Konrad Skórkiewicz

Selection of Q.Clear image reconstruction parameters for small lesions with the pathological uptake of ^{68}Ga-labeled somatostatin analogues

Abstract

PET/CT diagnostics uses iterative image reconstruction techniques to obtain reliable information about the biodistribution of radiotracers in the human body. Clinically used devices are usually equipped with several image reconstruction algorithms. Changing the image reconstruction algorithm or its modification by changing the number of iterations and subsets affects the study results.

The aim of my doctoral dissertation was to analyze the available image reconstruction algorithms in a clinically used PET/CT device installed at the University Hospital in Kraków (Department of Nuclear Medicine). The purpose of the analysis was to select an algorithm intended for the reconstruction of images of oncological patients treated and diagnosed in the Department of Nuclear Medicine. In particular, the conducted analysis was to lead to the selection of an algorithm that allows for a more accurate diagnosis of patients with neuroendocrine tumours, in whom a study with ^{68}Ga-labelled somatostatin analogues is performed at various stages of the disease.

The research was divided into two stages. In the first stage, the PET/CT examination of the NEMA phantom was analyzed. The study analyzed the effect of changing the β parameter (range 150 – 950, step 100) in the VP FX+Q.Clear and VP HD+Q.Clear algorithms on the semi-quantitative Standard Volume Uptake (SUV) scores and the ratio of the measured sphere to the background (CR coefficient). The homogeneity of the background in the body part of the phantom was also assessed with Minkowski analysis.

In the second part of the work, a comparative analysis of three image reconstruction algorithms VP FX+Q.Clear, VP HD+Q.Clear and VP FX was performed using the results of patients with advanced forms of cancer. The group of patients was carefully selected, because the impact of the reconstruction algorithm changes was tested, especially for small (< 2cm) metastases of neuroendocrine tumours.

The results obtained allowed us to assess the effect of the beta parameter value on Q.Clear reconstruction and the suitability of using Q.Clear reconstruction at various stages of cancer, especially at its early stage. The selected value of the β parameter is in the range of 350-450. It was found that it is more advantageous to use the VP FX+Q.Clear algorithm, which uses information from the correction of attenuation and time of flight of photons generated during the annihilation phenomenon.

Key words: Q.Clear algorithm, neuroendocrine tumours, NEMA standards