorded SDI of 3.8 and 7.8 in the excess reference value section, respectively, and PSA showed a sharp increase in SDI in excess of 0.20 ng/mL immediately after reagent change, and the retention rate of 0.04 ng/mL was significantly reduced. For the testosterone item, SDI was temporarily lowered to -2.5 in the section exceeding 10.1 ng/mL. In the PTH item, SDI rose to a maximum of 3.0 in the section below 57.0 pg/mL, but decreased to -2.3 in the section above 57.0 pg/mL, confirming fluctuations outside the allowable range. Finally, in the Estradiol item, SDI was as low as -16.5 in the section below 10.0 pg/mL, up to 21.5 in the section between 10.0 and 35.0 pg/mL, and more than seven times higher than the allowable standard in the test section excess of 35.0 pg/mL.

[Conclusion] The SDI of CA72-4 and Testosterone items temporarily increased after reagent change, but then recovered to the normal range, and the PSA item was readjusted to a stable value after adjusting the standard solution, although a clear difference between reagents was confirmed in the low concentration section. In addition, it was confirmed that the PTH item was due to the change in the reference value, and the Estradiol item was also adjusted downward in the high concentration section after adjustment of the standard solution to maintain consistent results. This study played an important role in strengthening the reliability and accuracy of test results by systematically analyzing the variability according to reagent change. In the future, it is thought that the quality of test results can be further improved by proactively identifying and managing potential variables through continuous monitoring.

[Key Words] Population Distribution, Reference Value, Standard Deviation Index

Evaluation of Variation Method to Improve the Sensitivity of Immunoradiometric Assay

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[Purpose] The concentration of PSA after radical prostatectomy in prostate cancer patients is a predictor of biochemical recurrence, and the American Urological Association (AUA) is defined as biochemical recurrence when the concentration of PSA is measured at 0.2 ng/mL or more, and when the concentration is measured at 0.2 ng/mL or more at the retest. This standard is also applied our hospital. In this laboratory, the PSA reagent using IRMA is used, and the sensitivity at a very low value was not as good as the reagent used in the department of laboratory medicine. This study aims to increase the reliability of the results by improving the precision and sensitivity of very low values.

[Material and Method] As a reagent for the study, PSA reagent using IRMA was used. As a method to improve the precision and sensitivity of very low values, a variation method on the serum volume (25μL, 50μL, 100μL, 200μL) was studied, and variation usefulness evaluation was conducted. The evaluation items were compared the results of precision, analytical sensitivity, recovery rate, dilution test, high-dose hook test, parallel test and very low concentration values (n = 20).

[Result] The validation results were displayed in the order of 25μL, 50μL, 100μL, 200μL. As the serum volume increased, it was confirmed that CV (%) improved. Analytical sensitivity(ng/mL) was 0.038, 0.041, 0.017, 0.015 and recovery rate (%) was 101±3, 101±3, 99±2, 97±4. Very low concentration values (ng/mL) between each volume (n=20) were 0.135±0.068, 0.076±0.050, 0.048±0.034, 0.046±0.034. And high dose hook effect appeared as the serum volume increased.

[Conclusion] Through the variation usefulness evaluation, it was confirmed that as the serum volume increased, the precision and sensitivity improved at very low concentration values. However, it is necessary to pay special attention to the occurrence of high-dose hook effect as the serum volume increases. In the case of tests that requires very low concentration values, it is thought that the reliability of the result will be increased if the variation method is properly used after the variation usefulness evaluation.

[Key Words] Immunoradiometric Assay (IRMA), Sensitivity, High-Dose Hook Effect

Investigation of Personal Dosimeter Loss Case and Measures to Prevent Loss

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[Purpose] It is intended to improve the management efficiency of personal dosimeters by analyzing and sharing personal dosimeter loss cases and loss prevention measures.
[Material and Method] From 2017 to 2021, data on the number of lost personal dosimeters were collected at large hospitals, and the number of personal dosimeters issued and lost were investigated.
[Result] In order to prevent loss by institution, methods such as the use of auxiliary rings, contact stickers and dosimeter necklaces were implemented.
[Conclusion] Hospitals are a business that frequently changes clothes, such as surgical gowns and work clothes, so there is a lot of loss. In addition, it was confirmed that the loss rate increases as the number of personal dosimeters issued increases.

[Key Words] Personal Dosimeter, Personal Exposure Dosimeter, Loss, Prevention of Loss, Penalty for Loss

Iterative Reconstruction with Scatter Correction in ^{123}I SPECT Imaging: Comparison of Preprocessing and Including Methods

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[Purpose] Iterative reconstruction is mainly used in SPECT imaging, and scatter correction is applied in iterative reconstruction processes that include scatter data and preprocessing that iterates after subtraction of projection data. However, there are various methods for scatter correction in iterative reconstruction, and their effectiveness may differ. Although preprocessing is not affected by the iterative algorithm, differences in the correction effect are not clear. Therefore, the purpose of this study was to evaluate the correction effectiveness of iterative reconstruction processes and preprocessing methods.

[Materials and Methods] Section and scatter phantoms filled with ^{123}I solution were used. Phantom data were acquired using LEHR, ELEGP, and MEGP collimators, respectively. Scatter correction was performed through preprocessing and iterative reconstruction processes, with energy windows set at 159 keV±10% and130 keV±10%. All SPECT images were reconstructed using the ordered subset–expectation maximization method with 10 subsets and the number of iterations was varied from 1 to 30. SPECT counts of different activity concentrations in the section phantom, as well as cold and hot regions in the phantom, were measured, and concentration linearity, scatter reduction rate, and percent coefficients of variation (%CV) were calculated.

[Results] There was good linearity between the radioactivity and counts on the images measured using both methods for all collimators and numbers of iterations. The scatter reduction rate for the preprocessing method exceeded 80% after 100 iterations, regardless of the collimator. However, the rates for the iterative reconstruction process with 100 iterations were 64%, 61%, and 63% using the LEHR, ELEGP, and MEGP collimators, respectively. The %CV increased with the number of iterations. The %CV was 21%, 18%, and 27% for preprocessing and 18%, 14%, and 22% for iterative reconstruction using the LEHR, ELEGP, and MEGP collimators, respectively.

[Conclusion] Although preprocessing and iterative reconstruction process showed good linearity, the effectiveness of scatter reduction differed between the two methods. These results suggest that the processing parameters for the scatter correction algorithm need to be optimized.

An Incidental Finding of Breast Cancer Osteolytic Bone Metastasis on ^{99m}Tc-TRODAT-1 SPECT Image

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Chun-Liang KUO

This report presents a case of suspected Parkinson's disease in a 76-year-old woman with a history of slurred speech, general weakness, unstable gait, and bradykinesia for months. A ^{99m}Tc-TRODAT-1 SPECT scan revealed a symmetrically decreased bilateral nigrostriatal system, including bilateral putamen and caudate nuclei. The scintigraphic findings may reflect normal aging or atypical Parkinsonism. The bilateral frontal bones and left temporal bone exhibited increased uptake of ^{99m}Tc-TRODAT-1, and previous ^{99m}Tc-MDP bone scan and computed tomography images were reviewed. Osteolytic lesions at the corresponding site indicated bone metastasis from breast cancer. Consequently, a careful review of the entire slice of the ^{99m}Tc-TRODAT-1 SPECT scan is recommended. The abnormal accumulation of radiotracer in the extrastriatal region should not be overlooked to avoid missing lesions.

[Key Words] Osteolytic Bone Metastasis, Breast Cancer, ^{99m}Tc-TRODAT-1 SPECT

Development of Detachable Inserts Simulating Alzheimer's Disease for the 3D Hoffman Phantom

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[Purpose] The 3D Hoffman phantom is commonly used in various SPECT phantom studies. This phantom is designed to simulate normal brain structures, but in the diagnosis of Alzheimer's disease (AD), a key diagnostic feature is the decline in accumulation observed in the posterior cingulate cortex. The aim of this study was to develop a detachable insert for the 3D Hoffman phantom that simulates the AD pattern on SPECT and to evaluate its usefulness.

[Materials and Methods] The detachable insert was created using a 3D printer (Guider2) after tracing the posterior cingulate cortex of the 3D Hoffman phantom using 3D data creation software (Fusion360). The phantom images with and without the insert were acquired using a SPECT/CT system with the LEHR for ^{99m}Tc and the ELEGP collimator for ^{123}I. The SPECT data were acquired in repeated continuous mode with varying acquisition times to introduce controlled variations in the dataset. A simulated AD patient and normal dataset for statistical analysis were reconstructed using OS-EM with resolution recovery correction, scatter correction, and CT attenuation correction. The performance and utility of the inserts were evaluated using the Z-score and the percentage of pixels with a Z-score ≥ 2 (extent ratio) in the posterior cingulate area. In addition, the count ratio was calculated from the counts in the posterior cingulate cortex of the AD pattern relative to those of the normal pattern.

[Results] The Z-score obtained with the insert was significantly higher than that without the insert (Mann-Whitney U test, $P < 0.05$): 2.9±0.3 for ^{99m}Tc and 2.2±0.3 for ^{123}I versus 1.1±0.5 for ^{99m}Tc and 0.9 ±0.1 for ^{123}I without the insert. The extent ratio with the insert was 56.6±10.1% for ^{99m}Tc and 34.0±7.3% for ^{123}I. Additionally, the count ratio in the posterior cingulate with the insert was 0.89±0.04 for ^{99m}Tc and 0.84±0.04 for ^{123}I.

[Conclusion] Detachable inserts made using 3D printing technology provided AD-like perfusion patterns on brain SPECT images. Our proposed insert can be useful for evaluating the SPECT image quality in brain phantom studies.

Establishing a Virtual Reality Teaching Plan for Nuclear Medicine Myocardial Perfusion Scan

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This study developed a virtual reality teaching plan for myocardial perfusion scan (MPS) in nuclear medicine based on student needs. Questionnaires from 19 under-graduate year training (UGY) students at our hospital between July and December 2023 were used to gather their learning requirements for MPS. Filming was done using an Insta360 panoramic camera and edited with Virti online software. Upon completion, the same 19 students studied the lesson plan and filled out a satisfaction questionnaire to assess its effectiveness. The needs assessment revealed that 73.7% (14/19) of the students were unfamiliar with the examination, and 57.9% (11/19) believed they needed 2.5 hours of learning and practice for proficiency. A 20-minute virtual reality video was produced to meet these needs, covering educational objectives, training duration, assessment goals, patient education, examination procedures, precautions, and more. According to the satisfaction questionnaire, all students agreed that the plan's length was appropriate, the test questions deepened their understanding, the interactive elements facilitated learning, and virtual teaching made learning more enjoyable. Additionally, 89.5% (17/19) found the video content clear and easy to understand, with an average satisfaction score of 8.95 out of 10. This study developed a virtual reality teaching plan for MPS based on student needs to serve as preparatory material before their internships.

[Key Words] Myocardial Perfusion Scan (MPS), Virtual Reality (VR), Teaching Plan

Validation of the Ability of SBR and SUV in ^{123}I-FP-CIT SPECT to Differentiate Dopaminergic Neurodegenerative Disease Using xSPECT

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[Purpose] ^{123}I-FP-CIT SPECT can image dopamine transporter (DAT) and its quantification such as specific binding ratio (SBR) and standardized uptake value (SUV) assists in differentiate dopaminergic neurodegenerative disease (dNDD) and non-dNDD, which differ in clinical management. This study aimed to evaluate the diagnostic accuracy of SBR and SUV for dNDD using xSPECT, a technique to obtain high-contrast SPECT images, and optimized parameters.

[Materials and Methods] SPECT images of a striatal phantom were acquired by applying xSPECT on SPECT/CT systems (Symbia Intevo) with varying reconstruction parameters. Regions of interest (ROIs) were depicted in the striatum and brain parenchymal background, and image quality was evaluated. Then, the system was calibrated for converting gamma-ray counts to radioactivity by sensitivity measurement. Bolt's method with large striatal ROI and the maximum and mean SUV (SUVmax and SUVmean, respectively), which were normalized by administration dose and body-weight, were measured by analyzing clinical ^{123}I-FP-CIT SPECT images of 29 patients with dNDD, including dementia with Lewy bodies and Parkinson's disease, and 18 patients with non-dNDD.

[Results] 30 iterations with convergence of striatal contrast and resolution recovery, and a Gaussian filter with full-width at half-maximum of 7.2 ㎜ with a good balance between contrast and background noise, were determined as the optimal parameters. SBR and SUV were significantly lower in dNDD, and showed high diagnostic accuracy for dNDD with areas under the ROC curve of 0.921 for SBR, 0.906 for SUVmax and 0.900 for SUVmean. SBR showed excellent specificity of 94.4%, whereas SUVmax showed excellent sensitivity of 96.6%. Our results were somewhat better than previous reports, probably due to the use of the high-contrast xSPECT algorithm and optimization of reconstruction parameters. Strong positive correlations were shown of SBR with SUVmax and SUVmean (r=0.798 and r=0.797; $P<0.01$). We speculated SBR and SUV were subject-independent and comparable.

[Conclusion] SBR and SUV showed very high diagnostic accuracy for dNDD, improved by using xSPECT and parameter optimization. SUV can be compared with SBR, and their comprehensive evaluation will improve diagnostic accuracy.

Clinical Value of Post-Treatment SPECT/CT with Lu-177 DOTATATE for Neuroendocrine Tumors

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[Purpose] Treatment failure and short response duration remain significant challenges in peptide receptor radionuclide therapy (PRRT). The importance of response monitoring is underscored by the potential to recognize early treatment failure, allowing for the implementation of improved and personalized treatment options. Previous report has demonstrated a strong correlation between pre-treatment Ga-68 DOTATATE PET and post-treatment Lu-177 DOTATATE SPECT SUV parameters, particularly SUV and MTV. Here, we aim to share our PRRT experience, incorporating post-therapy quantitative SPECT/CT.

[Materials and Methods] From 02/09/2021 to 08/31/2023, 32 patient images were collected. For each treatment, Lu-177 DOTATATE (200±10% mCi) was administered over 30 minutes via syringe pump. 24 hours later, whole-body planar and SPECT/CT scans were performed using a GE Discovery NM/CT DR scanner to collect Lu-177 emissions and generate images. Patient data were entered for decay correction. Standardized uptake values (SUVs) were obtained by normalizing radiotracer uptake within regions of interest over selected lesions.

[Results] Except for 3 patients, all patients completed 4 treatment cycles with no significant side effects during or after treatment. SPECT imaging during treatment showed changes in SUV values at selected lesion sites: For the 3 patients who did not complete 4 cycles, 2 had an increase in SUV 〉30% across 6 selected lesions, while 1 had an increase 〈30% in 1 lesion with new lesions indicating disease progression, suggesting limited benefit from this treatment. These 3 patients discontinued and were switched to other treatment plans. For the remaining patients, Lu-177 radiotracer concentrated in primary or metastatic tumors, confirming expected biodistribution with no new lesions.

[Conclusion] Post-therapy quantitative SPECT/CT imaging may be feasible for evaluating treatment response and tumor characteristics in NET patients undergoing PRRT, playing a crucial role in assessing disease progression and therapeutic efficacy. With PRRT now available in Taiwan, more NET patients could potentially benefit.

