Respiratory movements cause significant misregistration and altered SUVs in thoracic PET-CT studies with 18F-DG

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Abstract

PET-CT with 18F-DG studies are frequently used in the management of patients with lung malignancies. Unfortunately respiratory movements may influence significantly disease evaluation, particularly during longitudinal follow-up. Our aim is to investigate the influence of forced inspiration (I) and expiration (E) on shallow breathing (S) results (anatomic registration and SUV calculation).

We included 18 patients, 15 male and 3 female, with ages between 40 and 78 years, with pulmonary and hepatic lesions. Data was acquired on a GE Discovery LS/4 PET-CT Scanner starting 60 to 90 minutes after the i.v. administration of 18F-DG (5 MBq/Kg of patient weight). CT acquisition used 120 kV, 80 mA and 1.5 pitch and PET acquisition on 2D mode included 5 to 6 AFOV (4 minutes per bed position). A further 1 to 2 late AFOV (> 2 hours p.i.) acquisition was routinely undertaken on S and complemented by 2 other attenuation maps with CT, 120 kV, 60 mA and 1.5 pitch, in I and E. PET images (always on S) were acquired in 2D mode, 1 or 2 AFOV/6 minutes. Three emission image sets were then reconstructed with OSEM and MAC using the 3 attenuation maps. Each lung was divided in 3 segments - Superior, Medial and Inferior, and the liver lesions classified in Superior and Deep. Images were then analysed according to lesion anatomic registration, and lesion SUV calculated on I, E and S.

Our preliminary results show significant difference between SUV values (p=0.0154) of hepatic lesions located in superior segments in I and E. Lung lesions in the superior segment were better registered in S than in I or E. The worst misregistrations were observed in the inferior segments of the lung, with deviations up to 1,5 cm between I and E.

Conclusion: respiratory movements impact significantly in image registration and SUV calculation of lung and hepatic lesions, depending on their regional localization. Failure to correct adequately for respiratory movements in follow-up longitudinal studies may cause significant evaluation errors. A well defined and "rigid" protocol must be used for longitudinal studies.