[SY25] Chest Symposium ll

SY25-01

Impact of Measurement Variability in Lung Cancer – PET

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Due to its quantitative ability and ability to target cellular biology the use of PET has continuously increased for the assessment of therapeutic response in lung cancer. The most commonly used quantitative values are the standardized uptake value (SUV) of ^{18}F-deoxyglucose (FDG)-based quantitative PET parameters are used as radiomics features and therapeutic response criteria. Many biological and technical factors affect the measurement of SUV.

First factor is a normalization method for SUV calculation. SUV is calculated by activity concentration in tissue adjusted by the administered dose of radiopharmaceutical, background SUV of the blood pool and body size. There are several methods for body size measurement, which affects the SUV. Second factor is PET/CT scanner models and image acquisition/reconstruction protocol. PET/CT hardware models, image acquisition and reconstruction protocols also affect the quantitative measurement of SUV. For the performance of PET/CT scanners, the most important factors are the intrinsic resolution and detector sensitivity. In the image acquisition protocol, one of most important factors is uptake time. In the reconstruction protocols, the attenuation correction method, reconstruction method (analytical vs. statistical/iterative methods), and smoothing filter are major factors affecting SUV measurement. Third is patients' factor. SUV can vary due to the biological process such as different blood glucose and insulin levels. Fourth, most quantitative PET parameters have important problems related to measurement variability, precision and repeatability. This includes maximum SUV, average SUV, peak SUV, metabolic tumor volume, and total lesion glycolysis. Due to these measurement variabilities, the harmonization of PET quantitation has been studied.

Besides FDG, several other PET tracers are used for lung cancer, which include ^{18}F-Fluorothymidine for cell proliferation, ^{18}F-fluoromisonidazole for cell hypoxia, ^{18}F-alfatide for angiogenesis, and ^{11}C-PD153035 for EGFR mutation.

Keywords : PET, PET/CT, Lung cancer, Standardized uptake value, Therapy response

[SY25] Chest Symposium ll

SY25-02

Engineer's perspective on radiomics

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Recently, a high-dimensional analysis method known as radiomics has emerged. The approach is a novel analysis method that extracts hundreds or thousands of features (i.e., high-dimensional features) from imaging data which can be used for data mining. Radiomics could be applied to various disease types with minor modifications as the feature set is likely to include effective features that could cover a broad range of disease types. Radiomics have found tremendous success with lung imaging. To perform a good radiomics study, an interdisciplinary research team involving radiologists, engineers, and computer scientist is necessary. In this talk will start with an introduction to radiomics and continue with various ongoing issues in radiomics with an engineering perspective. The issues include 1) what problems can radiomics solve (generalizability of radiomics), 2) how many features do we need? 3) stability of the radiomics features, 4) research design for radiomics and etc.

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[SY25] Chest Symposium ll

SY25-03

Measurement Variability in Treatment Response Determination for Non–Small Cell Lung Cancer at CT Scans

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Assessment of antitumor activity of cancer therapies is generally determined by an anatomic measurement of tumor burden. Since its first introduction in 2000 and subsequent revision in 2009, Response Evaluation Criteria In Solid Tumors (RECIST) has served as the reference standard for measuring tumor burden and confirming tumor response. According to RECIST criteria, measurement is the maximal axial (in-plane) unidimensional measurement of a tumor's diameter. However, this conventional tumor size analysis is imperfect due to interreader and intrareader measurement variability, heterogenous tumor morphology, and different technical parameters at the time of scanning. In particular, manual segmentation of tumor volume, and technical factors such as choice of reconstruction kernel, slice thickness, and interscanner differences may cause considerable measurement variability of the tumor burden at CT scans, making the task more challenging for radiologists. All of these factors contribute to measurement variability, which can lead to an erroneous determination of treatment response/progression and thereby misinform treatment decisons. In this session, we will carefully discuss the various technical factors that may impact tumor measurement accuracy.

Keywords : Chest, CT, Tumor Response, Variability