The advantage of deep-inspiration breath-hold and cone-beam CT based soft-tissue registration for locally advanced lung cancer radiotherapy

Background and purpose: Three cone-beam computed tomography (CBCT) registration strategies combined with deep-inspiration breath-hold (DIBH) and free-breathing (FB) were explored, in terms of obtaining the smallest planning target volume (PTV).

Material and methods: CBCT images were acquired pre- and post-treatment in FB and DIBH, for 17 locally advanced lung cancer patients. Bony registration on the spine, and soft-tissue registrations on the primary gross tumor volume (GTV-T) and GTV-Total, including malignant lymph nodes (GTV-N), were retrospectively analyzed. Setup-margins and resulting PTVs were calculated. Results: For the spine, the smallest residual misalignments were observed in FB, independently of registration method. For GTV-T and GTV-N, soft-tissue registrations were superior to bony registration, independently of FB or DIBH. Compared to FB, PTV-Totals were during DIBH reduced by 13% and 8% for the soft-tissue and bony registrations, respectively. If intra-fractional motion was included, the corresponding gain of DIBH was reduced to 9% and 7%, respectively. Superiority of DIBH was mainly due to larger clinical target volumes in FB.

Conclusions: Despite larger setup uncertainties compared to FB, DIBH resulted in smaller PTV-Totals for all registration methods. Soft-tissue registrations were superior to bony registration, independently of FB and DIBH. During DIBH, undesirable arching of the back was identified. Daily CBCT pre-treatment target verification is advised.

General information
Publication status: Published
Organisations: Radiation Physics, Center for Nuclear Technologies, University Hospital Herlev
Contributors: Ottosson, W., Rahma, F., Sjöström, D., Behrens, C. F., Sibolt, P.
Pages: 432-437
Publication date: 2016
Peer-reviewed: Yes

Publication information
Journal: Radiotherapy and Oncology
Volume: 119
Issue number: 3
ISSN (Print): 0167-8140
Ratings:
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.36 SJR 2.099 SNIP 1.562
Web of Science (2016): Impact factor 4.328
Web of Science (2016): Indexed yes
Original language: English
Keywords: Lung cancer, DIBH, CBCT imaging, Setup methods, Margins
DOIs:
10.1016/j.radonc.2016.03.012
Source: FindIt
Source-ID: 2303439577
Research output: Contribution to journal › Journal article – Annual report year: 2016 › Research › peer-review