Lung cancer patients with atelectasis, pleural effusion, and pneumonia: When do we need to adapt the treatment plan?

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Purpose/Objective: Lung cancer patients experience changes of the lung tissue density due to atelectasis, pleural effusion or pneumonia/pneumonitis. Changes may be an indication for adaptation of the treatment plan in order to preserve sufficient target coverage.

Materials and Methods: We have analysed 165 lung cancer patients (Small Cell and Non-Small Cell) with daily cone-beam CT (CBCT). The CBCT scans were reviewed to find all patients with atelectasis, pleural effusion, pneumonia/pneumonitis. For all patients we looked for the reason, number, when the change appeared and disappeared, the measurable size of the change and the consequences for the dose distribution. In addition it was estimated if the lung change gave rise to a shift of the tumour leading to a geometric miss.

Results: 43 patients (26%) of the 165 lung cancer patients investigated had changes in their lung. 24 (15%) experienced atelectasis, 19 (12%) pleura effusion and 8 (5%) had pneumonia/pneumonitis visible on CBCT. Only major density changes had consequences for the dose distribution. In addition it was estimated if the lung change gave rise to a shift of the tumour leading to a geometric miss. For the pleura effusion and 8 (5%) had pneumonia/pneumonitis visible on CBCT. Only major density changes had consequences for the dose distribution. In addition it was estimated if the lung change gave rise to a shift of the tumour leading to a geometric miss.

With respect to time of appearance and disappearance there is no system for pneumonia/pneumonitis and pleural effusion. For the atelectasis the time of appearance and disappearance is shown in fig. 1. Half of the atelectasis cases are present at CT, while the other half appears during treatment. Only three patients have an atelectasis at CT that does not disappear at some point during the treatment.

Conclusions: For the 165 patients reviewed on CBCT an adaptive plan is necessary to assure a correct target coverage either due to changes in lung density in 12 patients (7%) or due to shift of the tumour because of the anatomical changes in 10 patients (6%). In total this corresponds to 12% of the patients being candidates for an adaptive treatment plan as a few patients are present in both groups. We do not find a clear system in the time of appearance nor disappearance of the changes, and we therefore recommend that an adaptive strategy is based on population based criteria, but evaluated on the individual patient by the RTT on a daily basis.