[OA037] Advanced dose calculation algorithms in lung cancer radiotherapy: Implications when treating in deep inspiration breath hold
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Purpose. Modern dose calculation algorithms model absence of lateral charged particle equilibrium to a limited extent. The resulting dose calculation uncertainties are most noticeable in strongly heterogeneous regions, like the thorax, and will increase in deep inspiration breath hold (DIBH) due to decreased lung tissue density.

Methods. For 17 stage I and 17 stage III lung cancer patients, a plan in free breathing (FB, based on midventilation) and in DIBH were generated with Anisotropic Analytical Algorithm (AAA). Stage I disease was treated with 3D-conformal stereotactic radiotherapy (SBRT), 45 Gy in 3 fractions, prescribed to 95% isodose covering 95% of PTV and aiming for 140% dose centrally in the tumour. Stage III disease was treated with volumetric modulated arc therapy (VMAT), 66 Gy in 33 fractions, prescribed to mean PTV dose. Calculation grid size was 1 mm for stage I and 2.5 mm for stage III. All plans were recalculated with AcurosXB with same MU as in AAA, for comparison on target coverage and dose to risk organs.

Results. Lung volume increase in DIBH resulted in 6% decreased lung density for stage I (from median –757 HU to –811 HU) and 12% for stage III (from median –723 HU to –822 HU). In stage I, AAA overestimated all PTV parameters (p-values <0.01) compared to AcurosXB, with largest impact in DIBH. Mean dose and D98% were overestimated by 2.0/2.3 Gy in FB and 3.1/4.0 Gy in DIBH. These clinically relevant differences may be a combination of small targets and large dose gradients in the SBRT treated volume. In stage III, AAA systematically overestimated the target coverage compared to AcurosXB. D98% was overestimated by median 1.1/1.2 Gy in CTV and 1.5/2.1 Gy in PTV, in FB and DIBH respectively (p < 0.01). Hot spots (estimated as D2%) did not differ between AAA and from AcurosXB, in both FB and DIBH. No significant difference was observed for lung and heart dose parameters between the algorithms, for both FB and DIBH, in the two patient cohorts.

Conclusions. Choice of calculation algorithm impacts the calculated dose distribution in the target. AAA overestimated target coverage compared to AcurosXB, especially in DIBH for stage I lung cancer treated stereotactically.

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[OA038] Does automation reduce the number of errors in quality control of treatment plans for external beam radiotherapy?
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Purpose. Any single treatment plan error should be detected and corrected prior to treatment either during a check procedure or by built-in safety features of the treatment planning (TPS) or record and verify systems. However, as delivery techniques have become increasingly complex the number of possible errors in a plan has increased dramatically. It is therefore desirable to automate as many check procedures as possible to eliminate manual errors. In this work we investigate the effect on error rates of introducing automation in quality control of patient treatment plans.

Methods. Dose constraints, fractionation and best practice guidelines for all treatment schemes in our clinic taken from relevant guidelines (institutional, national, international or clinical trial) were collected in a database. A TPS script was written to generate a report comparing plan information with reference values from the database as pass/fail criteria. To determine if automation reduces the number of errors compared to manual quality control, 322 consecutive plans approved for treatment with manual quality control between September 1st and October 1st 2017 were retrospectively subjected to automated quality control with the script. All errors were recorded and severity was scored using the recommendations from the AAPM TG-100 report.

Results. 320 errors were detected in 10,243 individual checks (3.1%). Three errors were found to have had impact on target dose, ranging from 0.5% (severity 5) to 7% (severity 7), while another 18 could have caused either geographic or dosimetric impact (severity 5+). The remaining 299 errors were either purely clerical or could at worst cause minor inconvenience to staff, severity score 1–2.

Conclusions. Automation of treatment plan quality control reduces error rates and increases adherence to guidelines compared to a purely manual workflow.

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[OA039] Contouring and dose reporting for lower urinary tract sub-structures in cervix cancer
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Purpose. Radiotherapy related bladder morbidity include various clinical endpoints (i.e. frequency, cystitis, incontinence, bleeding, fistula) that may be related to various anatomical sub-structures.