PO-0683
Multiple training interventions improve PET/CT based target volume delineation in NSCLC RTP
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Purpose or Objective: PET/CT based radiotherapy planning (RTP) has been shown to improve the consistency of target volume delineation (TVD) in lung cancer radiotherapy, hopefully leading to improved local control. This study assesses the impact of a standardized delineation protocol and multiple training interventions on PET/CT based TVD in NSCLC.

Material and Methods: Over a one year period, nuclear medicine physicians (NAP) and radiation oncologists (RO) with limited experience in PET/CT based TVD from nine different countries participated in a multicenter study. The first training intervention included a three-day training course, consisting of three contouring assignments which formed the basis of a teaching discussion with the aim of identifying and correcting misinterpretations of practical guidelines, and various lectures on PET/CT based RTP. The second training event contained detailed individual feedback reports about previous performed contouring assignments and a webinar on PET/CT based TVD in NSCLC. Eleven teams consisting of a RO and NAP performed joint gross tumor volume (GTV) delineation of the primary tumor as per a standardized delineation protocol. In-house developed software called Big Brother recorded any user-software interaction, consequently allowing visual inspection of delineation strategies. Six delineation cases were performed before, during and after the training program and were compared with agreed expert contours (GTVexp) to assess delineation performance.

Results: Following the three-day training course overall concordance indices for 3 repetitive cases increased from 0.57±0.11 (SD) to 0.66±0.10. Observer volumes were larger after the training and miss of GTVexp was significantly reduced from 79.01±52.35 cc (SD) to 42.86±38.08 cc. Results are summarized in table 1. After further feedback and the webinar overall concordance indices for another 3 repetitive cases increased from 0.64±0.10 (SD) to 0.80±0.08. A reduction of GTVexp miss from 78.89±44.51 cc (SD) to 30.87±20.26 cc was observed.

Conclusion: Following a training intervention, PET/CT based TVD in NSCLC RTP using a standardized delineation protocol led to significant improvement in delineation performance. A greater improvement in TVD with the use of multiple training events as compared to a single training event was observed.

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Does the dose to heart affect survival in NSCLC patient treated with definitive Radiotherapy?
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Purpose or Objective: High radiotherapy dose to the heart increase the risk of cardiac morbidity and death in early stage breast cancer and lymphoma. Recent reports (1,2) have indicated that an association between overall survival and dose to heart (e.g. V5 for the heart) are observable after radiotherapy of NSCLC patients as well. The objective of this study was to evaluate if overall survival was affected by high V5 to the heart in NSCLC patients treated with definitive radiotherapy (RT).


Material and Methods: In a single institution, 297 NSCLC patients were treated consecutively with definitive RT from 2001-2007 with at least 60 Gy. Concomitant chemotherapy was not part of the standard treatment initially but became a treatment option later in the study period (weekly docetaxel). RT was delivered as 3D RT without elective nodal irradiation. No constraint on dose to the heart was applied during treatment planning. The heart was delineated retrospectively and heart doses were extracted from the treatment planning system (mean heart dose (MHD) and V5). Patients were stratified in two groups depending on their heart dose being above or below the median value. Survival test was performed using Kaplan Meyer and log-rank test. All patients were followed to death.

Results: Patient and treatment characteristics are summarized in table 1. Median follow-up was 127 months. The overall median survival was 19.1 months with 1, 2 and 5 year survival of 69%, 41%, and 17%, respectively. Median V5 for the heart was 49%. No association between survival and heart dose were observed (p=0.29 see Fig 1). The same was true when including smoking, gender, and concomitant chemotherapy as strata in the analyses. Median MHD was 14 Gy. Survival for patients with MHD ≥14 Gy or <14 Gy was 17% and 21%, respectively (p=0.83).

Table 1. Comparison of results from contouring the GTV before and after the first training event, and before and after a complete training in the use of a standardized delineation protocol. Observer = median concordance index between the observed GTV and expert GTV.

| Contours before and after the three-day training course | Expert Volume (cc) Mean Group Volume (cc ± 5 SD) Miss (cc ± SD) Observer ± SD |
|---------------------------------------------------------|-------------------------------------------------|---------------------------------|---------------------------------|-----------------|
| Before 388.38 282.75 ± 46.28 After 408.48 ± 115.12 | 388.38 ± 39.24 58.94 ± 84.94 41.00 ± 0.34 |
| After 50.86 60.58 ± 6.99 Before 20.43 ± 6.99 20.64 ± 11.24 | 60.58 ± 1.11 88.8 ± 9.34 65.00 ± 0.15 |
| Before 164.46 84.91 ± 11.97 108.49 ± 94.23 | 164.46 ± 38.08 84.26 ± 11.66 108.49 ± 94.23 |
| After 50.86 60.58 ± 3.63 31.38 ± 23.14 | 60.58 ± 1.12 88.8 ± 9.34 65.00 ± 0.15 |

V5 to the heart in NSCLC patients treated with definitive radiotherapy.