OPTIMIZACIJA SPECT/CT IN PET/CT PROTOKOLOV

OPTIMIZATION OF SPECT/CT AND PET/CT PROTOCOLS

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IZVLEČEK

Uvod: Tomografski metodi slikanja v nuklearni medicini sta enofotonska emisijska računalniška tomografija (SPECT) in pozitronska emisijska tomografija (PET). Obe metodi prikažeta razporeditev radiofarmaka (RF) v telesu v treh ravninah. Pri prehodu fotonov skozi homogeno telo se prikaže neenakomerna razporeditev RF zaradi atenuacije. Računalniška tomografija (CT) v kombinaciji s funkcionalnimi metodami slikanja (SPECT/CT in PET/CT) korigira problem atenuacije fotonov. Slika, dobljena pri SPECT/CT in PET/CT, se lahko optimizira z uporabo CT za korekcijo atenuacije in fuzijo ter z rekonstrukcijskimi algoritmi, ki vključujejo korekcijo ločljivosti.

Namen: Namen opravljene raziskave je kvalitativno in kvantitativno oceniti in analizirati PET/CT in SPECT/CT slike z namenom optimizacije protokolov.

Metode: Uporabili smo NEMA body fantom in ga napolnili z 99mTc in 18F FDG v različnih razmerjih. Analizirali smo kontrastnost za SPECT/CT pri različnih rekonstrukcijskih algoritmih. Na PET/CT smo analizirali CNR (razmerje kontrast/šum) in CRC (koeficient vrnitve kontrasta) pri različnih matrikah. Primerjali smo tudi CNR med PET/CT in SPECT/CT. Za analizo smo uporabili programsko orodje SPSS 21.

Rezultati: Analiza kontrastnosti je pokazala statistično pomembno razliko med različnimi rekonstrukcijskimi algoritmi pri SPECT/CT ($p < 0{,}001$). Pri uporabi manjših matričnih elementov se CNR in CRC pri PET/CT povišata pri lezijah s premerom ≤ 1,21 cm do 11 %. Primerjava CNR za PET/CT in SPECT/CT je pokazala signifikantno razliko med obema metodama ($p = 0{,}002$). Pri obeh metodah se vrednost SNR viša glede na višino razmerja in kaže dobro korelacijo ($r = 0{,}85$ in $p < 0{,}001$).

Zaključek: Rezultati analize so potrdili, da se z optimizacijo slikovnih in obdelovalnih parametrov lahko vpliva na SPECT/CT in PET/CT slike.

Ključne besede: kontrastnost, SNR, CNR, SPECT/CT, PET/CT

ABSTRACT

Introduction: Tomographic imaging methods in nuclear medicine are single-photon emission computed tomography (SPECT) and positron emission tomography (PET). Both methods show the distribution of radiopharmaceuticals (RF) in the body in three planes. In the transition of photons through a homogeneous body, uneven distribution of RF due to attenuation appears. Computed tomography (CT) combined with functional imaging methods (SPECT/CT and PET/CT) corrects the problem of photon attenuation. The image obtained with SPECT/CT and PET/CT can be optimized by using CT for attenuation and fusion correction and reconstruction algorithms involving resolution correction.

Purpose: The purpose of the study is to qualitatively and quantitatively evaluate and analyze PET/CT and SPECT/CT images in order to optimize protocols.

Methods: We used a NEMA body phantom and filled it with 99mTc and 18F-FDG in different ratio. Contrast for SPECT/CT was analyzed for different reconstruction algorithms. CNR (contrast/noise ratio) and CRC (contrast return coefficient) for different matrices were analyzed on PET/CT. We also compared CNR between PET/CT and SPECT/CT. The SPSS 21 software tool was used for analysis.

Results: Analysis of contrastness showed a statistically significant difference between the different reconstructive algorithms in SPECT/CT ($p < 0.001$). When smaller matrix elements are used, CNR and CRC for PET/CT are increased for lesions ≤ 1.21 cm to 11% in diameter. The CNR comparison for PET/CT and SPECT/CT showed a significant difference between the two methods ($p = 0.002$). In both methods, the SNR value increases with respect to ratio height and shows a good correlation ($r = 0.85$ and $p < 0.001$).

Conclusion: The results of the analysis confirmed that SPECT/CT and PET/CT images can be affected by the optimization of the imaging and processing parameters.

Keywords: contrast, SNR, CNR, SPECT/CT, PET/CT

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