[Key Words] Lu-177 DOTATATE, Neuroendocrine Tumors, Peptide Receptor Radionuclide Therapy (PRRT), Quantitative, SPECT/CT Imaging

Poster Presentation

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Competency-Based Medical Education: Constructing a Consensus on Nuclear Medicine Milestones in Taiwan

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To promote Competency-Based Medical Education (CBME), the Taiwan Association of Medical Radiation Technologists (TAMRT) has completed the establishment of five core competencies and 12 Entrustable Professional Activities (EPAs) for radiologic technologists. This study aimed to utilize the focus group method to develop a consensus on nuclear medicine milestones in Taiwan, thereby enhancing CBME assessment tools. This consensus-building initiative on medical milestones in nuclear medicine focused on the sub-competencies within the five core competencies. A group of experts initially drafted learning milestones for each sub-competency. A nationwide survey was conducted in March 2024, followed by a national consensus meeting on March 30, 2024, involving 28 nuclear medicine medical education experts from teaching, regional, and local hospitals. Medical education experts first conducted a literature review on milestones and consensus-building training, followed by focus group discussions and voting. The focus group method was employed to discuss and vote on the milestones, resulting in 171 items being voted on. After the voting, 156 milestones were retained, 13 were modified, 1 was deleted, and 1 had its competency level adjusted. The modified Delphi method was then used to assess the degree of consensus, with a mean score of 4.93, resulting in the establishment of 125 Taiwanese nuclear medicine milestones.

This study, using the focus group method, has established a consensus on nuclear medicine milestones in Taiwan, laying the foundation for the development of CBME assessment tools. Future research can continue to monitor the application effectiveness of these milestones and make timely adjustments and improvements.

[Key Words] Competency-Based Medical Education, Milestone, Focus Group Method, Modified Delphi Method

Bone Scan with SPECT/CT Demonstrated Complex Regional Pain Syndrome

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Complex Regional Pain Syndrome (CRPS) is a condition that combines Reflex Sympathetic Dystrophy and Causalgia. People with CRPS produce immune mediators and antibodies in response to limb injuries, triggering an autoimmune reaction that impacts the nervous system's function. A 65-year-old male patient came for treatment for left shoulder and left hip joint pain. After a Nerve Conduction Velocity test, he was diagnosed with multiple neuropathy, pathologically showing axonal demyelination, which belongs to Multiple Sclerosis. Subse-quent hip replacement and arthroscopic surgery were performed. He became more sensitive to pain at this time, and the skin of his right toes turned blue-purple. A nuclear medicine three-phase bone scan with Tc-99m MDP was arranged. The image showed that the toes of the patient's right foot had no blood flow and no MDP intake. It was initially determined as the early stages of CRPS, exhibiting heightened sensitivity to pain in this initial stages of the condition. CRPS commonly manifests in the limbs, particularly distal to the original injury site, spreading to cause severe pain, swelling, and limb dysfunction. Diagnosis is typically based on X-ray im-aging, whole-body bone scans, and magnetic resonance imaging (MRI). Bone scans are commonly utilized, with increased MDP uptake and relatively bright in the affected area. However, patients with limited mobility or young patients may exhibit reduced uptake on the affected side. A nuclear medicine three-phase bone scan can rapidly diagnose CRPS. The high sensitivity and specificity of bone scans, along with SPECT/CT three-dimensional image, enable accurate diagnosis of CRPS in its early stages, with a sensitivity and specificity ex-ceeding 95%. Currently, there is no definitive cure for CRPS. Treatment options such as physical therapy, medication, and surgery aim to slow down the disease progression. It is crucial for individuals to receive on ac-curate diagnosis and promptly seek appropriate treatment and surgical intervention.

[Key Words] Bone Scan, Complex Regional Pain Syndrome, Multiple Sclerosis, SPECT/CT, Tc-99m MDP

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