T1-mapping and OE-MRI of patients treated with radiotherapy for breast cancer

Kindvall, Simon; Alkner, Sara; Kjellén, Elisabeth; Nilsson, Per; Svensson, Jonas; Diaz, Sandra; Wollmer, Per; Olsson, Lars E

2015

Document Version:
Publisher's PDF, also known as Version of record

Link to publication

Citation for published version (APA):

Creative Commons License:
CC BY-NC

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

Take down policy
If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.
Purpose: Radiotherapy (RT) of breast cancer has been shown to result in decreased performance in pulmonary function tests (PFT) up to ten years post-irradiation (Erven et al. 2012). However, PFT only provide global evaluation and cannot visualize regional differences in lung function. The purpose of this study is to investigate whether oxygen enhanced (OE) MRI and T1-mapping can be used to detect chronic regional changes in lung function after breast radiotherapy.

Subjects and Methods: In this pilot study, five women (52 – 60 years) who received RT of either left or right breast > 10 years ago, and for which treatment plans were available, were included. Seven healthy volunteers (42 – 64 years) were recruited as controls. Baseline T1-quantification and OE-MRI of a coronal slice was performed with the Snapshot FLASH pulse sequence (Arnold et al. 2004) on a SIEMENS Avanto Fit (Siemens Medical, Erlangen, Germany). Measurements were made during light inspiratory breath hold, with each T1-map being collected in 3 seconds. Medical air and oxygen was supplied by a Hans Rudolph V2-mask 7450 (Hans Rudolph Co., Kansas City, MO). The average of nine coronal T1-maps was used for baseline and OE measurements. For RT-patients, a ROI was drawn in the apical part of the lung where the treatment plan indicated a dose > 30 Gray. For the non-irradiated side and controls, a ROI was drawn encompassing the upper lung, down to the level of the aortic arch. The mean T1-value of the entire ROI was used. The OE effect was quantified as the change in transversal relaxation rate \( \Delta R_1 = R_{1(\text{air})} - R_{1(\text{air})} \). The T1 and \( \Delta R_1 \) of the three groups (right RT, left RT and controls) were tested with multiple comparisons ANOVA. All subjects performed PFT which was compared with Student’s T-test (all RT vs. controls).

Results & Discussion: No difference (p<0.05) between the RT group and controls were found for FEV, VC or DLCO. No difference (p<0.05) in R/L \( \Delta R_1 \) ratios was found between the left RT group and right RT group or controls. Baseline T1 values of the right and left ROI for all subjects are presented in the figure. The mean R/L T1-ratio of the right treatment group was significantly different from the other groups (p=0.013) with a mean of 0.96, compared to 0.99 (left treatment group) and 0.98 (controls). According to the treatment plans, the patients which received treatment of the right breast received > 30 Gy to 10-15 % of the lung volume, while treatment of the left breast resulted in > 30 Gy to 5 and 8 % of the lung.

References: