Purpose or Objective: Childhood cancer survivors (CCS) face high risk for late effects. Aside from malignant neoplasms, it is known that ionizing radiation induces benign tumours of, e.g., the central nervous system and other sites. Record-linkage with pathology report registries provides a unique opportunity to obtain non-selected and uniformly collected benign tumour information. We aim to estimate the incidence of histologically-confirmed solid benign tumours (SBT), to describe clinical characteristics and to quantify the role of radiotherapy (RT).

Material and Methods: The Dutch Childhood Oncology Group – Late effects after childhood cancer (DCOG LATER) is a collaborative effort of all 7 academic paediatric haematology/oncology centres in the Netherlands with clinicians and researchers who focus on optimal patient care and research in CCS. The DCOG LATER cohort includes 6168 five-yr CCS treated between 1963 and 2001 before the age of 18 yrs. The entire DCOG LATER cohort was linked with the nationwide Dutch Pathology Registry (PALGA) to ascertain histologically confirmed SBT (excluding skin) diagnosed between 1990-2014.

Results: We identified 1278 eligible pathology reports in 788 CCS after a median follow up since diagnosis of 22 yrs (max. 52). We excluded reports on SBT diagnosed within 5 yrs after childhood cancer (243 reports); 145 reports without a clear diagnosis in conclusion and 25 reports still to be classified. These preliminary analyses include 865 reports from 578 CCS, of whom 79% had one SBT, and 21% had multiple. Tumour locations included head/neck/CNS (36%), chest (13%), abdomino-pelvic (34%), and extremities (14%). Of 3% location was unclear. Most common SBT types in the head/neck/CNS were meningiomas (44%), often following cranial radiotherapy (RT) (93%); mammary fibroadenomas (49%), 1 in 6 after RT chest; colorectal adenoma (38%), including 1 in 4 after abdominopelvic RT, and female genital tract tumours (leiomyomas and ovarian mucinous cystadenomas) (29%), 1 in 3 after abdominopelvic RT. We will present effects of RT dose, chemotherapy and genetic syndromes.

Conclusion: This preliminary analyses give insight into the amount and types of histologically confirmed SBT in CCS in relation to RT. To our knowledge, this is one of the first comprehensive assessments of subsequent SBT among CCS. In ongoing clinical follow-up studies we aim to gain knowledge about risk factors and clinical characteristics (e.g. meningioma) to help guideline groups decide for or against screening of asymptomatic, high-risk CCS.
Results: The MR-linac platform is in the last phase of the assessment. At its pre-defined imaging position in the linac room, the MR was shimmed and configured to work at peak performance. The linac’s radiation beam output was also found to be within specifications, being not affected by multiple passive exposures (testing over one year) to the MR’s magnetic fringe field. A hybrid MR-kV framework is under development to enable comprehensive RT tools for MR-only RT planning, quantification of organ motion (fast imaging), in-room treatment guidance, and site specific adaptive RT workflows. QC procedures specific to the MR and linac integration were also developed for the mapping and correction of both scanner-related and patient-induced MR image distortions, mutual registration of the MR and linac isocenters, B0 mapping for monitoring the MR performance, 4D MR, and generation of synthetic CT data sets.

Conclusion: Key milestones of the MR and linac integration were achieved, supporting the feasibility of the system for clinical implementation.

OC-0544
Heterogeneous FDG-guided dose escalation of locally advanced NSCLC, the NARLAL2 phase III trial
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Purpose or Objective: Locally advanced lung cancer lacks effective treatment options and may require aggressive chemo-radiotherapy (RT) with high doses. In the light of the RTOG 0617 trial, multi-centre dose escalation trials should avoid increasing organ at risk (OAR) toxicity and require strict radiation therapy (RT) planning, quantification of organ motion (fast imaging), and standard plan. All enrolment centres were obliged to follow a standard plan. Dose to the lung in the experimental plan is kept similar to the lung dose in the standard plan. Patient enrolment started January 2015. Analysis of the first 20 patients demonstrates that the escalation goals were met for the target and that dose to OARs were similar to the standard plans (Table 1). The maximum dose for the standard plans was 72.6 Gy (110%). Higher doses were applied for the experimental plans, but only to small volumes respecting the strict normal tissue constraints (see figure).

Material and Methods: In the standard arm, the PTV is treated with a homogenous dose of 66 Gy/33 fractions (fx). In the experimental arm, the dose is escalated heterogeneously to the FDG-PET avid regions, and the planning target volume (PTV) can be reduced by implementing daily soft tissue based image-guidance and adaptive RT. Incorporating these elements, the randomized multi-centre trial NARLAL2 by the Danish Oncologic Lung Cancer Group aims at increasing loco-regional control at 30 months without increasing toxicity.

Results: In the pilot study, the dose escalated FDG-PET avid part of tumour (PET GTV-T) and lymph nodes (PET GTV-N) received an average mean dose of 91.9 Gy and 72.1 Gy, respectively. The combined clinical target volume (CTV-total) received an average mean dose of 78.6 Gy. This corresponds to a 16 % estimated increase in loco-regional control at 30 months. For the first 20 patients included, the experimental plan achieved an average mean dose of 92.3 Gy (SD 3.7) to PET GTV-T. A total of 11 large lymph nodes were escalated to an average mean dose of 72.1 Gy (SD 2.7) to PET GTV-N. CTV-total obtained an average mean dose of 75.8 Gy (SD 4.1). Normal tissue doses were similar for the experimental and standard plan (Table 1). The maximum dose for the standard plans was 72.6 Gy (110%). Higher doses were applied for the experimental plans, but only to small volumes respecting the strict normal tissue constraints (see figure).

Table 1: Dose to organs at risk (in absolute dose or percentage) as an average (with standard deviation) for the first 20 patients included.

<table>
<thead>
<tr>
<th>Organ at risk</th>
<th>Standard [S]</th>
<th>Exp. [E]</th>
<th>E-S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Lung Dose [Gy]</td>
<td>13.7 (3.7)</td>
<td>13.6 (3.8)</td>
<td>-0.1 (0.4)</td>
</tr>
<tr>
<td>Lung V20 [%]</td>
<td>22.0 (7.2)</td>
<td>21.4 (7.2)</td>
<td>-0.6 (0.6)</td>
</tr>
<tr>
<td>Mean Heart Dose [Gy]</td>
<td>8.4 (8.6)</td>
<td>8.2 (8.3)</td>
<td>-0.8 (0.8)</td>
</tr>
<tr>
<td>Heart V5 [%]</td>
<td>4.2 (3.9)</td>
<td>2.9 (3.9)</td>
<td>-0.6 (1.1)</td>
</tr>
<tr>
<td>Oesophagus V5 [%]</td>
<td>25.1 (13.7)</td>
<td>24.3 (14.0)</td>
<td>-0.8 (2.0)</td>
</tr>
</tbody>
</table>

Conclusion: A dose escalation trial with strict QA has been set up. Patient enrolment started January 2015. Analysis of the first 20 patients demonstrates that the escalation goals were met for the target and that dose to OARs were similar for the standard and the experimental treatment plans.

OC-0545
Results of a national audit of IMRT and VMAT patient QA
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